

Uniqueness, Authenticity and Integrity of the Primeval Beech Forests of the Carpathians as World Heritage Sites

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Abstract: The Primeval Forests are of a great importance because they act as natural laboratories and play an important role for science, education and biodiversity conservation. The paper deals with uniqueness, authenticity and integrity of the Primeval Beech Forests of the Carpathians, which in 2007 was inscribed on the World Heritage List. Virgin forests differ within each phytogeographic zone, forming specific forest types with their characteristic species composition, spatial structure, dynamics and overall diversity (including genetic diversity) due to site conditions related to the position above sea level and topography, macroclimate and nutrient and water availability. A minimum area wherein all succession stages of a forest community can take place depend strongly on particular forest types and their potential disturbance regime.

Keywords: primeval beech forest, uniqueness, authenticity, integrity, scientific and conservation value.

Introduction

The Primeval Beech Forests of the Carpathians (Slovakia and Ukraine), have been inscribed in 2007 at the World Heritage List on the basis of criterion (ix) as defined by the Operational Guidelines for the Implementation of the World Heritage Convention. They are indispensable to understanding the history and evolution of the genus *Fagus*, which, given its wide distribution in the Northern

Hemisphere and its ecological importance, is globally significant. Beech is one of the most important elements of forests in the Temperate Broad-leaf Forest Biome and represents an outstanding example of the re-colonisation and development of terrestrial ecosystems and communities after the last ice age, a process which is still ongoing (PICHLER et al. 2007). The Beech primeval forests of the Carpathians comprise all typical development stages of virgin forests: restoration, growing-up stages, optimum stage, destruction and decay stage (KORPEL 1989, 1995).

The nomination process was promoted by the European Conference in the Carpathian biosphere reserve (COMMARMOT & HAMOR, 2005).

Total Core area of WHS is 29 279 ha (100,0 %), in Slovakia 5 766 ha (19,7 %), and in Ukraine 23 513 ha (80,3 %). Total area of Buffer zone is 48 693 ha (100,0%), in Slovakia 13 818 ha (28,4 %), and in Ukraine 34 875 ha (71,6 %) (PICHLER et al. 2007).

Primeval Beech Forests of the Carpathians 2011 were extended by the Ancient Beech Forests of Germany to a trilateral World Natural Heritage Property with 15 component parts (KNAPP & FICHTNER 2012).

Uniqueness

The ecosystems of the Primeval Beech Forests of the Carpathians belong to the biogeographical province Middle European Forest (2.11.05) according to UDVARDY's classification (1975). The partition of the beech primeval forests of the Carpathians conditioned by their occurrence in two states rather than any natural division. They belong to the same biome and forests complex.

Primeval forests, except for boreal forests, can currently be found in mountain areas of the Central and South-East Europe (LEIBUNGUT 1982, MAYER 1987, KORPEL 1995). Compared to their original vast extent, nowadays area of these primeval forests has dropped to fraction of a fraction – just several thousand km². In the light of this fact, the global uniqueness of the European primeval forests remaining fragments becomes clear.

The Primeval Beech Forests of the Carpathians are unique because:

- The anthropogenic pressure throughout the centuries has had its greatest impact on the mesotrophic natural beech forests. They had almost entirely disappeared and today, they are significantly represented only in areas, now being presented in the serial nomination.
- Their localisation on the flysch and volcanic (Slovak Part) bedrock that gave rise to mesotrophic, nutrient-rich soils (eutric–dystric cambisols and andosols), both in the Slovak and Ukrainian parts; these natural conditions, along with sufficient precipitation, enabled a considerable accumulation of living and dead biomass (dying or dead trees subject to gradual decomposition); beech primeval forests of the Carpathians reach average growing stock levels (standing volume) of 687 m³, or maximum 800 m³; the balanced texture results in an occurrence of record tree dimensions within the ecological process of the developmental cycle, such as a beech tree 56,2 m in height

currently growing in the Havešová preserve, probably the highest European beech tree known to date.

- From the viewpoint of biodiversity and geobotany, the position on the boundary between *Carpathicum occidentale* and *Carpathicum orientale* enhances their species diversity, which is otherwise rather limited within pure beech forests. In these forests, quite specifically, mix the dominant East Carpathian species with the suboceanic populations spreading along the outer Carpathian Arc up to Ukraine. On volcanic bedrock (andesite), beech is the only hegemonic species that manifests the ability to entirely suppress even the shadow-tolerant herb layer, depending on the developmental cycle stages.
- Their biogeographical extension is restricted; regarding patterns such as tree species composition and specific developmental cycles, no such forests can be found in other parts of the world.
- The long-term research of beech primeval forests in the Slovak and Ukrainian part of the nominated series represents a significant added value from the point of science (STOYKO 2002); the respective localities have been subject to a periodical, 50 year long systematic research using a common methodical, internationally accepted approach (KORPEL 1989, 1995, VOLOŠČUK 2003, COMMARMOT et al. 2000, BRÄNDLI & DOWHANYTSCH 2003). This research not only continues but it is being expanded from various angles, e. g. trees necromass dynamics research, biodiversity (BUBLINEC & PICHLER 2001). Owing to ongoing global changes, such research can not be reproduced any more as the initial and boundary conditions have changed irreproducible. Thus, the beech primeval forests of the Carpathians offer a unique European etalon to assess the extent and rate of these changes.
- The concerned area has never been subject to any industrial development.

The “Beech Primeval Forests of the Carpathians” present forest associations whose main or sole constituent is the European beech (*Fagus sylvatica* L.). The most abundant among forest associations are *Fagetum pauper* and *Fagetum typicum* according by ZLATNÍK system or *Fagion* and *Tilio-Acerion* according the Zurich-Montpellier system (Tab. 1).

Besides, the joint nomination of Ukrainian and Slovak beech primeval forests generates an added value in the form of a thorough representation of natural beech forests falling into botanical unit *Carpathicum orientale*, and the transition towards *Carpathicum occidentale* in the Slovak part. These units cover the entire spectrum of site conditions in terms of climate gradients, and geological bedrock (crystalline, carbonate, flysch and volcanic). The Carpathian species mix with the sub-oceanic populations (PICHLER et al. 2007).

Authenticity

Authenticity and overall scientific value of localities in the serial nomination “Beech Primeval Forests of the Carpathians” is widely acknowledged within the international scientific circles (LEIBUNDGUT 1978, 1982, KORPEL 1995,

COMMARMOT et al. 2000, DAJOZ 2000). The development of concerned beech primeval forests is in a full accordance with to-date knowledge on the population genetics of beech (COMPS et al. 2001).

Beech expansion proceeded most probably along the Carpathians ridges from the south-east, the results of genetic analyses, however, indicate that Western Slovakia could also be influenced by another migration wave coming from the Alps. Ever since the Subboreal period beech represents dominant Slovak deciduous tree species thus forming a backbone of numerous nature reserves. For authenticity or naturalness is typical presence of autochthonous (aboriginal) species and absence of elements that demonstrate human intervention in the past (stumps, skidding roads, grazing), complex vertical and horizontal structure associated with developmental stages and phases (in sense of KORPEL 1995), presence of deadwood (laying and standing) in different stages of decay and ecosystems representation for the main forest communities of the region (Tab. 1). An important indicator of a primeval forests is a wide range of dimensions and age of trees both on the level of stand and species, as well as presence of large-sized and very old trees (KORPEL 1995).

The Primeval Beech Forests of the Carpathians contain habitats for maintaining the most diverse fauna and flora characteristic of the biogeographic province (e. g. *Rosalia alpina*), as well as those not restricted to a particular tree species. Perhaps contradicting the general perception, populations of brown bear (*Ursus arctos*), lynx (*Lynx lynx*) and wolf (*Canis lupus*) as big carnivores are not even bound to primeval forests in the strict sense but easily survive in extensive and relatively wild semi-natural and commercial Carpathian forests. Other types of habitats characteristic of mixed forests and organisms bound to tree species other than European beech are represented in sites that have already been inscribed on the list of world natural heritage.

Tab. 1. Syntaxonomic Units Valid for the Slovak part of the Primeval Beech Forests of the Carpathians

Primeval Forest	Syntaxonomic Units	
	Forest typology units (according to ZLATNÍK 1956)	Zurich-Montpellier School (according to MUCINA & MAGLOCKÝ eds. 1985)
Havešová Primeval Forest	<i>Fagetum pauper</i>	<i>Fagion</i>
	<i>Fagetum typicum</i>	<i>Eu-Fagenion</i>
	<i>Fagetum tiliosum</i>	<i>Acerenion</i>
Vihorlat Primeval Forest	<i>Fagetum pauper</i>	<i>Tilio-Acerion</i>
	<i>Fageto-Aceretum</i>	<i>Fagion</i>
	<i>Fraxineto-Aceretum</i>	<i>Eu-Fagenion</i> <i>Acerenion</i>
Stužica Primeval Forest	<i>Fagetum typicum</i>	<i>Tilio-Acerion</i>
	<i>Abieto-Fagetum</i>	<i>Fagion</i>
	<i>Fageto-Aceretum</i>	<i>Eu-Fagenion</i>
	<i>Fageto-Aceretum humile</i> <i>Fraxineto-Aceretum</i>	<i>Acerenion</i>

Integrity

To secure the integrity the nominated localities must contain all or a majority of mutually related and reciprocally dependent key components and necessary elements to demonstrate the key aspects of ecological processes that are essential for the long-term conservation of the ecosystems and the biological diversity they contain.

Continuous and undisturbed development of a primeval forest is possible only if a site has an area sufficient for all the ecological processes associated with a forest ecosystem. It is necessary to consider possible threats. No ever small forest fragment not influenced by man may be seen as a primeval (virgin) forest. Next to time, spontaneous development of a forest also needs space. For the beech primeval forests the minimal area is 30 - 50 hectares site, which secures sustainability and safety of the area from the potential outer pressure and to secure the functioning of key ecological processes pertinent to the nomination, i. e. autoregulation, homeostasis and autoreproduction of beech primeval forests in their entirety, i. e. including a constant proportion of the area taken by the respective developmental cycle stages across the primeval forest (KORPEL 1995).

This condition the Primeval Beech Forests of the Carpathians clearly fulfilled. This functional unity is established by undisturbed biogeochemical cycles, i. e. by energy and matter exchange between abiotic environment and organisms, as well as by complex ecological relations. No evidence of disruption of these key interconnections (such as the extraction of litter, wood, grazing, charcoal production etc.) has been found to date by *in situ* investigation or the review of historical records.

The maximum distance between the nominated properties is 30 km. Besides, they are interconnected by 250 ha beech primeval forest (not declared as a national nature reserve yet, but as protective forests effectively under protection), semi-natural forests and other beech primeval forest reserves within the Poloniny National Park and the Vihorlat Protected Landscape Area. The effects of abiotic factors as well as the exchange of biological information are therefore not restricted to any considerable level. These neighbouring forests feature only more simple texture in terms of aerial arrangement of individual developmental cycle stages. There not encircled by agricultural land, deforested land or man-made monocultures. The external pressure is therefore very limited.

The localities of the World Heritage have adequate long-term legislative, regulatory, institutional or traditional protection. The boundaries of that site reflect the spatial requirements of habitats, species, processes or phenomena that provide the basis for its nomination for inscription on the World Heritage List. The boundaries include sufficient areas immediately adjacent to the area of outstanding universal value in order to protect the site's heritage values from direct effects of human encroachment and impacts of resource use outside of the nominated area. The boundaries of the nominated site coincide with one or more existing or proposed protected areas, such as national parks, landscape protected area or biosphere reserves. The primeval forests, which are

properties of the World Heritage, are at the same time national nature reserves and so under strict protection regime. They are also encircled by an extra buffer zones and connecting corridors.

The World Heritage localities are the most important sites for the conservation of biological diversity, the variability among living organisms in ecosystems and the ecological complexes of which they are part and includes diversity within species, between species and of ecosystems.

The localities represent habitats for organisms bound to primeval forests only, such as organisms requiring the presence of trees necromass, either standing or lying, or birds and mammals nesting or living in tree cavities. In future, organisms having habitats in the World Heritage localities may well reclaim territories following the expected, more radical shift toward close-to-nature forestry, both in terms of respecting natural tree species composition as well as the ecological processes in the forests. The potential of this localities in this context again ensues from the status of beech as a climax tree species in the Central Europe.

Scientific value

The Beech Primeval Forests of the Carpathians as a natural feature consists of a biological formation – beech primeval forests, sustained by biogeochemical cycles as an indispensable part of this formation. As such, it is of outstanding universal value from the viewpoint of science because it does most completely and comprehensively reflects the ecological patterns of pure stands of European beech, which is the most important constituent of forests in the Temperate Broad-leaf Forest Biome, in the Middle European Forest biogeographical province and partly even in the biome of mixed mountain systems. The universal value of the nominated beech forests does consist both in the status of beech as originally the main forest constituent (after the return of tree species banished from Central Europe during the ice ages was complete), but also in their intrinsic ecological patterns as seen from the viewpoint ecology, i. e. complete stadial and developmental cycles that include all stages. In primeval forests the dynamics inherent to living systems are connected to ecological properties of dominant tree species, impact of abiotic factors related to geographical conditions and climate, to the complex topography and site properties (geological substratum, soil, nutrients and water availability), and to the impact of other organisms (e. g. outbreak of insect). The complex effect of all this factors may lead to development of temporary canopy gaps or even larger treeless areas as part of the succession. Under the given conditions, the spontaneous dynamics enables the forest community to exist continuously and in all its forms without limit in time.

In addition, elements of the “Beech Primeval Forests of the Carpathians” have been monitored and observed systematically for almost 50 years according to a single scheme (KORPEL 1995, VOLOŠČUK 2003). Therefore they provide a unique information on size necessary to allow for autoreproduction of similar ecosystems and biodiversity protection. At the same time their continuing

research delivers findings that enable and promote sustainable and site-adopted forestry in Europe and the establishment of new strict forest reserves.

Conservation value

Conservation value of the serial nomination “Beech Primeval Forests of the Carpathians” consists in the protection of the only remaining, pure beech (*Fagus sylvatica* L.) primeval forests as an important ecosystem (unique, complete and therefore outstanding). They also include habitats of entomofauna, avifauna and of some mammal species (bats) bound to habitats existing only in primeval forests, as well as their intact mycoflora (484 species recorded to date). These species at the same time serve as indicators of intactness of primeval forest ecosystems. Conservation value includes also the protection of the gene pool of beech (PICHLER et al. 2007).

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