

## Landscape changes in a 19<sup>th</sup> century wood pasture and grazing forest

PETRA BARTUS<sup>1</sup>, CSABA BARÁZ<sup>2</sup> and ÁKOS MALATINSZKY<sup>1</sup>

### Abstract

The Bükk Mountains were covered by continuous forests even in the 18<sup>th</sup> century. First plans for exploitation originate from the late 1700's; thus, this is the time when planned forest management in the Bükk Mountains started. Our aim is to shed light on land use and historical land cover changes of the grazing forest and wood pasture on the Magas Hill Forest (Ózd–Egercsehi Basin, NE-Hungary) since the 18<sup>th</sup> century, describe its current state (based on ethnographical data, maps, and field research), and give suggestions on its reconstruction and conservation management. The hills around Egercsehi and Mikófalva villages were once covered by 808.5 ha continuous grazing forest. This forest has almost totally disappeared, and one-time oak forests show no continuity with today's black locust stands, despite for a 35.3-ha patch in the southern slope of Magas Hill. This remnant is a various mosaic of closed forest, degraded grazing forest, wood pasture, clearing, and grassland, with old (150–200 year) veteran trees. As a consequence of no management (abandonment of forest grazing), original vegetation has almost totally been abolished by invasive alien species. Area of mowed, open grassland is 5.3 ha, while 20.1 ha commemorates on the one-time wood pasture, the remaining is shrubby (spontaneously) with afforestation. The area is not listed in the Hungarian cadastre of wood pastures. This register lists 6 wood pastures in Heves County; this current one is the 7<sup>th</sup>. The unique stand of veteran trees is still visible and the process of scrub encroachment might be stopped by adequate management, therefore, valuable habitats can be conserved. In favour of reconstruction of the wood pasture – grazing forest mosaic and maintenance of the desirable state, we suggest beef and sheep grazing, combined with mowing, depending on the state of afforestation.

**Keywords:** wood pasture, grazing forest, landscape change, forest use, landscape history, Bükk Mountains

### Introduction

Wood pastures and grazing forests have been determinant characters of the European landscape (GILLET, F. 2008; GARBARINO, M. *et al.* 2011), and play significant role in biotope networks and biodiversity conservation, as they host plant and animal species that are tied to natural or semi-natural, and agricultural areas as well (JOSE, S. 2012). Their high biodiversity is ensured basically by old veteran trees, dead trees, shrubs, and non-intensive grasslands (SZABÓ, M. *et al.* 2007; HARTEL, T. *et al.* 2013). According to PLIENINGER, T. *et al.* (2015), wood pastures are archetypes of

High Nature Value areas, and cover about 203,000 km<sup>2</sup> throughout the European Union. They highlight the landscape value, dynamic character and genetic resources as well as aesthetic, recreational, cultural values and role in traditional ecological knowledge. Wood pastures and grazing forests are well organised systems, but cannot exist without human activities and thus, are sensitive to management intensity (SALÁTA, D. *et al.* 2007; BARCZI, A. and NAGY, V. 2016).). Due to changes in management regimes, they are endangered in many European countries (BERGMEIER, E. *et al.* 2010), especially in those areas where the climax vegetation is any kind

<sup>1</sup> Szent István University, Faculty of Agricultural and Environmental Sciences, Department of Nature Conservation and Landscape Ecology. H-2103 Gödöllő, Páter K. u. 1. E-mails: petra.bartus16@gmail.com, malatinszky.akos@mkk.szie.hu

<sup>2</sup> Bükk National Park Directorate, Department of Education and Nature Studies. H-3304 Eger, Sándor u. 6. E-mail: eger.barazcsaba@gmail.com

of forest that accelerates natural succession in case of abandonment (VANDENBERGHE, C. *et al.* 2007; DEMÉNY, K. and CENTERI, Cs. 2008). In the United Kingdom, an action plan serves their research, maintenance and protection (HAW, K. 2012), while their detailed classification system and management principles were elaborated for Scotland by HOLL, K. and SMITH, M. (2002).

Our aim is to shed light on land use and historical land cover changes of the grazing forest and wood pasture on the Magas Hill (Ózd–Egercsehi Basin, NE-Hungary) Pannonian vegetation region (FEKETE, G. *et al.* 2017), since the 18<sup>th</sup> century, based on ethnographical data and historical maps; as well as to describe its current state via field research, and give suggestions on its reconstruction and conservation management. The area belongs to the Csornó Valley Hills, which is situated among Egercsehi, Bekölce and Mikófalva villages, surrounded by the Villó Valley and the valley of the Eger Stream (*Figure 1*). The forested area belongs to Egercsehi and Mikófalva villages since the 18<sup>th</sup> century. Until the late 19<sup>th</sup> century, Mikófalva used to be a village of nobles, while Egercsehi was inhabited by villeins (Soós, I. 1975).

Hungarian wood pastures were first observed from a nature conservation aspect by HARASZTHY, L. *et al.* (1997), who stated that this habitat type belongs to the most endangered ones in Hungary, due to abandonment or not suitable use. Similar processes are described by ZAGYVAI, G. and BARTHA, D. (2015). GEIGER, B. *et al.* (2011) supply a suitable methodology (PETŐ, Á. *et al.* 2008) for reconstructing land use history based on literature and archives sources, while NAGY, D. (2008), SALÁTA, D. *et al.* (2013) and SELMECI, M. *et al.* (2013) gave practical examples for investigations on historical maps. Our suggestions on favourable management of the studied habitats are based on the work of KENÉZ, Á. *et al.* (2007) who draw attention to the animal load and productivity of the grassland.

Grazing forests, characteristics of the Bükk Mountains, had suffered from the process of transforming copyholder tenure, and even more the drastic measure of the year 1853, which ceased the traditional communal land

ownerships and obliged to separate forests and pastures owned by the former villeins from those owned by the former squire (ANDRÁSFALVY, B. 2004). The village community possessed the wood independently. Village people were allowed to collect construction wood and firewood with the permission of the community. Wood pastures and grazing forests originate from this time, to ensure forage for livestock. These areas, as well as open pastures (without trees) were cared by the local inhabitants. Degradation and disappearance of wood pastures and grazing forests speeded up due to stricter rules on forest management, and separation of forests. Forest grazing was finally banned by the Act VII. of 1961, which made the subsistence of these unique land use forms impossible.

About 5,500 ha of wood pasture and grazing forest has remained in Hungary till date, but their extension still decreases due to afforestation and wood cutting. The project “Landscape Ecological Vegetation Mapping of Hungary” states that the wood pastures and grazing forests are among the eight most endangered wooded habitat types in Hungary (MOLNÁR, Zs. *et al.* 2008).

Various nature conservation problems affected the wood pastures and grazing forests. One of them is the temporary anarchic liaisons in properties. These areas belonged to the villages and commonages until 1945, only a few percent belonged to private owners. During the socialist-type agricultural industrialization they become state-owned (or co-operative). After the change of regime, as the co-operatives ceased, their status has become unclear and most of them remained unmanaged (at least temporarily). This time, illegal wood cuttings were regular, which were difficult to handle due to unclear property rights. A third significant group of problems is tied to economic use, such as lagging grazing and mowing. By mowing in due time, weed infestation (introduced via grazing) is prevented; however, if its date is not well determined, it interferes with seed dispersal of protected plants. Overgrazing may cause a similar problem, but it is un-

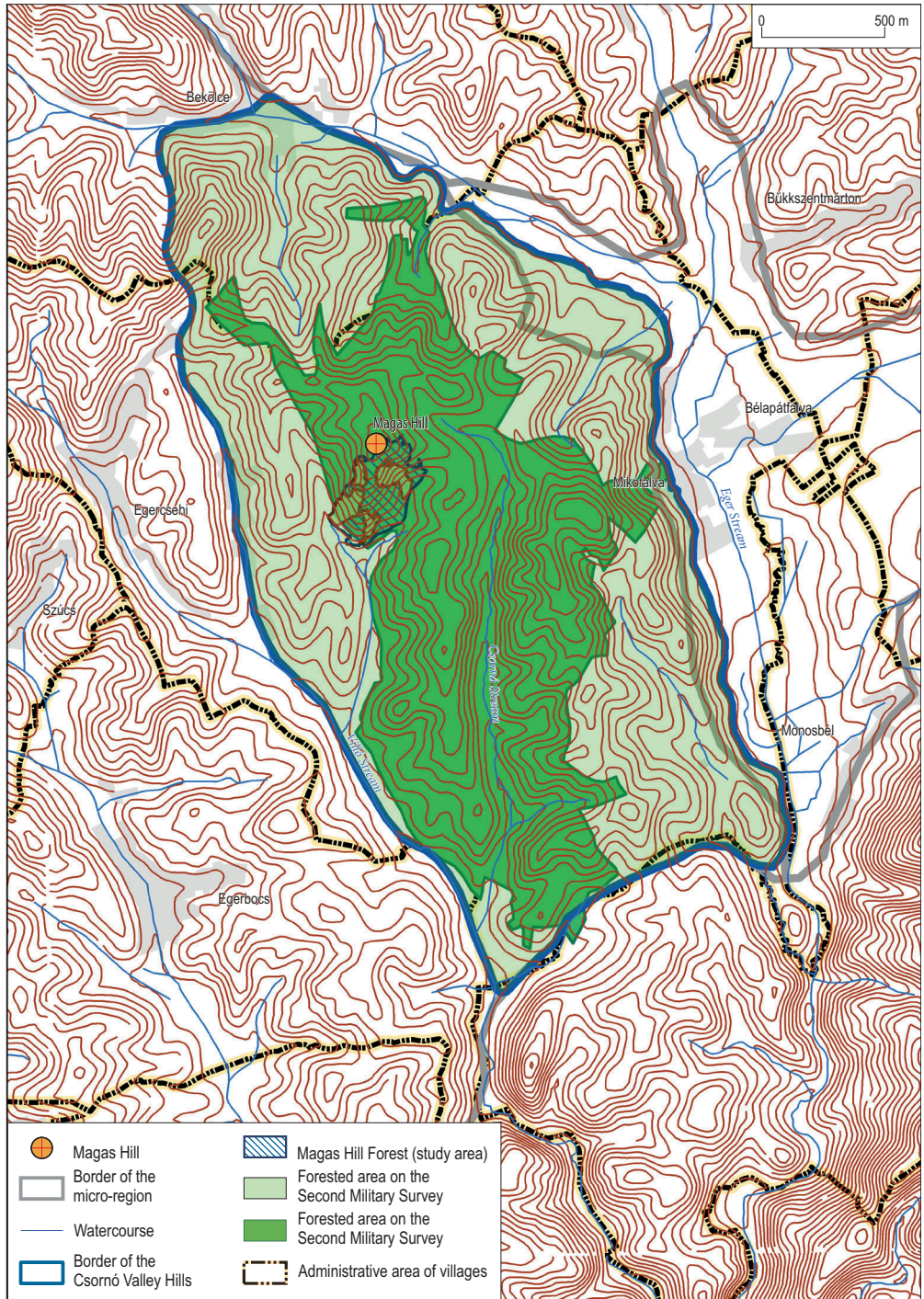


Fig. 1. The Csornó Valley Hills and the forest shown by the 2<sup>nd</sup> Military Survey

likely in Hungary due to changes in livestock keeping habits. Applying non-professional management methods may also harm grazing forests and wood pastures, and even destroy them in a long term. Some examples for this are: storing animal manure in a not sufficient place; spring burning of the grassland; abandonment of mowing; not sufficient substitution of dead trees. These rare habitats are endangered by land use change, too. Due to less grazing livestock, there is less need for pastures, and thus, the owners enable natural re-forestation, or create a forest by planting fast growing tree species, or convert it to arable land (HARASZTHY, L. et al. 1997).

One of the main reasons for the origin of grazing forests was the lack of pastures. As the main function of forests used to be livestock keeping in the past, Hungarian forests were grazed (by sheep, cow, and horse) and acorn consumed (by pigs) during several centuries, thus, changes in legislation (Forest Act in 1791, then the transformation of copyholder tenure, and separation of forests and pastures of villeins from squires after 1853) have become the main reasons for several later problems (TÉGLÁS, K. 1902).

## Material and methods

We name the hilly territory lying between the Eger Stream and the Villó Stream as Csornó Valley Hills, because the Csornó Stream divides it into two parts from north to south. This hilly territory of two ridges did not have a geographical name that covers the total area. Maps of the Third Military Survey (1869–1887) and 1:25,000-scale maps of the Hungarian Kingdom (1869–1887) name the western ridge (which contains the Magas Hill, 455 m) as “Csornóhegy” (the village cadastre map from 1863 names it as “Nagylápa-dűlő”, signed with XXIII on the map), while the eastern ridge that belongs to Mikófalva village is named as “Szőlőmege bérc”.

According to the present geographical system, this hilly area which contains the Csornó Valley Hills and is built up mainly by sedi-

mentary rocks belongs to the Ózd–Egercsehi Basin. The microregion’s Pannonian foothill was slashed by erosion and deflation during the Pleistocene. Its climate is moderately cool and moderately dry, with an average yearly temperature of 8.0–9.0 °C and annual precipitation of 580–620 mm. Due to this climate, hills and ridges are covered by forests, surrounded by less heat-demanding agricultural crops. Dominant soil type is luvisol, changed by fluvisols in the stream valleys. The mosaic-like and diverse vegetation evolved due to severe forest uses and cuts, with clearings and planted forests (DÖVÉNYI, Z. 2010). The Magas Hill Forest is the remnant of a huge 19<sup>th</sup> century grazing forest and wood pasture, surrounded by open grasslands. As a consequence of the abandonment of grazing, scrub encroachment and afforestation processes are visible.

We reconstructed land use history based on literature and archives sources:

- First Military Survey – Ministry of Defence, Institute and Museum of Military History, Map Archives, section XX/13, year 1783, scale 1:28,800, digital edition Arcanum (2004);
- Second Military Survey – Ministry of Defence, Institute and Museum of Military History, Map Archives, section XXXVII/45, year 1858, scale 1:28,800, digital edition Arcanum (2004);
- Hand-script maps, cadastre maps and copyholder tenure maps: based on the Map Archives of the National Archives of Hungary, and documents at the Heves County Archives (Hungaricana Hungarian Cultural Heritage Portal, <http://1>): Mikófalva village with Ughfalva in Heves County, 1888 (National Archives of Hungary, score: S 78 120. téka Mikófalva 001-011), cadastre map of Csehi village administrative area, 1961 (Heves County Archives, score: Heves U 83), Csehi village with Ördögfalva cadastre map, 1863 (National Archives of Hungary, score: S 78 Heves m. Egercsehi 001-004). The latter one contains description with land use types, too;
- 1:10,000-scale topographical map (Institute of Geodesy Cartography and Remote Sensing, 1989);

- Aerial photographs: years 1991 and 2005, Institute of Geodesy Cartography and Remote Sensing (accessed in the GIS database of the Bükk National Park Directorate, and the website of the service managed by the mentioned institute: <http2>);
- Maps and data of forestry management plans;
- Data of the national CORINE (CLC50) database;
- Orienteering maps (scale 1:15,000) from the years 1993 (Baglyas-hát, Kín-hegy) and 2001 (Villó-tanya): they present the hills along the Csornó Stream, but do not cover the Magas Hill Forest. We used them to find out (based on the signs), whether similar forest remnants might be found in the surroundings or not, but they illustrate only black locust stands.

Orienteering maps were provided by the orienteering clubs of Eger and Miskolc cities. They were scanned and digitalized, then georeferenced with the ArcMap software, and shape files were created to present vegetation cover. This process was done for every orienteering map (from different years) and thus, we were supplied by generalized, universal maps. The same software was used for processing maps of the Second Military Survey and cadastre maps from the 19<sup>th</sup> century, then polygons were drawn based on the different vegetation cover types. Creation of shape files followed this stage, which were the bases for creating maps for comparisons. Conclusions were formed based on these maps on the changes of vegetation during the ages.

Orienteering maps are detailed topographic maps, with scale 1:15,000. They show every object in the field that may influence the reading of the map, or choose of the route. Hardness of running in forests is divided into four categories (based on speed), and it is shown via the vegetation cover. If the vegetation of the forest floor is very lush, the map is darker green. Open areas (without trees) are yellow coloured, and spots that are easy to run are distinguished from those that are hard to pass (GUSZLEV, A. and ZENTAI, L. 2000).

Field investigations were done four times during 2016, from April till September. We compared the different markings of orienteering maps from different years, and validated aerial photographs and cadastre maps on the spot with current circumstances. Our route was registered by GPS device. Pictures were taken on the state of vegetation, and overview of the area. Exact spots of the veteran oak trees in the remnant forest were registered one by one. We measured trunk perimeter of the biggest trees at our breast height, with registering also the tree species. In case of plant names nomenclature follows the work of KIRÁLY, G. (2009). Field data were further processed with ArcGIS software: exact ranges were measured (and thus, conclusions formed) via the attribute table.

## Results

### *Formation of the Magas Hill Forest, and landscape management history of its surroundings*

The study area was covered by continuous forests surrounded by meadows and arable lands during the 18<sup>th</sup> and 19<sup>th</sup> century according to the First and the Second Military Surveys. The extension of the forest was 808.5 ha on the Second Military Survey map (*Figure 2*).

18<sup>th</sup> century descriptions on Egercsehi, that reflect to the “ancient” state, before water regulation works and severe landscape changes (column XIX, segment 13), also contain some reference on the forest along the Csornó Stream: “Surrounding forests comprise high oak and beech trees”, and “the road to Mikófalva leads through a high ridge, in forest, and can be used only in emergency.” Descriptions on Mikófalva mention: “The adjacent forest comprise oak and beech trees” (CSIFFÁRY, G. and B. HUSZÁR, É. 1999).

The cadastre map of Egercsehi (1863) shows forest cover in the study area, and describes it as pasture in the joint table (*Figure 3*). An explanation for this variance is given by exploring the livestock keeping methods of the 18<sup>th</sup> and 19<sup>th</sup> centuries as well as the question on

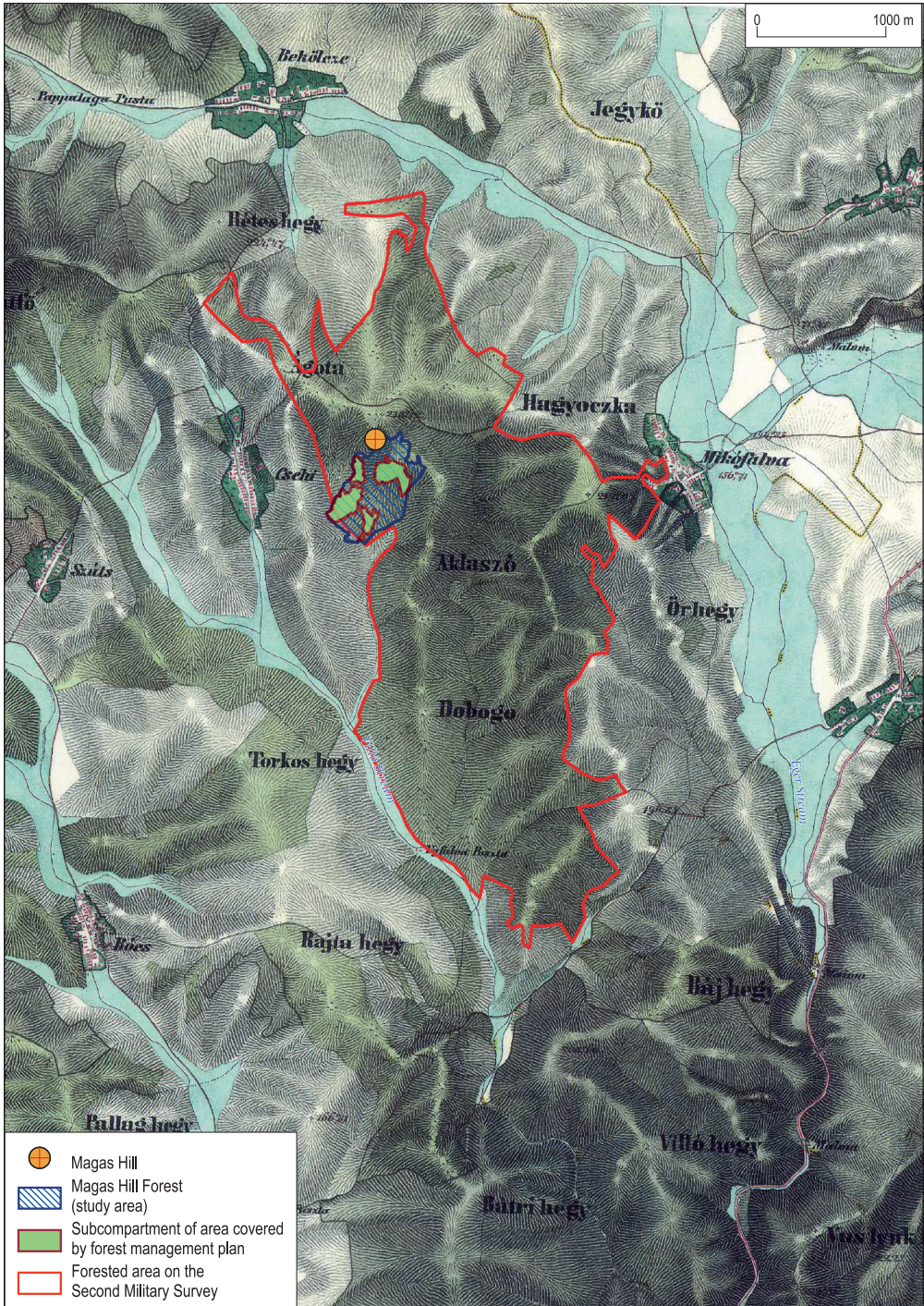


Fig. 2. The forest that covers Csornó Valley Hills still shown by the 2<sup>nd</sup> Military Survey

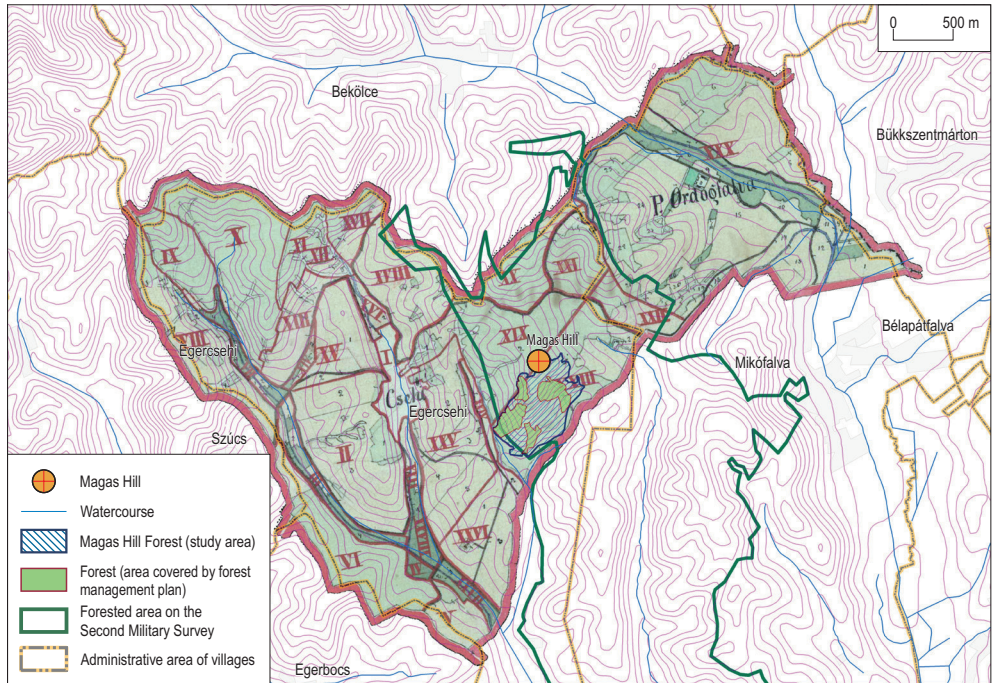


Fig. 3. The Magas Hill Forest, projected onto the cadastre map of 1863

pastures, forest ownerships, legal issues, use and management methods. The synthetic map of Hungarian forests (1896) does not show any forest between Mikófalva and Egercsehi.

Extended forests meant a main source of income for Mikófalva in the 18<sup>th</sup> century. A source from 1,700 mentions the forest as „forest of acorns”, and writes about pigs consuming acorn there. Tenants had to pay significant services in return for the squires (BAKÓ, F. 1965).

In the documentation of a legal action (connected to use of pastures) in 1818, tax-paying tenants and cotters complain about nobles converting some parts of the common pasture to cropland. These common pastures were situated in their own forests, but they considered them as commons, and thus, complained about illegitimate occupation (BAKÓ, F. 1965). Land arrangement, or regulation, happened during 1829–1830. The administrative area of the village was regu-

lated, but the pasture still remained common (BAKÓ, F. 1965; Soós, I. 1975).

According to the 2<sup>nd</sup> Military Survey, the surrounding hills were still totally covered by forests. Forest grazing went on in the area; mainly sheep grazed in the forests around Egercsehi and mainly pigs consumed acorns around Mikófalva. Thus, the forest functioned as a grazing forest, giving home for forest shepherding. This time, the registered land use type on the administrative area of Mikófalva was mainly forest. After the previously mentioned drastic measure of 1853, the process of separating forests and pastures owned by the former villeins from those owned by the former squire has finished until the late-1870s (PETERCSÁK, T. 2002). This process has led to dramatic changes in the 800-ha big forest of the Csornó Valley Hills: the forests thinned and ceased due to uncontrolled grazing (forest shepherding) and wood-cuts (Figure 4).

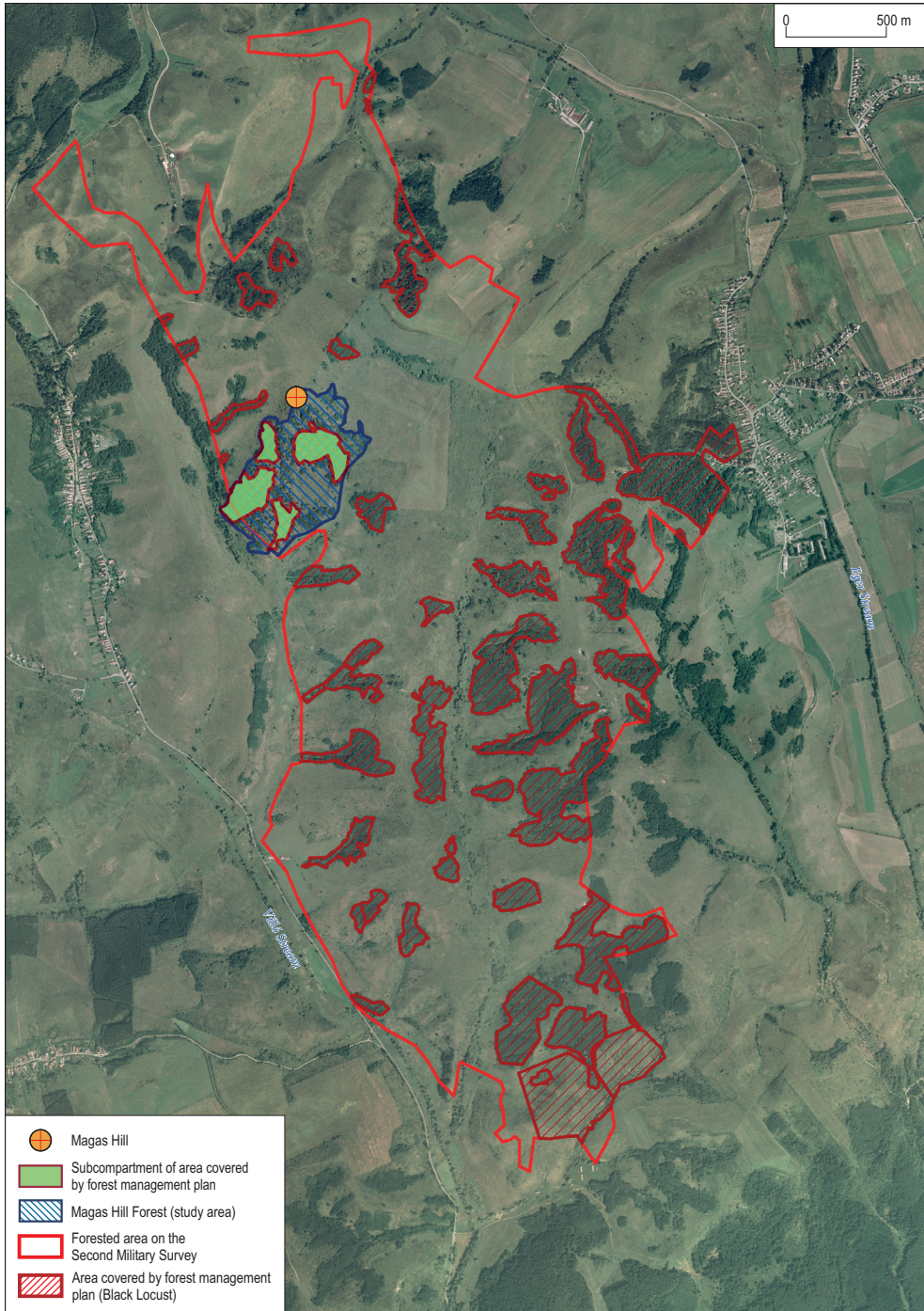


Fig. 4. Black locust stands replace today the 19<sup>th</sup> century 808.5 ha forest. These are not the remnants of one-time oak forests.



### The current state

The size of the remained mosaic-like patch (closed forest, grazing forest, wood pasture, clearing, and grassland), i.e. the studied area is 35.3 ha. Understory is dominated by a mass of common hawthorn (*Crataegus monogyna*), dog-rose (*Rosa canina* agg.), sloe (*Prunus spinosa*) and wild privet (*Ligustrum vulgare*), the most problematic species being black locust (*Robinia pseudo-acacia*).

In the CORINE Land Cover database (CLC50) the Magas Hill Forest is covered by bushy woodland, natural regeneration area (3.2.4.3). 11.98 ha of the area was measured as forest during the forest management planning process in 2002, while 17.11 ha in 2013 (Figure 5). 6.58 ha of this belongs to forest land use type (compartments 5/E, 5/H and 5/I), while the rest is registered as pasture. Compartment 5 is surrounded by pasture, with several veteran trees in its upper region (within the area covered by forest management plan).

The main current processes on the remnant of the one-time wood pasture are scrub encroachment and afforestation. Northern slope of the Magas Hill is mowed by rotary mower or mower-conditioner. 5.61 ha of the area covered by forest management plan is registered in harvesting mode, the remaining 11.5 ha is registered as leave alone, i.e., total restriction (with soil protection purpose). Dominant tree species are downy oak (3.95 ha), Turkey oak (4.17 ha), and sessile oak (0.4 ha). Black locust has appeared about 25 years ago in the sub-compartments 5/E, 5/G and 5/J (on 4.46 ha).

The area between Egercsehi and Mikófalva is dominantly covered by open grasslands. Relatively flat, round hilltops and slight hillsides dominate, with narrow and deep stretch-like valleys in between. The Csornó Stream passes from north towards south, with a wet, marshy stripe along.

Hilltops are bared with low grasslands, while hillsides are covered by groups of bushes and solitaire trees on the orienteering map from 1993. Scrubs are inter-related as a continuous patch in some places, and some patches of stinging weeds also occur on the

mentioned map. Most of the open areas are low grasslands, maintained by mowing and/or grazing. Really impassable, dense scrubby vegetation is shown only in the deep valleys; these are young black locust stands according to our field investigations. Continuous closed forests comprise of black locust only, except for the Magas Hill oak grove and fringe vegetation along the stream.

Hilltop clearings start to decrease due to scrub encroachment from hillsides according to the orienteering map from 2001. The surrounding of solitaire trees, bushes and their groups has changed during the previous eight years. Scrubs compose a continuous web on the hillsides, and stinging weed patches cover greater area, as well. These scrub patches are mainly sloe (*Prunus spinosa*) stands according to our field investigations. Very dense and tall stands of black locust rule the valleys, characterized by sparsely vegetated forest floor. Black locust stands are surrounded by scrubby stripes, which further decrease the area of open grasslands. Thus, mowed and grazed grasslands represent a smaller area.

Average age of the oak trees are estimated between 61 and 73 years based on trunk perimeter at breast height; veteran trees, however, may be 150 to 250 years old based on the method of RADÓ, D. (1999). Over 200 veteran trees were measured during our field studies, with trunk perimeter between 200 and 260 cm; 14 of them are over 300 cm perimeter, the greatest one exceeding 420 cm. These veteran trees are living witnesses of the one-time forest that is presented on the 2<sup>nd</sup> Military Survey maps (Figure 6, Photo 1).

### Discussion

The forest, which was continuous according to the military surveys and the related descriptions, comprised mainly oaks. At first roads were created on the area, later clearings were cut. The grazing forest has almost totally disappeared due to intensive grazing in the 19<sup>th</sup> and early 20<sup>th</sup> century (see the lack of pastures) and cuttings, only a small patch has

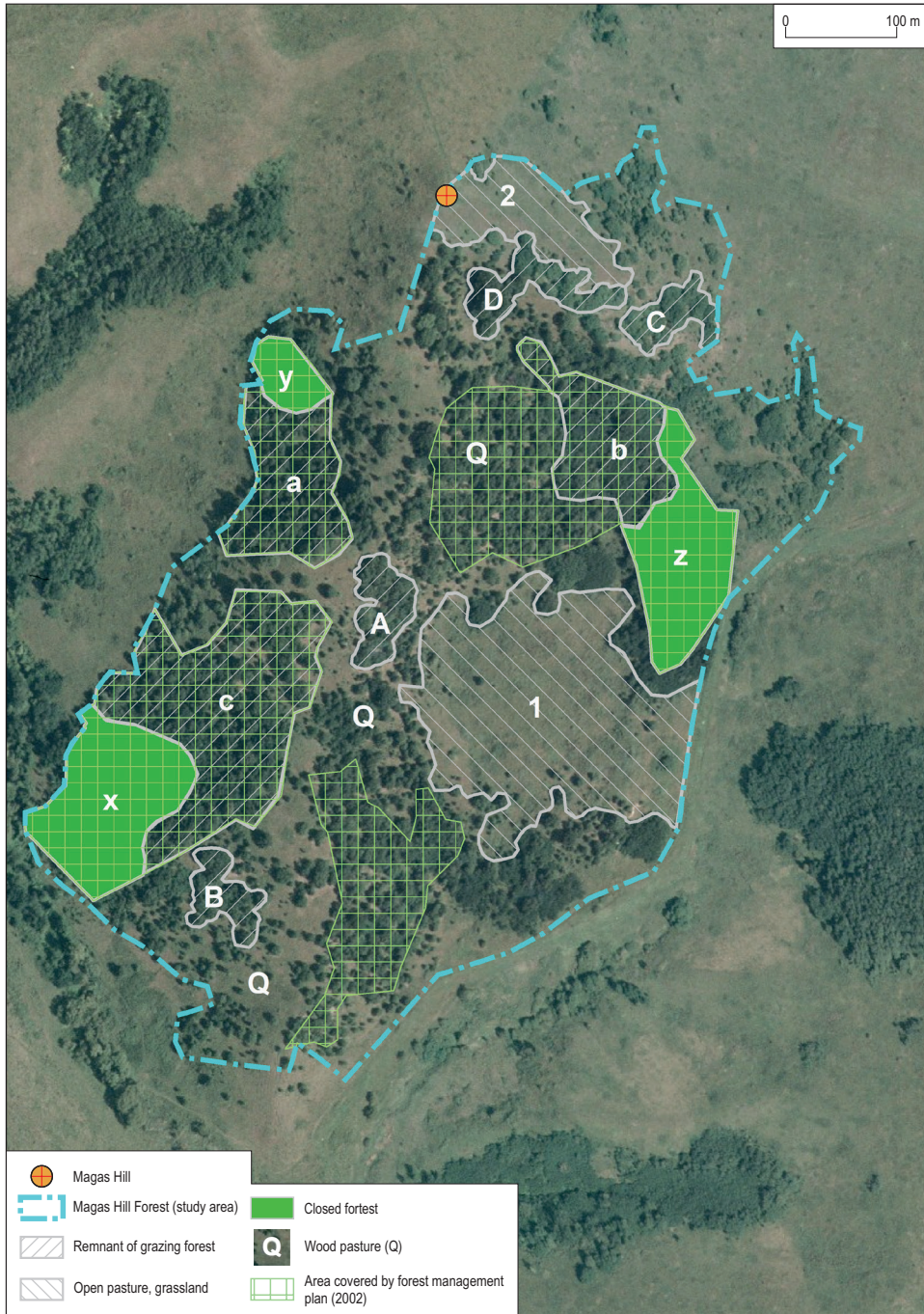


Fig. 5. Land cover categories and border of forest by planned management on the Magas Hill, projected onto aerial photo of 2005. – x, y, z = closed forest; A, B, C, D = remnant of grazing forest (outside forest); a, b, c = remnant of grazing forest (within forest); Q = remnant of wood pasture; 1, 2 = open pasture, grassland, meadow

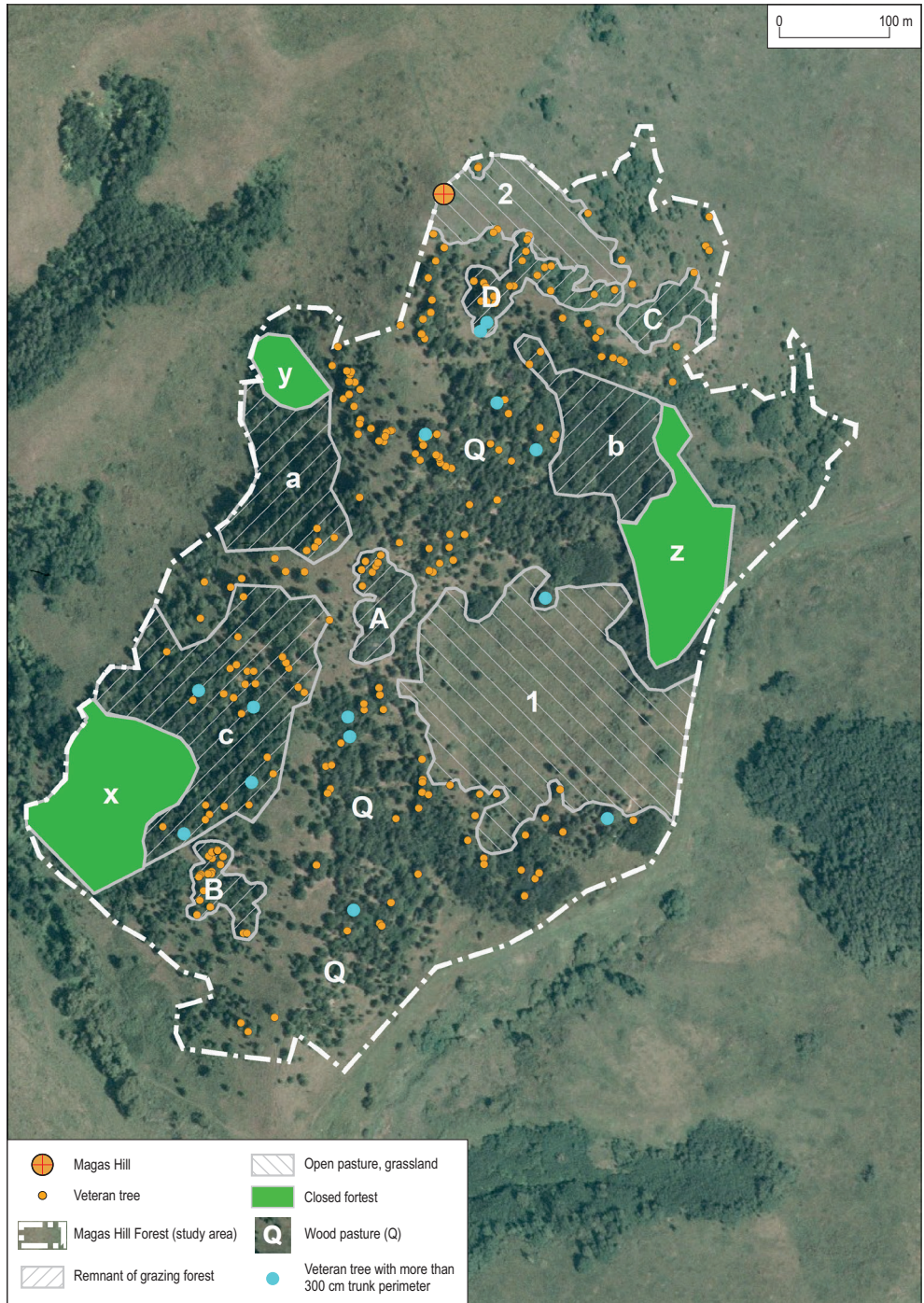


Fig. 6. Almost 200 years old veteran trees are the witnesses of the forest shown by the 2<sup>nd</sup> military survey map (compiled by BARTUS, P. 28.08.2016). – A, B, C, Q, a, b, c, 1, 2 = for explanation see Fig. 5.



*Photo 1.* Situation of oak trees above 300 cm trunk perimeter (at breast height) in the Magas Hill Forest, projected onto aerial photo of 2005

remained near Egercsehi. As a consequence of the abandonment of forest grazing, and the decreasing number of grazing livestock in the past decades, even this remnant patch has severely changed: it has become shrubby and afforested. The original vegetation has almost totally been abolished by intensive scrub encroachment. Although the area is illustrated with forest cover on the 19<sup>th</sup> century maps, the geographical names refer to activities tied to livestock keeping and forest cutting.

The fact that the registered land use type of forests has become pasture after 1853 (according to the cadastre map of 1863) might be interpreted as an answer for forest protection measures. The deviation between the registered land use and the real land cover can be explained by the laws, changes in tenancy relations, and lack of pastures.

The fact that several veteran trees have got regular foliage refers to their open position 150 years ago and thus, being the remnants of an open wood pasture. Most of the oldest ones, however, have got irregular (asymmetric) foliage, referring to their growth in a less open grazing forest.

Rate of canopy in wood pastures is between 5 and 50 per cent. Abandoned wood pastures are affected by scrub encroachment and afforestation by young trees, leading to closing canopy. We estimate that 20.1 ha of the Magas Hill Forest (total 35.3 ha) can be handled as wood pasture remnant (56.9%).

Rate of canopy in grazing forests is between 50 and 80 per cent. Canopy of non-grazed forests can close until 100 per cent due to scrub encroachment and afforestation. This grove forest type covers only 6.8 ha in the Magas Hill Forest (19.3%). Thus, 76.2 per cent of the area can be considered as the degraded (afforested, closed) remnant of one-time forest shepherding. The remaining 23.8 per cent is open grassland, and closed young forest (dominated by black locust) (*Table 1, Photo 1*).

We experienced on the 2016 field studies that the state of the area has changed for the better compared to 2001. Sheep were grazing throughout every single time when we visited the study area, and we have also seen freshly mowed grasslands. Extension of the dense scrub patches (shown by the 2001 map) has also decreased. Fringe vegetation along the stream is well recognizable.

Although the orienteering maps are well detailed, their use is very rare in landscape history studies. An advantage of this method is that these maps are frequently corrected and improved due to regular orienteering contests and thus, one may gain detailed information even on tiny changes of a certain area. Its disadvantage is that the most important aim of these maps is easy readability (during orienteering, i.e., running), therefore, the only aspect of vegetation illustration is the hardness of running. Such maps ensure too little information for people without a routine, but an experienced orienteering run-

Table 1. Land cover categories in the Magas Hill Forest (“Nagy-lápa-dűlő”)

Land cover	Area	
	ha	%
Closed forest (x, y, z) (rate of canopy 80–100%)	3.1	8.78
Remnant of grazing forest (A, B, C, D; a, b, c) (rate of canopy 50–80%)	6.8	19.26
Wood pasture (Q) (rate of canopy 5–50%)	20.1	56.94
Open pasture (1, 2)	5.3	15.02
Sum (“Nagy-lápa-dűlő”)	35.3	100.00

ner can really imagine the area (and its true, actual state) even based on the map only.

### Conclusions and suggestions

A mosaic-like, diverse, transitional landscape has evolved due to traditional livestock keeping, forest grazing (and acorn consumption). Wood pastures are the result of an organic management of the landscape (more than land use). The Magas Hill Forest is the remnant patch of a several century old 800-ha grazing forest, which evolved due to human shepherding activities. According to the evidence based by Military Surveys and their documentation, and ethnographical data, hills around Egercsehi and Mikófalva were once covered by an enormous continuous grazing forest. This has almost totally disappeared until nowadays, and there is no continuity between one-time oak forests and current black locust stands, except for a small 35.3-ha patch on the southern slope of the Magas Hill (called “Nagy-lápa-dűlő” in the past), a various mosaic of closed forest, degraded grazing forest, wood pasture, clearing, and grassland, with old (150–200 year) veteran trees. As a consequence of no management (abandonment of forest grazing), original vegetation has almost totally been abolished by invasive alien species.

Area of mowed, open grassland is 5.3 ha, while 20.1 ha commemorates on one-time wood pasture, the remaining area is shrubby (spontaneously) with afforestation.

The studied area is not listed in the Hungarian cadastre of wood pastures (HARASZTHY, L. et al. 1997). This register lists six wood pastures in Heves County; this cur-

rent one is the seventh, as it has only been ‘discovered’ during our filed investigations.

Wood pastures ensure a unique habitat for those species that live in the transition zone of forests and open areas. Their survival can be ensured only by maintaining the traditional way of management. Since they represent high landscape and nature value, and there is no chance to create similar habitats as a consequence of forest cuts, therefore, their reconstruction and conservation are essential, in line with the Sustainable Development Goals 15.1, 15.5 and 15.8 (JANCOSVSKA, P. 2016). It is obvious (based on literature sources that present the state of Hungarian wood pastures and grazing forests) that there is an urgent need for fast intervention and definite action. The Magas Hill Forest is privately owned and not protected by nature conservation laws. Therefore, it is vital to inform and advise the owner, investigate in research programs, meet the conditions for declaring the area as nature protected, develop management guidelines, complement law deficits, ensure maintenance costs, as well as reform the agricultural subsidy system.

The unique stand of veteran trees and the wood pasture landscape is still visible, and the process of scrub encroachment might be stopped by adequate management. The fight against them would cost millions of Euros (DEMETER, A. et al. 2016). Thus, valuable habitats can be conserved. In favour of reconstruction of the wood pasture – grazing forest mosaic and maintenance of the desirable state, we suggest beef and sheep grazing, combined with mowing, depending on the state of afforestation, based on direct experience by the Bükk National Park Directorate.

**Acknowledgement:** The authors give special thanks to the Bükk National Park Directorate for the opportunity to use its GIS software and aerial photographs, and Krisztián Kovács, head of Forestry Department for his valuable information. We are grateful to Imre VERES for the orienteering maps, and to Dr. György RÓZSA, chief archivist at the Borsod-Abaúj-Zemplén County Archives as well as to the staff of Heves County Archives.

## REFERENCES

- ANDRÁSFALVY, B. 2004. Hagymány és környezet. Az elkülönözés és arányosítás következményei (Tradition and environment. Consequences of separation and scaling). *História* 26. (5): 19–20.
- BAKÓ, F. 1965. Mikófalva (Village Mikófalva). *Az Egri Múzeum Évkönyve* 3. 181–243.
- BARCZI, A. and NAGY, V. 2016. Kurgans: Markers of the Holocene Climate Change(s). *Review of Faculty of Engineering Analecta Technica Szegedinensia* 10. (1): 47–52.
- BERGMEIER, E., PETERMANN, J. and SCHRÖDER, E. 2010. Geobotanical survey of wood-pasture habitats in Europe: diversity, threats and conservation. *Biodiversity and Conservation* 19. 2995–3014.
- CSIFFÁRY, G. and B. HUSZÁR, É. 1999. *Heves megye II. József-kori katonai leírása (1783–1785)* (Military description of Heves County from the time of King Joseph the 2<sup>nd</sup> [1783–1785]). Eger, Heves Megyei Levéltár.
- DEMÉNY, K. and CENTERI, CS. 2008. Habitat loss, soil and vegetation degradation by land use change in the Gödöllő Hillside, Hungary. *Cereal Research Communications, Supplement* 36. 1739–1742.
- DEMETER, A., SARLÓS, D., SKUTAI, J., TIRCZKA, I., ÓNODI, G. and CzÓBEL, Sz. 2015. Kiválasztott özönfajok gazdasági szempontú értékelése – a fehér akác és a mirigyes bálványfa (Economic valuation of selected invasive species). *Tájökológiai Lapok / Journal of Landscape Ecology* 13. (2): 193–201.
- DÖVÉNYI, Z. ed. 2010. *Magyarország kistájainak katasztere* (Inventory of microregions in Hungary). Bővített és átdolgozott kiadás, Budapest, MTA Földrajztudományi Kutatóintézet.
- FEKETE, G., KIRÁLY, G. and MOLNÁR, Zs. 2017. A Pannon vegetációrégió lehatárolása (Delineation of the Pannonian vegetation region). *Botanikai Közlemények* 104. (1): 85–108. DOI: 10.17716/BotKozlem.2017.104.1.85
- GARBARINO, M., LINGUA, E., MARTINEZ SUBIRÁ, M. and MOTTA, R. 2011. The larich wood pasture: structure and dynamics of a cultural landscape. *European Journal of Forest Research* 130. 491–510.
- GEIGER, B., SALÁTA, D. and MALATINSZKY, Á. 2011. Táj történeti vizsgálatok a kiskombosi fás legelőn (Studies on the landscape history of the wood pasture near Kiskombos). *Tájökológiai Lapok / Journal of Landscape Ecology* 9. (2): 219–233.
- GILLET, F. 2008. Modelling vegetation dynamics in heterogeneous pasture-woodland landscapes. *Ecological Modelling* 217. 1–18.
- GUSZLEV, A. and ZENTAI, L. 2000. *A tájfutótérképek nemzetközi szabványa* (International standard of orienteering maps). Budapest, ELTE Eötvös Kiadó.
- HARASZTHY, L., MÁRKUS, F. and BANK, L. 1997. *A fás legelők természetvédelme* (Nature conservation of wood pastures). Budapest, WWF füzetek 12.
- HARTEL, T., DORRESTEIJN, I., KLEIN, C., MÁTHÉ, O., MOGA, C.I., ÖLLERER, K., ROELLING, M., WEHRDEN, H.V. and FISCHER, J. 2013. Wood-pastures in a traditional rural region of Eastern Europe: Characteristics, management and status. *Biological Conservation* 166. 267–275.
- HAW, K. 2012. Wood pasture: definition, restoration, creation – Practical Guidance. *WoodWise – Woodland Conservation News* 2012 / Winter, 1–15.
- HOLL, K. and SMITH, M. 2002. *Ancient Wood Pasture in Scotland: Classification and Management Principles*. Scottish Natural Heritage Commissioned Report F01AA108.
- JANCSOVSKA, P. 2016. Fenntartható fejlődési célok (Sustainable development goals). *Tájökológiai Lapok / Journal of Landscape Ecology* 14. (2): 171–181.
- JOSE, S. 2012. Agroforestry for conserving and enhancing biodiversity. *Agroforestry Systems* 85. 1–8.
- KENÉZ, Á., SZEMÁN, L., SZABÓ, M., SALÁTA, D., MALATINSZKY, Á., PENKSZA, K. and BREUER, L. 2007. Természetvédelmi célú gyephasznosítási terv a pénzesgyőr–hárskúti hagyásfás legelő élőhely védelmére (Pasture management plan aiming nature conservation for the protection of the wood pasture between Pénzesgyőr and Hárskút). *Tájökológiai Lapok / Journal of Landscape Ecology* 5. (1): 35–41.
- KIRÁLY, G. ed. 2009. *Új magyar fűvészkönyv. Magyarország hajtásos növényei. Határozókulcsok*. (Hungarian plant determination book). Jósvalfő, Aggteleki Nemzeti Park Igazgatóság.
- MOLNÁR, Zs., BÖLÖNI, J. and HORVÁTH, F. 2008. Threatening factors encountered: Actual endangerment of the Hungarian (semi-)natural habitats. *Acta Botanica Hungarica* 50. 199–217.
- NAGY, D. 2008. *A Gömör–Tornai-karszt történeti felszínborítása* (Historical land cover of the Gömör–Torna Karst). Jósvalfő, ANP Füzetek 5.
- PETERCSÁK, T. 2002. Népi erdőbirtoklás és erdőhasználat (Rule and management of forests by the folk). In *A Bükki Nemzeti Park. Hegyek, erdők, emberek*. Ed.: BARÁZ, Cs., Eger, 467–474.
- PETŐ, Á., BARCZI, A., JOÓ, K. and GRÓNÁS, V. 2008. Phytolith analysis of modern soil profiles as a tool to demonstrate land use changes and anthropogenic

- impacts (Case study from the Bakony Mountains). *Cereal Research Communications* 36. 955–958.
- PLIENINGER, T., HARTEL, T., MARTÍN-LÓPEZ, B., BEAUFOY, G., BERGMEIER, E., KIRBY, K., MONTERO, M.J., MORENO, G., OTEROS-ROZAS, E. and UYTVANCK, J.V. 2015. Wood-pastures of Europe: Geographic coverage, social-ecological values, conservation management, and policy implications. *Biological Conservation* 190. 70–79.
- RADÓ, D. 1999. Bel- és külterületi fasorok EU-módszer szerinti értékelése (EU-standard evaluation of tree lines of inner parts and out skirts). *Lélegzet* 7–8. suppl.
- SALÁTA, D., PETŐ, Á., KENÉZ, Á., GEIGER, B., HORVÁTH, S. and MALATINSZKY, Á. 2013. Természettudományos módszerek alkalmazása tájtörténeti kutatásokban: Kisgombosi esettanulmány (Applying multidisciplinary approach in landscape history research: case study of Kisgombos wood pasture). *Tájökológiai Lapok / Journal of Landscape Ecology* 11. (1): 67–88.
- SALÁTA, D., SZABÓ, M., KENÉZ, Á., MALATINSZKY, Á., DEMÉNY, K. and BREUER, L. 2007. Adatok a pénzesgyőr-hárskúti hagyásfás legelő tájtörténetéhez (Data to the landscape history of the wood pasture between Pénzesgyőr and Hárskút). *Tájökológiai Lapok / Journal of Landscape Ecology* 5. (1): 19–25.
- SELMECI, M., HÖHN, M. and SALÁTA, D. 2013. A lébényi Tölgy-erdő tájtörténeti kutatása (Studies on the landscape history of the Tölgy-erdő in Lébény). *Tájökológiai Lapok / Journal of Landscape Ecology* 11. (2): 261–277.
- SOÓS, I. 1975. *Heves megye községei 1867-ig* (Villages of Heves County until 1867). Eger, Heves Megyei Tanács.
- SZABÓ, M., KENÉZ, Á., SALÁTA, D., SZEMÁN, L. and MALATINSZKY, Á. 2007. Studies on botany and environmental management relations on a wood pasture between Pénzesgyőr and Hárskút villages. *Cereal Research Communications* 35. (2): 1133–1136. DOI: 10.1556/CRC.35.2007.2.242
- TÉGLÁS, K. 1902. A legelőkérdés erdőgazdasági és közzgazdasági szempontból (The pasture issue from management and economy aspects). *Erdészeti Lapok / Journal of Forestry* 41. (10): 1117–1142.
- VANDENBERGHE, C., FRELÉCHOUX, F., MORAVIE, M.-A., GADALLAH, F. and BUTTLER, A. 2007. Short-term effects of cattle browsing on tree sapling growth in mountain wooded pastures. *Plant Ecology* 188. 253–264.
- ZAGYVAI, G. and BARTHA, D. 2015. Nyírségi erdőtömbök és környezetük tájtörténeti vizsgálata (Landscape history research on notable forests and their surroundings in Nyírség). *Tájökológiai Lapok / Journal of Landscape Ecology* 13. (1): 59–72.

#### Map sources:

- http1: Maps Hungaricana database. – <https://maps.hungaricana.hu/hu/>
- http2: Aerial photographs (1959–2005). Budapest, Institute of Geodesy Cartography and Remote Sensing. –<http://www.fentrol.hu/hu/>
- Military Surveys I (1764–1784); II (1806–1869); III (1869–1887). Mapire database. Budapest, Arcanum Database Ltd. – <http://mapire.eu/hu/>

