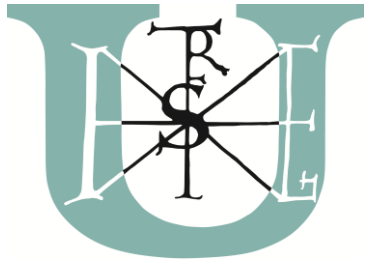

SZENT ISTVÁN UNIVERSITY

THESIS OF PHD DISSERTATION

TIPOLOGY AND NATURE CONSERVATIONAL ASPECTS OF WOOD PASTURES IN THE NORTH HUNGARIAN MOUNTAINS

Dénes Saláta

Gödöllő

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The doctoral school

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Approval of the Head of School Approval of the Supervisors

1. Premises and objectives

Wood pastures belong to the agro-forestry systems. These semi-natural habitats have paramount importance both worldwide, and in throughout Europe. In Hungary, despite their former wide distribution and intensive usage, as a result of mainly the processes that occurred in the 1950's – considering the current domestic researches and databases – relatively few areas have remained on countrywide or major geographical region level. Regarding most of the remained areas, their maintenance is handled by nature conservation, but in spite of this we have relatively few information and data even from the individual fields and even from the larger landscape units' wood pastures.

The North Hungarian Mountains, as a major geographical region with high forest coverage and significant expanse of natural protected areas, can be particularly suitable for analyzing the changes in land use and the examined habitat type's past and present. During the exploration of the current situation, the areas' identification and classification on major geographical region level, and the examination of the sample areas in the North Hungarian Mountains' wood pastures are needed. Therefore, the main aims of the dissertation:

1. Exploration of the North Hungarian Mountains' wood pastures, thereby the substantiation of the future cadastral works based on literary and visual sources.
2. Typology and classification of the North Hungarian Mountains' wood pastures, which can be the basis of the country-leveled typology too, based on foreign sources, examples and own researches.
3. Selection and complex research of study areas to assess the conservation status, considering the landscape diversity and the main successional stages of the North Hungarian Mountains' wood pastures.

2. Materials and methods

2.1. Collection of the potential wood pastures of the North Hungarian Mountains

During the research, I have found two visual sources, that allows the unified and accurate identification of the possible wood pastures, and also covers the whole researched area: these are the topographic maps from the 1980's (scale: 1:10000, source: Department of Geodesy Remote Sensing and Land Offices – FÖMI) and the satellite images of the Google Earth Pro collection. The large solitary trees and grasslands were marked specially on the topographic maps, so the spots where both signal codes appeared can be evaluated as grassy-woody areas. The scattered trees and the different vegetation of their environment can be clearly identified on the satellite photos.

The examination of the sources happened manually over several stages. During the overview of the maps, the signal codes gave an opportunity of a certain leveled reconstruction of the state of the areas. Next to the mentioned sources there is high priority for using the existing data (research work of Haraszthy et al. (1997), the verbal communications of informants, and the data of MTA ÖK ÖBI MÉTA).

The four sources were compared manually and the results were narrowed down to the areas, which can be found in many sources. The coverage, that I have got this way, was compared with the digital version of Marosi & Somogyi's (1990) inventory of microregions of Hungary; the free database of the national high-resolution CORINE Land Cover Database (CLC 50, scale: 1:50000, FÖMI); and also, with the following datasets of the Nature Conservation Information System Public Relations Module: national parks, landscape protection areas, nature conservation areas, high nature value areas, Nature 2000 sites and National Ecological Network.

2.2. Establishment of the typology

More classification systems were evolved for the identification of the wood pastures (and also the agro-forestry systems), but the most useable typological system was created by Holl & Smith (2002) because of its purpose and practical considerations. During the adaptation of the system, the Hungarian and Scottish field work and professional consultation with

Kate Holl had decisive importance, what revealed the parallelism, the main differences and location-dependent characteristics of the topic.

During the establishment of the classes, the main aspect was that it approaches the topic in a particular way, including the typical wood pasture type of the North Hungarian Mountains' mounds and hills, and also can be suitable for comparing them with foreign areas – even if only at the level of the main groups. An important aspect was the existence of the abandonment and the elapsed time since the abandonment.

I have chosen a temporary solution to create the domestic subclasses, in terms of the features related to arboreal species: I describe them with native and regionally native, native and regionally non-native, and non-native or invasive species, because in most of the cases the filling happens with invasive species, e.g. black locust-tree. I use the 'regionally non-native' phrase for the species, which are considered as forestry regionally non-native species by the forestry profession and the regulating forestry legalization (e.g. FM Decree 45/2015.). In spite of the accepted identification in botany and ecology these ones can be native species, but in the particular landscape they are non-native ones.

Considering the work of Holl & Smith (2002), I have supplied the adapted system with a 'identification key' to facilitate the orientation between the main groups – the 30% coverage value in the key corresponds to the legal environment (Act XXXVII., 2009).

Besides the typology, the number of the areas identified as wood pastures in the North Hungarian Mountains can prove to be an interesting question, too. The MÉTA project provides the most detailed data from the research area (Bölöni et al. 2011b), but if we consider the habitat-approached and historical data, the proportion of them will be higher than the 500 hectare areas referenced for the North Hungarian Mountains. Also, the data of Varga et al. (2014), which is based on the data of the MÉTA and fieldworks should be mentioned, too.

2.3. The study sites and the historical backgrounds of the nature conservation assessment

In the North Hungarian Mountains, during the adaptation of the typology, mainly the succession progress types dominate. I have selected study sites from the known wood pastures to make the research representative on a major geographical region scale, that are common spatial and use-abandonment examples in the case of the region (Figure 1.).

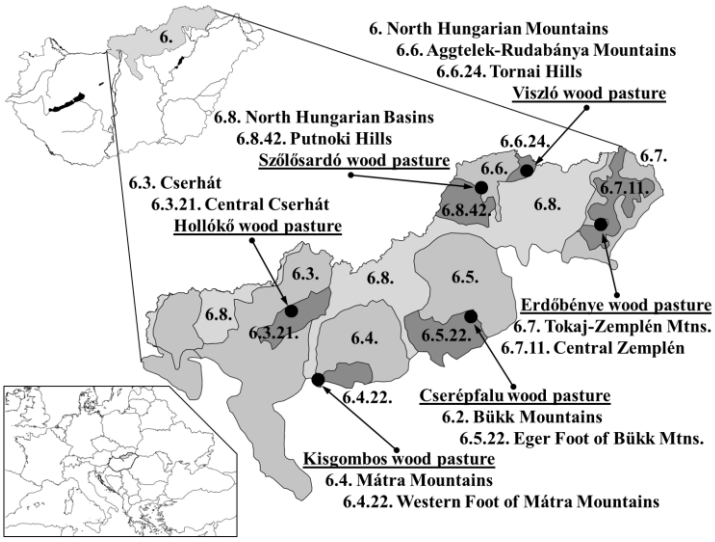

Figure 1. The location and the landscape environment of the researched areas
Complied with QGIS 2.8.0 'Wien' program
based on Marosi & Somogyi (1990) and Dövényi (2010)

Reflecting on the nature conservation aspects, the wood pasture of Cserépfalu (CSF) (174 hectares) affects the nature conservation area of Bükk National Park, the Habitat Directive Site called Hór-valley and South-Bükk, the Bird Directive Site called Bükk mountain and its periphery regions. The Erdőbénye (EB) wood pasture (214,6 hectares) is a nature conservation area. Its central and wood pasture parts were researched, supplemented by forested areas. The area concerns the Bird Directive Site of Zemplén Mountains with the Szerencs Hills and the Hernád-valley. The Hollókő (HK) wood pasture (31,6 hectares) is part of the Hollókő Landscape Protection Area, so it is a conservation area. The Kisgombos (KG) wood pasture (27,4 hectares contains 10 hectares of black locust forest) area is a non-protected, like the Szőlősardó (SZA) (29,5 hectares) and the Viszló (V) wood pastures (63 hectares) too.

In the case of each study site the unique stories are of high importance, so I reviewed the landscape historical sources' applicable parts, maps sections and records: Country description of the First Military Survey; First, Second and Third Military Surveys and the topographic maps from the period of the Second World War [MD Military History Institute and Museum Collection of Maps (HM HIM TT)]; 1:10.000 EOTR topographic maps (FÖMI); archive aerial photos (HM HIM TT and FÖMI), recent satellite images (Google Earth Pro). The obtained information was supplemented verbally by people involved in this research area.

2.4. Collection and evaluation of biotic data

Generally, in terms of the vegetation, the wood pastures and the study sites are relatively diverse and heterogeneous. The everyday practice – especially beyond the local scale – can hardly interpret the habitats, plant communities (and them heterogeneity) as treatment units, so I have used habitats in the meaning of 'appearance' of different parts during the work, which represent the 4 main directions of each area (Figure 2.):

- Treeless habitat [TL]: mostly treeless and shrub-free areas.
- Wood pasture habitat [WP]: classic wood pasture parts, where scattered trees can be found on the grass, their crown is not abutted and the presence of shrubs is not important in the case of the habitat.
- Shrubland habitat [SL]: the dominance of the shrubs influences the understorey – irrespectively of their height. In this habitat, it may occur on smaller, more opened areas, even trees, but the habitat is determined by shrubs (perhaps the density of the trees' regrowth)
- Woodland habitat [WL]: woody areas, which were mainly spawned from the earlier wood pastures' self-forestation. Inside the habitat there can be more open and shrubby spots but the habitat is determined by the closely standing trees and the crowns' high closure.

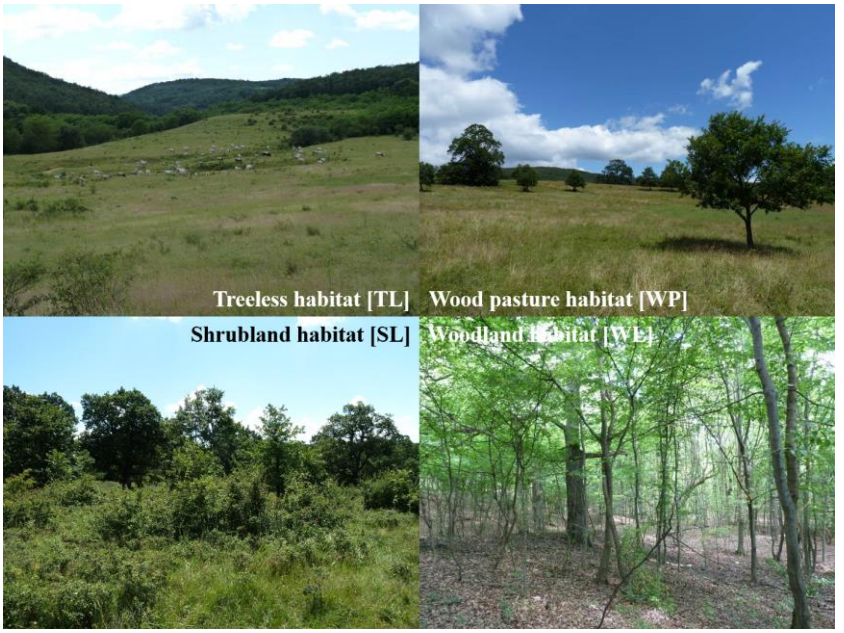

Figure 2. Typical examples of each habitats from the Cserépfalu wood pasture

This contraction amounts to the merging of the plant community/habitat-level information but this can serve as the basis for comparison in the case of this distance and landscape-level research. One third of the southern part of Kisgombos, and the area in Hollókő, from the road extending in the N-NE-S-SE direction to E – which includes almost the whole shrubland parts – have been disqualified from the data collection because of its disturbance.

2.4.1. Examination of the vegetation

The recording of botanical data was performed in July 2011. The records were made by the method of Braun-Blanquet (1964), in every level, but the coverage values were given proportionally in %, therefore the smaller areas can be characterized with at least 10-10 records in the case of every habitat. The size of the quadrats was 2×2 m for treeless and wood pasture habitats, 5×5 m for shrubland and 10×10 m for woodland parts.

I have examined the composition of the vegetation by Simon's (1988, 1992, 2000) nature conservation value categories (TVK), Borhidi's (1993, 1995, Horváth et al. 1995) social behaviour types (SBT), Pignatti's (2005) and Pignatti et al.'s (2001) life form types in the case of each species.

During the further examination of the woody vegetation, tree-ring sampling was done, in 4 cases from the 6 areas; I have ignored the two 'most valuable' areas in nature conservation. We took tree-ring samples from the area specific species' visibly healthy veteran tree specimens (13 pcs), and randomly from the younger woody plant specimens (14 pcs) with the help of a Pressler increment borer (Mora 5,15 mm core perimeter, 600 mm long, 2 cutting edge drills). During the processing of the samples, instead of the analogue methods I have used digital raster-based method, by using open-source, free softwares. I have scanned the polished samples with a 0,1 mm calibration slide and on the resulted raster I have recorded each of the growth-rings by lines, their length was measured with the help of proportions, so the raster stock of the samples and the vector layers containing the growth-ring's width were checked, and stored in one project.

During the collection of tree-rings, I have met with traces of dry-rot several times; out of the 27 samples, 5 were unsuccessful because of dry-rotting, which affected 4 veteran tree individuals, therefore in the case of Kisgombos wood pasture 3 individuals were examined with Fakopp 3D Acoustic Tomograph (Fakopp Bt., Fakopp n.a.).

2.4.2. Examination of bumblebees

The collection of bumblebee individuals done between the 14th and 24th July 2011 by fragrance-decoy [anethol-eugenol 9:1 (Hamilton et al. 1970)] with varsa trap (CSALOMON VAR-L). The determination of the traps happened in an area-proportion way, so we have placed at least one triple trap-group in each habitat of the research area. Based on the data of previous fieldworks and Bakos (2011), the south part of the Cserépfalu pasture, the bigger treeless part of Erdőbénye, the south part of Kisgombos, the east and west edge of Szőlősardó and the west edge of Hollókő area were disqualified during the sampling of the year 2011.

The bumblebees were identified by Réka Bakos on the basis of Móczár (1957) under the direction of Dr. Miklós Sárospataki. To complete the information gathered by the traps, while preparing the botanical records, observational data collection has happened in the immediate vicinity of the quadrats – with the exception of Hollókő and Kisgombos areas.

2.4.3. Ornithological observations

The collection of ornithological data happened with the help of Tibor Juhász and Ádám Izsó rangers in 2011; we have chosen the monitoring method, two-time point count as recommended, a relatively reliable method for the Hungarian fragmented habitats (Báldi et al. 1997, Szép 2000, 2007). During the work, we have applied the 'Hungarian Common Bird Monitoring Scheme' method (Szép and Nagy 2002, MME MK 1999-2011) developed by the Hungarian Ornithological and Nature Conservation Society to optimize the sample areas, which is less reticulated and adapts to the shape of the areas. Recording dates: Cserépfalu – 4th June (the first survey couldn't be realized); Erdőbénye – 23rd April and 21st May; Hollókő and Kisgombos – 28th April and 18th May; Szőlősardó and Viszló 24th April and 22nd May.

While processing and analysing the data, I have ignored the individuals, which were recorded beyond 100 metres and flown over the detection area, and the 1-1 extra records of Szőlősadró and Viszló wood pasture placed outside of the research area. The data was sorted according to the indicator values of each bird species (Szép 2007, Tucker & Evans 1997) considering the number of individuals.

The vegetation, bumblebee and ornithological data were analysed with hierarchical cluster [UPGMA (Unweighted Pair Group Method with Arithmetic Mean – group average procedure)] and ordination multivariate [PCA (Principal Components Analysis – major component analysis)] methods. In the case of botanical and ornithological data, I have studied diversity based on two most common diversity indexes [Shannon-Wiener (H) and Simpson (1-D)], the uniformity and the drawing of Rényi's diversity profiles. For the data management and processing I have applied Microsoft Excel 2013 and PAST – PAleontological STatistics 3.06 software packages, while the GIS work was completed by QGIS 2.12 'Lyon' program. The data management of the tree-rings happened by the using of TRiCYCLE 0.3.0 SNAPSHOT and Tellervo 1.2.1 program.

3. Results

3.1. Areas of the North Hungarian Mountains, that can be identified as wood pastures

As the result of the collation on the topographic maps, I could mark 659 points, which average about 291 meters in altitude. About 15% of the areas, (100 pieces) were recorded in good condition. The shrubbing, and the combined shrubbing areas amount to about 73,5% (485 pcs), the afforesting and afforesting-receding regions to about 8,3% (55 pcs), and the purely receding areas to about 2,9% (19 pcs).

I also used a multi-level collation based on typical disposition pictures, on the collection of Google Earth Pro satellite recordings from the past 10 years, by which I could find 240 identifiable and 148 possible wood pastures.

I manually compared the points taken from the topographic maps and satellite recordings with the data from the MÉTA project (76 pcs) and other sources (48 pcs). At least 2 confirmations from different sources were set as the minimum threshold, so the number of areas that could be marked has been reduced to 194 pieces (Figure 3.).

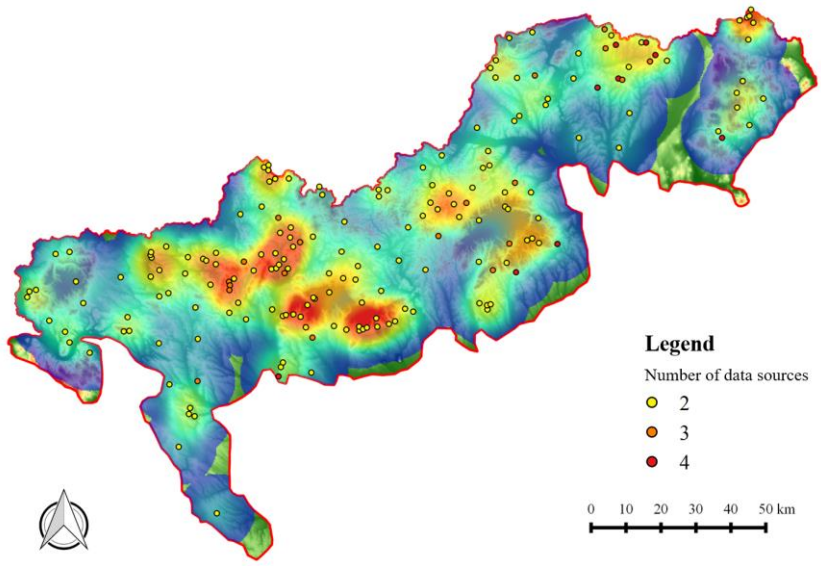

Figure 3. The locations and density of the wood pastures in the North Hungarian Mountains, based on multiple sources [2 (165 pcs) – 3 (20 pcs) – 4 (9 pcs)]
DEM source: Jarvis et al. (2008), Reuter et al. (2007)

The distribution of the areas is not even, there are areas of particular importance in the North Hungarian Mountains: the Cserhát, the Mátra, the Bükk foothill areas, the Aggtelek-Rudabánya Mountains, the Cserehát and the Zemplén Mountains. Narrowing the picture to microregion level, giving homes to at least 10 areas are: Central Cserhát, Southern Mátra and Central Zemplén. Other emphasized areas are the Terényi Hills, the Litke-Etes-Hills, the Egri-Bükkalja, the Uppony Mountains, the Putnok Hills and the Eastern Cserehát.

In the North Hungarian Mountains, manually collating the current data based on multiple sources on the land coverage of wood pastures, it can be said, that most of the potential areas can be characterized by 'spontaneously shrubbing-wooded', 'natural grasslands with trees and shrubs', 'natural open canopy deciduous forests on non-soggy areas' and 'natural closed canopy deciduous forests on non-soggy areas' land use classifications.

Examining the conservation concerns, it can be said, that 27,83% can be found on, or in contact with protected areas in the following distribution: 11,85% (23 pcs) National Park, 13,40% (26 pcs) Landscape Protection Area, 2,75% (5 pcs) Nature Reserve. It's worth noting, that the Márkházapuszta Wooded Pasture Nature Reserve (273 ha) and the Erdőbenye Wood Pasture Nature Reserve (214 ha) are independent nature reserves.

24 points can be marked as wood pasture in High Natural Value (HNV) areas, 8 in Bodrogköz, 4 in Bükkalja and 12 in Northern Cserehát HNVs. In terms of Natura 2000 areas, 32,99% (64 pcs) of the area is Bird Directive and 27,84% (54 pcs) is Habitat Directive Site. Some areas are affected by both category.

Based on the sources, 55,15% (107 pcs) of the marked wood pasture areas are considered as core area, 24,74% (48 pcs) as ecological corridor, and 5,67% (11 pcs) as buffer zone in the National Ecological Network – 166 pieces altogether, 85,57% of the total marked areas.

3.2. Typology of wood pastures in the hilly and mountainous regions of the North Hungarian Mountains

1. Active or recently abandoned wood pastures

1.1. Ancient wood pasture with long established semi-natural ground-flora (stability)

1.1.1. Tree species are native and regionally native*
1.1.2. Tree species are native and regionally non-native
1.1.3. Tree species are non-native or invasive

1.2. Ancient wood pasture with improved (intensive) grassland (stability)

1.2.1. Tree species are native and regionally native
1.2.2. Tree species are native and regionally non-native
1.2.3. Tree species are non-native or invasive

1.3. Ancient wood pasture with advanced leaf mould and young shrubs
(early stage of abandonement)

1.3.1. Tree species are native and regionally native
1.3.2. Tree species are native and regionally non-native
1.3.3. Tree species are non-native or invasive

1.4. Ancient wood pasture on agricultural, urban or other areas

1.4.1. Tree species are native and regionally native
1.4.2. Tree species are native and regionally non-native
1.4.3. Tree species are non-native or invasive

1.5. Young wood pasture

1.5.1. Tree species are native and regionally native
1.5.2. Tree species are native and regionally non-native
1.5.3. Tree species are non-native or invasive

2. Abandoned, infilled/infilling wood pastures

2.1. Long abandoned ancient wood pasture infilled with secondary evolved, mature woodland (self-reafforested and self-afforested ancient wood pastures)

2.1.1. Tree species of infilled woodland are native and regionally native
2.1.2. Tree species of infilled woodland are native and regionally non-native
2.1.3. Tree species of infilled woodland are non-native or invasive

2.2. Long abandoned ancient wood pasture infilled with under-planted and mature woodland (under-planted and reafforested ancient wood pastures)

2.2.1. Tree species of under-planted woodland are native and regionally native
2.2.2. Tree species of under-planted woodland are native and regionally non-native
2.2.3. Tree species of under-planted woodland are non-native or invasive

2.3. Recently abandoned ancient wood pasture infilled with shrubs or under-planted with young trees (self-reafforested and reafforested wood pastures)

2.3.1. Species of infilled shrubs and trees are native and regionally native
2.3.2. Species of infilled shrubs and trees are native and regionally non-native
2.3.3. Species of infilled shrubs and trees are non-native or invasive
2.3.4. Under-planted tree species are native and regionally native
2.3.5. Under-planted tree species are native and regionally non-native
2.3.6. Under-planted tree species are non-native or invasive

*I use the ’regionally non-native’ phrase in its forestry management meaning.

Identification key for the typology

1. Present of veteran trees
   - Yes 3
   - No 2
2. Wood pasture habitat (grassland component with scattered, possibly group of trees)
   - Yes Young wood pasture 1.5.
   - No Not wood pasture
3. Veteran trees with
   - More than 30% cover 8
   - Less than 30% cover 4
4. Coverage of veteran trees less than 30%
   - Non-pastoral landscape element Parks, orchards and abandoned grapeyards
   - Pastoral or grazing origin landscape element 5
5. Coverage of veteran trees less than 30%
   - Currently grazed 6
   - Currently non-grazed 7
6. Currently grazed
   - Ancient wood pasture with long established semi-natural ground-flora 1.1.
   - Ancient wood pasture with improved (intensive) grassland 1.2.
7. Currently non grazed
   - Ancient wood pasture with advanced leaf mould and young shrubs 1.3.
   - Ancient wood pasture on agricultural, urban or other areas 1.4.
8. Coverage of veteran trees more than 30%
   - Wood pasture with coverage 30-100% (old scattered trees) 9
   - Infilled with secondary evolved, mature woodland (older than 25 years) 2.1.
   - Infilled with under-planted mature woodland (older than 25 years) 2.2.
   - Infilled with shrubs or under-planted with young trees 2.3.
9. Wood pasture with coverage 30-100%
   - Currently grazed 6
   - Currently non-grazed 7
   - Non-pastural landscape element Parks, orchards and abandoned grapeyards

3.3. Historical overview of the study sites

When judging the current state of the wood pastures, and planning their rehabilitation, the history of the area can have major importance. In the case of the Cserépfalu site, it can be said, that based on the First Military Survey's (1782-85) country description (HM HIM TT) the area consisted of high-bodied and dense oak forests. On the Third Military Survey (1883) the wood pasture habitat was clearly identifiable, and the topographic maps made in the 1940's are the perfect depiction of the wood pastures. Based on the archive aerial photographs (1952, 1958, 1979) in addition to much denser stands, in the 1950's, signs of intensive land use and rarefaction were already present. Since their abandonment (possibly the 1980's), significant self-afforestation had begun. Since 2005, they have reestablished the pastures, after the grassland treatments, which included mechanical and manual fellings, stem-crushings, and reapings.

The Erdőbenye area was a high-bodied, dense oak forest at the end of the 18th century [The First Military Survey's (1782-85) country description HM HIM TT and Csorba (1990)]. The area is a smaller fragment of a much larger wood pasture, where signs of significant abandonment were not found. Since it has been declared protected, there are ongoing pasture maintenances: annual autumn reaping, stem-crushing, and the rehabilitation of self-afforesting areas.

The Hollókő area is a unique example of Hungary's (mountain range) wood pastures, because since 1987 Hollókő is part of the world heritage. Historically, on the First Military Survey (1752) it's not indicated as forest and no information can be found on the country description. On the Second Military Survey (1854-1855) it's already indicated as forest, and based on the picture it was a sparsely ingrown area, probably used as a pasture. In the 1940's, on the topographic maps, the area had the same key as the surrounding forests. The abandonment of certain parts of the area probably began in the 1960's, while in the 1980's the grazing has stopped completely. Since the end of the 2000's small parts have become pasture areas again.

The Hatvan-Kisgombos wood pasture's history has been revealed in detail, using several methods (Geiger 2010, Geiger ez al. 2011, Saláta et al. 2013a). On the First and Second Military Surveys (1783-1784 and 1855), it's indicated as forest. Based on the description it could have been similar to a classic wood pasture. The abandonment of the area has begun somewhere

around the 1980's. An educational trail can be found in the area, and it can be found as Kisgombosi Öreg Tölgyes in the settlement depository of the Hungarikum Committee, listed as national value, under the environment specialty category.

The history of the Szőlősardó area is less known. During the time of the First Military Survey (1782-85) the oak forests were high-bodied and sparse, easily permeable. Based on the sources, it can be stated, that it's a strongly decreased fragment of a once much bigger system, which permanent abandonment happened in the 1980's.

The history of the Viszló wood pasture is revealed (Kardos 2016), the area, during the First Military Survey (1784) was covered with high-bodied oak forests. In the second half of the 20th century, the area showed a well-maintained picture. Shrubbing has been experienced since the end of the 1980's, while the grazing stopped permanently in the 2000's.

3.4. Biotic results

3.4.1. Vegetation

While examining the vegetation of the sample sites, we recorded 290 species. 43,1% of the species came from 1, 24,83% from 2, 11,03% from 3, 12,41% from 4, 5,17% from 5 and 3,45% from 6 sites. Reviewing the results of the multivariational analysis it can be said, that based on the composition of the vegetation, the treeless and the wood pasture habitats' locations were relatively mixed and well separated from the shrubland and woodland habitats. The analysis based on the habitats shows that the treeless and the wood pastures are close to each other, while the shrubland, and especially the woodland habitats are separated. Comparing the sites, the Hollókő, the Viszló and the Cserépfalu wood pasture form a group, the Kisgombos area stand apart, while the Erdőbénye and the Szőlősardó area form a separated group. The former group's separation is the result of the presence of the Turkey oak (*Quercus cerris*) and partly the aspen (*Populus tremula*), the Erdőbenye and the Szőlősardó site is dominated by the common hornbeam (*Carpinus betulus*), while in the Kisgombos site, mostly field maple (*Acer campestre*) can be found.

Based on the Shannon and Simpson Diversity Indices the values of Hollókő are the highest (3,59 and 0,94), while the values of the Erdőbénye site are the lowest (2,78 and 0,85). Excluding these 2 areas the hypothesis,

that the abandonment and the self-reafforestation causes the diversity to decrease, can only be proven partly, since if we sort the areas in terms of abandonment (CSF → V → KG → SZA), it can be seen, that the Shannon index's values adjust to this line: 3,51 → 3,36 → 3,23 → 3,00, while the Simpson index's values do not: 0,91 → 0,93 → 0,94 → 0,89. Calculating the values on the habitats, the wood pastures, then the treeless, followed by the shrubland, and finally the woodland habitats can be considered one kind of sequence [WP (4,00/0,97) → TL (3,72/0,94) → SL (2,85/0,89) → WL (2,63/0,86)], which with the overall data proves the wood pasture's greater diversity. Based on the diversity profiles, all we can determine is that the wood pasture and the treeless habitat's values significantly exceed the values of shrubland and woodland habitats. Looking at the habitats of the sample area it has to be stressed out that in the case of three areas the wood pasture aparts while in another three cases the treeless parts had – among habitats in the site – the highest values.

Examining the distribution of the nature conservation categories, the disturbance resistant vegetation's lowest proportion is in Hollókő, while the highest is in Szőlősardó, with more than 42%. The order of species showing the natural condition and degradation is as follows: Hollókő (67,3/32,7), Erdőbenye (63,0/37,0), Cserépfalu (58,0/42,0), Viszló (53,6/46,4), Szőlősardó (53,2/48,8) Kisgombos (48,9/51,1). Only the Kisgombos area's proportion reaches the 50% mark. Examining per habitats, the woodland habitats has higher naturalness, while the treeless habitats are characterized by higher degradation rates, respectively. The rate of protected species is minimal, partly because the spring aspect hasn't been examined. It has to be stressed out that in the treeless, and wood pasture habitats, in addition to the relatively diverse rate of the weed species, the disturbance resistant vegetation's presence is significant.

Based on the evaluation of the social behavior of each area's vegetation, the rate of the natural competitors (C) is showing a relatively big diversity. In addition to the varying specialist species (S), whose proportion still stays below 5%, the rate of the generalist species is diverse: lowest is the Erdőbénye (11,39%), highest is the Viszló site (31,95%). The presence of natural pioneers (NP) is minimal. The proportion of the disturbance resistant species fluctuate between 18% and 31%. The weed proportion rate reaches 5% at the Hollókő area, and 8,55% at the Kisgombos area. The lowest rate of the endemic flora's ruderal competitors (RC) is about 1% in Erdőbenye, and

the highest is 9,7%, in Szőlősardó. Following the same direction on each area's habitats, Cserépfalu, Erdőbenye, and Hollókő's natural competitor rate follows the TL → WP → SL → WL increasing order. In the Kisgombos and Viszló sites the wood pasture habitats, while in Szőlősardó the treeless and wood pasture habitats show a higher generalist and weed species proportion. A great example is the Szőlősardó area's wood pasture habitat, in which the generalist, disturbance resistant, weed- and alien-aggressive competitor vegetation already supplanted the species hinting towards natural conditions. By and large it can be said, that thanks to the endemic shrub- and tree species, the shrubland and woodland habitats show a more natural picture, while the treeless and wood pasture habitats' have a higher rate of generalist and disturbance resistance species.

Examining the composition of the vegetation based on the Pignatti life form rankings, the annual (T) species coverage rate reaches the 5% mark only in the Hollókő area. The rate of further herbs – geophyton (G) and perennial plants (H) – is the lowest (46,2%) in the Erdőbenye area, while highest (66,3%) in the Hollókő area, though the grassland perennial plants' proportion (H caesp. e.g. *Poa* and *Festuca* species) is the lowest in this area. For the rest, the surface coverage of herbs and woody plants shows a 55-50/45-50% distribution. In the treeless and wood pasture habitats, typically the rate of the herbs, more precisely the grassland (H caesp) and the rising stemmed annual species (H scap) is more significant. In the shrubland and woodland habitats, the rate of the branched-growing trees and shrubs (P ceasp) and the columnar-growing trees (P scap) becomes significant. With the shrubbing, woody plants appear at a higher rate [apart from the P caesp and the P scap life forms, also the shrubs (NP)], the herbs are being suppressed, and in the end, during the self-reafforestation, with the increase in the proportion of trees, the rate of the shrubs is decreasing, while the herbs completely disappear, with the exception of a few life forms.

3.4.2. Examination of the age of the woody vegetation

In the case of wood pastures, the woody vegetation has particular importance, especially the old veteran trees, because they are habitats on their own, they lend a distinctive picture of the land with their special shape, they are important elemets of the biotope network and they represent significant genetic values.

The examined wood pastures tree specimens are mostly divided between sessile oak (*Quercus petraea*) and Turkey oak (*Q. cerris*). Their perimeter is varying between 200-300 cm, their age rarely passes 200 years, which doesn't mean that there can't be 300 years old trees on these areas, but guessing without inquiry always requires increased attention and temperance.

Among the growing patterns based on tree-ring some similarities can be experienced, which at least in this case, can be seen from the growth sequence of more than 100 years old specimens from two separate oak species (e.g. 1870-1880, 1905-1920, 1920-1950 or 1980-1995). These latter ones are probably thanks to the large scale climatic effects, while the former ones can be explained by the effects on each individual tree (Saláta et al. 2013a), and the area's microclimatical conditions. The younger tree- and shrub specimens can be put into two main sections age-wise: 40-50(60) and 20-40 years – except for the Szőlősardó area's 60-80 years old hornbeam and sessile oak specimens.

The 3 pieces of oak from Kisgombos has been examined with the Fakopp method. After examining the results, it can be seen – even with the specimens found healthy during the increment boring – that the inside of the trunks shows a loose, probably decayed tissue, which draws attention to the significane of the veteran trees, and also to the importance of a – more or less – destruction-free examination.

3.4.3. Bumblebees

In 2011, we were successful in collecting 6 bumblebee species [buff-tailed bumblebee (*Bombus terrestris*), garden bumblebee (*B. hortorum*), common carder bee (*B. pascuorum*), shrill carder bee (*B. sylvarum*), red-tailed bumblebee (*B. lapidarius*) and the red-shanked bumblebee (*B. ruderarius*)] with trapping, of which the *B. sylvarium* is protected. The bumblee species' domestic occurrences does not contradict the work of Józan (2011).

In several habitats this method failed to collect bumblebees, or in many cases we could only collect one, or two species', one or two specimens. There is not a single habitat or area, where all six species could be found. The *B. terrestris* and the *B. hortorum* was found in all 6 areas, while the *B. sylvarum* appeared only in 1, the Viszló wood pasture.

Examining the similarity of the bumblebee communities of each habitat it can be said, that the separation of the groups is due to the three most common species' (*B. terrestris*, *B. hortorum* and *B. pascuorum*) presence/absence, or the number of specimens.

During the supplementary observations, both on the Erdőbenye and on the Cserépfalu sites, 1-1, non-trapped, new species were found, moreover the method increased the number of specimens taken from the traps, at least on the treeless and wood pasture habitats. During the observation of Szőlősardó and Viszló areas, no bumblebees were found.

Comparing the list of bumblebee species collected and detected in 2011 based on the UTM segment network with the work of Sárospataki et al. in 2003, it can be stated, that the *B. terrestris* had three, the *B. hortorum* had four, the *B. pascuorum* had two, the *B. sylvarum* had one, the *B. lapidaries* had two, and the *B. ruderarius* had two new occurrences in two UTM quadrats.

3.4.5. Ornithological data

While collecting the ornithological data, 52 bird species' 573 specimens could be recorded within the sampling circuits. 48 of the 52 species are under protection. Some species occurred in almost every area's each habitat, while some species were found sparsely, possibly only in one study site on only in one habitat.

Sorting the data by areas, it can be said, that 7 species were only found on the Cserépfalu area, 7 only on the Kisgombos, 4 only on the Erdőbenye, 4 only on the Viszló, and 2 only on the Hollókő sites. All species recorded on Szőlősardó area were also found on other areas. Using the same sorting method by habitats, it can be said, that 4 species occurred only in woodland, 5 only in treeless, 6 only in wood pasture and 6 only in shrubland habitats. Examining the number of species and specimen based on habitats, the treeless habitats fall behind – except for the Szőlősardó area, where the area and its surroundings' strong shrubbery could serve as an explanation.

The species typically found on agricultural areas [e.g. common starling (*Sturnus vulgaris*), european turtle dove (*Streptopelia turtur*)] could be found in treeless and wood pasture habitats, nonetheless the red-backed shrike (*Lanius collurio*) have also been spotted in shrubland habitats, while the yellowhammer (*Emberiza citrinella*) also occurred in shrubland and

woodland parts. In most of the areas the forest species [e.g. common chiffchaff (*Phylloscopus collybita*), common nightingale (*Luscinia megarhynchos*), Eurasian blue tit (*Parus caeruleus*)] preferred the woodland, shrubland and wood pasture habitats. The distribution of the generalist species [e.g. Eurasian blackcap (*Sylvia atricapilla*), common chaffinch (*Fringilla coelebs*), great tit (*Parus major*)] showed a relatively large diversity.

By examining the habitats' species and specimen numbers with multivariatonal methods, it can be said, that the Cserépfalu area's woodland and wood pasture areas, the Erdőbenye area's wood pastures, and the Hollókő area's treeless habitats differ the most from the others, from which the treeless habitats are mostly situated closer to each other, while the shrubland and woodland parts are located in a mixed order. The ordination analysis supplement this: the locations of the wood pasture habitats, in terms of the closeness of the treeless, shrubland and woodland areas, are mixed, drawing attention to their complex nature. Comparing the habitats, the shrubland and woodland areas show a relatively close relationship, while the wood pasture habitats differ on a higher level, and the treeless habitats firmly differentiate from the previous three.

The Rényi diversity profiles cross each other in multiple cases, nevertheless on the currently used, or recently abandoned areas, the curves of the wood pasture habitats are running higher, while on the areas abandoned a long time ago – except for Szőlősardó's woodland areas – the shrubland and woodland habitats curves are running higher. Comparing the diversity profiles calculated from the overall data of the habitats, we can conclude, that the wood pasture habitat has the highest diversity, followed by the shrubland and woodland habitats, and finally by the treeless habitats.

Based on the thermal imagery of the observed bird specimens' distribution, it can be concluded, that all six areas have more or less preferred points, parts, which can not only be wood pasture habitat, but also treeless, shrubland or woodland habitat.

3.5. New scientific results

- Developing a new, GIS based indetification method to collect the eligible wood pasture areas of the North Hungarian Mountains, and to serve as ground for later cadastre works on a national level.

- By comparing the different databases with the developed method, 194 areas in the North Hungarian Mountains, confirmed by several sources, can be designated and analyzed in many point of views.

- By reviewing the domestic and foreign typologies of different perspectives, developing a system adapted to the local conditions, which classifies wood pastures, that can be the basis for a national typology.

- Based on the results of the vegetation survey from the wood pasture study sites in the North Hungarian Mountains, I concluded, that despite the low overlap of the species, overall, the wood pasture habitat possesses the highest diversity values, which is followed in order by the treeless, shrubland and woodland habitats.

- Based on the complex biotic survey of the wood pasture study sites of the North Hungarian Mountains, the role of wood pastures in biodiversity preservation is confirmed, but during a reasonable conservation treatment, in addition to the wood pasture habitats' emphasized preservation, a common, complex formation is sought after with the treeless, shrubland and woodland habitats.

Novel scientific result

- The application of a novel GIS based method in the subject of wood pastures to process the tree-ring samples taken from the woody plant vegetation.

4. Conclusions and suggestions

Because of their historical aptitude, wood pasture was a widespread land use in the North Hungarian Mountains (Varga and Bölöni 2009), but being endangered makes the cadastrate inspection an urgent, albeit substantian matter. It was my goal during my work to establish a cadastre on a major geographical region level. To achieve this, I have developed a new GIS based scientific method to identify wood pastures, and to be able to compare them with different data bases. Based on the results, it can be said, that in a topographical point of view, most of the wood pasture areas can be found on foothill areas, and only few of them could be considered to be in a good condition during the making of the 1:10.000 scale topographic maps. The signs of shrubbing and self-reafforestation was present on the maps on most of the areas. Comparing the datas of the satellite images, the MÉTA data base, and the WWF surveys, I can point out 194 pieces of land, which primarily concentrate in Cserhátvidék, in North Hungarian basins, and in the Bükk-Mátra area.

Land use can be described with the CORINE land use classification as ‘spontanious shrubbing-afforesting’, ‘natural grassland with trees and shrubs’, ‘open canopy natural deciduous forest on non-soggy area’, and ‘closed canopy natural deciduous forests on non-soggy area’. Examining their conservational concerns, it can be said, that most of them aren’t under protection, but 23 pcs are in contact with national parks, 26 with protected areas, and 5 with nature reserves. Considering the latter, it’s important to emphasize, that the Erdőbenye and Márkházapuszta wood pastures are independent nature reserves on about 487 hectares, which contradicts that the wood pasture land use in the North Hungarian mountains is around 500 hectares (Bölöni et al. 2011b), especially, if we take into account the relatively good conditioned Cserépfalu wood pasture’s more than 100-hectare area. It has been confirmed by several sources that most of the areas are part of the Natura 2000 sites or National Ecological Network, which points out, that on the examined area, nature conservation plays a key role in the preservation of the wood pasture areas and values they represent.

It’s important to designate, do a field inspection, and to survey the condition of the potential, almost 200 areas as soon as possible, but these tasks are beyond the scope of this thesis.

To get better knowledge of the North Hungarian Mountains' wood pastures, we should classify them (Bergmeier et al. 2010) with a system, that, in addition to being able to record conditions, it offers a practical point of view, and can be used without scientific experience. Out of the classification methods thus far, the Holl and Smith typology, made for the Scottish Natural Heritage in 2002, fits these conditions, and during joint work it has been proved, that with a proper adaptation, it's applicable to the examined area. While configurating it to the local conditions, the visualization of the progression of succession, and the threat of invading species were key standpoints. The developed typology with the attached identification key is suitable to reach the goals.

To supplement the work made in GIS environment, and to get to know the wood pasture areas of the North Hungarian Mountains, the appointed areas, both from landscape, succession, and conservation point of view, give the cross-section of the land with the term that there are no identical wood pastures, histories, or ecological aptitude, fauna and flora, so their treatment is unique to a certain level. Examining their history, it can be stated, that on a national level, the First Military Survey's country description (1782-1785) is the one, that has a good chance of giving data on the habitats, or in a lucky case, on the wood pasture itself, but at least on the forest surrounding the settlement. The first visual source being applicable on a nation level, where the examined land use can be seen, is the collection of the topographic maps made during World War II (1941-1944), while the archive aerial photographs made during the second half of the 20th century provides thorough data of the area. In spite of all these, while examining a wood pasture's history, the mentioned sources have to be included in the research.

Based on the unique history of the study sites, overall it can be said, that the utilization of wood pastures has begun to change after the 1950's (with the increasing shrubbing, and area overuse), their abandonment has begun in the 1980's at the latest, which confirms the results of the historical researches (Saláta 2009, Varga et al. 2012, Samu et al. 2015) – in some cases it has already taken place. Its worth mentioning, that based on the aerial surveys of the Erdőbenye, Hollókő and Szőlősardó areas, we are talking about a fragment of a much larger areas, used as either wood pasture or grazing forest. The only chance of survival for the areas under conservational protection and management, is to ensure rehabilitation works, stem-crushings, reaping and grazing.

The wood pasture, having significant natural and conservation assets, furthermore thanks to the positive margin effect, is considered a higher diversity area (Haraszthy et al. 1997). Although these values, with the changes in the areas' usage and habits, could disappear.

Based on the results of the vegetation inquiries, it can be said, that the area's floral overlap is relatively low, but comparing the areas' habitats, the treeless and the wood pasture parts show an increasing resemblance to each other, rather than the shrubland or woodland habitats found on the same area, moreover the former habitats' diversity values are steadily climbing. By performing the diversity research on all four habitats, I can comfirm the previous assumptions (Haraszthy et al. 1997), the wood pasture habitat has the highest diversity values. The treeless, shrubland and woodland habitats follow it in order. Performing the diversity inquiries on the areas, the assumption, that the abandonment (Mitlacher et al. 2002, Catorci et al. 2011a, 2011b) and the self-reafforestation affect the vegetation (Jávor et al. 1999, Vandenberghe et al. 2007), can be proven, their diversity decreases. The Erdőbenye and Hollókő areas, found at the ends of the abandonment row, serve as an exception – the former one's diversity indicators are the lowest, while the latter one's are the highest, which is partly because of the environmental assets, on the Erdőbenye site it's partly because of the land use (Fuls 1992, Holl and Smith 2002), and partly because of the Hollókő area's wood pasture and woodland habitats high diversity.

The cover ratio of the species suggesting naturalness and degradation is also most favorable on the Hollókő and Erdőbenye areas, while only in the case of Kisgombos, the ratio is under 50%, which latter can be explained by significant disturbance in the past, and by the fact, that the area is surrounded by arable lands and instensively cultivated orchards (Geiger et al. 2011, Saláta et al. 2013a). Examining the distribution by habitats, the woodland parts are usually the ones with higher naturalness, while the treeless habitats have the higher degradation.

Examining the vegetation by social behavior types reaveals that thanks to the endemic shrub- and tree species' presence the shrubland and woodland habitats show a more natural picture, while the flora of the treeless and wood pasture habitats can be described with a higher proportion of generalist and disturbance resistant vegetation, which confirms the former habitats reason of existence.

Examining the vegetation by life form types outlines that the treeless and wood pasture habitats are dominated by herbs, while the shrubland and woodland habitats by woody plants.

Examining the age of the woody plants on four areas, I could point out, that the age of the older trees – regardless of their perimeter – rarely reach 200 years, so estimating their age without inquiry requires more attention and temperance. The younger shrub- and tree specimens age groups confirm the data of the history of abandonment. The tree-ring samples and the results of the 3D acoustic tomograph survey of Kisgombos draws attention to the particular importance of the veteran trees (Hartel et al. 2014), and to the widespread and – more or less – destruction-free examination.

Based on the results of the collection of the bumblebee biotic data, the areas are moderately rich, 6 species' 69 specimens could be collected with trapping, but in several habitats, no specimens could be collected with the method. In the case of all 6 species, new occurrence data could be provided to the work of Sárospataki et al. made in 2003. Despite of the low species and specimen number it can be seen, that the bumblebee community of the areas is determined by the presence of the three most common species (*Bombus terrestris*, *B. hortorum* and *B. pascuorum*). The observation supplementing the trapping significantly increased the number of specimens found in the traps, moreover they added new species to the outcome of the trappings, confirming the statement of Bakos (2011) and Vaskor (2013) suggesting that the method requires improvement. No new species were found on the Szőlősardó and Viszló areas, which can be explained by the decrease in the ratio of the blooming plants during the drier periods in July (Vaskor et al. 2015).

Based on the data expanded with the observations, on the Cserépfalu and Erdőbenye areas, the highest species and specimen numbers were on the wood pasture habitats, but some specimens could also be found in the treeless, shrubland and woodland habitats. So, it can be stated, that the presence of all 4 habitats – in addition to the proper use of the land – is important to diversify the structure, which can contribute to the sustain of the bumblebee communities (Carvell 2002, Sárospataki et al. 2016).

During the collection of the data based on the locally optimized MMM protocol, 52 bird species' 573 specimens could be observed. Looking at the ratio based on the indicator value of the different bird specimens, the

agricultural area specific species were typically found in treeless and wood pasture habitats, but there were some species, which specimens were also observed in shrubland and woodland habitats. In the majority of the areas the forest species were typically found in the woodland, shrubland and wood pasture habitats, while the proportion of the specimens of the generalist species shows a relatively huge variety. Based on these, it can be stated, that with the changes in the areas, the bird communities are also changing (Gregory et al. 2005). In terms of composition the treeless habitats show greater resemblance to each other, than the other habitats. All in all, they show a mixed picture, which draws attention to the importance of all 4 habitats, the important role of the shrubland and woodland habitats, and to the fact, that the given locality played only a small role in the composition of bird communities.

According to the results of the diversity research, in the case of the currently used, or recently abandoned areas, the wood pasture habitats show larger values, while on the areas with advanced succession mostly the shrubland and woodland habitats showed larger diversity, and overall the wood pasture habitats possess the largest diversity (Hartel et al. 2014), confirming that their proper use could contribute to the protection of diversity (Báldi et al. 2004, Ceia and Ramos 2016). Depicting the distirubtion of noticed specimens, and the bird communities observed in the given period on a heat map it can be seen, that all 4 habitats, thus also the presence of shrublands are important (Batáry et al. 2014, Hartel et al. 2014).

5. Publications related to the dissertation

Peer-reviewed articles with impact factor

1. Kiss T. – Lévai P. – Ferencz Á. – Szentes Sz. – Hufnagel L. – Nagy A. – Balogh Á. – Pintér O. – **Saláta D.** – Házi J. – Tóth A. – Wichmann B. – Penksza K. (2011): Change of composition and diversity of species and grassland management between different grazing intensity in Pannonian dry and wet grasslands. Applied Ecology and Environmental Research 9(3): 197-230. (IF 2010: 0,547)

Peer-reviewed articles in Hungarian

2. **Saláta D.** (2009): Legelőerdők egykor és ma – A fás legelők és legelőerdők kialakulásának és hasznosításának emlékei egy öreg-bakonyi (pénzesgyőr-hárskúti) fás legelő tájtörténeti feltárásának példáján keresztül. Erdészettörténeti Közlemények (Historia Forestalis) LXXIX.: 1-80. (teljes szám)
3. Geiger B. – **Saláta D.** – Malatinszky Á. (2011): Tájtörténeti vizsgálatok a kisgombosi fás legelőn. Tájökológiai Lapok 9(2): 219-233.
4. **Saláta D.** – Wichmann B. – Házi J. – Falusi E. – Penksza K. (2011): Botanikai összehasonlító vizsgálat a Cserépfalui és az Erdőbényei fás legelőn. Animal welfare, etológia és tartástechnológia – AWETH 7(3): 234-262.
5. **Saláta D.** – Falusi E. – Wichmann B. – Házi J. – Penksza K. (2012): Faj- és vegetáció-összetétel elemzése eltérő legeltetési terhelés alatt a cserépfalui és az erdőbényei fáslegelők különböző növényzeti típusaiban. Botanikai Közlemények 99(1-2): 143-159.
6. **Saláta D.** – Pető Á. – Kenéz Á. – Geiger B. – Horváth S. – Malatinszky Á. (2013): Természettudományos módszerek alkalmazása tájtörténeti kutatásokban – Kisgombosi esettanulmány. Tájökológiai Lapok 11(1): 67-88.
7. Penksza K. – Pápay G. – Házi J. – Tóth A. – Saláta-Falusi E. – **Saláta D.** – Kerényi-Nagy V. – Wichmann B. (2015): Gyepregeneráció erdőirtással kialakított gyepekben mátrai (Fallóskút) mintaterületeken. Gyepgazdálkodási Közlemények 2015(1-2): 31-44.
8. Penksza K. – Fehér Á. – **Saláta D.** – Pápay G. – S.-Falusi E. – Kerényi-Nagy V. – Szabó G. – Wichmann B. – Szemethy L. – Katona K. (2016): Gyepregenációs és vadhatás vizsgálata cserjeirtás után parádóhutai (Mátra) mintaterületen. Gyepgazdálkodási Közlemények 14(1): 31-41.
9. Katona K. – Fehér Á. – Szemethy L. – Saláta D. – Pápay G. – S.-Falusi E. – Kerényi-Nagy V. – Szabó G. – Wichmann B. – Penksza K. (2016): Vadrágás szerepe a mátrai hegyvidéki gyepek becserjésedésének lassításában. Gyepgazdálkodási Közlemények 14(2): 29-35.

Conference proceedings in English

10. Uj B. – Penksza K. – **Saláta D**. (2014): Study on the changes of vegetation composition of the wood pasture near Cserépfalu, Hungary (2011-2014). in: A. Čelkova (ed.): 21st International Poster Day and Institute of Hydrology Open Day – Transport of water, chemicals and energy in the soil-plant-atmosphere system – Proceedings of peer-reiviewed contributions. 13th of November 2014, Institute of Hydrology SAS, Račianska 75, Bratislava, Slovak Republic, ISBN 978-80-89139-33-0, pp. 359-366.

11. Uj B. – Penksza K. – **Saláta D**. (2014): Study on the changes of vegetation composition of the wood pasture near Cserépfalu, Hungary (2011-2014). in: A. Čelkova (ed.): 21st International Poster Day and Institute of Hydrology Open Day – Transport of water, chemicals and energy in the soil-plant-atmosphere system – Proceedings of peer-reiviewed contributions. 13th of November 2014, Institute of Hydrology SAS, Račianska 75, Bratislava, Slovak Republic, ISBN 978-80-89139-33-0, pp. 359-366.
12. Kardos Zs. – Saláta-Falusi E. – Penksza K. – **Saláta D.** (2016): Vegetation changes between 2011 and 2016 on Viszló Wood-Pasture, North Hungarian Mountains in: A. Čelkova (ed.): 23rd International Poster Day and Institute of Hydrology Open Day – Transport of water, chemicals and energy in the soil-plant-atmosphere system – Proceedings of peer-reiviewed contributions. 10th November 2016, Institute of Hydrology SAS, Dúbravská cesta 9., Bratislava, Slovak Republic, ISBN 978-80-89139-38-5, pp. 53-57.

Conference proceedings in Hungarian

13. **Saláta D**. – Varga A. – Malatinszky Á. – Kenéz Á. – Penksza K. (2010): Előtanulmány a magyarországi fás legelők és legelőerdők XIX-XX. századi történetéhez. Tájhasználat és tájátalakulás a 18-20. században. VIII. Tájtörténeti Konferencia. 2010. július 8-9-10., Kalocsa, Környezetkímélő Agrokémiáért Alapítvány, ISBN 978-963-06-2214-1, pp. 102-108.
14. Geiger B. – **Saláta D.** – Malatinszky Á. (2011): A hatvan-kisgombosi fás legelő tájtörténeti vizsgálata. Erdei Ferenc VI. Tudományos Konferencia. 2011. Augusztus 25., Kecskemét, ISBN 978-963-7294-98-3 Ö, I. kötet ISBN 978-963-7294-99-0, pp. 603-607.
15. Bakos R. – **Saláta D.** – Malatinszky Á. – Sály P. – Horváth S. – Sárospataki M. (2011): Előzetes vizsgálatok a cserépfalui fás legelő poszméh faunisztikai és botanikai viszonyainak feltárásához. Erdei Ferenc VI. Tudományos Konferencia. 2011. Augusztus 25., Kecskemét, ISBN 978-963-7294-98-3 Ö, III. kötet ISBN 978-615-5192-01-2, pp. 215-219.
16. **Saláta D.** – Geiger B. – Pető Á. – Horváth S. – Kenéz Á. – Malatinszky Á. (2012): Természet- és történelemtudomány határán – Különböző tudományterületek integrálása a Kisgombosi Fás Legelő tájtörténeti kutatásának példáján in Füleky Gy. (szerk.) (2012): A táj változásai a Kárpát-medencében – Történelmi emlékek a tájban. IX. Tájtörténeti Konferencia kiadványa. Balatoni Múzeum, Keszthely, 2012. június 21-23. Környezetkímélő Agrokémiáért Alapítvány, Gödöllő, ISBN 978-963-06-2214-1, pp. 297-302.
17. Bakos R. – **Saláta D.** – Sály P. – Vaskor D. – Horváth S. – Malatinszky Á. – S-Falusi E. – Penksza K. – Sárospataki M. (2012): Fás legelők poszméh-közösségeinek vizsgálata az Északi-középhegységben botanikai adatok figyelembevételével. Magyar Biológiai Társaság XXIX. Vándorgyűlése, Előadások összefoglalói, 2012. október 19. Magyar Biológiai Társaság, Fővárosi Állat- és Növénykert, Budapest, ISBN 978-963-87343-6-5, pp. 65-71.
18. **Saláta D.** – Selmeci M. – Szalai D. – Szalai T. (2013): Táj- és területhasználat-történeti adatok jelentősége földhasználati rendszerek tervezésénél. Gazdálkodás és Menedzsment Tudományos Konferencia – „Környezettudatos gazdálkodás és menedzsment" Kecskeméti Főiskola, Kertészeti Főiskolai Kar, Kecskemét, 2013. szeptember 5., ISBN 978-615-5192-19-7 Ö, II. kötet ISBN 978-615-5192-21-0, pp.1020-1024.

19. **Saláta D.** – Varga A. – Penksza K. – Malatinszky Á. – Szalai T. (2013): Agrárerdészeti rendszerek és alkalmazási lehetőségeik a hazai ökológiai gazdálkodásban. IV. Gödöllői Állattenyésztési Tudományos Napok és XIII. Risk Factor of Food Chain konferenciákon megjelent előadások és poszterek anyagai. AWETH 9(3): 315-320.

Conference abstracts in English

20. **Saláta, D**. – Kenéz, Á. – Malatinszky, Á. – Penksza K. (2010): Landscape historical research of the wood pasture between Pénzesgyőr and Hárskút villages, Bakony Mts., Hungary. Workshop on Landscape History, 22. April 2010, Sopron, Hungary. p. 29.
21. **Saláta D**. – Penksza K. – Malatinszky Á. – Kenéz Á. – Szentes Sz. (2010): Wood-pastures of Hungary, a disappearing silvopastoral system. Grassland in a changing world – European Grassland Federation 23th General Meeting. August 29th – September 2nd 2010, Kiel, Germany. Book of Abstracts p. 183. Poster No. 5.1.31.
22. Varga A. – Bölöni J. – **Saláta D.** – Molnár Zs. (2011): Grazed woodlands, wood pastures and abandoned wood pastures in the Carpathian-basin from the 18th century until today. Frontiers in Historical Ecology 2011. 30th of August to 2nd of September, Birmensdorf, Switzerland. p. 45. Poster No. PB4.
23. **Saláta D.** – Geiger B. – Pető Á. – Horváth S. – Kenéz Á. – Malatinszky Á. (2013): On the frontier of natural and historical sciences: An integrated multi-proxy approach to assess the landscape history and evolution of Kisgombos Wood Pasture, Hungary. Circulating natures: Water - Food - Energy: Abstract book of the 7th Conference of the European Society for Environmental History. 2013. augusztus 21-24., München, Németország, p. 137.
24. **Saláta D.** – Bakos R. – Malatinszky Á. – Sárospataki M. – Penksza K. (2013): Data to the vegetation and bumblebee fauna of the wood pastures in the North Hungarian Mountains. „VIII. Carpathian Basin Biological Symposium – I. Sustainable development in the Carpathian Basin" international conference, Book of abstracts. Szent István University, Gödöllő, Hungary, ISBN 978-963-269-387-3 p. 64.
25. Uj B. – Penksza K. – **Saláta D**. (2014): Study on the changes of vegetation composition of the wood pasture near Cserépfalu, Hungary (2011-2014). 21st International Poster Day and Institute of Hydrology Open Day – Transport of water, chemicals and energy in the soil-plant-atmosphere system – Abstracts. 13th of November 2014, Institute of Hydrology SAS, Račianska 75, Bratislava, Slovak Republic, pp. 24-25.
26. Uj B. – Penksza K. – **Saláta D**. (2014): Study of the wood pasture near Cserépfalu: changes of vegetation composition between 2011-2014. „II. Sustainable development in the Carpathian Basin" international conference, Book of abstracts. Budapest, 2014. december 11-12. Szent István University Press, Gödöllő, Hungary, pp. 151-154.
27. **Saláta D.** – Bakos R. – Malatinszky Á. – Juhász T. – Izsó Á. – Sárospataki M. – Penksza K. (2015): Complex research on biodiversity (flora, bumblebee and common bird fauna) of wood pastures in the North Hungarian Mountains. ICCB ECCB 2015 Mission Biodiversity: Choosing New Paths for Conservation, 27th International Congress for Conservation Biology and 4th European Congress for Conservation Biology, Montpellier, France, 2-6. August 2015., Abstract Book. Society for Conservation Biology. p. 606.

28. Uj B. – Házi J. – Pápay G. – **Saláta D.** – Penksza K. (2015): Effects of the conservation management on the grassland vegetation of Sár Mountain in Hungary. ICCB ECCB 2015 Mission Biodiversity: Choosing New Paths for Conservation, 27th International Congress for Conservation Biology and 4th European Congress for Conservation Biology Montpellier, France, 2-6. August 2015., Abstract Book. Society for Conservation Biology. p. 716.
29. **Saláta D.** – Malatinszky Á. – S.-Falusi E. – Penksza K. (2016): Studies on botany of wood pastures in the North Hungarian Mountains. In: Agrillo, E. – Attore, F. – Spada, F. – Casella, L. (eds.): 25th Meeting of the European Vegetation Survey, Book of Abstracts, 2016. április 6-9., Sapienzia University, Róma, 115 p., p. 90.
30. Kardos Zs. – Saláta-Falusi E. – Penksza K. – **Saláta D.** (2016): Vegetation changes between 2011 and 2016 on Viszló Wood-Pasture, North Hungarian Mountains. 23rd International Poster Day and Institute of Hydrology Open Day – Transport of water, chemicals and energy in the soil-plant-atmosphere system – Abstracts. 10th November 2016, Institute of Hydrology SAS, Dúbravská cesta 9., Bratislava, Slovak Republic, p. 10. (p. 327.)

Conference abstracts in Hungarian

31. Bakos R. – **Saláta D.** – Sárospataki M. (2011): Poszméhfaunisztikai vizsgálatok az Északi-középhegység fás legelőin. VII. Magyar Természetvédelmi Biológiai Konferencia. 2011. november 3-6., Debrecen.
32. Bakos R. – **Saláta D.** – Sárospataki M. (2011): Poszméhfaunisztikai vizsgálatok az Északi-középhegység fás legelőin. I. SzaKKKör Konferencia – Szakkollégiumok konferenciája a környezet- és természetvédelemért. Az I. SzaKKKör konferencia elődásainak összefoglalói. Szent István Egyetem, 2011. november 14., Gödöllő, ISBN 978-963-269-281-4 p. 28.
33. **Saláta D.** – Honfy V. – Varga A. – Malatinszky Á. – Penksza K. (2012): Agroerdő-gazdálkodás, különös tekintettel európai és hazai példákra. XVII. Bolyai Konferencia, 2012. május 5., Bolyai Kollégium, Budapest. No. XXI. p. 30.
34. **Saláta D.** – Honfy V. – Varga A. – Malatinszky Á. – Penksza K. (2012): Agroerdő-gazdálkodás, mint multifunkcionális mezőgazdasági területhasználat – európai és hazai formák. II. SzaKKKör Konferencia – Szakkollégiumok konferenciája a környezet- és természetvédelemért. II. SzaKKKör konferencia előadásainak összefoglaló CD kiadványa. Szent István Egyetem, 2012. május 7., Gödöllő, ISBN 978-963-269-288-3 p. 38.
35. Vaskor D. – Bakos R. – **Saláta D.** – Sárospataki M. (2013): Természetvédelmi kezelés alatt álló fás legelők poszméhközösségei. XVIII. Bolyai Konferencia, 2013. március 23-24., Bolyai Kollégium, Budapest. No. XLIII. p. 47.
36. Vaskor D. – Bakos R. – **Saláta D.**– Lengyel A. – Penksza K. – S.-Falusi E. – Malatinszky Á. – Sárospataki M. (2013): Természetvédelmi kezelés alatt álló fás legelők poszméhközösségeinek vizsgálata. IV. SzaKKKör Konferencia – Szakkollégiumok konferenciája a környezet- és természetvédelemért. IV. SzaKKKör konferencia előadásainak összefoglaló CD kiadványa. Szent István Egyetem, 2013. április 22., Gödöllő, ISBN 978-963-269-346-0 p. 12.
37. **Saláta D.** – Varga A. – Penksza K. – Malatinszky Á. – Szalai T. (2013): Agrárerdészeti rendszerek és alkalmazási lehetőségeik a hazai ökológiai gazdálkodásban. IV. Gödöllői Állattenyésztési Tudományos Napok. Előadások és

poszterek összefoglaló kötete. 2013. október 24-26., SZIE, Mezőgazdaság- és Környezettudományi Kar, Gödöllő, ISBN 978-963-269-385-9 p. 41.

38. Varga A. – Bölöni J. – **Saláta D.** – Biró M. – Horváth F. – Samu Z. T. – Bodor Á. – Molnár Zs. (2014): Magyarországi fáslegelők és legelőerdők jelenlegi természetvédelmi helyzete és problémái. In: Schmidt D. – Kovács M. – Bartha D. (szerk.): X. Aktuális Flóra- és Vegetációkutatás a Kárpát-medencében nemzetközi konferencia absztraktkötete. 2014. március 7-9., Nyugat-magyarországi Egyetem Kiadó, Sopron, ISBN: 978-963-334-153-7. 235 p., p. 225.
39. Pápay G. – Házi J. – Besnyői V. – **Saláta D**. – Uj B. – Fürjes Zs. (2014): Cserjeirtás hatásainak vizsgálata a Mátrában (A case study of the effects of shrub eliminating in Mátra Mts.). „II. Sustainable development in the Carpathian Basin" international conference, Book of abstracts. Budapest, 2014. december 11-12. Szent István University Press, Gödöllő, Hungary, pp. 117-118.
40. **Saláta D.** – Bakos R. – Malatinszky Á. – Juhász T. – Izsó Á. – Sárospataki M. – Penksza K. (2016): Biodiverzitás vizsgálatok az Északi-középhegység két Natura 2000-es fás legelőjén. In: Zimmermann Z. – Szabó G. (szerk.): Natura 2000 területek természetvédelmi vizsgálatai, élőhelykezelési, fenntartási tapasztalatai a „Fenntartható fejlődés a Kárpát-medencében III." című konferenciasorozat keretében. Absztraktkötet. 2016. március 17-18., Szent István Egyetem, Egyetemi Nyomda, ISBN 978-963-269-526-6, 80 p., p. 69.
41. Kardos Zs. – S.-Falusi E. – Penksza K. – **Saláta D.** (2017): A növényzet változásainak vizsgálata a viszlói fás legelőn (2011-2016). In Hajdu T. – Hanga Z. – Korsós Z. – Mecsnóber M. – Penksza K. – Surányi D. (szerk.): A Magyar Biológiai Társaság XXX. Vándorgyűlése – Program és összefoglalók, 2017. február 17-18., Magyar Biológiai Társaság, Budapest, ISBN 978-963-87343-8-9, 120 p., p. 95.
42. Katona K. – Fehér Á. – Szemethy L. – **Saláta D.** – Pápay G. – S.-Falusi E. – Kerényi-Nagy V. – Szabó G. – Wichmann B. – Penksza K. (2017): Növényevő vadfajok szerepe a mátrai gyepek szukcessziós folyamataiban. In Hajdu T. – Hanga Z. – Korsós Z. – Mecsnóber M. – Penksza K. – Surányi D. (szerk.): A Magyar Biológiai Társaság XXX. Vándorgyűlése – Program és összefoglalók, 2017. február 17-18., Magyar Biológiai Társaság, Budapest, ISBN 978-963-87343-8-9, 120 p., p. 28.

Peer-reviewed book chapter in English

43. Centeri Cs. – Renes, H. – Roth, M. – Kruse, A. – Eiter, S. – Kapfer, J. – Santoro, A. – Agnoletti, M. – Emanueli, F. – Sigura, M. – Slámová, M. – Dobrovodska, M. – Štefunková, D. – Kučera, Z. – **Saláta D.** – Varga A. – Villacreces, S. – Dreer, J. (2016): Wooded grasslands as part of European agricultural heritage. In: Agnoletti, M. – Emanueli, F. (Eds.): Biocultural Diversity in Europe. Environmental History 5. Springer International Publishing, ISBN 978-3-319-26313-7, DOI 10.1007/978-3-319-26315-1, 555 p.

6. References

Bakos R. (2011): Poszméh együttesek összehasonlító vizsgálata a cserépfalui fás legelő különböző növényborítású területein. Diplomadolgozat, SZIE ÁOTK Biológiai Intézet, Budapest, 51 p.

Batáry P., Fronczek, S., Normann, C., Scherber, C., Tscharntke, T. (2014): How do edge effect and tree species diversity change bird diversity and avian nest survival in Germany' largest deciduous forest? Forest Ecology and Management 319: 44-50.

Báldi A., Moskát Cs., Szép T. (1997): Madarak – Nemzeti Biodiverzitás-monitorozó Rendszer IX. Magyar Termszettudományi Múzeum, Budapest, 81 p.

Báldi A., Verhulst, J., Kleijn D. (2004): Eltérő intenzitással kezelt agrárterületek madárközösségeinek összehasonlítása. Természetvédelmi Közlemények 11:449-455.

Bergmeier, E., Petermann, J., Schröder, E. (2010): Geobotanical survey of wood-pasture habitats in Europe: diversity, threats and conservation. Biodiversity and Conservation 19: 2995-3014.

Borhidi A. (1993): A magyar flóra szociális magatartás típusai, természetességi és relatív ökológiai értékszámai. JPTE Növénytani Tanszék, Pécs, 91 p.

Borhidi A. (1995): Social behaviour types, the naturalness and relative ecological indicator values of the higher plants in the Hungarian flora. Acta Botanica Academiae Scientiarum Hungaricae 39: 97-181.

Bölöni J., Molnár Zs., Kun A. (szerk.) (2011b): Magyarország élőhelyei – Vegetációtípusok leírása és határozója ÁNÉR 2011. MTA Ökológiai és Botanikai Kutatóintézete, Vácrátót, 441 p.

Braun-Blanquet, J. (1964): Pflanzensoziologie. 3. kiadás. Springer-Verlag, Wien-New York. 865 p.

Carvell, C. (2002): Habitat use and conservation of bumblebees (Bombus spp.) under different grassland management regimes. Biological Conservation 103: 33-49.

Catorci, A., Ottaviani, G., Ballelli, S., Cesaretti, S. (2011a): Functional differentiation of central apennine grasslands under mowing and grazing disturbance regimes. Polish Journal Ecology 59(1): 115-128.

Catorci, A., Ottaviani, G., Cesaretti, S. (2011b): Functional and coenological changes under different long-term management conditions in Apennine meadows (central Italy). Phytocoenologia 41(1): 45-58.

Ceia, R.S., Ramos, J.A. (2016): Birds as predators of cork and holm oak pests. Agroforestry Systems 90: 159-176.

Csorba Cs. (1990): Zemplén vármegye katonai leírása:1780-as évek. Borsodi Levéltári Füzetek 32. 238 p.

Dövényi Z. (szerk.) (2010): Magyarország kistájaink a katasztere. 2., átdolgozott és bővített kiadás. MTA FKI, Budapest, 876 p.

Fakopp (n.a.): Fakopp 3D Acoustic Tomograph User's Manual. Fakopp Bt., Ágfalva, 41 p.

Fuls, E.R. (1992): Ecosystem modification created by patch-overgrazing in semi-arid grassland. Journal of Arid Environments 23(1): 59-69.

Geiger B. (2010): Botanikai és tájtörténeti vizsgálatok a Kisgombosi Fás Legelőn. TDK dolgozat, SZIE MKK KTI Természetvédelmi és Tájökológiai Tanszék, Gödöllő, 76 p.

Geiger B., Saláta D., Malatinszky Á. (2011): Tájtörténeti vizsgálatok a kisgombosi fás legelőn. Tájökológiai Lapok 9(2): 219-233.

Hamilton, D.W.N, Schwartz, P.H., Townshend, B.G. (1970): Capture of Bumble Bees and Honey Bees in traps baited with lures to attract Japanese beetles. Journal of Economic Entomology 63(5): 1443-1445.

Haraszthy L., Márkus F., Bank L. (1997): A fás legelők természetvédelme. WWF füzetek 12, Budapest, 23 p.

Hartel T., Hanspach, J., Abson, D.J., Máthé O., Moga, C.I., Fischer, J. (2014): Bird communities in traditional wood-pastures with changing management in Eastern Europe. Basic and Applied Ecology 15: 385-395.

Holl, K., Smith, M. (2002): Ancient Wood Pasture in Scotland: Classification and Management Principles. Scottish Natural Heritage Commissioned Report F01AA108.

Horváth F., Dobolyi Z.K., Morschhauser T., Lőkös L., Karas L., Szerdahelyi T. (1995): FLÓRA adatbázis 1.2 – Taxonlista és attribútum-állomány. Vácrátót.

Jarvis, A., Reuter, H.I., Nelson, A., Guevara, E. (2008): Hole-filled seamless SRTM data V4, International Centre for Tropical Agriculture (CIAT), available from http 12.

Jávor A., Molnár Gy., Kukovics S. (1999): Juhtartás összehangolása a legelővel. In: Nagy G., Vinczeffy I. (szerk.): Agroökológia – Gyep – Vidékfejlesztés, pp. 169-172.

Józan Zs. (2011): Checklist of Hungarian Sphecidae and Apidae species (Hymenoptera, Sphecidae and Apidae). Natura Somogyiensis 19: 177-200.

Kardos Zs. (2016): A viszlói fás legelő rehabilitációjának megtervezése természetvédelmi szempontok figyelembe vételével. Szakdolgozat. Szent István Egyetem, Mezőgazdaság- és Környezettudományi Kar, Természetvédelmi és Tájgazdálkodási Intézet, 53 p.

Marosi S., Somogyi S. (szerk.) (1990): Magyarország kistájainak katasztere. MTA FKI, Bp., 1024 p.

Mitlacher, K., Poschlod, P., Rosén, E., Bakker, J.P. (2002): Restoration of wooded meadows – a comperative analysis along chronosequence on Öland (Sweden). Applied Vegetation Science 5: 63-73.

MME MK (1999-2011): Mindennapi Madaraink Monitoringja. MME Monitoring Központ, Nyíregyháza, digitális verzió: http 26.

Móczár M. (1957): Méhfélék – Apidae. Hymenoptera III. Magyarország állatvilága, Fauna Hungariae 13. kötet, 13. füzet, Akadémiai Kiadó, Budapest, 76 p.

Pignatti, S., Bianco, P.M., Fanelli, G., Paglia, S., Pietrosanti, S., Tescarollo, P. (2001): La piante come indicatori ambientali – Manuale tecnico-scientifico. ANPA Agenzia Nazionale per la Protezione dell'Ambiente, Dipartimento Stato dell'Ambiente, Contorlli e sisteni Informativi és Centro Tematico Nazionale, Conservazione della Natura, Roma-Aosta, 108 p.

Pignatti, S. (2005): Valori di bioindicazione delle piante vascolari della Flora d'Italia (Bioindicator values of vascular plants of Flora of Italy). Braun-Blanquetia 39: teljes szám

Reuter, H.I., Nelson, A., Jarvis, A. (2007): An evaluation of void filling interpolation methods for SRTM data, International Journal of Geographic Information Science 21(9): 983-1008.

Saláta D. (2009): Legelőerdők egykor és ma. Erdészettörténeti Közlemények 79: 1-80.

Saláta D., Pető Á., Kenéz Á., Geiger B., Horváth S., Malatinszky Á. (2013a): Természettudományos módszerek alkalmazása tájtörténeti kutatásokban – Kisgombosi esettanulmány. Tájökológiai Lapok 11(1): 67-88.

Samu Z.T., Bódis J., Varga A. (2015): Egy belső-somogyi fás legelő múltja, jelene és jövője természetvédelmi szempontból. Természetvédelmi Közlemények 21: 253-261.

Sárospataki M., Novák J., Molnár V. (2003): Hazai poszméh- és álposzméhfajok (Hymenoptera: Apidae, Bombus és Psithyrus) UTM-térképezése és az adatok természetvédelmi felhasználhatósága. Állattani Közlemények 88(1): 85-108.

Sárospataki M., Bakos R., Horváth A., Neidert D., Horváth V., Vaskor D., Szita É., Samu F. (2016): The role of local and landscape level factors in determing bumblebee abundance and richness. Acta Zoologica Academiae Scientiarum Hungaricae 62(4): 387-407.

Simon T. (1988): A hazai edényes flóra természetvédelmi-érték besorolása. Abstracta Botanica 12:1-23.

Simon T. (1992): A magyarországi edényes flóra határozója. Tankönyvkiadó, Budapest, 892 p.

Simon T. (2000): A magyarországi edényes flóra határozója. Harasztok – virágos növények. Nemzeti Tankönyvkiadó, Budapest, 976 p.

Szép T. (2000): A madár-monitorozás új módszerei és lehetőségei. Ornis Hungarica 10(1-2): 1-16.

Szép T. (2007): Madarak monitorozása – Ökológiai és evolúciós folyamatok feltárásának lehetőségei. Doktori disszertáció. Nyíregyházi Főiskola, Nyíregyháza. 150 p.

Szép T., Nagy K. (2002): Mindennapi Madaraink Monitoringja (MMM) 1999-2000. MME Birdlife Hungary, Budapest, 41 p.

Tucker, G.M., Evans, M.I. (1997): Habitats for birds in Europe: a conservation strategy for the wider environment. BirdLife International, Cambridge, 464 p.

Vandenberghe, C., Freléchoux, F., Moravie, M.-A., Gadallah, F., Buttler, A. (2007): Short-term effects of cattle browsing on tree sapling growth in mountain wooded pastures. Plant Ecology 188: 253-264.

Varga A., Bölöni J. (2009): Erdei legeltetés, fáslegelők, legelőerdők tájtörténete. Természetvédelmi Közlemények 15: 68-79.

Varga A., Bölöni J., Molnár Zs. (2012): Egy beerdősült fás legelő tájtörténete és faállományszerkezete. Kitaibelia 17(1): 153.

Varga A., Bölöni J., Saláta D., Biró M., Horváth F., Samu Z.T., Bodor Á., Molnár Zs. (2014): Magyarországi fáslegelők és legelőerdők jelenlegi természetvédelmi helyzete és problémái In: Schmidt D., Kovács M., Bartha D. (szerk.): X. Aktuális Flóra- és Vegetációkutatás a Kárpát-medencében nemzetközi konferencia absztraktkötete. 2014. március 7-9., Nyugat-magyarországi Egyetemi Kiadó, Sopron, p. 225.

Vaskor D. (2013): Fás legelők eltérő vegetációtípusainak összehasonlítása poszméhek közösségszerkezeti jellemzői alapján. Diplomadolgozat, SZIE ÁOTK Biológiai Intézet, Budapest, 43 p.

Vaskor D., Józsan Zs., Lengyel A., Sárospataki M. (2015): Féltermészetes gyepek és parlagok méhközösségei és növény-megporzó kapcsolatai a Cserhátban. Természetvédelmi Közlemények 21: 383-394.