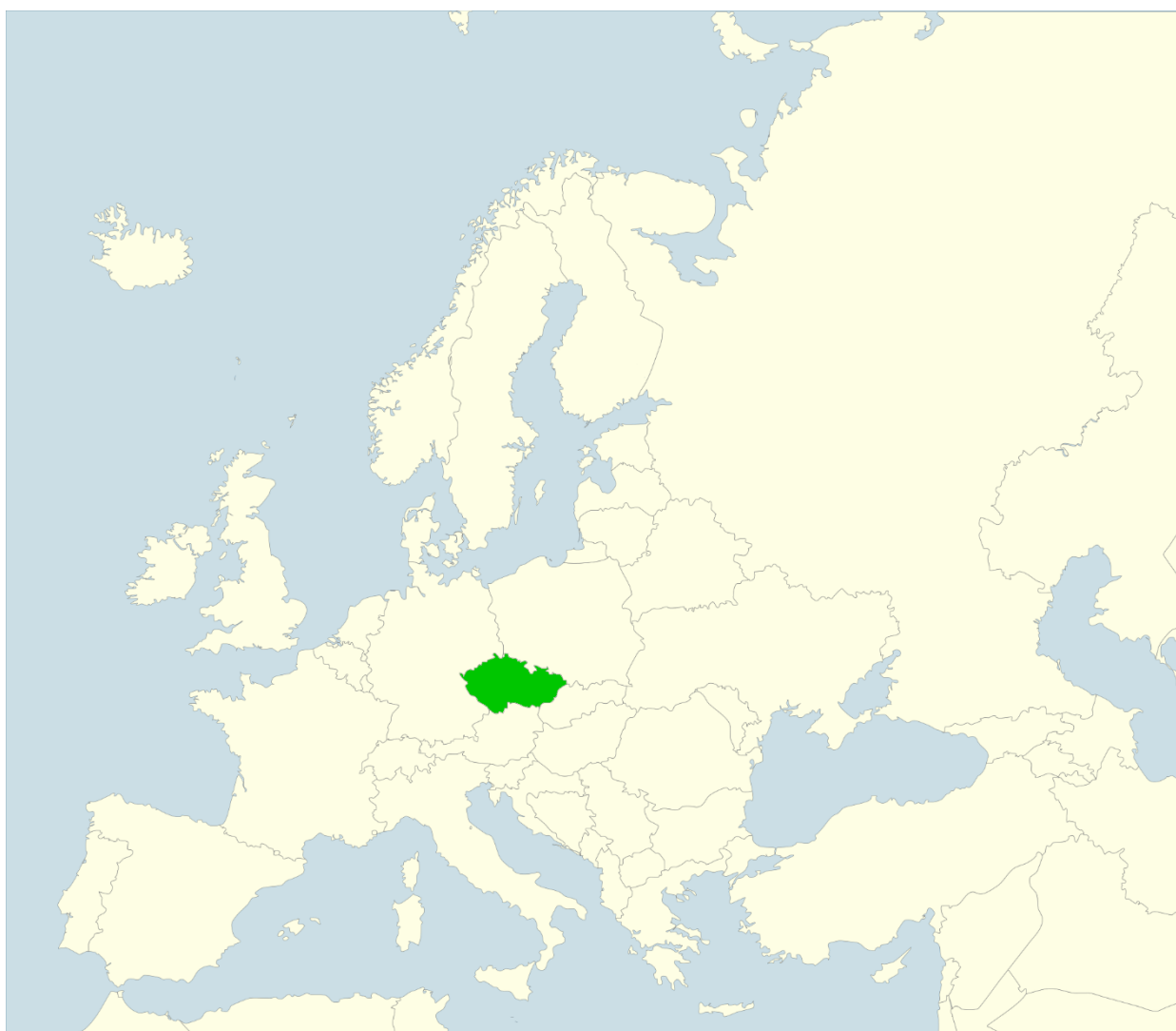


## ANCIENT COPPICE WOODLANDS IN THE LANDSCAPE OF THE CZECH REPUBLIC

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**Abstract:** Ancient coppice woodlands are forest stands of coppice origin with a long-term continual development and preserved typical natural and historic elements of old coppices. Significant natural elements in ancient coppices include polycormons of coppice shoots, pollard trees, trees with holes, dendrotelms, reserved trees, ecotones, glades and significant plant and animal species. Significant historic elements of localities with ancient coppices include archaeological monuments, boundary ditches and walls, boundary stones, boundary trees, myths and legends, sacral objects, old roads and paths, technical objects and plough land remainders. The paper presents differentiation of assumptions for the occurrence of ancient coppices in the territory of the Czech Republic using the COPF coefficient and examples of results from basic regional inventory (Kuřim region) and detailed local survey (locality Lebeďák) of coppice-originated forests. The extinction of the phenomenon of ancient coppice woodlands would mean irreparable impoverishment of the natural and cultural heritage.

**Key words:** ancient coppice woodland, natural and historic elements, possible occurrence at national level, regional inventory, local survey, Czech Republic

**Souhrn:** **Starobylé výmladkové lesy v krajině České republiky.** Za starobylé výmladkové lesy označujeme lesní porosty výmladkového původu s dlouhodobým kontinuálním vývojem a zachovanými typickými přírodními a historickými prvky starých pařezin. K významným přírodním prvkům ve starobylých pařezinách patří výmladkové polykormony, hlavaté stromy, doupné stromy, dendrotelmy, výstavky, ekotony, světliny a významné druhy rostlin a živočichů. Mezi významné historické prvky lokalit starobylých výmladkových lesů řadíme archeologické památky, hraniční příkopy a valy, hraniční kameny, hraniční stromy, pověsti a legendy, sakrální objekty, staré cesty a stezky, technické objekty a zbytky plužiny. V článku je prezentována diferenciace předpokladů výskytu starobylých pařezin na území České republiky s využitím koeficientu COPF a příklady výsledků základního regionálního (Kuřimsko) a podrobného lokálního (Lebeďák) průzkumu lokalit lesů výmladkového původu. Zánik fenoménu starobylých pařezin by znamenal nenapravitelné ochuzení přírodního a kulturního dědictví.

**Klíčová slova:** starobylé pařeziny, přírodní a historické prvky, předpoklady výskytu na celostátní úrovni, regionální inventarizace, lokální výzkum, Česká republika

## 1. Introduction

Ancient coppice woodlands which we call forest stands of coppice origin with a long-term continual development and preserved typical natural and historic elements of ancient coppices. Preserved localities of ancient coppice woodlands with old stools and stool heads represent an important evidence of ancient forest use and deserve permanent care and protection focused on the conservation of all natural and historic elements.

Coppices represent ancient and memorable form of sustainable landuse. The start of coppicing in European lowland forests already in the Neolithic period is documented by results of dendroarchaeological research (Szabó 2009). In prehistoric times, forests provided multiple benefits such as construction and fuel wood and their function for feeding domestic animals was irreplaceable. Apart from forest grazing, it is assumed that from the very beginnings of animal husbandry, domestic animals were fed or given as additional feed cut twigs and shoots of some broadleaved species, which is archaeologically documented from the Young Neolithic period (Dreslerová 2012). In the Pannonian part of the Danube basin, coppice shoots of trees were used as important building material for woven constructions of fences and farm buildings. The technique of woven buildings in the Danube basin is documented, for example, by

the illustration of Quad structures on the triumphal column of Marcus Aurelius in Rome (80s of the 2<sup>nd</sup> century AD), whose envelopes are created of dense sticking of vertical twigs intertwined with horizontal, wicker woven rings (Mencl 1980).

One of the oldest historic documents on coppice woodlands in the Czech Republic is the inventory of forests in the districts of Mikulov and Lednice from 1384 (Nožička 1956). Data in this inventory indicate that the rotation period for local coppice woods was seven years and no standards were mentioned. Such a short production time was induced by the need of raising fuel wood as quickly as possible. This rotation period was gradually extended and the density of standards increased. Towards the end of the 17<sup>th</sup> century, the rotation period of coppice woods was 11–13 years and approximately 0.7 standards were left per hectare. Efforts to thin coppice shoots (stored coppices) were recorded already in the 17<sup>th</sup> century. In 1807–1808, the studied area was managed as coppice with standards of different age with a rotation period of 35 years and variable density of standards ranging from 1 to 49 per hectare (Müllerová, Szabó, Hédl 2014).

The significant extent of coppice woodlands in the late Middle Ages is documented by results of a study of their distribution in Moravia (Szabó et al. 2015). The overview of coppice woodlands distribution in Moravia in the late Middle Ages was compiled from a database of written archive records with the information on the occurrence of coppice woodlands in individual cadastres. The authors estimate the area of coppice woodlands in Moravia in the late Middle Ages at 4500 km<sup>2</sup>, which is 20% of the total area.

In the Middle Ages, coppice forests served mainly to produce fuel wood but they were also used for the production of thin utility assortments, charcoal, tan bark, livestock grazing and for additional feeding of animals with dried twigs and foliage. In river floodplains, people used withes. Pollard willows and rare preserved stands of pollard willows belong to characteristic elements of the cultural alluvial landscapes until today (Kasala 2004).

In low coppiced forests, the rotation period ranged from 20 to 40 years. In addition to the low forest, coppicing was used a management system also to grow coppices with standards, in which generatively regenerated reserved trees of some tree species, mainly oak, were left in the coppice until an age of 100–150 and even more years. Thanks to the lower consumption of fuel wood, coppice-originated low forests and coppices with standards started to be gradually converted in the 19<sup>th</sup> century into high forests with essentially longer rotation period. Coppices were converted into high forests either by direct conversion when the new stand was established by individuals of generative origin, usually by artificial regeneration, after coppice extraction, or by indirect conversion when stool shoots were gradually thinned until only a single stem remained on the stool. The indirect conversion gave rise to stored coppices (into high forests derived coppices), which currently predominate on the area of coppice-originated forests in the Czech Republic and which are usually classified as high forest in forest records. In 1953, the area of coppice forests in the Czech Republic totalled 81 090 ha (Vyskot 1957). In 2009, 7 thousand hectares of wooded land (0.27% of total forest area) was classified as low forest and 2 thousand hectares (0.09% of total forest area) as coppice with standards (Ministerstvo zemědělství 2009). The application of standard forest management procedures, there is a danger that ancient coppices in the existing stored high forests, which gradually reach felling age will be lost.

Coppices forests with a long-term continual development that we call ancient coppice woodlands can be considered *man made natural ecosystems* (Maarel 1975). These communities either came to existence or are maintained by human intervention and are characterized by high diversity of wild plant and animal species, i.e. by high ecological stability. The significance of low forests and coppices with standards for landscape biodiversity has been recently pointed out by many authors (e.g. Hédl, Kopecký, Komárek 2010, Müllerová, Hédl, Szabó 2015).

Naturalistic importance of the remainders of ancient coppice woodlands is in the Czech Republic in the area of primeval ecumene and subecumene comparable with the significance of the remainders of natural forests (primeval forests) in higher vegetation tiers (Buček 2009). This is why the localities of ancient coppice woodlands in the primeval residential landscape represent an important component of ecological network (Buček, Drobilová, Friedl 2011). A number of localities of ancient coppice woodlands are protected within small- and large-scale strictly protected areas (Machar 2009). Nevertheless, the management of these areas is focused mainly

on the conservation of biodiversity. Cultural and historic aspects of the emergence, development, condition and significance of coppice-originated forests in the territory of the Czech Republic have been given virtually no attention so far.

There is no doubt that the localities of ancient coppice woodlands belong not only to the significant components of the ecological network in the landscape but also to historic landscape structures. Historic landscape structures are often referred to as landscape memory because they represent a specific, historically delimited and spatially incessantly diminishing subtype of current landscape structure (Jančura 1998). The localities of ancient coppice woodlands represent mixed natural and cultural systems and it is useful to apply a holistic concept of multifunctional landscape in their delimitation, which needs a transdisciplinary approach (Naveh 2001). There is a principle at applying this concept that holistic landscape structures represent singular units representing more than just a sum of their individual components since their value consists of interactions between natural and historic elements. This approach should be used in the delimitation and valuation of the localities of ancient coppice woodlands. A similar multidisciplinary approach was used, for example, in the mapping of traditional cultural landscapes in the Mediterranean area of Sicily (Cullotta, Barbera 2011). Significant elements of the traditional Sicilian landscape are mountain forests, affected by humans for 3 thousand years, which currently consist mainly of old coppice woodlands (Barbera, Cullotta 2012).

An exemplary concept for research, protection and management of ancient forests was elaborated in Great Britain (see e.g. Peterken 1993, Rackham 2003, Read, Frater, Wright, 1999). Continually developing forests are referred to as *ancient forest (woodland)*. Ancient woodlands in Britain usually include forest areas sized over 2 ha that have been continually under forest at least since 1600. Many localities of ancient woodlands were however recorded already in the inventory of land from the end of the 11<sup>th</sup> century (so-called Domesday Book from 1086). In 1973–1991, an inventory of ancient woodlands was conducted in Britain, which was connected with the historic survey and assessment of the condition of their localities and their significance in the landscape (Marren 1992). The long-term research of ancient coppice woodlands made it possible to propose a system of measures and interventions leading to sustainable conservation of natural, cultural and historic values (see e.g. Buckley 1992, Starr 2005).

In the cultural landscape of the Czech Republic, the localities of ancient coppice woodlands belong to developmentally most advanced forest biocoenoses. They represent significant elements of the ecological network, are essentially important for the conservation of biodiversity and landscape character, and should also be considered significant cultural and historic monuments and part of the landscape memory (Buček et al. 2016).

In the paper are presented characteristics of significant natural and historic elements typical for localities of ancient coppice woodlands and results of investigation at national, regional and local level. At a national level, possible occurrence of ancient coppice woodlands on the territory of Czech Republic can be estimated by using the COPF coefficient. At a regional level, basic research is used to determine the occurrence of ancient coppice woodlands in the administrative districts of municipalities with extended powers (MEPs), example of Kuřim region is presented. The local level is focused on specific localities with ancient coppice woodlands, in which detailed research is conducted, example of locality Lebedřák is presented. Results of detailed research have practical impacts on the conservation and management of individual localities.

## 2. Natural and historic elements of ancient coppice woodlands

Ancient coppice woodlands as holistic landscape structures are characterized by the occurrence of numerous natural and historic elements. Their frequency and good condition is decisive for the delimitation of the localities of ancient coppice woodlands and for the determination of their significance (Maděra et al. 2016).

Significant natural elements in ancient coppice woodlands include polycormons of coppice shoots, pollard trees, trees with holes, dendrotelms, reserved trees, ecotones, glades and significant plant and animal species.

*Polycormons of coppice shoots* (Figure 1, Figure 2, Figure 3, Figure 4) develop through vegetative regeneration of woody plants. The capacity of regenerating vegetatively from dormant or adventitious buds is a basis for the existence of coppice woods. The capacity of creating stool shoots or root suckers greatly differs in individual tree species (Úradníček et al. 2010). Old coppice polycormons are valuable evidences to the original genepool of broadleaved tree species from the period before the rational forest management with seeds often transported over long distances. The age of polycormons of coppice shoots can reach several hundreds of years. For example, in the Podyjí National Park, an oak polycormon was analysed with seven coppice stems, which was aged 825 years (Vrška et al. 2016). The occurrence of old polycormons of coppice shoots is a decisive criterion for the delimitation of the localities of ancient coppice woodlands and for the assessment of their significance.



*Fig 1. Polycormon of coppice shoots with massive shoot head on the locality Lebeďák (MEP Boskovice).*



*Fig 2. Polycormon of coppice shoots above the edge of gully on the locality Lebeďák (MEP Boskovice).*





Fig 3. Polycormon of coppice shoots (*Quercus robur*) with massive shoot head and dendrotelms. Locality Želešický háj (MEP Šlapanice).



Fig 4. Polycormon of coppice shoots with massive shoot head and dendrotelm. Locality Hlína (MEP Ivančice).

*Pollard trees* (Figure 5, Figure 6) come to existence if the stem is pruned at a height where a typical swollen "head" gradually develops. Characteristic pollard trees are willows; in other tree species, they are rather rare. Since the traditional technique of pollarding has lost significance, the phenomenon is gradually disappearing from the landscape. If we want to keep the over-aged pollard trees in the landscape, we have to start pruning them again and establish new ones (Mitchell 1989).

*Trees with holes* (Figure 7, Figure 8). Characteristic of ancient coppice woodlands is frequent occurrence of trees with stem cavities. Den trees are old trees with stem cavities which certain mammals use as shelter. Nest trees serve as nest or roosting sites for particular bird species.

*Dendrotelms* (Figure 9, Figure 10). Cavities in stools or stems that are at least periodically filled with water create a specific microhabitat important in terms of a possible occurrence of some kinds of organisms. In ancient coppice woodlands, dendrotelms develop characteristically in the middle or on the margin of old stools. The occurrence of dendrotelms is important in terms of biodiversity (Kitching 1971).





*Fig 5. Pollard trees on boundary of land properties. Locality Hlína (MEP Ivančice).*



*Fig 6. Pollard tree (*Quercus petraea* agg.). Locality Bosonožský hájek (MEP Brno).*



*Fig 7. Polycormon with one tree with holes on the locality Lebeďák (MEP Boskovice).*



*Fig 8. Tree with hole on the locality Opálenka (MEP Kuřim).*





Fig 9. Dendrotelm in massive stool head on the locality Březina (MEP Kuřim).



Fig 10. Middle dendrotelm in the polycormon of coppice shoots. Locality Hlína (MEP Ivančice).

*Ecotones* (Figure 11, Figure 12) are communities of forest margins and with the occurrence of heliophytes in them, they are very important for biodiversity (Lacina 2008). Ecotones can be differentiated by emergence and development, site characteristics and species composition, by duration, location of adjacent communities, by structure, width, integrity, species diversity and by the degree of similarity of the species composition of ecotones with the adjacent communities (Kiliánová et al. 2009). Ecotones often exhibit the highest concentrations of polycormons with coppice shoots.



Fig 11. Shrub ecotone community on the locality Hájek (MEP Kuřim).

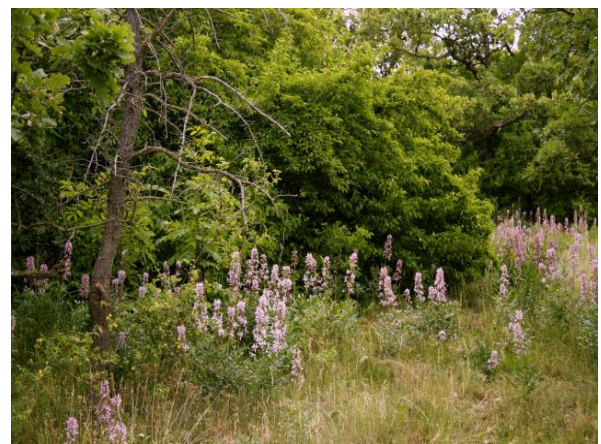


Fig 12. Herb ecotone community with *Dictamnus albus*. Locality Doutnáč in Bohemian karst (MEP Beroun).

*Glades* (Figure 13, Figure 14) emerge in coppices either naturally as steppe or forest-steppe enclaves on extreme ecotopes, or artificially as grassland or pastoral enclaves. Glades are important refuges of many rare and threatened plant and insect species (Konvička et al. 2004).





Fig 13. Glade with natural tree regeneration damaged by herbivores. Locality Sokolí skála (MEP Tišnov).



Fig 14. Forest steppe enclave on steep slope with shallow soil. Locality Týřov in Křivoklátsko (MEP Rakovník).

Reserved trees (standards) (Figure 15, Figure 16) are trees usually of seed origin, left in coppices during main felling even for several rotation periods in order to produce high-quality assortments, to provide for natural regeneration, for aesthetic reasons or nature conservation aspects.



Fig 15. Reserved tree (standard) in ancient coppice woodland. Locality Ve žlebčách (MEP Vyškov).



Fig 16. Reserved (standard) tree on the locality Babi hřbet (MEP Kuřim).

*Significant species and true forest plant species* (Figure 17, Figure 18). Specific stand conditions of ancient coppice woodlands, light regime in particular, together with their historic development create unique environment for the existence of many diverse plant and animal species. Many of them are bound only to ancient coppice woodlands and can be found in other biotopes only sporadically. A specific group of plants is formed by the so-called true forest species to which belong plant species with optimum in semi-shaded up to shaded environments of forest stands, i.e. forest hemisciophytes and sciophytes (Zlatník 1970). These are usually at the same time species belonging to poor and slow colonizers (Kubíková 1987), i.e. species either not spreading into the secondary forests at all or spreading very slowly.





Fig 17. *Dactylorhiza sambucina* is an example of significant species that grows in the glade on the locality Březina (MEP Kuřim).



Fig 18. Significant species *Daphne cneorum*. Locality Velký Kosíř (MEP Olomouc).

Significant historic elements of localities with ancient coppice woodlands include archaeological monuments, boundary ditches and walls, boundary stones, boundary trees, myths and legends, sacral objects, old roads and paths, technical objects and plough land remainders (Buček, Černušáková 2016).

*Archaeological monuments* (Figure 19) include localities of ancient fortified and unfortified settlements, burial mounds and flat burial places, castle ruins, abandoned medieval villages, stone circles, menhirs, grain pits and other structures. The significance of forests for the conservation of archaeological monuments is documented by the fact that of more than 30 000 known archaeological localities in the Czech Republic, approximately a third occurs in forests (Sokol 2006). The occurrence of notable archaeological monuments on the localities of ancient forests considerably increases their cultural and historic significance.



Fig 19. Archaeological monument in ancient coppice woodland. Locality Moravsko-Krumlovský les (MEP Moravský Krumlov).



*Boundary stones* (Figure 20, Figure 21) are topographic field monuments (Bukačová 2001) giving evidence about property ownership and historic development of the landscape. The simplest boundary stones used to be provided only with a decoratively carved serial number or initials of the estate, more important boundary stones bear also data. The oldest boundary stones found in coppice woodlands originate from the 16<sup>th</sup> century (Figure 20).



Fig 20. The oldest boundary stone from 1588. Locality Obora Holedná (MEP Brno).



Fig 21. Boundary stone with emblem crown of monastic estates. Locality Pekárna (MEP Brno).

*Boundary ditches and walls* (Figure 22, Figure 23) are old-time ways of marking forest boundaries, documented in many European countries, and can be considered part of the European cultural heritage (Szabó 2010). They bring important evidence about property conditions and historic development of the landscape but their importance is not properly appreciated, they are not registered and their original function is mostly forgotten.



Fig 22. Boundary wall on the locality Lebedák (MEP Boskovice).



Fig 23. Boundary ditch. Locality Želešický háj (MEP Šlapanice).

*Boundary trees* (Figure 24, Figure 25) were to mark boundaries of land properties, estate boundaries or boundaries of forest ranges, even borders of units of spatial forest division. Margins of isolated localities of ancient coppice woodlands and boundaries with farmlands use to exhibit



concentrated occurrence of old stools and pollard trees. In coppices on boundaries of individual land properties, trees of seed origin were often left as reserved trees, which survived several rotation periods of the low forest. These boundary trees complemented the course of land borders marked by boundary stones or boundary ditches. Boundary trees in Moravia were also pollard trees documented by archives from the 16<sup>th</sup> century (Bukačová 2001).

*Myths and legends* belong to intangible monuments and give a valuable testimony about the perception of the forest landscape and its history by local population. Rather sparse but very valuable are legends directly referring to coppice localities with their significant elements. For example, a legend related to an ancient coppice wood locality called Ochůzky in South Moravia mentions a boundary pollard oak tree: "...There is an oak tree on the margin of Kloboucký forest in Ochůzky, under which Moravian Anabaptists buried a treasure, which they could not take with them when they had to leave the country. Slovaks searched Ochůzky, and actually found an old and low pollard oak, called a head, which was standing there as a boundary mark. They dug under the tree and found a lot of gold and silver money" (Ošmera 1993).

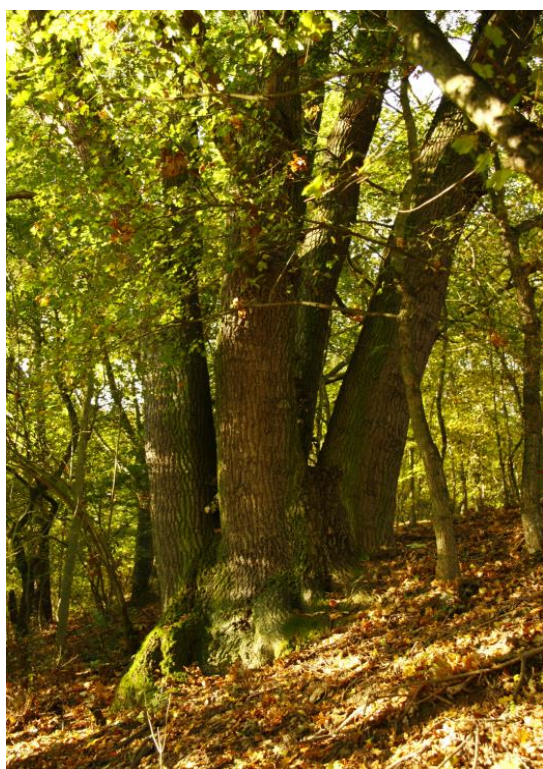


Fig 24. Boundary tree on the locality Lebed'ák (MEP Boskovice).



Fig 25. Boundary trees on the locality Opálenka (MEP Kuřim).

*Sacral objects* (Figure 26, Figure 27) are important small monuments that may occur in the localities of coppice woods such as crucifixes, stone crosses, wayside crosses, pictures on trees, chapels, Stations of the Cross and memorials. The small sacral objects represent significant expressions of Christian liturgy in the cultivated landscape (Kopeček, Löw, Kučera 2015).





Fig 26. Sacral object in the ancient coppice woodland. Locality Moravsko-Krumlovský les (MEP Moravský Krumlov).



Fig 27. Picture on tree as an example of sacral object. Locality Přední kout (MEP Hustopeče).

*Old roads and paths* (Figure 28, Figure 29) considerably influence the character of the contemporary landscape (Klimek, Bolina 2015). The use over hundreds of years gave rise to a pattern of local paths and roads in coppice forests, which served mainly for timber hauling. Felled coppice stems were skid to them by hand and then transported by horse and carriage to longer distances, usually to nearby rural settlements. The preserved remainders of old roads and paths (especially sunken roads) document the ways of access to land in the past and of ancient timber transport technologies.

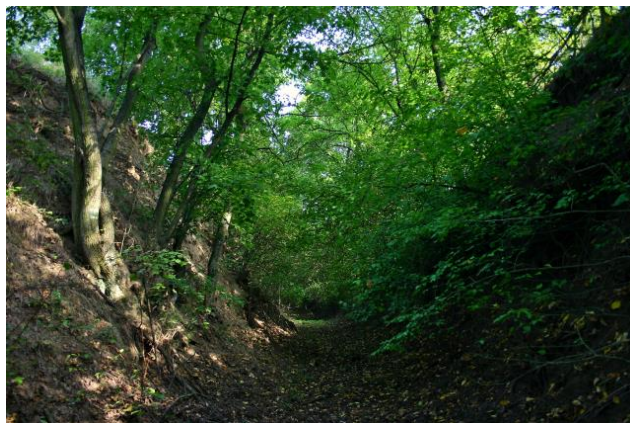


Fig 28. Old sunken road. Locality Pouzdřany steppe (MEP Hustopeče).



Fig 29. Old path in ancient coppice woodland. Locality Hlína (MEP Ivančice).

*Technical objects* (Figure 30, Figure 31). Many old technical structures were preserved in the localities of coppice woods, which are no more used and lost their original function, but still deserve attention and conservation. These include e.g. charcoal burner platforms, old tunnels, quarries, loam and sand pits, dumps, dugouts, military ditches and walls, fountains and springs. Most frequently occurring are small rural quarries. The occurrence of charcoal burner platforms (charcoal kilns) in coppice-originated woods brings evidence to intensive influencing of forests by logging in the past. Most conspicuous are remainders of charcoal burner platforms in sloping terrains where the earth extracted during the digging of platforms into the slope was used in modelling the other part of the platform on the slope (Bobek, Matoušek 2015).





Fig 30. Example of technical objects – loam pit in ancient coppice woodland. Locality Kolby forest (MEP Hustopeče).



Fig 31. Burner platform (charcoal kiln) as an example of technical objects. Locality Týřov in Křivoklátsko (MEP Rakovník)

Plough land remainders (Figure 32, Figure 33) represent important agrarian anthropogenic forms because they document the former agricultural use of a part of the area of contemporary forest stands. Most often, we find *agrarian terraces* in the forests, i.e. slope steps formed by a nearly horizontal, as a rule narrow and long platform and by a steeper terrace slope. Frequently, there are also knobs of *agrarian piles* emerged from stones collected in the field. Their interconnection gave rise to long *agrarian walls* (Kirchner, Smolová 2010). Agrarian terraces, piles and walls became often overgrown with coppiced woody plants. This is why some of them still bear important old polycormons even outside the continuous localities of ancient coppice woodlands.

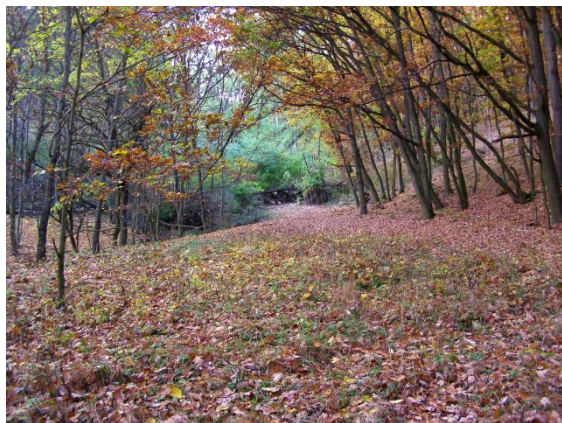


Fig 32. Plough land remainders. Locality Hlína (MEP Ivančice).



Fig 33. Agrarian wall with *Carpinus betulus* polycormons. Locality Sokolí skála (MEP Tišnov).

### 3. Methods

Suitable spatial frameworks for the research of ancient coppice woodlands in the contemporary landscape are districts of municipalities with extended powers (MEPs). MEP districts constitute cadastral areas of individual incorporated municipalities. There are 206 MEPs in the Czech Republic, also called "small districts".

#### 3.1 Assumptions for the occurrence of ancient coppice woodlands in the Czech Republic

To identify differences in natural, historic and current assumptions for the occurrence of ancient coppice woodlands in administrative districts of municipalities with extended powers (MEPs), Maděra et al. (2015b) created coefficient called COPF (based on the first three letters in "coppice" and a letter for forest), which consists of COP index values in MEPs, differentiated according to



the area of forests existing in the MEPs. It is calculated by dividing the values of COP index in the MEP by the currently existing forest area in the MEP in km<sup>2</sup>.

The basic COP index (Maděra et al. 2015a), from which the COPF coefficient values are derived, is determined for a comprehensive complex assessment of the assumption for the occurrence of localities with ancient coppice-originated forests in the territory of the Czech Republic. The set of criteria includes natural, historic and current indicators. The weight of individual criteria was determined by expert method. The catalogue of COP index criteria is formed by the following indicators:

- Natural conditions for the emergence of coppice woodlands
- Area of low forest in 1845
- Area of low forest in 1941 and 1947
- Area of oak stands in 1941 and 1947
- Current area of low forest in forest records
- Current area of coppice with standards in forest records
- Area of the Natura 2000 habitats with a possible occurrence of coppice woodlands

Developing the catalogue of criteria, criteria weight determination and designing the verbally numerical scale for their assessment, Maděra et al. (2015a) used the currently available knowledge of natural, historic and current conditions for the emergence of ancient coppice woodlands.

Values of individual indicators for individual MEPs were stored in the form of a so-called geodatabase and processed in the environment of geoinformation systems (GIS). Resulting values of the COPF coefficient, also stored in the environment of relevant geodatabase, were subsequently linked with the polygon layer of MEPs based on a clear identifier (corresponding MEP numbers in the two data sources). Individual ranges of values of the verbally numerical scale were then visualized by using the applied gradient of the requested palette. The resulting product was a map of COPF coefficient values for the areas of all MEPs within the Czech Republic.

### 3.2 Inventory of localities with ancient coppice woodlands

Inventory of ancient coppice-originated woodlands brings important information about their occurrence in the given territory, their size and current condition (preservation and significance). The inventory can be conducted only by field survey; remote sensing demonstrably cannot distinguish the coppice origin. Field research can reveal information about the presence of natural, cultural and historic elements that are of essential importance in assessing the significance of localities with ancient coppice woodlands (Maděra et al. 2016b).

#### 3.2.1 Basic survey

Basic survey serves to prove the occurrence of ancient coppice woodlands, to map their size and to assess their significance in general. Mapped territory is usually administrative district of a municipality with extended powers. Mapping in forest stands is made to detect the occurrence of polycormons with coppice shoots, which clearly identify their coppice origin. When a coppice-originated stand is found, natural, cultural and historic elements occurring therein are evaluated. The evaluation of these elements is made by using a verbally numerical scale (Tab 1).

Tab 1. Evaluation of element significance.

1	none
2	low
3	intermediate
4	high
5	exceptionally high

The comprehensive evaluation of localities combines data about the representation of coppice-originated woody plants and the significance of individual natural and historic elements. Decisive for the classification of the localities of coppice-originated forests as ancient coppice woodlands is tree layer condition, or how many polycormons with coppice shoots constituting the primary and most significant natural elements of ancient coppices are preserved in current forest stands. The resulting classification of site significance is based on a scale combining the coppice significance (Tab 2) and evaluation of coppice size (Tab 3): A1, A2, A3, B1, B2, B3, C1, C2, C3.

Tab 2. Significance and resulting classification of localities.

A	significant ancient coppice woodlands
B	ancient coppice woodlands
C	stored high forests

Tab 3. Size of coppice-originated forests occurring on the locality.

1	coppices on the whole area
2	coppices on a larger part of the area (more than 50%)
3	coppices on a smaller part of the area (less than 50%)

### 3.2.2 Detailed survey

The aim of a detailed survey of the localities of ancient coppice woodlands is to characterize the conditions of individual localities with ancient coppice woodlands, significant localities (Category A in particular), to map, record and describe all preserved natural, cultural and historic elements. Results of detailed survey serve as groundwork data for possible conservation and management of the locality.

The detailed survey is conducted especially on significant localities of ancient coppice woodlands and is based on locality division into segments, homogeneous in terms of the condition of coppice-originated forests. In each segment, the occurrence and significance of natural, cultural and historic elements is assessed (see Tab. 1). Subsequently, each individual segment is subject to detailed survey, at which all preserved natural, cultural and historic elements of ancient coppice woodlands are recorded, localized and characterized. The elements are localized by using GPS. Output is a detailed plan of the locality on scale following out from the locality size (1 : 500 – 1 : 5 000) and a database of natural, cultural and historic elements.

## 4. Results

### 4.1 Assumptions for the occurrence of ancient coppice woodlands in the Czech Republic according to COPF coefficient

Very good assumptions for the occurrence of coppices according to COPF (Figure 34) coefficient are in 9 MEPs (total area 1947.48 km<sup>2</sup>) with 274.30 km<sup>2</sup> of forest. Good assumptions are in 14 MEPs (total area 3656.59 km<sup>2</sup>) with 773.15 km<sup>2</sup> of forest and intermediate assumptions are in 25 MEPs (total area 9896.92 km<sup>2</sup>) with 2352.86 km<sup>2</sup> of forest. On the other hand, poor assumptions exist in 33 MEPs (total area 9647.81 km<sup>2</sup>) with 2344.61 km<sup>2</sup> of forest and very poor assumptions are in 125 MEPs (total area 53717.95 km<sup>2</sup>) with 20918.82 km<sup>2</sup> of forest. Percentages of these values are presented in Tab 4.



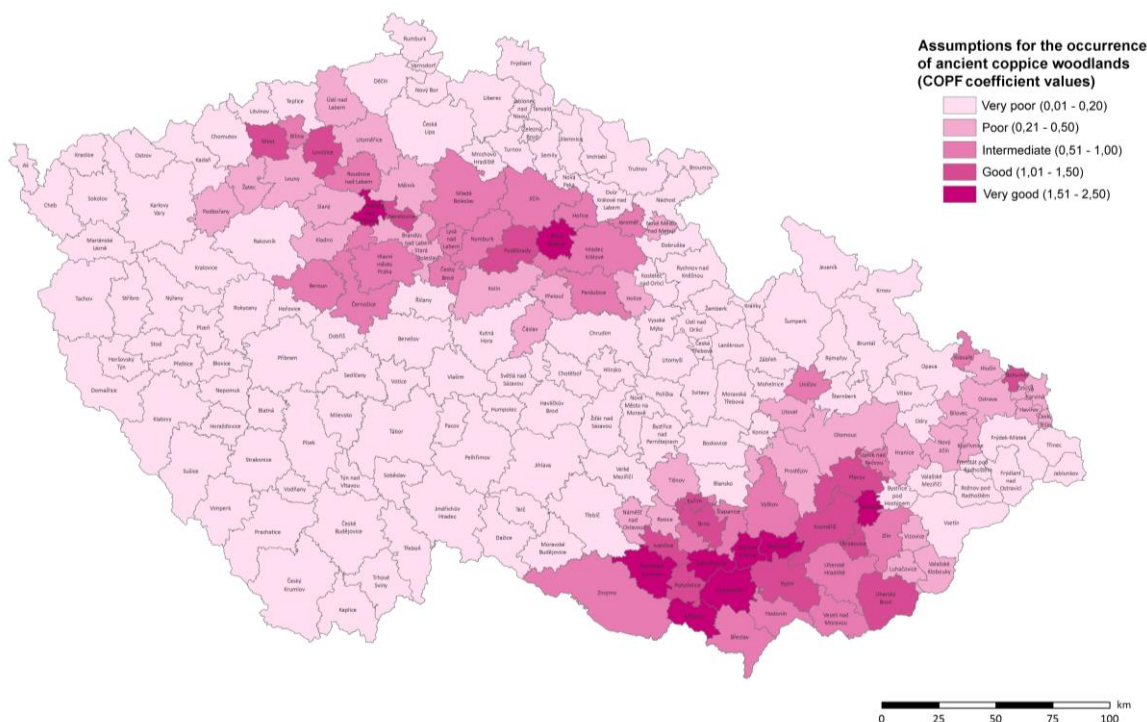


Fig 34. Assumptions for the occurrence of ancient coppice woodlands in the Czech Republic according to COPF coefficient. Assumptions and COPF coefficient values are displayed for districts of municipalities with extended powers (MEPs).

Tab 4. Number of MEPs, area of MEPs and forest area percentage in MEPs according to individual COPF coefficients degrees, i.e. according to assumptions for the occurrence of ancient coppice woodlands (in %).

Assumptions for the occurrence of ancient coppice woodlands (COPF)	COPF coefficient	Number of MEPs	Percentage from the total number of MEPs	Area of MEPs (km <sup>2</sup> )	Share of MEPs area in the total area of all MEPs (%)	Forest area percentage in MEPs
Very poor	0.01–0.20	125	60.68	53717.95	68.11	78.45
Poor	0.21–0.50	33	16.02	9647.81	12.23	8.79
Intermediate	0.51–1.00	25	12.14	9896.92	12.55	8.82
Good	1.01–1.50	14	6.80	3656.59	4.64	2.90
Very good	1.51–2.50	9	4.37	1947.48	2.47	1.03

#### 4.2 Ancient coppice woodlands in the Kuřim region

Model MEP chosen for the assessment of coppice-originated forests in terms of the presence of significant natural and historic elements was that of Kuřim in the South Moravian Region (Figure 35), situated northwest of Brno on the borderline between the Bohemian-Moravian Upland and the Brněnská vrchovina upland (Demek et al. 2006). The MEP administrative district area totals 7 704 ha and consists of 10 partial cadastral areas. The studied area belongs in the Brno bioregion (Culek 1996), which represents a marginal part of the Hercynian biogeographical sub-province. Relief consists of a rugged upland falling into deep fault gaps of the Svatka River and Bílý Potok Brook. The lowest point of the area is the Svatka River water level in Veverská Bitýška (230 m a.s.l.) and the highest point is the peak of Babí lom Quarry (562 m a.s.l.).



Fig 35. Three main levels of ancient coppice woodlands research. At the national (supra-regional) level (Czech Republic) possible occurrence of ancient coppice woodlands can be estimated by using the COPF coefficient. At the regional level, basic research is used to determine the occurrence of ancient coppice woodlands in the administrative districts of municipalities with extended powers (MEP Kuřim). The local level is focused on specific localities with ancient coppice woodlands, in which detailed research is conducted (Lebedčák).

Forest stands occupy 35.5% of the model area; predominant are rather secondary coniferous (spruce, pine) stands, less represented are mixed and broadleaved woods (Drobilová 2008). Extensive fragments of near natural to natural forests of the type of thermophilous oak and oak-hornbeam stands occur especially in the natural parks of Baba and Podkomorské lesy Forests reaching into the Kuřim MEP territory. Isolated game refuges occur in patches in a relatively large area of arable land (esp. in cadastral areas of Veverská Bitýška, Chudčice and Kuřim).

The Kuřim area belongs to MEPs with favourable natural prerequilocities for the occurrence of localities with coppices. A fifth (20.61%) of its area has very good conditions (A) for the emergence of coppice woods, and natural conditions of the remaining part of the area are good (B). Similar natural preconditions exist on the current forest area in the MEP Kuřim. 645 ha of current forests (23.65%) show very good natural conditions for the emergence of coppice woods and the remaining 2083 ha have good conditions (Buček & Černušáková 2015). COPF coefficient in the MEP Kuřim is 1.28, i.e. assumptions for the occurrence of ancient coppice woodlands according to COPF coefficient are good.

Landuse reports of 1845 for cadastral areas constituting the administrative district of today's MEP Kuřim indicate that low forests occupied an area of 1200 ha. The largest proportion of coppice woodlands was in the cadastral areas of three villages: Moravské Knínice (514 ha), Jinačovice (323 ha) and Lelekovice (180 ha). Somewhat smaller were areas of low forest in the cadastral areas of other villages: Kuřim (87 ha), Čebín (38 ha), Rozdrojovice (34 ha), Hvozdec (26 ha). Landuse reports from Chudčice and Veverská Bitýška do not mention the low forest area at all because forests occurring in these two cadastral areas in 1845 were only coniferous. Nevertheless, coppice woods might have emerged on localities classified as shrubs, which occupied 6 ha in c.a. Veverská Bitýška and 2 ha in c.a. Chudčice.

Following the detailed field survey, we selected 20 localities with preserved natural or cultural-historic elements of ancient coppice woodland (Figure 36). Criterion for selection as a locality of ancient coppice woodlands was at least a singular occurrence of vital polycormons of coppice shoots. In the assessed forest stands, these were most frequently polycormons of sessile oak (*Quercus petraea* agg.), in lesser numbers of hornbeam (*Carpinus betulus*) and field maple (*Acer campestre*).



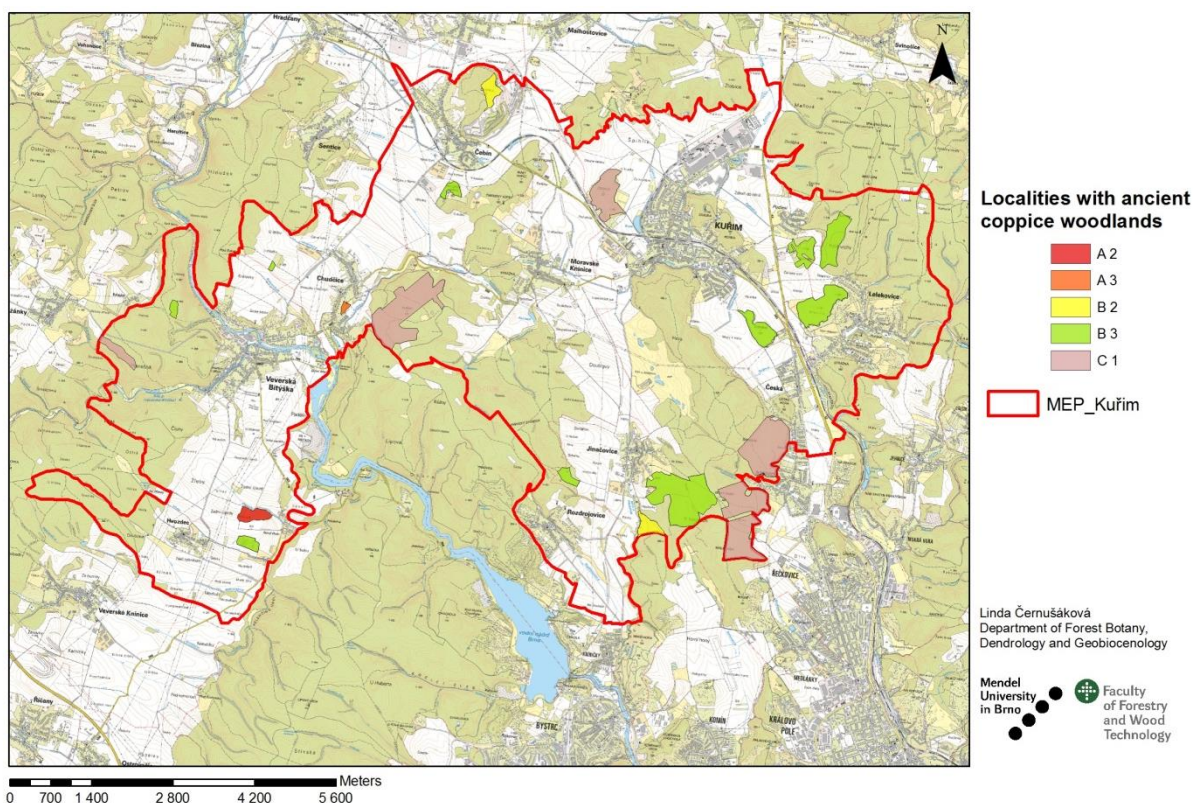


Fig 36. Ancient coppice woodlands in the administrative district of MEP Kuřim.

Total area of current localities with coppice-originated forests amounts to 546.7 ha. Two localities (Hájek and Chudčický háj Grove) with a total area of only 11.3 ha were classified as significant ancient coppice woodlands (Category A) because they exhibit very significant polycormons with coppice shoots. Twelve localities (187.4 ha) are ancient coppice woodlands (B), where polycormons with coppice shoots are of low or intermediate significance. The largest area (348 ha) of the delimited localities of coppice-originated forests occupy six localities with stored high forest (C), high forest derived from coppice where polycormons with coppice shoots have not been preserved (Tab 5).

The basic survey of localities in the studied area showed that local forests of coppice origin exhibit all defined natural and historic elements (Tab 6) with the exception of pollard trees, which did not belong to used forms of delimiting land property boundaries in this area according to preserved historic records. Instead of them, boundary trees were usually pedunculate oaks or boundary stones secured proprietary rights in the landscape in case of manor-house estates.

Tab 5. Evaluation of the localities of coppice-originated forests delimited in the administrative district of MEP Kuřim.

	Babí hríbět	Březina	Cimperk	Čebínská horka	Doubrava nad Mokří	Haluzník	Hájek	Holé vrchy	Hranečník	Hrbatá	Chudčický háj	Kuňky	Malá Baba	Nad stanoviskama	Opálenka	Pod Vápenicí	Sychrov	Šiberná	U vodojemu	Velká Baba
Locality nr.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Area [ha]	74	32	22	5.7	3.2	1.2	9.5	13.7	10	6	1.8	63	85	8.7	14	6,5	56	16,4	5,8	112
<b>NATURAL ELEMENTS</b>																				
Dendrotelms	3	3	1	2	2	1	4	2	2	1	4	1	2	1	4	2	2	2	1	2
Trees with holes	3	3	2	2	2	2	3	2	2	2	1	1	2	1	3	1	3	2	1	3
Ecotones	1	3	3	3	1	3	4	1	1	2	2	1	1	2	3	1	1	3	2	1
Pollard trees	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Glades	1	3	1	1	2	2	4	2	1	2	1	3	1	1	2	1	1	2	2	1
Polycormons of coppice shoots	3	3	1	2	3	2	4	2	1	2	3	1	1	3	3	3	1	2	2	1
Reserved trees	2	2	1	2	1	3	1	1	2	1	1	1	2	1	2	1	2	2	1	2
Significant species and true forest plant species	2	5	2	4	4	3	5	4	4	4	4	4	4	4	3	3	4	5	3	4
<b>HISTORIC ELEMENTS</b>																				
Archaeological elements	1	1	1	1	1	1	1	1	1	1	1	1	1	1	4	1	1	4	1	1
Boundary ditches and walls	1	1	1	1	1	1	3	1	1	1	1	1	2	1	4	1	4	1	1	1
Boundary stones	3	1	1	3	1	4	1	1	1	1	3	1	1	1	1	1	1	1	3	1
Boundary trees	1	1	1	3	1	1	4	1	1	1	4	1	1	2	3	3	1	2	1	1
Myths and legends	1	1	4	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Sacral objects	1	1	1	1	1	1	1	1	1	1	1	1	1	1	3	1	1	1	1	1
Old roads and paths	1	3	1	1	1	1	1	1	2	1	1	1	1	1	3	1	3	1	1	1
Technical objects	2	2	2	3	1	1	1	1	1	3	1	2	1	1	3	1	2	3	1	1
Plough land remainders	1	1	1	3	1	1	4	1	1	1	3	1	1	1	3	1	1	3	2	1
Final classification	B3	B3	C1	B3	B3	B3	A2	B3	C1	B2	A3	C1	C1	B2	B3	B3	C1	B3	B3	C1



Tab 6. Occurrence of natural and historic elements on localities with coppice woodlands in MEP Kuřim.

Natural elements	Number of localities	Historic elements	Number of
Dendrotelms	13	Archaeological monuments	2
Trees with holes	15	Boundary stones	6
Ecotones	13	Boundary ditches and walls	5
Pollard trees	0	Boundary trees	8
Glades	12	Myths and legends	3
Polycormons with coppice	16	Sacral objects	2
Reserved trees	8	Old roads and paths	4
Significant species	21	Technical objects	10
		Plough land remainders	8

Polycormons with coppice shoots, if preserved, are located almost exclusively on the margins of localities whose cores were converted into stored high forest derived coppice during the 1950–70s. The only exception is the Hájek locality where the polycormons occur interspersed on ca. 60% of area.

As for significant species of ancient forests, MEP Kuřim is one of extraordinarily valuable territories because these species were demonstrated to occur in all 20 studied localities by the field survey. The most valuable localities are Březina, Hájek and Šiberná.

Reserved trees, trees with holes, dendrotelms and small glades commonly occur in 50% of the localities.

Ecotone communities are mainly of the character of shrubby edges and are preserved especially in localities isolated by cultivated farmland – Hájek, Březina, Opálenka and Šiberná. Main stand-forming woody plants are *Prunus spinosa*, *Rosa canina*, *Swida sanguinea* and *Ligustrum vulgare*, rare species such as *Cornus mas*, *Staphylea pinnata*, *Sorbus torminalis* or *Rhamnus cathartica* occur very often too.

The area is highly valuable archaeologically; there are more than 40 current archaeological localities there, of which two coincide with the boundaries of the localities of coppice woodlands.

Boundary stones are represented relatively in abundance in the studied area; important localities in this respect are Opálenka and Sychrov.

Boundary ditches or walls are located almost exclusively in localities situated within the plough land of local residential communes and are thus in contact with farmed lands (localities Hájek, Haluzník and Chudčický háj Grove).

Boundary trees are rather frequent, mainly representatives of pedunculate oak (*Quercus robur*). Apparently, the species was planted to delineate precisely boundaries of land properties.

Technical objects are represented by small rural quarries (called "lůmky") of diverse sizes, occurring interspersed in forests stand across the MEP.

The historic structure of plough land in the administrative district of MEP Kuřim practically stopped existing, especially due to changes in agriculture caused by socialist collectivization and withdrawal from small-scale manufacturing processes. This is why the historic element is missing in the local landscape. During the field research, we discovered only isolated flats at margins of some localities, suggesting the previous agricultural use.

### 4.3 Lebeďák – Significant locality of ancient coppice woodlands

The locality of ancient coppice woodlands Lebeďák is in the South Moravian Region, ca. 30 km north of Brno and ca. 2.5 km southwest of Boskovice (Figure 35). It belongs in MEP Boskovice. The studied area occupies 9.3989 ha and its predominant part (9.281 ha) coincides with a strictly protected area – natural monument Lebeďák.

The locality is situated on the edge of the Boskovická brázda Furrow (Demek et al., 2006), on a steep slope built of ferruginous clay stones, siltstones, fine to medium-grained sandstones and reddish-brown to rusty brown agglomerates at altitudes ranging from 309 to 382 m a.s.l. Thanks to its location on a steep and mostly to the south oriented slope, the site is warm and insulated most of the day.

Shallow soils of sunny localities are potentially predominated by the *Querceta humilia superiora* groups of geobiocoene types (Buček, Lacina 2007) together with the *Querci-fageta aceris* group of geobiocoene types bound to deeper soils of slope dips and bases. Currently, the dry sites are colonized by thermophilous oak stands (alliance *Quercion petraeae*), while the remaining area is predominated by oak-hornbeam stands (alliance *Carpinion*) and by transitions thereto.

For a detailed survey, the locality was divided into 23 segments (Figure 37). Total area of the segments of ancient coppice woodlands including the segments of glades, which were classified with ancient coppice woodlands, amounts to 8.0798 ha, i.e. nearly 86% of the locality area. Ancient coppice woodlands do not occur only on 1.0752 ha (11.44% of the territory). By contrast, the most valuable Category A (significant ancient coppice woodland) occupies nearly 41% of the territory (Figure 38). The segment of transitional character (O/C) with a sporadic occurrence of elements bound to ancient coppice woodlands has only a negligible share (2.59%).

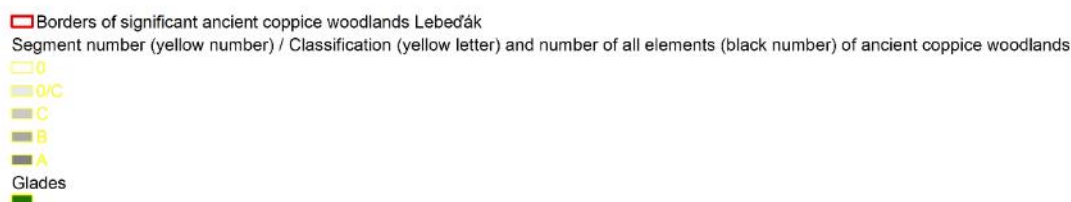


Fig 37. Division of significant ancient coppice woodlands Lebeďák into homogenous segments, their classification and number of discovered elements of ancient coppice woodlands.



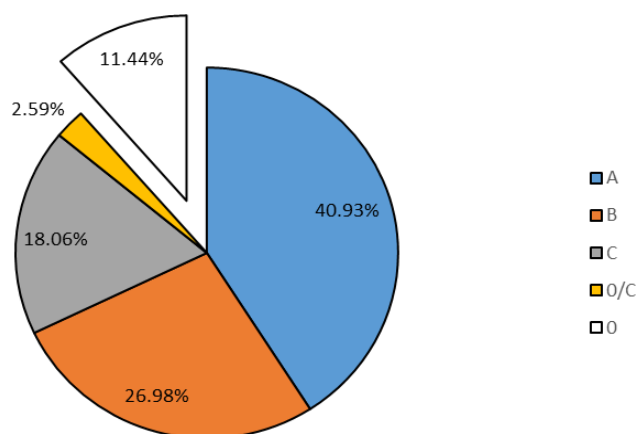


Fig 38. Representation of ancient coppice woodlands categories on the Lebed'ák locality.

Tab 7. Occurrence of natural and cultural-historic elements of ancient coppice woodlands in individual segments (significance: 1 – none, 2 – low, 3 – intermediate, 4 – high, 5 – extremely high).

Segment number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	18	19	20	21	22	23	24	
Classification of ancient coppice woodlands	0	C	C	C	O/C	A	C	0	0	0	C	A	C	B	A	0	A	B	A	A	0	0	B	
Number of all elements in the segment	1	5	8	7	3	5	3	2	2	2	5	5	4	7	6	3	8	8	2	8	4	2	3	
Natural elements of ancient coppice woodlands	Polycormons with coppice shoots	1	3	2	3	3	4	3	1	1	1	3	4	2	3	4	2	4	2	3	3	2	1	2
	Trees with holes	1	1	2	2	1	3	1	1	1	1	1	2	1	2	2	1	2	2	1	2	1	1	1
	Dendrotelms	1	1	1	3	1	3	1	1	1	1	2	3	1	2	3	1	2	2	1	2	1	1	1
	Pollard trees	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Reserved trees (Standards)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Ecotone communities	1	3	1	1	1	1	1	1	1	1	1	1	3	1	1	1	1	1	1	1	1	1	1
	Glades	1	2	3	2	2	3	3	5	5	3	2	3	1	3	3	1	3	2	1	3	1	5	3
	Significant species	3	4	3	3	3	3	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Cultural and historic elements of ancient coppice woodlands	Boundary ditches and walls	1	1	3	1	1	1	1	1	1	1	1	1	1	2	1	1	2	2	1	1	1	1	1
	Boundary stones	1	1	2	3	1	1	1	1	1	1	2	1	1	2	2	1	2	2	1	2	3	1	1
	Boundary trees	1	1	3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	1	1
	Old roads and paths	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Plough land remainders	1	1	3	3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Technical objects	1	2	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	1	1	1	1	1
	Archaeological monuments	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	1	3	1	1	1
	Sacral objects	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	1
	Myths and legends	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

There are 13 of 17 monitored elements of ancient coppice woodlands on the locality at various numbers and diverse layout. Of these, 6 are natural (of 8 monitored) and 7 cultural-historic (of 9 monitored) (Tab 7). The maximum number of elements (8) was detected in four segments but only 2 of them are classified in the highest category of the significance of ancient coppice woodlands (A). Occurrence of the elements of ancient coppice woodlands in the individual segments and links to the categories of significance of ancient coppice woodlands are presented in Figure 39.

On this locality, nearly all natural, cultural and historic elements were found with the exception of pollard trees, reserved trees and old roads; no myths or legends are known either.

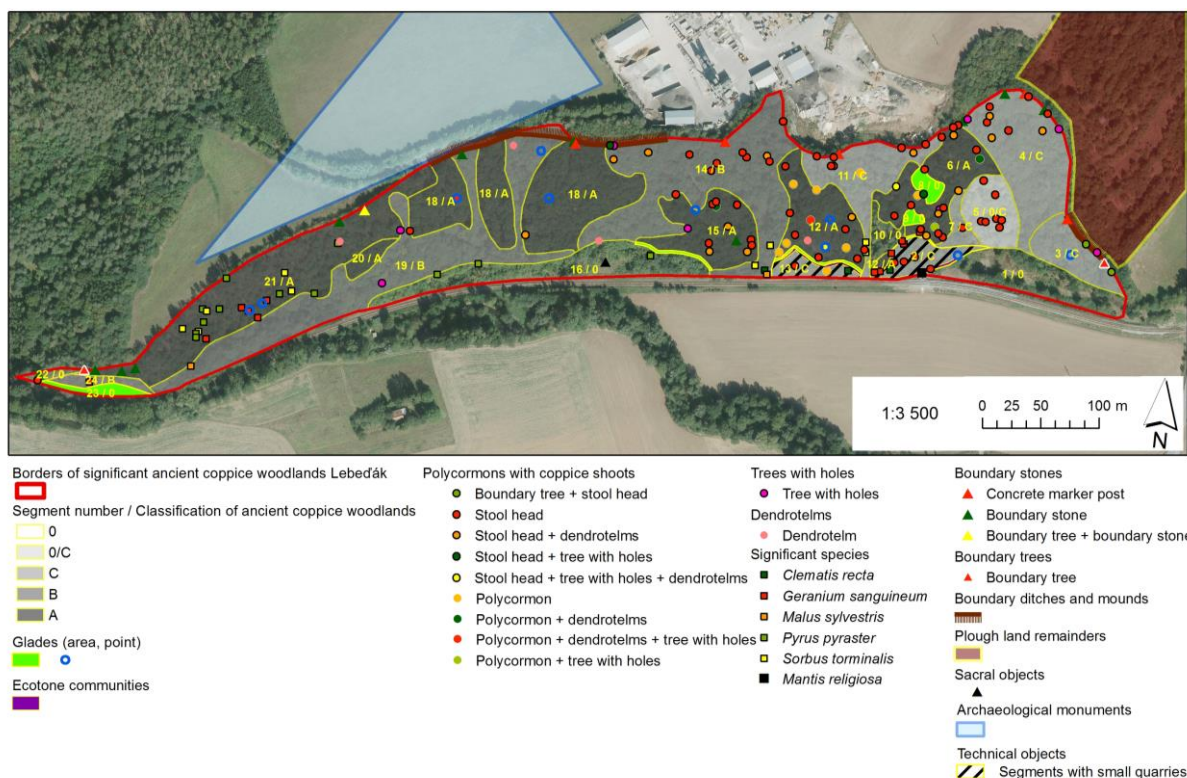


Fig 39. Occurrence of the elements of ancient coppice woodlands in the individual segments and links to the categories of significance of ancient coppice woodlands on the Lebed'ák locality.

Polycormons with coppice shoots and stool heads occur most frequently above the edges of gullies, fault slopes and sunlit localities. As anticipated, they are dominantly bound to the category of significant ancient forests (A) because the category is defined by the high representation of polycormons. Most frequently occurring are stools heads of sessile oak (*Quercus petraea* agg.), and sparse are stool heads in other, less represented, tree species – European hornbeam (*Carpinus betulus*), small-leaved linden (*Tilia cordata*), field maple (*Acer campestre*). Sporadically, some oak young stools became overgrown with shoots too, which provides insufficient but still at least minimum representation of another generation of stool heads and polycormons for the future.

Trees with holes and dendrotelms occur interspersed across the area, more often again in the segments of ancient coppice woodlands, many a time in combination with other elements, usually stool heads and polycormons. Some dendrotelms on the site are permanently under water, some serve as stem hollows to wild bees, which indicate broken dendrotelms on fallen trees.

Ecotone communities are very frequent on the locality and many a time they emerge on small glades too, thanks to which the two elements merge sometimes. Communities of forest edges either occur on the interface of the forest and non-forest environment, or on more pronounced slope edges, thanks to which they are permanently exposed to light. They contribute to higher biodiversity in the area and often serve as refuges to some significant species.

Glades are an even more frequent element on Lebed'ák than ecotones, and can be considered one of the specific characteristics of the locality. They are typically represented as small patches in stand gaps, e.g. after a dead dominant tree. Larger glades were classified as special segments. An exceptional glade is included in the segment with grass-herb community bound to sunlit agglomerate rock in the western part of the locality, on which some significant species occur that cannot be found elsewhere on the locality, e.g. *Seseli osseum*. This small rock is apparently



the northernmost finding place of this species within its partial natural range in the Svitava River catchment.

During the detailed survey, we found 24 significant species (Figure 40) – 23 plant species and one animal (critically threatened common European mantis). Among plants, the most valuable findings included once again the occurrence of the threatened (Grulich 2012) *Clematis recta*. Identified were however other 6 endangered plant species. The locality is very significant in phytogeographical terms too because of the occurrence of some thermophilous plants, which penetrate through the Svitava R. basin further on to the north only very exceptionally, e.g. the above-mentioned *Clematis recta*, *Seseli osseum*, but also *Geranium sanguineum*, *Centaurea stoebe* or *Vicia pisiformis*.

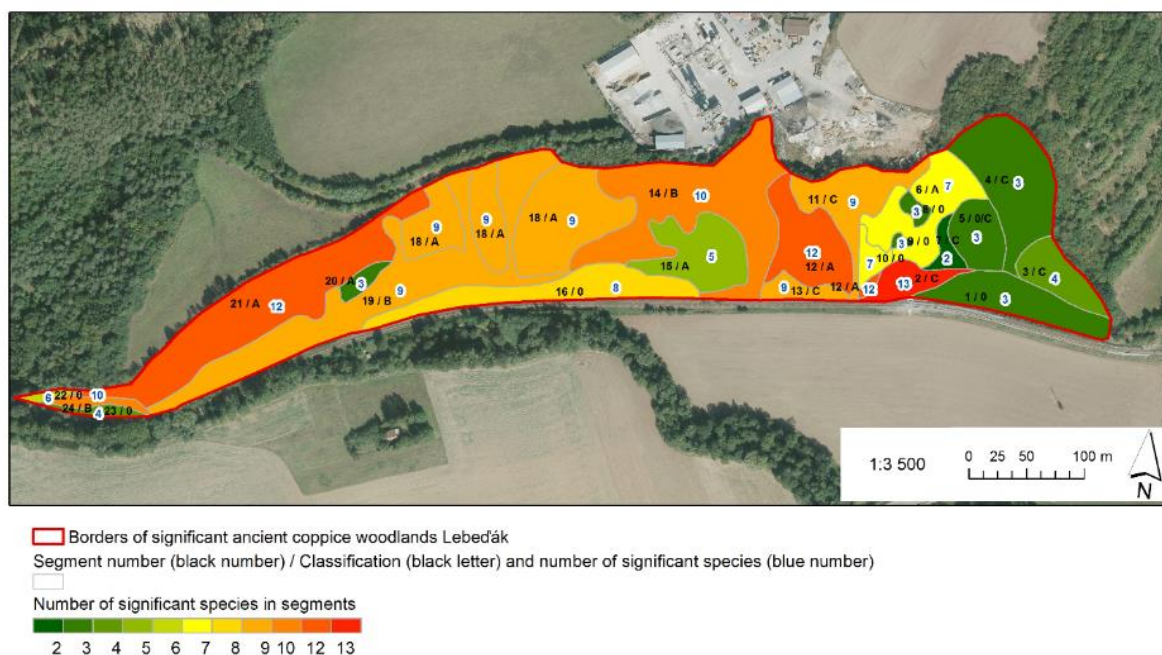


Fig 40. Numbers of significant species in the individual segments on the Lebed'ák locality.

Cultural and historic elements are less abundant in the studied area than natural elements. Most frequent are boundary stones, which occur almost exclusively at the northern boundary of the locality. We found 17 boundary stones altogether, 11 of which were various types of carved stones and border stones, and 5 were more recent concrete marker posts. In one case, the boundary stone position coincided with the position of boundary tree. Inconspicuous are boundary walls occurring at the northern margin of the locality. Unlike the other cultural and historic elements, boundary trees occur in the area very rarely. They are once again located at its northern border; two of them exhibit massive stool heads and in one case, the boundary tree is an individual of pedunculate oak (*Quercus robur*), i.e. the species that was observed as a boundary tree also on other localities (Buček, Drobilová, & Friedl 2010).

The only sacral element is a holy image at the southern edge in a segment in which the ancient coppice does not occur. Technical objects worth mentioning are small quarries occurring at the slope base in the southern part of the locality, which are almost imperceptible today and overgrown with vegetation. On their upper edges, open ecotone communities emerged due to anthropogenically conditioned exposure, hosting some significant species. Adjacent to the eastern border are plough land remainders. It is interesting that boundary stones and boundary trees occur also at these places, and a part of the border is even accentuated by a wall. A part of the northern border neighbours with an archaeological site from the Palaeolithic period occurring behind the slope edge, i.e. again on more favourable relief forms outside the steep slopes.

In terms of its significance, the Lebed'ák locality is classified in Category A2, i.e. significant ancient coppice woodland with coppices on most of the area.

## 5. Discussion and conclusion

In a number of European countries, coppices have been converted into high forests on a greater part of their area (Kadavý et al. 2011), by which not only natural (Bradshaw et al. 2015) but also cultural and historic values are endangered which are connected with the coppice system (Rotherham & Ardron 2006; Szabó 2010). This is why in Great Britain, for example, an inventory of ancient forests was launched in the 1980s (Glaves et al. 2009a, 2009b; Spencer & Kirby 1992). Results of inventories were followed by measures focused on their conservation (Goldberg et al. 2007). In the Czech Republic, the issue of ancient forests, their occurrence and protection has been considerably underestimated up to now. Therefore, we present the concept of ancient coppice woodlands and possibilities of their inventory in this paper.

The occurrence of ancient coppice woodlands can be ascertained similarly as their condition on three main levels in the Czech Republic. At a national (supra-regional) level, possible occurrence of ancient coppice woodlands can be estimated by using the COPF coefficient. Thanks to this, regions (MEPs) can be identified, in which the occurrence of ancient coppice woodlands is most likely and where it is rational to direct their possible protection. Regions (MEPs) with high COPF coefficient values exhibit a more likely occurrence of ancient coppice woodlands of higher significance and on larger areas than regions with lower COPF coefficient values. At a regional level, basic research is used to determine the occurrence of ancient coppice woodlands in the administrative districts of municipalities with extended powers (MEPs). The main output of basic research is a delimitation of localities with ancient coppice woodlands within the administrative districts of municipalities with extended powers (MEPs), classification of their significance (Categories A, B, C) and evaluation of natural, cultural and historic elements occurring therein. The local level is focused on specific localities with ancient coppice woodlands, in which detailed research is conducted. The detailed research is preferably directed to the most significant localities of ancient coppice woodlands (Category A). Its outputs are gained from partial segments, homogeneous in terms of the condition of ancient coppice woodlands, from the identification, surveying and detailed characterization of detected natural, cultural and historic elements. Results of detailed research have practical impacts for the conservation and management of individual localities, partial segments and individual elements.

The first research results indicate that ancient coppice woodlands have been preserved in the Czech area but their existence is acutely threatened because they gradually reach felling age as stored high forests (Slach et al. 2016). The map of the assumed occurrence of ancient coppice woodlands constructed according to COP index (Maděra et al. 2016b) was verified on the example of MEP Kuřim where 547 ha of coppice-originated forests were recorded as compared with 1200 ha of coppice woods recorded in the inventory of 1845. The decrease documents the process of converting the coppices, which reached maximum spread in the Middle Ages (Szabó et al. 2015), into the high forest described from the Czech Lands already in the 16–17th centuries (Müllerová et al. 2014, 2015), signalling a need for their inventory and establishment of appropriate care (Maděra et al. 2016a).

Ancient coppice woodlands represent an undervalued and at the same time diminishing phenomenon of contemporary Czech cultural landscape in lower vegetation altitudinal zones. Not even the possible renaissance of coppicing, which has been recently greatly discussed (e.g. Kadavý et al., 2011; Konvička et al., 2004), can guarantee the regeneration of ancient coppice woodlands since these developed into their current form only after the former active coppicing had been abandoned for several decades. Ancient coppice woodlands are valuable not only for their preserved natural values but also as a cultural and historic relict of the formerly common management of forests at lower altitudes. The localities of ancient coppice woodlands undoubtedly deserve enhanced care and protection focused on the preservation of significant natural and historic elements. The extinction of the phenomenon of ancient coppice woodlands would mean irreparable impoverishment of the natural and cultural heritage.



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