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Coppice-with-standards in floodplain forests – a new subject for nature protection

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ABSTRACT: At present, the coppice-with-standards system has become so rare in floodplain forests that it is considered a natural monument. In 1990, the coppice-with-standards system was not recorded in the territory of the Czech Republic. This state contradicts the increasing interest of nature protection organizations in the relict remainders of the coppice-with-standards system, which is to be considered the closest to naturally preserved lowland forest type, and is, therefore, recommended as the final state of the biocentres and biocorridors in today's floodplain forests. The aim of this paper is to present the results of the inventory dealing with the present occurrence of the coppice-with-standards system in the floodplain forest of the Litovelské Pomoraví Protected Landscape Area (PLA) in a historical context.

Keywords: coppice-with-standards; floodplain forest; forest management; storeyed high forest

The floodplain landscape belongs to the youngest geological, geomorphological, and landscape formation in Europe. Both the origin and the development of floodplain landscapes in Central Europe have been the subject of a long-term study (for an overview see e.g. Rulf 1994). During the prehistoric period and the Middle Ages, the floodplain landscape was subjected to extensive settlement and served simultaneously as an important communication and migration space (see Opravil 1983; Poláček 1999) leaving no doubt that humans had an essential influence on the formation of floodplains in Europe (Rybníček 2001). The natural ecosystems of Central European floodplains, which were predominantly covered by floodplain forests, were very strongly influenced by humans during the whole of the Holocene. The anthropogenic conditionality of the formation and development of floodplain forest ecosystems has lead to their present understanding as so-called archaeocoenoses (Řehořek 2001). From the viewpoint of European biodiversity, the floodplain forests are considered immensely valuable habitats (Wenger et al. 1990; Klimo, Hager 2001). The floodplain forests were usually managed in the silvicultural system of coppice-with-standards. According to Konšel (1931), this forest type is defined as "a mixture of coppice and high forest of seed origin". The forest stand of coppice-with-standards usually consists of two storeys: the understorey is created by coppice and the overstorey composes of big trees of generative origin (so-called standards or reserved trees) (Mayer 1992).

The coppice-with-standards system was presumably developed in France, where it was designed by J. B. Colbert for Louis XIV, king of France, between 1664 and 1683. The aim was to fulfil the triune function of the king's forests: (1) production of strong oak trunks used for building and navy, (2) production of firewood and timber, and charcoal, (3) pig grazing on acorns from the mature oaks of the top

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stand layer. The features of the coppice-with-standards silvicultural system with prevailing oak in the top layer and coppice in the bottom layer proved very interesting from an economic point of view, and the coppice-with-standards form remained in use in many floodplain forests of Central Europe until the first half of the 20th century (Mezera 1956). Regarding its character, production, silviculture and biodiversity, the coppice-with-standards forest represents a valuable, close-to-nature forest management object. At present, however, the coppice-with-standards system has become so rare in floodplain forests that it is considered a natural monument (Míchal et al. 1992). The coppice-with-standards forest has had a long tradition in Czech lands. Within the territory of the present Czech Republic, the coppice-with-standards silvicultural system was most common around 1900, when it took up almost 3% of the total area, which was ca 60,000 ha at that time (figures from the Reambulated Cadastre), primarily in Moravia. In 1990, the coppice-with-standards system was not recorded in the territory of the Czech Republic (Kadavý 2007). This state contradicts the increasing interest of nature protection organizations in the relict remainders of the coppice-with-standards system, which according to Míchal (1998) is to be considered the closest to naturally preserved lowland forest type, and is, therefore, recommended as the final state of the biocentres and biocorridors in today's floodplain forests.

The aim of this paper is to present the results of the inventory dealing with the present occurrence of the coppice-with-standards system in the floodplain forest of the Litovelské Pomoraví Protected Landscape Area (PLA) in a historical context.

METHODS

The presented case study was carried out in the floodplain forests of Litovelské Pomoraví, which is located within the floodplain of the Morava River (Upper Moravian Vale, the Czech Republic). In the typology of the Forest Management Institute, this type of forest geobiocoenosis belongs to the first forest altitudinal zone (Plíva 2000), which corresponds to the second vegetation zone according to Zlatník (1976). The prevailing forest type groups are elm ash weed plain, from the geobiocoenological viewpoint *Ulmi Fraxineta carpini* of the higher order. In the flooded areas, various biotope types are present depending on the distance from the river and duration of flooding (willow alder carr, poplar plain, etc.). For detailed characteristics of the floodplain forest geobiocoenoses in Litovelské Pomoraví see Machar (2008b).

In the course of this study, research was carried out *in situ* to confirm the initial hypothesis which postulated the presence of the coppice-with-standards system among the groups of stands that are described as layered although ranked among the high forest types in the forest management plan. Based on the data from the forest management plans, all the layered stand groups within the study area were recorded on the working maps and then were visually examined in the field in 2007. The result of the research is a summary map of the study area which indicates those stand groups that preserved the features of the coppice-with-standards silvicultural system.

RESULTS

Historical development of the coppice-with-standards forest type in the floodplain forest of Litovelské Pomoraví

There are many written documents in the account books of the City of Olomouc (which was the owner of the forests from the 16th century until 1950, when the forests were taken over by the state) which can be used for the study of the historical development of the floodplain forests in Litovelské Pomoraví (Hošek 1985). Since 1992, the City of Olomouc has been in charge of its historical property once again. As the accounting documents from the 16th century show, the city gained substantial revenue from wood and acorns, while in the fertile years, revenues from the sale of acorns were up to twice as high as the revenues earned from the sale of wood. This permits the assumption of a high abundance of oak in the floodplain forest at that period. Intensive grazing was common in the floodplain forest until around 1850, when it was officially abolished. In 1754, the city forests were geodetically located and their first taxation dates back to 1795. The forest management plan concerning the middle forest was elaborated based on age-class divisions with a rotation period of 25 years. Additionally, precise maps were drawn. The map of the Březová forest district contains a note stating that there is no non-stocked forest land in the district and that almost the whole area is regularly flooded by the Morava River, which, however, does not interfere with the growth of the stand. The notes further state that more attention should be directed towards the plantation of oak, because seeding with acorns was rarely successful and when attempted in the clear-cut areas, the saplings could not compete

with the coppice shoots. For the same reason, a forest tree nursery for oak transplants was set up in the Březová forest district. In a similar way, notes related to the Horka forest district state that the whole area up to the plough-land at Daliboř locality was regularly flooded. The floodings were often so high that it was possible to sail the forest in a boat.

Jan Pawost, the author of the management plan, master of the hounds, also noted that it was necessary to pile the wood properly. Oak saplings of the height of an adult person were planted. The land-register of the city property from 1784 describes a coppice-with-standards system in Litovelské Pomoraví, where the standards were present in ca 1/3, the rest consisted of coppice and softwood. In the floodplain near Horka nad Moravou with an area of 207 ha, the upper standard layer covered half the area. Stand groups with oak up to 400 years of age were by no means exceptional.

The next management plan was drawn up in 1833 (head forester Antonín Prokop Schwarz). Schwarz draw up the management plan in the form of the area control method with a rotation period of 35 years, while emphasizing firewood production from the coppice. The oak was a dominant woody species strongly prevailing in both the forest districts, which composed the upper layer that was 300–400 years old, together with ash, elm and lime. The rotation period for the oak standards was set at 150 years, for the ash and elm standards it was 70 years. The oldest oak standards in the Březová forest district were as old as 586 years. The dominance of the oaks was assessed negatively by Schwarz, because they inhibited coppice growth which was the main subject of interest. The forest management means were recorded in detail; documentation since 1869 has been preserved. For example, between 1869 and 1939 more than 1.5 million transplants consisting of oak (27.5%), ash (23.5%), alder (27.6%), birch (11.6%), locust (1.4%), elm and maple (each 0.9%), poplar (1.2%), and larch (0.4%) were planted in the Horka forest district.

In the forest management plan from 1886, its author, Heřman Ludwig, differed from his predecessor concentrating instead on the upper layer and oak plantation rather than on the acorns. Three age classes were defined for the standards, which in the year of the coppice harvest (with a 35-year rotation period) would be 70, 105 and 140 years old. During the following updates in the forest management plan, little was changed in the already set principles and the floodplain forest was managed in the form of a composite forest with a rotation period of 35 years until 1950. In that year, however, a dramatic change in forest management occurred. The aim of the state was to transform the stand in the form of the coppice-with-standards to the form of the high forest. The rotation period for the upper layer was set at 100 years and in 1980, when the upper layer abundance significantly increased, its rotation period was extended to 140 years with the view of producing a strong oak assortment. In 1962, moreover, the National Forests set up a large pheasantry (1,340 ha) and due to the game management, the floodplain forest was classified as a special-purpose forest. This has brought many negative aspects, such as the introduction of spruce as covering for the pheasants and the establishment of large areas of agricultural land. In 1990, following the declaration of the area a Protected Landscape Area, the pheasantry was abolished.

Therefore, it may be concluded that the coppice-with-standards silvicultural system was practiced in the floodplain forests of Litovelské Pomoraví at least from the mid-eighteenth century until the 1950s. The coppice-with-standards silvicultural system led to highly ecologically stable stands which were distinguished by their exceptionally high biodiversity.

Inventory of the coppice-with-standards forest type in the floodplain forest of Litovelské Pomoraví

Field research results have confirmed the initial hypothesis: the last occurrences of a stand close to

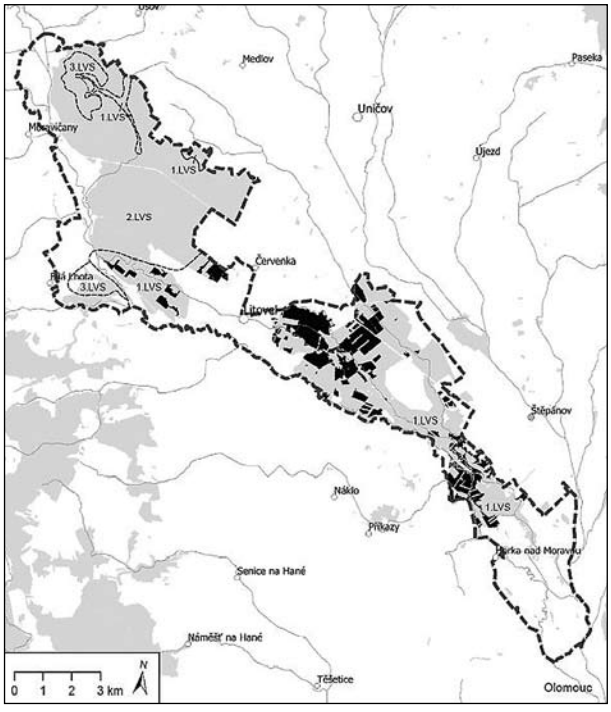

Fig. 1. Distribution of storeyed high forests in the Protected Landscape Area (PLA) Litovelské Pomoraví
(1. LVS – the 1st forest vegetation zone according to the Forest Management Institute in Brandýs nad Labem)

Fig. 2. Typical habitat of storeyed high forests in the PLA Litovelské Pomoraví: locality Na Rakousích

Fig. 3. Typical habitat of storeyed high forests in the PLA Litovelské Pomoraví: locality Panenský les

the coppice-with-standards type were recorded as the layered stands of the high forest in the forest management plan. All 734 ha of stand were found, which in terms of composition, show the features of the coppice-with-standards type (Fig. 1). Characterization of these forest stands is in Machar (2001). During the field research, however, it was not possible to find a stand the structure of which would fulfil the definition of the coppice-with-standards type in all aspects. All the parts of the stand which were identified as having some of the features of the coppice-with-standards forest type are in fact a high forest, generally composed of two more or less distinguishable layers: the lower or younger layer is formed from the remains of the initial coppice and the upper or older layer consists of the initial standards present in the coppice-with-standards forest type (Figs. 2 and 3). The development of these stands is doubtlessly a result of indirect stand conversion, during which the coppice was – partly by means of cultural practices and partly by reservations – transformed into the high forest type.

The implication for the forest management in the Protected Landscape Area Litovelské Pomoraví

Konvička et al. (2006) suggested that the ongoing extinction of certain heliophilous forest butterfly species in Litovelské Pomoraví (e.g. *Parnassius mnemosyne*) may be directly connected with the termination of coppice forest management and with the transition to high forest type forest management. The potentially positive impact of the coppice-with-standards forest on avian biodiversity is also confirmed by studies concerning the impact of floodplain forest fragmentation on the ornithocoenosis structure (Machar 2008a). There is a huge amount of stands which are close to the coppice-with-standards form (see Konšel 1931) (Figs. 2 and 3). However, the present forest management is not aimed at the conservation of the coppice-with-standards forest type. It is therefore to be recommended that on the occasion of the forest management plan update the stands be proposed for coppice management.

DISCUSSION

The ecological significance of the coppice forest (low and coppice-with-standards) for the preservation of biodiversity has been known for several years (Buckeley 1992). The increased interest in both nature protection and forestry practices in the silvicultural system of coppice-with-standards is presently proved by two large complementary research projects: a project supported by the Ministry of Agriculture of the Czech Republic *Coppices and Coppice-with-standards – a Forest Management Alternative* and a project of the Ministry of Environment of the Czech Republic *Target Management of Endangered and Protected Organisms in Coppices and Coppice-with-standards under the Natura 2000 System*. The ecologically valuable coppice-with-standards silvicultural system has virtually vanished throughout Central Europe including the Czech Republic (Míchal 1998). The state of the occurrence of the coppice-with-standards silvicultural system, described in this paper in the study area of Litovelské Pomoraví, corresponds to the state of forests in the Czech Republic as a whole (ÚHÚL – Forest Management Institute – 2000). It is important to realize that the coppice-with-standards forest type

is a typical anthropogenic formation that is created and sustained through the intensive care of foresters and significantly influenced by grazing in the long run (Vera 2000). After all, the well-known South Moravian floodplain "native forests" that are found at the confluence of the Morava and Dyje rivers were formerly used as grazing forests (Vrška et al. 2006).

The former views represented by traditional forestry (e.g. Polanský 1947) considered the coppice-with-standards type less important than the high forest type as far as production was concerned. That is why methods facilitating the transformation of the coppice-with-standards to the high forest are methodically well developed (e.g. Mayer 1992). However, as proved by Kadavý et al. (2007), these traditional views are wrong, because the production of coppice-with-standards type on a high-quality soil may considerably exceed the production of high forest. Therefore, the first successful attempts at the practical re-introduction of this silvicultural system (Utínek 2004) are being carried out.

The ecological similarity of the coppice-with-standards forest and of the selection forest is apparent. Both silvicultural systems enable the successful conservation of a local species-rich mixture of woody species and the soil under the stand is not subjected to extreme changes, as is usual with clear-cutting. However, a significant difference between the coppice-with-standards and selection forest is the intervals between silvicultural practices, which are significantly longer in the case of the coppice-with-standards forest compared to intensively managed selection forests. Two facts are significant from the viewpoint of nature protection: (1) In the case of the coppice-with-standards forest, the upper stand layer consists of purposely cultivated mature oak samples on which the existence of immensely large biodiversity of fungi, plants and animals depends; (2) Recurring harvesting of the coppice in the case of the coppice-with-standards forest creates very favourable living conditions for heliophilous forest organisms. Therefore, the importance of the coppice-with-standards forest for the biodiversity of the landscape is especially significant for invertebrates preferring open and light forests (Konvička et al. 2006), and further for those species dependent on mature oak samples, especially when these are exposed to the sun as a result of coppice harvesting.

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Střední les v luhu – nový předmět zájmu ochrany přírody

ABSTRAKT: V současné době je tvar středního lesa v luzích jako porostní útvar velmi vzácný, proto se dokonce považuje za přírodní památku. V roce 1990 nebyl na území ČR střední les vůbec evidován. S tímto stavem je paradoxně v rozporu vzrůstající zájem ochrany přírody o reliktní zbytky porostů tvaru středního lesa, protože se tyto porosty považují za nejpřírodnější dochované nížinné lesy a doporučují se jako cílová podoba biocenter a biokoridorů v lužních lesích. Cílem článku je prezentovat výsledky inventarizace aktuálního rozšíření hospodářského tvaru středního lesa v lužním lese Chráněné krajinné oblasti Litovelské Pomoraví v kontextu historického vývoje.

Klíčová slova: střední les; lužní les; lesní hospodaření; víceetážový vysoký les

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