

Historical Coppicing and its Legacy for Nature Conservation in the Czech Republic

Radim Hédľ

INTRODUCTION

I wrote this contribution having in mind a twofold perspective on coppicing: a historical one and an ecological one. The logic connecting these two otherwise distinct views is that the long-term presence, or even dominance in some regions of coppice management in the Czech Republic has influenced both past and current forest ecosystems. And vice versa, the historical range of coppicing has been largely determined by ecological factors. One cannot fully understand one aspect without the other. Despite being so widespread an activity, ranging from the prehistory up to the first half of the 20th century, coppicing has been deliberately and entirely abandoned in the past decades. The research devoted to historical and ecological

aspects of former coppice management partly aims to restore it for conservation and production purposes. In the Czech Republic, this process is just begun - nevertheless, this is stunning progress compared to the situation less than two decades ago, when coppicing was completely absent from nature conservation handbooks (e.g. Míchal and Petříček 1999) and not even mentioned in forestry. Up until now, several research projects directly or indirectly focusing on coppicing have been completed, or are still running, and a growing interest among the conservationists can be clearly observed. As foresters tend to be much more conservative as a whole, the future of coppicing restoration for wood production remains somewhat less promising.

BRIEF HISTORICAL PERSPECTIVE ON COPPICING FROM THE MIDDLE AGES TO THE 20TH CENTURY

Coppicing was a widespread management system in the Czech lands (Bohemia, Moravia and Silesia) at least since the Late Middle Ages. Its historical range strongly correlates with the extent of lowlands (150 to about 500 m a.s.l.), which occupy roughly one-third to half of the country area. This correlation is apparently because the lowlands are the most fertile, and hence the most densely populated areas of the Czech Republic since prehistory. Coppicing was a primary source of fuel energy, so the constant production of fuelwood was of high societal

concern, at least until it was replaced by fossil fuels at some time during the 19th century.

Forest has always been relatively scarce in the lowlands of the Czech Republic. Only sites least favourable for agriculture, such as slopes or stony soils, were left to forest management. This could explain why coppicing, an intense and effective fuelwood production system of the past, prevailed in the lowlands. Two noteworthy examples, illustrating which factors historically played a role in decision making with regard to the forest management type,

Corresponding Author: Radim Hédľ, radim.hedl@ibot.cas.cz

were presented by Szabó and Hédl (2013). Coppicing was clearly preferred where the natural conditions allowed. Non-timber forest systems, including wood pasture, were probably applied only in the relatively less suitable situations. To fully understand the driving factors for particular types of management in the past would, however, require further research. This situation was typical for central and northern Bohemia, southern Moravia and adjacent parts of Silesia (Figure 1). The structure of forest vs. agricultural land use remained conservative for centuries in these regions, with crop fields predominating and forest areas being relatively small (Mackovčín et al. 2011).

In Moravia and Silesia, the proportion of coppicing systems within all types of forest management can be relatively precisely established for the 18th and 19th centuries. This information has been obtained through extensive research, using all available archival material for the region (http://longwood.cz/?page_id=165). The share of coppicing in Moravia and Czech Silesia ranged from zero to 100% in individual cadastres (civil parishes), showing a strongly uneven pattern. In the densely populated lowlands, the proportion of coppicing on all forest systems was typically more than 50%, often 80–100% (apart from quite significant areas without forest). In contrast, forested uplands had little or no coppicing management and in the transitional belts the coppicing proportion varied between zero to about 30–40%. Interestingly, the corresponding geographic pattern of coppicing in Moravia could be traced back to the Middle Ages (14th century), pointing to the long-term stability of coppicing systems for at least six centuries (Szabó et al. 2015).

In Bohemia, the western part of the Czech Republic, no reliable data for a similarly detailed mapping of the historical coppicing area exists. Land use and management data from the so-called Stable Cadastre, a land use survey of the 1820s–1840s, was rewritten long after the survey and in an unsystematic manner (P. Szabó, pers. comm.). Although this information is now freely available on the internet (<http://archivnimapy.cuzk.cz/uazk/pohledy/archiv.html>), further critical research is required in order to construct a detailed map of the historical coppicing for Bohemia. Nevertheless, approximations can be made: a map of the historical area of coppicing in the whole Czech Republic has recently been published by Maděra et al. (2017), which confirms that coppicing prevailed in the lowlands of both Bohemia and Moravia (Figure 1).

A map of coppice forests for 1947, presented in the above-cited paper, shows a very similar pattern, indicating a persistence of coppice at time when there was no active coppicing in the country any more. The leading researchers in forestry at that time emphasised the negative

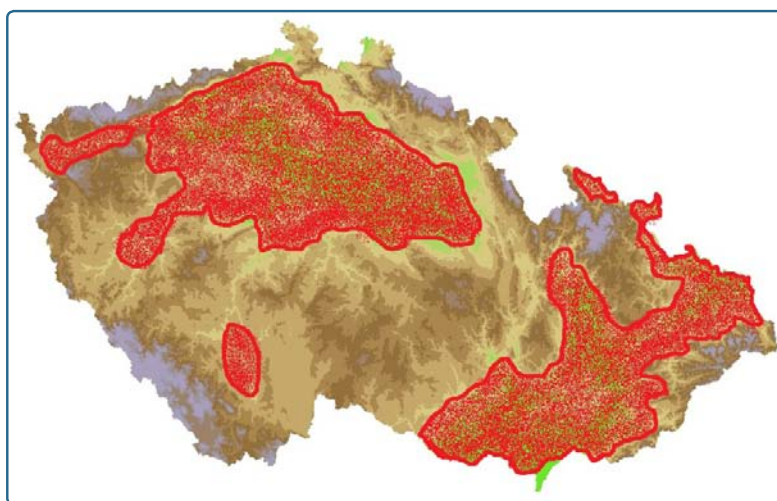


Figure 1. The approximate historical range of coppice forests in the Czech Republic, based on historical research by P. Szabó and his colleagues and published maps by Maděra et al. (2017). The area with significant historical coppicing (outlined in red) correlates with the lower altitudes (150 to 500 m a.s.l.). Current coppicing restoration work (not shown) is confined to no more than seven small-scale sites (situation in 2018).

aspects of coppicing, instead proposing methods for converting the remaining coppices into high forest (e.g. the special issue of *Lesnictví [Forestry]* devoted to coppicing, 1957/2). Probably the last deliberate coppicing activity was performed shortly before the WW II. Studies using tree-rings and archival resources (maps

and written documents) confirm the story of gradual coppicing abandonment over the past two centuries in Děvín, one of the most significant sites with historical coppicing in the Czech Republic (Altman et al. 2013, Müllerová et al. 2014). The last regular coppicing was applied there in 1935/1937.

LEGACY OF HISTORICAL COPPICING AND EFFECTS OF COPPICING ABANDONMENT IN TODAY'S FORESTS

The legacy of historical coppice management in forests of the Czech Republic has yet to be published. Persistent effects of past coppicing management in the present forest ecosystems has so far received only little attention. To the author's knowledge, there has been no systematic study of the effects of past coppicing on abiotic (e.g. soil chemistry) or biotic properties of forest ecosystems. The latter includes the distribution of individual species and communities, as well as patterns in biodiversity. Why would this knowledge be worth the attention of researchers, conservationists and forest managers?

The approach is similar to other studies on the legacy of past land use. Several studies have shown a marked legacy of ancient land

use on soil properties and biotic communities (reviewed by Hermy and Verheyen 2007). These legacy effects could be somewhat more complex (and subtle) than coarse transitions from agricultural land to forest. However, they may be at least partly responsible for the current distribution of oak (Maděra et al. 2017) or the biodiversity of forest understory vegetation (Figure 2). Unpublished research by Hédl et al. shows that 19th century coppicing in Moravia significantly explains current species richness at the plant community level. Plots in cadastres with the 19th century coppicing show a higher number of vascular plant species than in plots where coppicing was absent. However, the contribution of coppicing, independent from other factors, is relatively low. At a still broader perspective, patterns of the historical coppicing (outlined above) largely coincide with the potential vegetation (after Neuhäuslová et al. 1998). Oak and oak-hornbeam forests are the types of potential vegetation prevalent in areas where coppicing once dominated. One must keep in mind that the natural conditions largely correlate with land use and partly with management types, so statements about the net effects of coppicing on the actual or potential distribution of species or ecological communities require careful differentiation.

On the other hand, changes in biodiversity and composition following coppicing abandon-



Figure 2. Coppicing in the Děvín Nature Reserve, Pálava, showed positive effects on flowering of herb species of forest understory, such as *Primula veris*.

ment are relatively well documented. Related research is based on two types of evidence: recent resurveys of vegetation plots, recorded at times shortly after the coppicing abandonment, and comparisons of sites with varying or contrasting parameters of environmental conditions, resembling the situation in active coppices. Both types of studies were performed in forests with historically prevalent coppicing in southern Moravia and central Bohemia. Several groups of organisms were targeted in these studies: vascular plants and their communities (Hédl et al. 2010, Kopecký et al. 2013, Müllerová et al. 2015), butterflies (Benes et al. 2006, Freese et al. 2006), epigeic invertebrates (Spitzer et al. 2008) and saproxylic beetles (Vodka et al. 2009, Vodka and Cizek 2013). Paradoxically, historical coppicing has sometimes been associated with extant, but declining populations of some species (Konvicka et al. 2008, Roleček et al. 2017), whereas research has shown that past coppicing may not be responsible for these changes (Szabó 2013), especially not for the long-term survival of the studied populations. Generally, coppicing and wood pasture, along with other non-forestry uses such as litter raking, could have comparable effects on biodiversity (e.g. Vild et al. 2015, Chudomelová et al. 2017, Douda et al. 2017).

Summarising the published studies from sites in the Czech Republic, the main conclusion would be that the coppicing abandonment has led to a decline in biodiversity. This concerns the species-rich deciduous lowland forests, where coppicing was the dominant forest management system up to the first half of the 20th century. The decline affected both individual species requiring forest habitats with frequent canopy opening and the ecological communities where species richness decreased and homogenization of species assemblages was documented. Remaining knowledge gaps concern the effects of coppicing abandonment on other groups



Figure 3. Coppicing restoration in the Na Voskopě Nature Reserve, Bohemian Karst. Clearings have been made to monitor the ability of coppiced individuals to resprout and the effects on biodiversity.

of organisms, namely those requiring shadier conditions and biomass accumulation.

Largely motivated by the alarming results of the above-cited studies, some coppicing has been restored in the past decade in order to promote vanishing biodiversity. At present, seven sites (some of them with several sub-sites) have so far been restored to traditional coppicing (Figure 3). The total extent of these sites hardly exceeds a few hectares, and most of them are found in protected areas, including natural reserves and national parks. Nonetheless, plans aim to restore at least a hundred hectares, pooling all sites. Results from freshly restored coppices showed positive effects on species and/or functional diversity of various taxonomic groups (Vild et al. 2013, Sebek et al. 2015, Šipoš et al. 2017, Hédl et al. 2017); the last case cited is of a newly established traditional coppice on former agricultural land. An important feature of coppicing restoration studies is that they capture the effects of one-time canopy opening rather than the long-lasting effects of coppice management. Several coppicing cycles would have to be run to assess the actual effects on ecological communities under the current environmental conditions.

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