Assessment of the Distribution and Characteristics of the Oldest Forest Stand from the Romanian's Western Plain

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Abstract

The present study analysed the stand of the main forest formations from West Plain based on their composition, age classes, diameters, heights, and the spatial distribution. The stands' analysis did not limit to the study of the distribution of forest species, but also covers aspects regarding the flora, climate and soil. In short, the study presents both the forest station as well as the forest type. The analysed stands belong to the period 1995-2008, from 121608 ha located in the West Plain. The stands are managed by 13 Forests Districts and contain 151 stand elements older than 120 years.

Keywords: old grow forests, soil, forest station, age, structure

INTRODUCTION

The first attention given to the identification and protection of the most valuable specimens of monumental secular trees, took place about 80 years ago (Giurgiu, 2004). At that time, for the Gold Book of Veterans from our forests it was proposed to make an inventory of old and large trees, curiosities and unusual formations, from the forests owned by the State, privately owned ones as well as in parks (Moldovan, 1934).

Large old trees are biological legacies, representing the biological and ecological continuity of genetic resources and constituting habitats for a variety of organisms (Manning *et al.*, 2009). Despite their recognized multiple values, large old trees are in a global decline (Lindenmayer *et al.*, 2014; Faison, 2014), and the urgent need for developing conservation policies to halt their decline was voiced by some authors (Lindenmayer *et al.*, 2014; Blicharska and Mikusinski, 2014).

Some sources attribute the decline of large old oaks to secondary forest successions because these are sensitive to low light conditions, as well as to direct cuttings (Bergmeier *et al.*, 2010; Hartel *et al.*, 2013; Ollerer, 2014).

The aim of present study was to compile an inventory of the oldest stands from the Western Plain from Romania, highlighting the areas occupied by trees older than 120 years. It was analysed the structure of the arboretums, and was registered biometric characteristics, accessibility, and density of the forest road network as well as zoning with functional categories that offer active conservation for the old trees.

MATERIALS AND METHODS

The stand's age was determined with every forest management plan (conducted at 10 years interval) and is reported from 5 to 5 years. The age was determined by taking into account the

year when the regeneration occurred as well as by counting the annual rings from the fresh stumps, in addition to the number of years required to achieve the height of the stem at which the determination is made. Based on these standards, the present paper has started with an inventory of all forests from the West Plain (by extracting them from forest management plans realized during 1995-2008 for 13 forests districts) (Forest management plans, 1995-2008). The forests were then organized in a decreasing hierarchy based on their age. Ages over 170 were taken into account for establishing the 151 stand elements that were studied (by using the Excel program and its functions). For each site and stand were analysed besides general characteristics such as the surface and location, also the average diameter and height, stand structure and consistency, field exposition and slope, altitude, soil types and station types.

RESULTS AND DISCUSSIONS

The analysis of the existent data has shown that the surface occupied by state forests in the West Plain is of 121608 ha.

The distribution of stands on age categories of 20 years each is presented in Figure 1. A relatively uniform distribution can be observed, except for stands over 100 years that occupy only 5% of the total surface.

The West Plain hosts 151 stand elements for stands over 170 years. The Southern Carpathians have more and older forests (250 years) (Căntar *et al.*, 2019) as the field is hardly accessible there. On the other hand, all forests from the West Plain are easily accessible so they were cut at their exploitability age.

By referring strictly to the old analysed stands, can be observed that the number of old stands decreases (Figure 2), as it was reported also in the Southern Carpathians (Căntar *et al.*, 2019).

Figure 1. The distribution of stands from the West Plain on age categories

Figure 2. The surface occupied by the oldest stands from the West Plain

The oldest stand from this area is a 210-year-old common beech stand from Lunca Timișului. This one is followed by 200-year-old stands located also in Lunca Timișului, with the exception of one stand situated in Timișoara Forest Districts. By far, the oldest stands are located in Lunca Timișului (126 stands), followed by Timișoara (39 stands), Lugoj (17 stands) and Săvârșin (5 stands). Old stands are not found at all in the central and north part of the West Plain (Bihor and Satu Mare Counties) (Figure 3).

Table number 1 presents the oldest 27 stands together with their most representative characteristics.

Pedunculate oak (*Quercus robur* L.) is the characteristic species for the oldest stands located

in the West Plain. Ash (*Fraxinus excelsior* L.) and sessile oak (*Quercus petraea* (Matt.) Liebl.) are sporadically present.

The average diameter and height of the oldest stands from this area registered high values with average diameters between 60 and 98 cm and average heights between 26 and 33 m (Table 1).

The stands structure is relatively heterogeneous regarding the age (stands with different ages that exceed 20 years for seed trees and 5 years for sprout trees). Only a few stands are homogeneous-aged (where all trees have the same age and originate from the same fructification or from artificial regeneration or from sprouts and suckers after cuttings). Old stands with a relatively even-aged or uneven-aged structure do not exist in this area.

Figure 3. The location of the oldest stands from the West Plain (<http://geografiebranesti.blogspot.com> – main map)

Table 1. The oldest 27 stands from the West Plain

Forest District	Species	Surface (ha)	Age (years)	Average diameter (cm)	Average height (m)	Structure	Distance from the road	Functional category	Flora	Soil	Station type
Lunca Timișului	pedunculate oak	6.6	210	78	33	3	9	4J	81	2102	8512
L. Timiș	p. oak	1.1	200	98	30	3	7	5J	71	2101	8511
L. Timiș	p. oak	1.5	200	78	28	3	6	4J	71	2101	8511
L. Timiș	p. oak	0.9	200	80	33	1	7	4J	71	2109	8511
L. Timiș	p. oak	0.5	200	60	30	3	15	4J	71	2102	8512
L. Timiș	p. oak	0.5	200	68	28	3	15	4J	71	2102	8512
L. Timiș	p. oak	1.3	200	72	32	3	16	4J	71	2102	8512
Timișoara	p. oak	0.2	200	86	26	3	13	5C	73	2102	9641
L. Timiș	p. oak	6.6	190	76	31	3	5	4B	71	2102	8512
L. Timiș	p. oak	4.5	190	84	32	3	4	4B	71	2102	8512
L. Timiș	p. oak	8.4	190	88	24	3	4	4B	71	2102	8512
L. Timiș	p. oak	0.6	190	68	32	1	7	4J	71	2109	8511
L. Timiș	p. oak	4.4	190	88	31	1	7	4J	71	2119	8512
L. Timiș	ash	4.4	190	68	30	1	7	4J	71	2119	8512
L. Timiș	p. oak	1.7	190	74	31	3	11	5J	71	2102	8512
L. Timiș	p. oak	1.3	190	66	30	3	9	4J	81	2102	8512
L. Timiș	ash	1.3	190	78	33	3	9	4J	81	2102	8512
L. Timiș	p. oak	1.4	190	78	31	3	14	4J	71	2102	8512
L. Timiș	p. oak	1.7	190	62	32	3	14	4J	71	2102	8512
L. Timiș	p. oak	2.5	190	68	26	3	14	4J	71	2102	8512
L. Timiș	ash	2.5	190	64	32	3	14	4J	71	2102	8512
L. Timiș	p. oak	0.6	190	76	31	3	14	4J	71	2102	8512
L. Timiș	p. oak	0.5	190	70	26	3	14	4J	71	2102	8512
L. Timiș	p. oak	3.8	190	76	32	1	13	4J	71	2102	8512
L. Timiș	p. oak	0.1	190	74	30	1	16	4J	71	2102	8512
L. Timiș	p. oak	2.0	190	84	26	3	8	3G	74	2202	8332
Lugoj	sessile oak	0.4	190	82	29	3	6	1A	61	2201	6151

Note: Terms present in the table represent: **Structure:** 1= even-aged stand; 3=relatively uneven-aged stand. **Functional category:** 3G= Dispersed forest bodies, with surfaces of 100 ha, situated in field areas; 1,4B= Forests from around counties, cities and villages, as well as forests situated in their buildable area; 1,4J= Forests with an exceptional game interest; 1,5C= Natural reservations; 1,5J= Secular forests of exceptional value as well as portions of forests with rare species; 2,1A= Forests destined to mainly produce thick trees of superior quality.

Flora: 61= *Asarum-Stellaria*; 71= *Erachypodium-Geum-Pulmonaria*; 73= *Carex pilosa*; 74= *Carex brizoides-Agrostis alba*; 81= *Arum-Pulmonaria*. **Soil type:** 2101= redic preluvisol; 2102= mollic redic preluvisol; 2109= redic vertic-stagnic preluvisol; 2109= redic vertic preluvisol; 2201= preluvisol ; 2219= vertic-rendzic preluvisol.

Station type: 6151= Hill oak stands (Hungarian oak, Turkish oak) Bi small edaphic eutricambosol; 8511= Forest plain, meadow, Bm high edaphic stagnosol; 8512= Forest plain, meadow, Bs high edaphic stagnosol; 9641= Meadow silvosteppe, Bm, zonal phreatic soil, humid, stagnic and semigleic that is non-flooding or rarely flooded.

The structure of these stands can become an important criterion for creating smart forests as was recorded in the Southern Carpathians for Norway spruce (Dincă *et al.*, 2019b), or for alder (Blaga *et al.*, 2019).

The distance from the closest road is relatively small (4-9 km) in most cases. However, in numerous cases are recorded higher distances (10-16 km), a fact that is explained by the nature of these stands (old forests that have remained unexploited, either located in protected areas or in inaccessible areas).

The functional category is assigned to each arboretum within the forest management plans by which are given special protection functions (e.g. soil, water, wildlife, etc.), or protection and production (generally wood production). In this study, the functional category of the majority of these stands is 4I (Forests with an extreme game interest), followed by some stands that belong to 4B (Forests from around counties, cities and villages) and 5J (Secular forests of extreme value). *Erachypodium-Geum-Pulmonaria* is the flora specific for these stands, followed sometimes by *Arum-Pulmonaria*.

The most commonly found soil types for these stands are mollic redic preluvisol (dominant), redic vertic-stagnic preluvisol and redic vertic preluvisol. All these soils are preluvisol subtypes from the Luvisol class. They are rich in nutritive elements (Crișan *et al.*, 2017; Dincă *et al.*, 2019a), but present a humidity deficit in certain periods of the year (Dincă *et al.*, 2018).

The station types specific for these old stands are Forest meadow plain, Bs high edaphic stagnosol and Forest meadow plain Bm high edaphic stagnosol. The mentioned station types are of high favourability for local stands, a fact that is translated in high tree dimensions and advanced ages as well as by the other ecosystem services that the forest can offer (Spârchez *et al.*, 2011; Enescu *et al.*, 2018; Pleșca *et al.*, 2019; Dincă and Achim, 2019).

CONCLUSIONS

Pedunculate oak (*Quercus robur* L.) is amongst the most important deciduous tree species from Europe. In the West Plain, this species forms some of the oldest stands (reaching advanced ages of 210 years). The stands older than 120 years (5% of the total number of studied stands) are represented

by pedunculate oak (86%), ash (13%) and sessile oak (1%). The lack of protected natural areas on extended surfaces as well as the existence of a dense network of roads has led to narrow surfaces where old aged stands can grow. From a functional point of view, the most significant surfaces are occupied by stands with game functions (46%), by forests from around counties, cities and villages (32%) and by secular forests with an exceptional value (5%). In regard with their structure, the old stands are almost exclusively uneven-aged (77%).

The dominant soil type belongs to the Luvisol class - mollic redic preluvisol. The station on which old stands grow in the West Plain is favourable and implies remarkable diameters and heights.

We can conclude that the West Plain offers extremely favourable conditions for the growth and development of oak stands. However, the small surface occupied by old stands is caused by the absence of protected natural areas and by the high accessibility degree.

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