MONUMENTAL TREES AS A NEW PHENOMENON OF RECREATIONAL LANDSCAPE UTILIZATION

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Abstrakt
The contribution presents results of terrain mapping of monumental trees in the area of floodplain forests along the confluence of Thaya and Morava rivers in the Czech Republic. The study region is located within the Lower Morava Biosphere Reserve and is part of NATURA 2000. Therefore, this region represents an important object from the viewpoint of recreational landscape utilization, where monumental trees, so-called veterans, can increase the tourist potential of this region, especially in the context of the overall decline of monumental trees in the European landscape. Currently, the monumental trees are disappearing mainly due to ongoing climate change, changes in groundwater levels as well as fungal diseases.
Based on terrain mapping, a total of 648 trees were recorded in the categories: A) *veterans* - trees with largest dimensions in the region, B) *candidates* - trees with the potential to grow to veteran dimensions, and C) *fallen trees or torsos*. The following parameters were identified: GPS position, stem girth, tree height, crown diameter and health status. We recorded 245 *veterans* and 80 *candidates* for different tree species. Of this number, 69 trees grew as solitaires, i.e. the trees most attractive to the public using the area for recreation. This data can serve as a source of information for forestry management, nature conservation and recreational landscape use.

Key words: recreation, solitaire tree, tree veterans

Introduction

Trees are a natural resource, they have been associated with human life since time immemorial. The wood of the trees accompanies him from the cradle to the coffin. And above all, monumental or otherwise important trees have always been admired and worshipped by humans (Hrušková and Úradníček, 2021). The Christian tradition of Central Europe accentuates monumental trees as a necessary complement to sacred buildings in the landscape, remarkable trees also very often coexist with folk architecture and complete the urban structure of village monument reserves). Monumental trees form the basic skeleton of valuable castle parks, city orchards incorporated into the image of city monument reserves and historic settlements (Pacáková-Hošťálková et al., 2004; Kuča et al., 2015; Rudl and Machar, 2021). Monumental trees in the landscape, forests and solitaires are key components of ecosystems. In particular, old trees – solitairs represent the key habitats for huge number of biota and can serve as ecological niche for the spread of this species to the surrounding forest stands (Slach et al., 2016). Pollard willow trees or almost dying torsos are also very attractive from decorative point of view. Many monumental trees that have reached old age and massive proportions are scientifically valuable habitats, we often call these old trees veterans or “tree old men”. Trees connection of the present with the past and their memory is also the memory of the nation (Hrušková, Hössl et al., 2017).
The first scientist who studied monumental trees in Bohemia and Moravia was Chadt-Ševětínský. He pointed out the largest trees of individual species and monumental trees became the first destination for tourists (Chadt-Ševětínský, 1899). Many years have passed since then, and monumental trees have entered in to the Central List of Nature Conservation in the Czech Republic and become protected by law. There are more than 53,000 items in the database (https://drusop.nature.cz/portal/). But there are still a large number of trees, for example in Pohansko (studied area), which are not protected.
The return to the study of monumental trees began again in our country during the 1990s. Not only NATURA 2000 habitat mapping has contributed to this, but also the television project “Trees are Watching Us” initiated by PhDr. M. Hrušková. Monumental trees have become popular in various competitions: Brno City Tree (2002), Tree of the Year of the Czech Republic and European Tree of the Year - organized annually by the Partnership Foundation. There is also an European initiative ECTF - European Champion Tree Forum, which unit together more than 300 people from all over Europe, dealing with monumental trees. One of the meetings took place also in the Czech Republic in 2016 (Hrušková, Úradníček, 2016).

The aim of the study was: 1) to mapping large tree species in a selected area; 2) to identify solitary trees as attractive trees to the public for recreation and 3) to evaluate the health status of these trees.

Materials and methods

Mapping of monumental trees was performed in the area of floodplain forests along the confluence of the Thaya and Morava rivers in the Czech Republic (Fig. 1). The studied area covers 4000 ha situated in the cadastral territory of the city Lanžhot, where the mean annual rainfall reaches 500 mm and the mean annual temperature 9.6 °C (Miklín and Hradecký, 2016). The area is relatively flat with a maximum elevation difference of 35 m. The area spreads on river geological sediments, while the higher sandy parts (called 'hrudy') represent remains of old dunes. A several-metre-thick layer of flood soils and clays has been deposited since the twelfth century as a result of deforestation of higher parts of the river basins (Miklín and Hradecký, 2016). The study area is located within the Lower Morava Biosphere Reserve and is part of NATURA 2000. The regulation of the Thaya River and the construction of three artificial water reservoirs above the studied area had direct anthropogenic impacts on this floodplain ecosystem (Šenfeldr et al., 2021). Since 1993, the revitalization was initiated using a system of channels and sluices, leading to an increase in the groundwater table (Maděra 2001) in selected parts of the Thaya River floodplain forest ecosystem. The most common tree species in the area are pedunculate oak (*Quercus robur*) and narrow-leaved ash (*Fraxinus angustifolia*). There are associated other tree species such as hornbeam (*Carpinus betulus*), field maple (*Acer campestre*), lime (*Tilia cordata*), European white elm (*Ulmus laevis*), field elm (*U. minor*), black and white poplars (*Populus nigra*, *P. alba*), white willow (*Salix alba*) (Klimo et al., 2008).

The mapping of monumental trees, so-called veterans, took place from 2018 to 2021. The mapping of trees took place through a systematic walking of the study area. Data from the studies Dreslerová (2011) and Miklín et al. (2016) were used as supporting material. The trees were evaluated as monumental according to the established registration values of the girth at breast height (Tab. 1) and according to the criteria of veteran trees (Read, 2000).

The following data were recorded for every mapped tree: GPS position, biotope (solitaires, edge of a forest stand, in the forest stand, riparian forest stand - trees located next the river or channel), diameter at breast height (GBH), tree height, crown diameter, health status and vitality (by the classification Kolařík et al. 2005). The mapped trees were categorized into three groups: veteran trees, candidates trees, fallen trees and standing torsos. All the data were recorded, processed and mapped using the app ArcGIS Collector and Esri ArcGIS (Desktop and Online) software.

Fig. 1: Localisation of the study area

Tab. 1: The species registration limits of girth at breast height (GBH) for their classification as the monumental trees.

Genus	GBH (cm)	Genus	GBH (cm)
Quercus	500	*Aesculus*	300
Fraxinus	400	*Juglans*	300
Populus	400	*Robinia*	300
Salix	400	*Acer*	300
Tilia	400	*Pyrus*	250
Ulmus	400	*Malus*	200
Carpinus	300	*Crataegus*	100

Results

In total, we recorded 245 veterans, 54 candidates and 349 fallen trees and torsos for 13 tree species (Fig. 2). The highest number of both veterans and candidates was recorded for *Quercus robur* (68 veterans, 38 candidates), and second highest number was found for *Fraxinus angustifolia* (49 veterans, 5 candidates). Some tree species were represented only by very low numbers of their veterans and candidates occurrence (*Populus nigra* – 5, *Aesculus hippocastanum* – 1, *Tilia cordata* - 3, *Tilia platyphyllos* - 1). The detailed distribution of recorded tree species within individual categories is presented in Fig. 3.

Most of the veterans as well as candidates were recorded in biotope category forest stands (111) and their edges (82), while 69 trees occurred solitary. The lowest number of trees occurred in riparian forest stand biotope category (Fig. 4).

Most trees were classified to critical health category (27%) while less proportion of trees (8%) showed excellent health status. Detailed distribution of trees in health status categories is showed in Fig. 5.

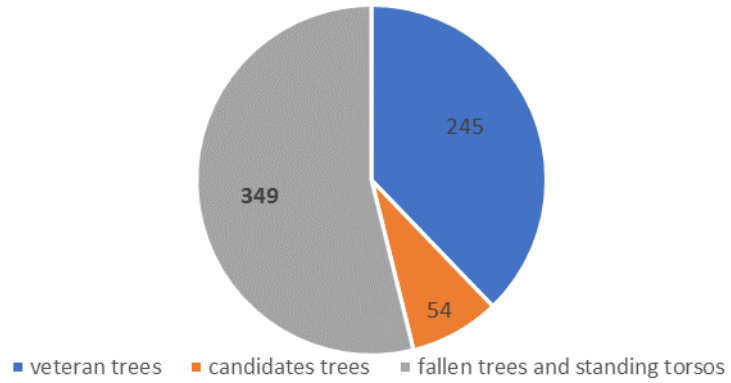

Fig. 2: Number of recorded trees in the categories: veteran trees, candidates trees, fallen trees and standing torsos

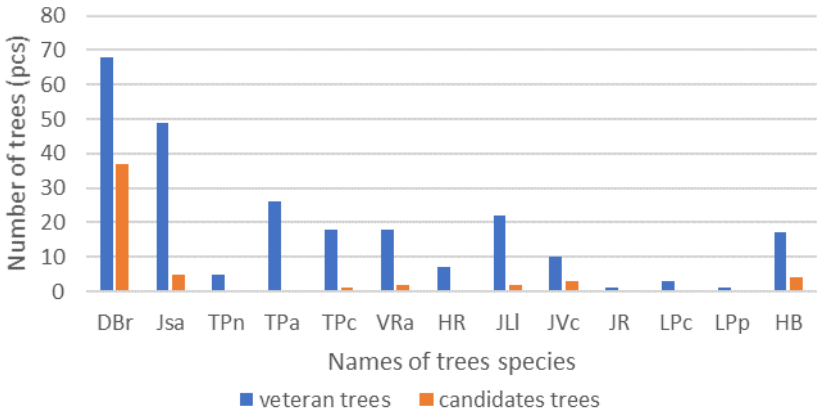

Fig. 3: Numbers of trees by the trees species and categories. DBr – *Quercus robur*, JSa – *Fraxinus angustifolia*, TPn – *Populus nigra*, TPa – *Populus alba*, TRc – *Populus canescens*, VRa – *Salix alba*, HR – Pyrus pyraster, JLl – Ulmus laevis, JVc – Acer campestre, JR – *Aesculus hippocastanum*, LPc – *Tilia cordata*, LPp – *Tilia platyphyllos*, HB – *Carpinus betulus*

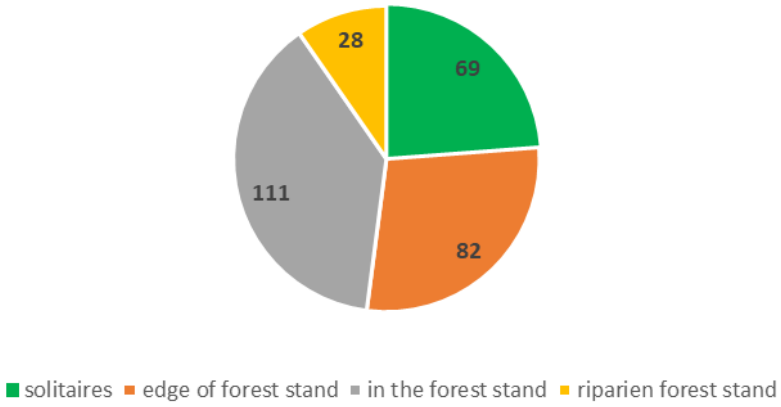

Fig. 4: Numbers of veteran a candidates trees by the biotope

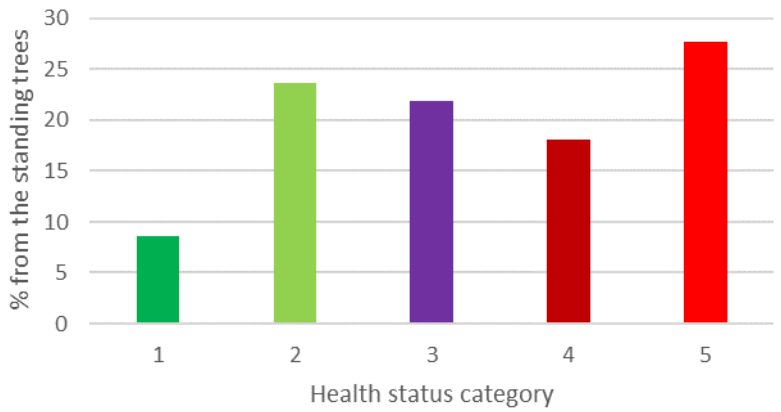

Fig. 5: Health status category expressed for the standing trees. Category 1 - excellent health up to Category 5 - critical health (Kolařík et al., 2005)

Discussion

In our study, we recorded 245 veterans, 54 candidates and 349 fallen trees or torsos. Most of these trees were oaks, ash trees, poplars and elms. The veteran trees have the greatest value for biodiversity as well as tourism (Machar et al., 2020). Only 69 trees have been recorded as solitary trees, which are considered to be most attractive for public in terms of recreational land use. The considerable decline of veteran trees during recent period is visible according to our results as most trees showed critical health status. This is caused by a wide range of biotic and abiotic factors (Klimo et al., 2008). The increasing drought severity with related decrease of groundwater levels as well as insects and fungi diseases (Klimo et al., 2008) represent the key factors which negatively affecting veteran tree health (Klimo et al., 2008). The effect of these influences is intensified by ongoing climate change (Kowalska et al., 2020). Most of the recorded tree species are sensitive to these health complications. Oaks as well as ash trees suffer from a drop in groundwater level caused by Thaya and Morava river regulation during 1970s and recent precipitation deficits (Šenfeldr et al., 2021). While ash trees show strong sensitivity to groundwater level fluctuation and drought (Šenfeldr et al., 2017), the oak revealed to be more resistant to these environmental variables due to its deeper root system better eliminating negative decrease of groundwater levels. On the other hand, the 1990s river revitalization activities led to back increase in groundwater levels, in some parts of the study area and had the positive effect on tree vitality (Šenfeldr et al., 2021).

Based on long term forest management experiences, the preservation of surrounding trees and shrubs in close proximity of veteran oaks is key for their survival. The surrounding trees and shrubs prevent the stems of veteran oaks to direct sunlight which doesn't make them so attractive to insects (e.g. *Cerambix cerdo*, *Lucanus cervus*). The removal of shaded trees/shrubs can cause very quick dieback of oak veterans.

During several last decades, ash trees have declined due to ash necrosis caused by the fungus *Hymenoscyphus pseudoalbidus* (Chandelier et al., 2011). This disease currently has a very negative effect on ash vitality and decrease their decorative value due to defoliation. Elms are long-term threatened by Dutch elm disease (Strobel and Lanier, 1981). Therefore, it is necessary to pay attention to veterans and especially to candidates, so that these trees continue to serve as the attractive tree for the public and recreational use of the landscape.

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Souhrn
Článek prezentuje explorativní výzkum mapování významných stromů v oblasti lužních lesů podél dolních toků řek Moravy a Dyje. Šetřené území je součástí UNESCO Biosférické rezervace a částí NATURA 2000. Jedná se tak o atraktivní lokalitu rekreačního využívání krajiny, kde významné stromy, tzv. veteráni můžou zvyšovat turistický potenciál území, zejména pak v kontextu jejich celkového ubývání v krajinném prostoru. Mizejí zejména z důvodů houbových chorob, poklesu hladiny spodní vody a přicházejících klimatických změn.
Při mapování bylo zaznamenáno celkem 648 stromů v kategoriích veteráni (stromy největších tloušťkových dimenzí v oblasti), čekatelé (stromy s potenciálem dorůst dimenzí veteránů) a padlé stromy či torza. Zjišťovány byly následující parametry: GPS poloha, obvod kmene, výška, průměr koruny, nasazení koruny a hodnocení zdravotního stavu. Celkem bylo vymapováno 245 veteránů a 54 čekatelů různých druhů dřevin. Z tohoto počtu rostlo 69 stromů jako solitéry, tedy stromy nejvíce atraktivní pro veřejnost využívající oblast k rekreaci. Většina z těchto stromů byly duby, jasany, topoly a jilmy. Z hlediska památkových stromů mají největší hodnotu. Bohužel je však vidět značný úbytek veteránských stromů v posledních letech. Příčinou jsou probíhající klimatické změny a abiotické/biotické poškození stromů. Většina vymapovaných dřevin je na tyto zdravotní komplikace citlivá. Duby i jasany trpí poklesem hladiny podzemní vody způsobeným regulací řek a deficitem srážek (Šenfeldr et al., 2021). Jako problematické se ukazuje odstraňování keřového patra nebo oslunění kmene dubů (způsobené jejich výrazným uvolněním), kdy jsou následně napadeny tesaříkem. V posledních letech ubývá jasanů v důsledku nekrózy jasanu způsobené houbou *Hymenoscyphus pseudoalbidus* (Chandelier et al., 2011). Jilmy jsou dlouhodobě ohroženy grafiózou jilmů (Strobel a Lanier, 1981). Je proto nutné věnovat významným stromů a zejména stromům - kandidátům, aby tyto stromy i nadále sloužily jako atraktivní stromy pro veřejnost a tedy rekreační využití krajiny.
Data získané v této studii můžou také sloužit jako zdroj informací pro management lesního hospodářství, ochrany přírody a rekreačního využívání krajiny.

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