



SZENT ISTVÁN UNIVERSITY

SURVEYS ON BOTANY AND LANDSCAPE MANAGEMENT
IN THE PUTNOK HILLS

PH.D. THESIS

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INTRODUCTION AND GOALS

Looking at the map of nature protected areas in Hungary, there are only a few smaller areas in the Northern Hungarian Mountain Range that do not have any bigger territory declared as nature protected area. Among these areas, one could find until the designation of Natura 2000 areas also the Borsod Hills, an organic joint of two micro-regions, the Sajó River's Valley and the Putnok Hills. This landscape creates a smooth transition between the flat Great Hungarian Plain and the mountains. Its mild hills create mosaics with flowering meadows and silent groves.

Researches on this area were started by author during spring 1999 after visiting the educational centre of the Ecological Institute for Sustainable Development Foundation in Gömörzölös. Species richness of this mosaic-like area was highly visible, leading to more detailed surveys. These studies were helped by the Aggtelek National Park Directorate as well.

Previous botanists (Fábry, Szontagh, Budai, Thaisz, Boros, Hulják, Zólyomi, Soó, Czente) observing the surrounding areas were concentrating on the peat bogs near Kelemér village. In the light of its importance, there are only a few literature data and herbarium collections concerning the vegetation of other parts of the currently studied area. Its folklore and settlement history, however, have been thoroughly observed since the 1980's.

Besides the floristical data unique for Hungary or interesting for a bigger area, also habitats in a close-to-nature state are taken into account during the research work. Historical and current forms of landscape management are also observed, since the valuable taxa found may be preserved in situ only within their original habitat, sustaining the management patterns used through hundreds of years in the past (grazing, hayfield management, extensive land use on arable lands). Exploring pedological relations and state of soils in the area has got a high importance as well, since as a consequence of anthropogenic processes, water and wind erosion has been strengthened on several areas during the latest decades. Landscape management and long term maintenance and conservation of main characteristics of soils is only possible by preserving the diversity of living beings generated on them in parallel.

Knowledge on different habitat types, land use patterns and botanical values is indispensable for the preparation of detailed and practical management plans serving the aims of nature conservation on a certain area. Based on these, the **main aims of my work** were the following ones:

- besides **exploring botanical values** and comparative analysis on their previous literature data and herbarium collections of taxa new for the local or a bigger area
- determining species rich **habitats** and the **factors endangering them** and,
- by **exploring traditional landscape management patterns** (by analysing ethnographic works with a landscape ecological view) and the **soils** giving base for them,
- **give a base for management preserving natural values** of the habitats.

Besides natural conditions, exploration of values of the built environment (and, as a part of this, buildings of management) is also indispensable for a thorough view on the area.

During researches prepared at landscape scale and in landscape protection marked attentions are paid to the landscape altering effects of human society and to the usefulness of natural environment for human society. It is landscape use that determines structure, function and dynamics of most landscapes in the above mentioned process. Change in the use of landscape is particularly regulated by economic and social forces. Therefore, knowledge on social geography should be integrated for comprehending current status and future function of the landscape. Economic activities, climate change and long-scale changes in landscape induced by landscape use should be examined.

Agricultural landscape should play a role also in nature conservation during preservation. In optimal cases, besides their producing function, landscapes used by agriculture or forestry on the biggest part of the Earth's surface preserved some of their role in ecological regulation, therefore they carry nature conservational, social, cultural etc. importance, too. Best sign for agriculture and nature conservation depending on each other is that more than half of the endangered plant and animal species of Central Europe live in anthropogenic ecosystems. Besides protected areas for nature, importance of habitats in close-to-natural conditions is more and more emphasized. However, if the advantages of large-scale agriculture become the sole aspect, a landscape „impoverished” in components will not be able to correspond to the large number of functions.

The UN Convention on Biological Diversity lays severe pressure on Hungary's agriculture, too. It is a requirement in the conceptions aiming the development of an up-to-date land use in Hungary that agrarian landscape, besides its basic productive function, has to be capable to supply ecological functions, too. According to the conception based on the principle of biotope grids, at least 8-12 percent of the agrarian landscape has to be covered by biotopes in close-to-natural conditions to achieve the mentioned aim.

Today it can be stated quite surely that there are almost no areas in Hungary that had never been disturbed. Regeneration of abandoned areas is a characteristic process as well, the direction of which leads our attention onto several problems of nature conservation and environmental protection. Habitats in a close-to-natural state generated by these processes usually differ from original natural vegetation.

It is a key factor in the process of sustainability that in spite of homogenising tendencies of our globalising world, we do should rely on naturally diverse, adaptive and creative local customs. Besides their function ensuring the conservation of natural values, landscape use patterns – once really diverse, and still in current remains beautiful – are presented with an emphasise on culture historical and custom preserving aim.

MATERIAL AND METHODS

Botanical relations of the research area have been explored between spring 1999 and spring 2006, while landscape management, landscape history and pedological conditions were observed between 2002 and 2006, 15 to 20 times per year, spending altogether cca. 360–380 days on the area. Investigations cover the western and central part of the Putnok Hills and the adjacent zone of the Sajó Valley. Sajó River was considered as the southern border, and the southern border of the main part of Aggtelek National Park as the northern border of the research area.

Investigations were prepared on the territories of the following 18 villages: Alsószuha, Dövény, Dubicsány, Felsőkelecsény, Felsőnyárad, Gömörszőlős, Imola, Jákfalva, Kelemér, Putnok, Ragály, Sajóalgóc, Sajókaza, Serényfalva, Szuhafő, Trizs, Zádorfalva and Zubogy. Total size of the research area is 28365 hectares, its population covers 18882 inhabitants (2001), meaning 66 people/km².

Geographical names, occurrence spots of certain taxa were registered according to the 1:10000 scale map published by the Institute of Cartography of the Hungarian Army.

During **floristical surveys**, enumeration of plant taxa follows the nomenclature of Simon (2000). Association names follow the coenosystematic system of Borhidi (2003). Nature protected species and their value are listed based on the relevant legislation (13/2001. (V. 9.) KöM enactment, modified by 21/2001. (IX. 28.) KöM enactment and 23/2005. (VIII. 31.) KvVM enactment).

In the nomenclature of **habitat types** based on vegetation, categories of the two-times modified General National Habitat Classification System (mmÁ–NÉR) were used, because during the national programme Mapping Hungary's Natural Vegetation Heritage (MÉTA, between 2003 and 2005) about 180 botanists mapping the habitats used this uniformed system, generated through several sample mappings. Habitat types presented in the dissertation were observed several (at least 4) times, in different stages and in different parts of the vegetation period.

A thorough **habitat map** was prepared together with my supervisor on the central part of the research area (40 km² sized area of the Suuha Valley around Dövény, Jákfalva, Sajóalgóc and Sajókaza villages) for the National Biodiversity Monitoring System (NBmR), using 1:10000 scale map, correctly signing the borders of certain habitat spots and giving their Á-NÉR categories¹. Species lists of the different habitat spots, indicating nature protected and invasive species, are presented in the Appendix of the dissertation.

During **coenological investigations** describing the most valuable habitats on their typical vegetation patches, the method of Braun–Blanquet (1964) was followed. Covering rates are given in percentage. Sizes of quadrates were 2x2 m in cliff and dry grasslands, 4x4 m on meadows and 20x20 m in forests.

The Herbarium Carpato-Pannonicum collection of the Botanical Collection of Hungarian Natural History Museum was reviewed concerning all the rare and/or nature protected species found in the area. Specimens collected with permission during the researches (*Pulsatilla pratensis* subsp. *zimmermannii*, *Scilla kladnii*) were placed there as well.

¹ During this habitat mapping, the new mmÁ–NÉR system was still under construction, this is why (and because of the descriptions of NBMR) Á–NÉR codes were used in the tables of the habitat map.

Pedological surveys (and in parallel ones concerning **erosion**) were prepared during the vegetation period of 2003, 2004 and 2005 years, on the most characteristic spots of valuable habitat types based on vegetation studies and on sample areas of extensive land use (small parcels of arable lands, mowed grasslands, grape yards), with help of colleagues from the Department Landscape Ecology and of Nature Conservation at Szent István University. Field observations were made partly by using a Pürckhauer sampler (Finnern 1994) and partly by exploring thorough soil profiles (Szabolcs 1966). Observed areas were the following ones: alluvial meadows and tall herb fringe communities of Alsó- and Felső-rét near Dövény; fen area of Alsó-rét near Alsószuha; fen spot along Keleméri Stream north of Gömörzölös; steppe grasslands generated since the abandonment of previous grape yards on Iván-tető near Zádorfalva; old grape yards and orchards with mowed lawns on Ragyás-szőlő hill area near Szuhafő; alder grove and oak-hornbeam forest of Bakóc Valley near Alsószuha; eastern hill slope of Lengyel-oldal near Alsószuha with three different type of vegetation (in the upper, middle and lower third of the slope); upper, middle and lower third of the slope on an eroded arable land in Cuda area near Gömörzölös.

Soil factors that are important from vegetation ecological aspect (pH, lime content, organic matter and nutrient content, water management factors) were analysed on collected samples based on the soil and agro chemistry analyses method books of Buzás (1988, 1993) in the laboratory of the Department of Pedology and Agro Chemistry of SzIU. Analysed parameters were the following ones: pH/H₂O, pH/KCl, humus % (with Tyurin method), total organic matter %, CaCO₃ %, AL-P₂O₅, AL-K₂O.

During the **detailed observations on historical forms and current methods of management**, besides giving a view on the characteristic management patterns of the macro region (Northern Hungarian Mountain Range) and within it, the 'eastern palóc' folk group, author concentrated mainly on the central and well detachable part of the research area (Szuha Valley, territory of Alsószuha, Dövény, Szuhafő and Zádorfalva villages) symbolising the backgrounds and conditions of the historical South Gömör region well, and the areas around Gömörzölös, because of the detailed literature data concerning the history of this village, designated to be „the Sustainable Village” through a foundation's programme.

Sources used during investigations on old management methods, landscape history and effects of land abandonment were the following ones:

- narrations of local inhabitants and colleagues of the Ecological Institute (Miskolc), the educational centre of Gömörzölös and the Aggtelek National Park Directorate,
- maps of military mappings (based on which changes in land use can be followed up well),
- descriptions given to the first military mapping (Csorba 1993),
- literature on ethnography and on history of cooperatives in the South Gömör region,
- meaning the thorough analysis of the library of Gömör Museum in Putnok town,
- and the collections on the history of villages in Gömörzölös (in the Tompa Mihály Library).

SUMMARY

In the current dissertation, introduction to the geographical situations of the observed area is followed by presenting botanical values, with referring to endangering factors and giving proposals on maintenance of habitats, and exploring traditional landscape management methods that play a crucial role in conserving rare species. Literature review, herbarium data, occurrence and endangering factors of plant taxa new for the area are also presented. During the observation of landscape management history, basically ethnographical and historical geographical works are analyzed with a landscape ecological approach and management focused point of view. By exploring botanical, pedological and management characteristics of the micro region, I wish to give basis for the elaboration of management plans for the Aggtelek National Park Directorate.

Among 807 taxa found, 144 can be pointed out as being nature protected (64 taxa) or meaning important occurrence for a broader area (80 taxa). One species was found as new for the Hungarian flora, 3 taxa are new for the *Matricum* territory (Northern Hungarian Mountain Range), 25 are new for the *Tornense* (territory between the Sajó and Hernád rivers), while 55 are new for the Putnok Hills and/or Sajó Valley micro regions. Literature and herbarium (found in the Herbarium Carpato-Pannonicum collection of the Botanical Collection of Hungarian Natural History Museum) data (closest occurrences to the spots where I found) of these 144 important taxa are also presented. Rare plant species were found mainly in wetlands, alder groves, extensively cultivated orchards and abandoned grape yards, meanwhile rare weed species were found on extensively cultivated arable lands. Most significant one is *Geum rivale*, a new member of the Hungarian flora. Besides that, *Iris aphylla* subsp. *hungarica*, *Pulsatilla pratensis* subsp. *zimmermannii*, *Oenanthe banatica*, *Cardamine glanduligera*, *Conringia orientalis*, *Rapistrum perenne*, *Orchis tridentata*, *O. militaris*, *Epipactis albensis*, *Carex cespitosa*, *Festuca javorkae*, *Stipa dasphylla* can be emphasized.

36 habitat types were found in the research area based on the modified Á-NÉR (Hungarian General Habitat Classification System) categories. 26 coenological investigations were made on the typical vegetation patches of the most valuable habitat types. Habitat map of the central part of the research area was also prepared (40 km² area in the Szuha Valley around Dövény, Jákfalva, Sajógalgóc and Sajókaza villages; scale: 1:10 000) with the list of species on 206 different patches.

Naturalness characteristics, endangering factors, current and proposed management methods of the 12 habitat groups occurring are presented. Detailed botanical and pedological descriptions of the most valuable habitat types (large sedge communities, tall herb fringe communities, *Molinia* meadows on peaty soils, alluvial meadows and lowland hay meadows, fen meadows, *Arrhenatherion elatioris* hay meadows and *Festuco rubrae*-*Cynosuretum* grasslands, alder groves, extensively cultivated orchards and abandoned grape yards, extensively cultivated arable lands, mosaic-situated agrarian habitats) are also presented. Meanwhile describing designated sample areas, botanical treasures, vegetation, management relations, soil and erosion characteristics (highly influencing arable land cultivation) and endangering factors are also covered.

Natural conditions of the observed territory are beneficial for forestry, hay meadow and pasture management, crop cultivation on arable lands with favourable soil conditions and less heat-demanding, not frost-sensitive horticultures. Thousand years old agricultural activities on diverse habitats of the Putnok Hills resulted in specially structured landscape mosaics.

Establishment of villages and development of arable lands happened by deforestation. The lairds did not forbid the conversion of forests into arable lands until the mid-18th century. Use of forests was subordinated for the interest of animal husbandry, which process (together with efforts to grow sprouts from the trees to harvest bark) resulted in a general fail of forests. Optimal relation between the capacity of agriculture to support population and the number of population was realized for the early 19th century. Village people interfered their overpopulation on their own (with migrating away). Coverage rate of arable lands, hay meadows and pastures was significantly lower than the national average in the 19th century. Crop production on arable lands served self-sufficiency.

The observed villages are surrounded by poorly fertile arable lands. Ecological factors are not beneficial for high-scale agricultural production, therefore, primarily forage for animal husbandry and potato and vegetables for self-sufficiency were produced in the second half of the 20th century, meanwhile, sheep breeding remained significant. After development of heavy industry in the Borsod Basin in the 1960's, a significant part of the inhabitants of villages became employed in mining and industrial centres and moved away from the area or started to commute, therefore the traditional small-parcel land use was abandoned in several areas and, because of decreasing animal stock, a part of the hayfields and pastures was also left. In the 1980's, only arable lands lying close to villages were managed. Most of former sheep pastures are currently unused. Abandoned arable lands are in different stages of succession, depending on the time passed since abandonment and invasive weed species are spreading on some wet meadows along streams. Mosaic situation of arable lands and relatively intact habitats assisted the new expansion of natural vegetation on the abandoned lands and, as a result of becoming grassland again, secondary slope grasslands generated, giving home for valuable plant species. Besides that, rare weed species of arable lands can also survive. Lawn below fruit orchards was mowed regularly, resulting in the generation of a habitat similar to forest steppes in a close-to-natural condition. Eroded surfaces of abandoned grape yards served the generation of secondary dry grasslands similar to steppe meadows, giving home for rare, nature protected plant species.

Naturalness characteristics did not decline on the observed area at a rate as in other parts of Hungary during the past centuries. Landscape use was characterized by rationality determined by natural conditions. Although, the landscape was converted into cultural landscape, artificial environment fitted into the frame of natural elements relatively harmoniously. Structure of tiny villages, lack of industry, agricultural character of the area, poorly fertile soils of arable lands, lack of farmers with capital for new production technologies, and, therefore, preservation of traditional extensive land use orienting to the natural conditions, peripheral condition of the region and lack of main roads with high traffic altogether supported the preservation of several natural values, habitats in good condition and mosaic-like, diverse cultural and semi-cultural landscapes. Land use of the territory is currently dominated by grassland and forest management methods. Arable lands realize an average of 10 percent of the total area, even less in some places. Determinant part of the area (above 80 percent) refers to natural or close-to-natural conditions. Based on the rate of nature conservation value categories, covering rate of species referring to natural conditions is relatively high, however, rate of species referring to degradation is also important in several patches. A reason for this phenomenon can be constant cultivation and disturbance of these areas in the past.

CONCLUSIONS AND SUGGESTIONS

Authors' researches strengthened the vision known from one-time travellers and researchers of the past, according to which Gömör–Kis-Hont County was considered as „the small Hungary” due to its diverse natural conditions. Natural conditions characteristic for hilly areas or flatlands of plains can be found together here, in the Putnok Hills.

The view of nature has changed elementarily on the observed areas in the presence of humans during the past centuries. Once extended forests and ancient marshy world along the river Sajó have been replaced by arable lands, pastures, hayfields, fruit orchards, grape yards and built areas for nowadays. Changes in the environment have been accelerated in the past decades: with its direct and indirect effects, heavy industry founded in the vicinity has decreased the size and naturalness of habitats further. On the other hand, however, by luring the working population away, has helped nature's new expansion and increasing mosaic-like areas in the landscape that has been threatened by intensive large-scale farming through a few decades. Abandonment of certain management methods, however, has strengthened deteriorating processes from a nature conservation point of view.

Natural environment of the Putnok Hills basically determines types and intensity of management activities, which fact is verified also by data gained during landscape historical studies. Settlement with remarkable population had been created only in the edges of the territory, not in a central position; therefore, settlements within the Putnok Hills cannot be mentioned even as basic centres. Despite the fact that mining has taken place in the southern, south-eastern part of the area, no remarkable industry has evolved; the villages are definitely agrarian settlements. Management was basically affected by the fact that there was a shortage of lands suitable for arable farming and even those were poorly fertile. Carrying capacity of the area is low, and population acted upon this well, this is why depopulation could have appeared only in a few villages (in favour of avoiding decrease of dominium sizes) before the urbanization processes of the second half of the 20th century. As peasants owning small or medium-sized dominium suffered from lack of capital, no new production technologies were introduced, therefore the traditional, extensive land use acting upon natural conditions, and the standard of production common in the whole country in previous times have remained in this area for a long time. Crop production and animal husbandry could ensure a modest life only complemented by the products of forests and home handcraft works.

Based on historical literature data it can be stated that, in spite of country roads avoiding its central parts, the villages of the Putnok Hills, situated peripherally in the border region of two historical counties Borsod and Gömör–Kis-Hont had extended commercial connections with dynamic industrial regions surrounding them until loosing territories after the 1st world war, when a majority of the villages has lost most of their administrative, commercial and cultural connections, and their state has continuously worsened since then. Creating some elements of infrastructure were not able to balance the decrease of other public services, this is why the population of villages, although at a slower rate currently, is still decreasing. All these processes, however, helped the conservation of several values of natural environment, habitats in good naturalness state and mosaic-like, diverse cultural and semi-cultural landscapes.

Based on multi-aspect survey approach and research it can be stated that the conditions of this landscape have constantly affected and formed the everyday life of its population. Humans tried to comply with the conditions determined by the landscape, and a conscious landscape altering activity using nature for their own interests also appeared: humans

increased the area of arable lands, hayfields and pastures by deforestation and uses forests for several aims.

Forestation has started and can be constantly followed also during the research period on hayfields and pastures of the Putnok Hills and the adjacent Sajó Valley as part of natural succession processes. Grazing and mowing have taken place on the meadows through centuries until the mid-20th century. Due to humans' and animals' presence, processes of succession could not start, since appearing trees and shrubs were mowed, grazed or trampled. Fortune of the grasslands is basically determined by their exposure, angle of slopes (from point of view of erosion and water stock) and vegetation cover, which affects water regime of the soil. This is why nature conservation activities may be made only customised, fitted to the conditions of the area and values to be preserved. In case of abandonment of small parcel grape yards, valuable plant species appear on the previously disturbed or eroded surfaces. Despite, abandoning mowing activities in extensive fruit orchards will result in becoming more shrubby and disappearing rare plant species. Natural or induced burning of grasslands in some years plays an important role in avoiding closing of vegetation cover and becoming shrubbier, in secondary, semi-natural dry grasslands, therefore they serve the preservation of their botanical values.

The Putnok Hills play an important role as green corridor between the Aggtelek and Bükk National Parks. Besides, it is important also as a buffer zone both towards these national parks and towards enriching the Sajó River (which has turned to be alive and has become much cleaner in the past few years), with its diverse habitats in a close-to-natural state in the vicinity of the Borsod industrial zone.

Stream valleys of the area play a crucial role in ensuring ecological connections and long moving possibilities between habitats. Maintaining or re-starting mowing on wet areas unfavourable for arable farming along the Szuha Stream (around Szuhafő, Zádorfalva, Alsószuha, Dövény and Jákfalva villages) makes it possible to roll back invasive plants, helps the regeneration of natural vegetation and preserves the characteristic landscape view.

Different habitats of the area give home for numerous management types from abandoned or extensively or intensively managed arable lands, through hayfields and pastures, until grape yards and fruit orchards, and all of these are surrounded by mild hill slopes and alder groves along streams. With the help of these border zones, harmonic management meets natural biotopes almost unnoticed. Different processes such as forestation, weedyess, generation of secondary grasslands and slope steppes, and the new expansion of species becoming rare in other parts of the country maintain diversity together. These dynamic changes, together with the population of tiny villages giving nice examples for sustainable management and lifestyle (e.g. in Gömörszőlős) make this area attractive not only for botanists, but also for everyday people who want to escape from the polluted environment of crowded towns.

Based on my field investigations the following areas are highly worth for nature protection: alluvial meadows along the Szuha Stream primarily between Alsószuha and Jákfalva villages; abandoned grape yards and extensively cultivated fruit orchards north of Gömörszőlős and between Zádorfalva and Szuhafő villages; alder groves north of Szuhafő; the Bakóc Valley near Alsószuha; the Hegyes-tető north of Putnok; and grasslands of Szár Hill, Ráró Hill and their surroundings north of Sajókaza.

Results of the research that is detailed exploration of vegetation types generated in the Putnok Hills (and soil types and old and current management patterns determining them) have a basic importance in favour of creating and extending a nature friendly management that

serves the preservation of rare and protected plant species and their natural or close-to-natural habitats, and avoids degradation. This way, the agri-environmental programme of this important Environmentally Sensitive Area can be organised well.

Factors threatening the explored habitats from a nature conservation point of view are the following ones (based on my researches):

- Decrease of livestock
- Depopulation of villages
- Abandonment of mowing on wet meadows and in extensively cultivated fruit orchards, generation of forestation and bushiness
- Mowing made by not suitable tool (big machines instead of hand mow or electric hand mow)
- Grazing made by not suitable animal species (sheep) or habitat type (wet meadows becoming dry)
- Overgrazing
- Damage made by the too big population of games
- Spontaneous appearance of not indigenous tree species (primarily *Robinia pseudo-acacia*)
- Weedyess, expansion of adventive (invasive) species strengthening nowadays (*Solidago canadensis* and *Helianthus decapetalus* on meadows; *Fallopia japonica* and *Bidens frondosus* along streams; *Ambrosia artemisiifolia* along dirt roads)
- Chemicals and organic materials leaching out from some remained large-scale arable land
- Fire-raising (village youth early Spring): although may be suitable in favour of avoiding forestation, however, it strengthens homogenising, decreases diversity and is extremely harmful for invertebrates
- Human trampling and flower collecting (primarily digging out *Iris sibirica*), illegal waste deposition (fortunately not usual).

Suggestions in favour of preserving the values of nature (based on the results):

- Regular mowing once a year (end of Summer) on wet meadows (large sedge communities, *Molinia* meadows on peaty soils, alluvial meadows and lowland hay meadows), which increases the aesthetic value of the landscape (feeling of being cared of) in parallel with avoiding weedyess and forestation
- Ensuring suitable water supply for wet meadows
- Extensive grazing of cattle completed by mowing (folded onto the aftercrop) on alluvial meadows (not in large sedge communities and tall herb fringe communities), avoiding overgrazing, mitigating trampling and manuring onto the smallest extent (by careful selection and usual change of the route leading to the pasture)
- Ensuring economic incentives in favour of mowing e.g. the „Habitat Development Programme for *Crex crex*”, or the „Maintenance of *Carex elata* communities, alluvial meadows and fens” Programme hopefully launched in the near future within the frames of the Environmentally Sensitive Areas Programme of the National Rural Development Plan

- Banning drainage and break of and artificial fertiliser use on natural grasslands
- Change from arable land use onto grassland use on arable lands created by melioration of wet meadows
- Mowing of *Arrhenatherion elatioris* hay meadows and grazing of *Festuco rubrae–Cynosuretum* grasslands by concentrating on animal carrying capacity (sheep herds are partly ensured for this)
- Avoiding forestation of grasslands by regular picking shrubs off in lack of grazing
- Banning forestation with not indigenous tree species and creation of monocultures (primarily in cases of *Robinia pseudo-acacia*, *Pinus* spp. and *Quercus rubra*)
- Close-to-natural forestry, maintaining rate and age structure of tree species similar to the natural conditions
- Maintaining the cultivation of orchards containing rare, old fruit breeds
- Mowing the grasslands of abandoned grape yards and orchards in favour of avoiding forestation and appearance of aggressive invasive tree species
- Abandoned parcels of grape yards are one of the most species rich areas of the cultural landscape, therefore their conservation and protection (and avoiding their new management) are highly important tasks
- Maintenance of small parcels of arable lands is favourable both from a culture historical and landscape diversity point of view and for nature conservation aspects as well
- Besides biological and landscape diversity, adequate cultivation structure of arable lands is important also in favour of preserving soil fertility and avoiding erosion
- In favour of generating maintenance methods, knowledge on management history of the landscape is also necessary.

Habitats of the observed area can be preserved and sustainable landscape management can be combined with eco-tourism based on local products, cleanness and calmness and with conservation of the traditional village view. In favour of realising sustainable development, economic, social and environmental aspects should be integrated, trans-sectoral thinking, multifunctional use of local resources and integrated planning based on carrying capacity, and conservation of organic culture are needed, long-term favours of the community should be put forward, reasons of problems should be answered systematically and different activities should be handled together in one uniform system.

NEW SCIENTIFIC RESULTS

1. I registered 807 vascular plants in the Putnok Hills micro region. I also found plant species that had no previous data from the area. Among vascular taxa I registered, 1 is new for the Hungarian flora (*Geum rivale*); 3 are new for the Matricum flora territory (*Bidens frondosus*, *Festuca javorkae*, *Oenanthe banatica*); 25 for the Tornense flora region (*Pulsatilla pratensis* subsp. *nigricans*, *Ceratophyllum submersum*, *Trifolium angulatum*, *Vicia cassubica*, *Myosotis nemorosa*, *Plantago major* subsp. *intermedia*, *Rapistrum perenne*, *Conringia orientalis*, *Sicyos angulatus*, *Iva xanthiifolia*, *Senecio erucifolius*, *Senecio aquaticus*, *Centaurea indurata*, *Cerastium dubium*, *Polygonum neglectum*, *Humulus scandens*, *Elodea canadensis*, *Potamogeton berchtoldii*, *Potamogeton lucens*, *Epipactis albensis*, *Orchis militaris*, *Festuca vojtkoi*, *Brachypodium rupestre* subsp. *rupestre*, *Hordeum murinum* subsp. *leporinum*, *Acorus calamus*); while 55 for the Putnok Hills or the Sajó Valley micro regions (*Equisetum ramosissimum*, *Dryopteris dilatata*, *Pulsatilla grandis*, *Clematis integrifolia*, *Ranunculus sardous*, *Aquilegia vulgaris*, *Prunus fruticosa*, *Chamaecytisus ratisbonensis*, *Trifolium fragiferum*, *Galega officinalis*, *Colutea arborescens*, *Peplis portula*, *Eryngium planum*, *Bifora radians*, *Oenanthe aquatica*, *Galium uliginosum*, *Geranium phaeum*, *Geranium palustre*, *Euphorbia salicifolia*, *Gentiana cruciata*, *Gentianopsis ciliata*, *Echium maculatum*, *Mentha pulegium*, *Gratiola officinalis*, *Veronica scutellata*, *Orobanche lutea*, *Cardamine amara*, *Cardamine glanduligera*, *Viola elatior*, *Pseudognaphalium luteo-album*, *Inula helenium*, *Rudbeckia laciniata*, *Galinsoga quadriradiata*, *Artemisia pontica*, *Cirsium palustre*, *Cirsium oleraceum*, *Crepis praemorsa*, *Primula elatior*, *Paris quadrifolia*, *Leucosium aestivum*, *Iris pumila*, *Juncus tenuis*, *Juncus atratus*, *Cephalanthera longifolia*, *Listera ovata*, *Dactylorhiza incarnata* subsp. *incarnata*, *Dactylorhiza majalis*, *Eriophorum latifolium*, *Carex buekii*, *Carex vesicaria*, *Glyceria declinata*, *Agrostis gigantea*, *Stipa dasyphylla*, *Leersia oryzoides*).

2. I described habitat types of the Putnok Hills micro region with traditional landscape management methods occurring on them and the endangering factors threatening them, this way I ensured data for future management plans in favour of preserving them.

3. I arranged into one unity the brief, monographic summary of variable data concerning the Putnok Hills presented in different forms of several types of publications, by analysing basically ethnographic and historical geographic works with a landscape ecological approach and management concerned point of view.

4. Based on my field investigations I suggested the following areas for nature protection: 1. wet meadows along the Szuha Stream between Alsószuha and Jákfalva villages; 2. abandoned grape yards and extensively cultivated fruit orchards north of Gömörszőlős and between Zádorfalva and Szuhafő villages; 3. alder groves north of Szuhafő; 4. the Bakóc Valley near Alsószuha; 5. the Hegyes-tető north of Putnok; 6. grasslands and grape yards of Szár Hill and Ráró Hill north of Sajókaza.

5. I stated that the abandonment of small parcels of grape yards in the Putnok Hills launched processes favourable for nature conservation (due to geological backgrounds). As a consequence of erosion driven by century-old hoeing and great slope angle, loessy parent material appeared on the surface, resulting in the appearance of protected plant taxa characteristic for loess grasslands of foothill regions.

6. Based on coenological investigations prepared in the habitat of *Stipa dasyphylla* near Sajókaza I stated that, because of its special species composition, it is well-founded to describe this plant association as a new coenotaxon.

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