A GEOGRAPHICAL APPROACH TO IDENTIFYING REMAINS OF ONCE PRIMEVAL OAK FORESTS. CASE-STUDY: THE ARGEŞ RIVER LOWER BASIN, ROMANIA

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Abstract. Once representing one of the most common landscape elements of the vast forests which covered the Central Romanian Plain, the rare and scarce common oaks still surviving nowadays are characterized by remarkable ecological, aesthetic and historical-cultural values. They can provide vital information to experts from various domains, such as landscape sustainable planning and biodiversity management, applicable especially on areas characterized by intense anthropic disturbance, high risk of natural hazards, or high levels of biodiversity. Based on the use of field measurements, statistical analyses and old maps overlaying, the paper aims to identify the oaks located within the Argeş River lower basin characterized by girths exceeding 4 meters and estimate their age. Also, according to their past location on the Charta României Meridionale, we modelled the oaks potential of being remains of once primeval forest. Our results reveal that the study area possesses at least 35 remarkable oaks with a girth varying between 400 and 830 cm and an estimated age of 170 to 600 years old. The oaks modelled as having the highest potential of being initial forest remains are located mainly in the central part of the study-area, while those with the lowest potential occur especially in the proximity of Bucharest. The importance of the results lies in their utility of modelling the distribution of primary species, sustainable planning, reforestation management, or tourism.

1. INTRODUCTION

The common, or English oak (*Quercus robur*) is the largest and most widely-distributed oak species, very common especially in the lowlands of Northern, Western and Central Europe (Kingsbury, 2015). This is a large-growing and long-lived species, often characterized by the presence of remarkable specimens. Defining a remarkable tree is an extremely difficult task with a high degree of subjectivity and ambiguity. It is widely agreed that such an individual is considered as being a big specimen capable of providing higher services for different human communities and natural organisms, such as shelter, aesthetics or biodiversity support (Hartel & Tamas, 2015). Remarkable oaks possess the potential of being remains of once pristine or primeval forests.

A primeval forested ecosystem is usually concentrated within vast intact and uninhabited landscapes. Intact forested landscapes are defined as highly connected mosaics of natural ecosystems characterized by the lack of anthropic influences and a size large enough to support healthy habitats for indigenous species and especially large native mammals (Potapov *et. al.*, 2016). In Europe, intact forests are located in the northern part of the Scandinavian Peninsula, in the Caucasus Mountains and in the Carpathian Mountains and are mainly formed of conifers and European bench species (Potapov *et. al.*, 2016). Once, much of Europe was covered by compact oak forests, yet virgin forests are totally absent now (Kingsbury, 2015).

However, in some parts of Europe isolated oaks are preserved, possible remains of the once great primeval forests, as in the case of our study-area, the Argeş River lower basin, located in the central section of the Romanian Plain (Fig. 1) (Tufescu & Mocanu, 1985). From a geographical perspective, the study area is located at the contact between the continental and the steppe European

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biogeographical regions (Grigorescu, 2010). Based on the classification made by Raul Călinescu, the basin is occupied by the Euro-Siberian and Central-Asian-Pontic biogeographical sub-regions (Călinescu, 1969). Favoured by low altitudes (between 300 and 100 meters), temperate continental transition climate, dense river systems and latitude (between 44 and 45 degrees), the northern section of the basin is located within the common oak forest area, the main species being represented by common oaks in the lowlands and sessile oaks or even benches, in the hill areas (Posea *et al.*, 2005; Grecu *et al.*, 2012; Peahă, 1974). Other regions extensively located in the same vegetation area include the plateau of Suceava, the eastern half of the Western plain and finally the central and southern areas of the Transylvanian depression (Călinescu, 1969). These areas were dominated once by compact oak forests.

Centuries of human intervention have resulted in the total replacement of the initial forests with younger and highly managed ones. The first notable deforestations took place in the Neolithic, yet only on small surfaces. At the end of the Iron Age, the forests were at their peak extention, proper to the actual area of forest soils. Extended deforestations occurred in the Feudal period, hence with no continuity, given the lack of stable settlements in the central lowlands because of numerous robberies and migrations (3^{rd}–4^{th} centuries). Deforestations intensified at the beginning of the 19^{th} century caused by the surplus of the Carpathian population (Grigorescu, 2010). The next century's anthropic impact on oak forests continued to be insignificant, favoured by low population density and Turkish monopoly over Romanian agriculture (Tudose, 2007). Foreign 17^{th} century travellers depicted the Romanian plains as a wild wasteland, dominated by vast forests, packs of wolves and gangs of bandits (Vărzaru, 1984). Starting with the Adrianople Treaty (1829), agriculture became the dominant economic activity and settlements considerably increased, the once intact forests being abusively cleared off (Vijulie, 2010). In 1864, the law of ownership, initiated by Alexandru Ioan Cuza, led to the possession of agricultural land by numerous peasants, while in 1918 the land reform initiated by King Ferdinand ended up in replacing several forests with pastures (Vijulie, 2010). The cleared landscape brought to light fertile soils suitable to corn and wheat culture, while the wood was used for the construction of roads and buildings. The socialist period generated massive deforestations in the swamps of the Danube meadows. Therefore, the largest present-day forest corps occur at Bolintin (4,800 ha), Comana (5,000 ha) and Brăneşti (2,000 ha); all of which were planted between 140 and 10 years ago (Grigorescu, 2010).

The ecological significance of today's common oak forest patches usually the preservation of their habitat function for various floristic species by having several protected areas for *Crochus banaticus* and *Crochus moesiacus flavum* (Râioasa Forest), *Ruscus aculeathus* (Oloaga–Grădinari Forest) or *Paeonia peregrina* (Padina–Tătarului and Manafu Forests). Also, a few larger and less fragmented forests represent habitats for different colonized large mammals much appreciated by hunters, such as *Sus scrofa* (Comana and Bolintin), Cervus elaphus (Comana) and *Dama dama* (Bolintin) (Grigorescu, 2010). Finally, the forests of Comana, Nebuna and Ţegheş are characterized by the presence of very rare centuries-old oak specimens defined as monuments of nature.

There are several reasons why studying and consequently preserving old or pristine forests in Romania represents a highly important task. Romania stands out as the last country that possesses notable surfaces covered with temperate primeval forests in Europe, because the Carpathian Mountains are remote (Veen & Biriş, 2005; Khorn *et al.*, 2012; Biriş, 2014). Pristine forests represent crucial habitats for biodiversity conservation and sustainability (Gibson *et al.*, 2011). Furthermore, the old Carpathian forests play a vital role in the regulation of climatic phenomena, stocking considerably higher quantities of carbon than younger and highly administred ones do (Keeton *et al.*, 2010). Ultimately, studies regarding the intact forest spatial and temporal dynamics in Romania indicate a decline by 1.3% between 2000 and 2010, materialized in major threats concerning their ecological services (Khorn *et al.*, 2012).

The relevance of our study is centered on the utility of results as a basis for reconstructing primeval natural landscapes by modelling species distribution methods. Also, models regarding oak

distribution under various future climatic scenarios could be made, such assessments being very useful for future sustainable reforestation planning and management. Nevertheless, our results could indicate areas characterized by a greater need for biodiversity conservation and protection, or even unknown trees which are suitable candidates for a monuments-of-nature status. Furthermore, our findings could represent a basic point for future studies regarding the oak social and cultural influence on the historical landscape characterizing the Argeş River lower basin. Finally, the 35 remarkable oaks identified could be valorised by the local communities for their tourist and aesthetic potential.

Other representative studies regarding the once intact oak forests cover both earlier writings centered on describing all the vegetation formations characterizing the initial Romanian landscape (Călinescu, 1969; Giurescu, 1976) and even recent articles on the spatial and temporal dynamics of representative areas once covered by oak forests (Vijulie, 2010; Grigorescu, 2010). Also, there are several studies focusing on establishing the age of other very large oaks, or poplars in Transylvania or Moldavia, conducted by Prof. Dr. Pătruţ (Pătruţ, 2011; Pătruţ *et al.*, 2011; Pătruţ *et al.*, 2010, Pătruţ *et al.*, 2012).

Based on these conceptual aspects, the main objectives of these papers are: 1) identifying the remarkable oaks within the Argeş River lower basin, 2) estimating their age and 3) modelling their potential of being intact forest remains.

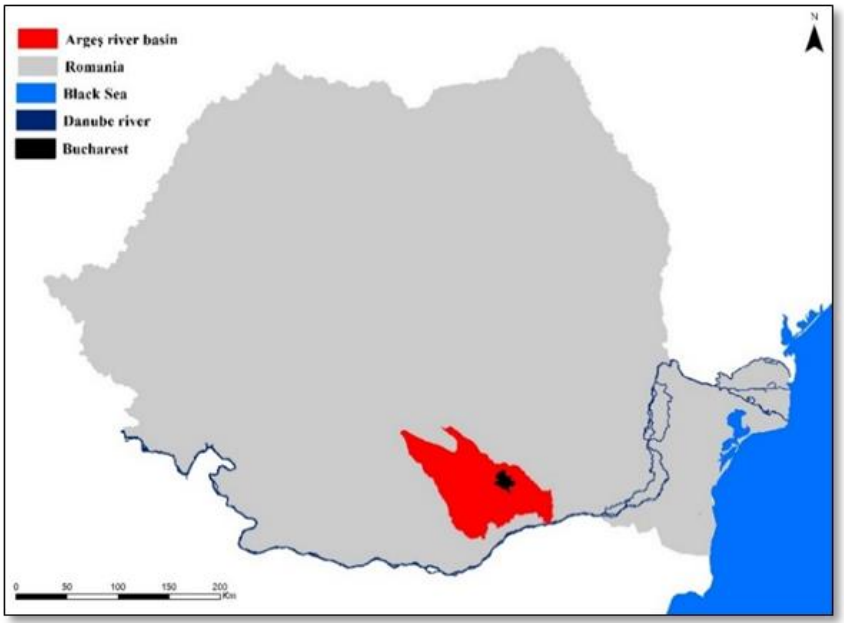


Fig. 1 – The study-area (*Source:* A.N.C.P.I., 2006).

2. METHODOLOGY

The first objective (1) is the identification of remarkable oaks. The first step includes the selection of locations with potential such oaks, by consulting various available sources: speciality books, web sites and online satellite maps. In some cases, oral information represented another crucial source. Also, old books from different domains, such as forestry or tourism, proved very useful, even if the information was outdated (Cucu & Ştefan, 1970; Giurescu, 1976). A number of thirteen territorial administrative units encompassing old and large oaks were selected, such as Bucharest Municipality and the communes of Pasărea, Cernica, Mogoşoaia, Chitila, Buftea, Ţegheş, Bulbucata, Letca, Drăgăneşti-Vlaşca, Videle and Târnava.

The second step consists in field validations through measurements which lasted from January 2015 to February 2017, and were conducted in all seasons, by using different travel methods. Often, size represents the most important criterion in identifying remarkable trees. The size of a tree is usually defined by the girth of its trunk, which in most cases represents the quickest and easiest measurable parameter. It is important to understand that the trunk girth of a tree is an extremely subjective element in defining remarkable trees and there is no universally accepted valid value applicable to any species which makes the difference between big trees (which are remarkable) and common trees. In other words, a specific trunk girth for one tree species may be considered highly valuable, while the same girth for another species may be considered insignificant. Typically, when it comes to common oaks in Romania, a remarkable oak is described as having a trunk girth exceeding 4 metres (Hartel & Tamas, 2015). We, therefore, collected only the geographical locations of oaks with a measured trunk girth at a 1.30 metre chest height, which equals or exceeds 4 metres, since the 1.30 metre chest height girth value is suggested by the convention of European forestry standards (Pătruț, 2011) (Fig. 2A). In case a targeted oak possessed a burl, knot, lump or a bifurcation at that specific height, the measurement was made beneath and not above, or at its right.

The second objective (2) is age estimation of identified remarkable oaks. To assess it, we selected an additional fifteen remarkable oaks located in several areas of Romania (thirteen in Transylvania's Breite plateau, one in Cajvana and another in Ţebea, the last two being the largest and the second largest, respectively oaks in Romania), for which the age was estimated by the carbon dating method, their chest height trunk girth being also measured (Pătruţ, 2011; Pătruţ *et al.*, 2011; Pătruţ *et al.*, 2010). The two available variables for the additional fifteen oaks were analyzed by statistical methods, using RStudio (RStudio Team, 2015). After making the Shapiro-Wilk normality test, we identified whether there was a statistically significant difference between the distribution of the two variable values and the normal distribution (Sig. = 0.015 for the circumference and Sig. = 0.000 for age). Furthermore, we wished to determine whether a causal relationship exists between the two variables, and so we used a Generalised Linear Model. The results of the GLM show that there is a statistically significant causal relation between the dependent variable, represented by the girth, and the independent one, represented by age (Sig. = 0.000). Based on the results, we extracted the following causal relation between the two variables: age = (girth – 2.271) / 0.009, where 2.271 represents the intercept value.

The identified causal relation was applied to the girth values of the remarkable oaks from the Argeş River basin, resulting in the prediction of the potential age of the trees. Such a method is characterized by possible major errors, based on the fact that the biggest oaks are not always the oldest ones, too. The reason resides in the environmental conditions which influence the growth-rate of the oaks. Practically speaking, the largest oak can also be the oldest oak and, at the same time, the one located in the area with the most favourable environmental conditions (Hartel & Tamas, 2015; Pătruț, 2011).

The third objective (3) is the modelling of the remarkable potential of oak remains of once intact forests, based on two selection criteria: a) age, over 200 years old and b) location within forests, or another natural land-use class on a map older than at least one century, such as Charta României Meridionale (Szatmary, 1864).

We used the 200-year-old threshold (Fig. 2B) because it is approximately the period when the historical Treaty of Adrianople was signed (1829), and the great deforestation of the Romanian intact oak forest began in an extremely aggressive manner, converting the initial forest-dominated landscape into agricultural land (Vijulie, 2010; Vărzaru, 1984). Hence, oaks older than 200 years have a higher probability of being remains of primeval forests than younger ones.

We preferred for our modelling the Charta României Meridionale to older maps, such as the Austrian Map of Wallachia (Specht, 1791), because it has a better technical applicability in GIS software. Charta României Meridionale represents an updated version of the original topographical measurements of the Second Military Survey of the Habsburg Empire Army (Habsburg Army, 1806–1869). In that campaign, our study-area was mapped in 1856, approximately twenty-five years after the Adrianople Treaty, and represents a deforested landscape compared to the one on the Austrian Map of Wallachia. Yet, because deforestation actions were just underway, we assume that intact forests were still the dominant landscape element. Based on the lack of detailed cartographical evidence, it is difficult to establish exactly when total deforestation of the original forests took place, and also when their total replacement ended. Consequently, by using the Charta României Meridionale legend we identified the land-use classes in the Argeş River lower basin landscape to approximatively 150 years ago, and then reclassified them based on Table 1. The thirty-five remarkable oaks present-day locations were superimposed on the reclassified land-use classes. For all oak locations, the reclassified land-use classes superposed on the Charta României Meridionale were extracted (Fig. 2B, Fig. 2D). The oaks located then within a natural land-use class (such as forest) are characterized by the possibility of being remains of that forest (which in time would probably have been a pristine one). Hence, they posses a higher potential of being primeval forest remains than the ones located back then in anthropic land-use classes.

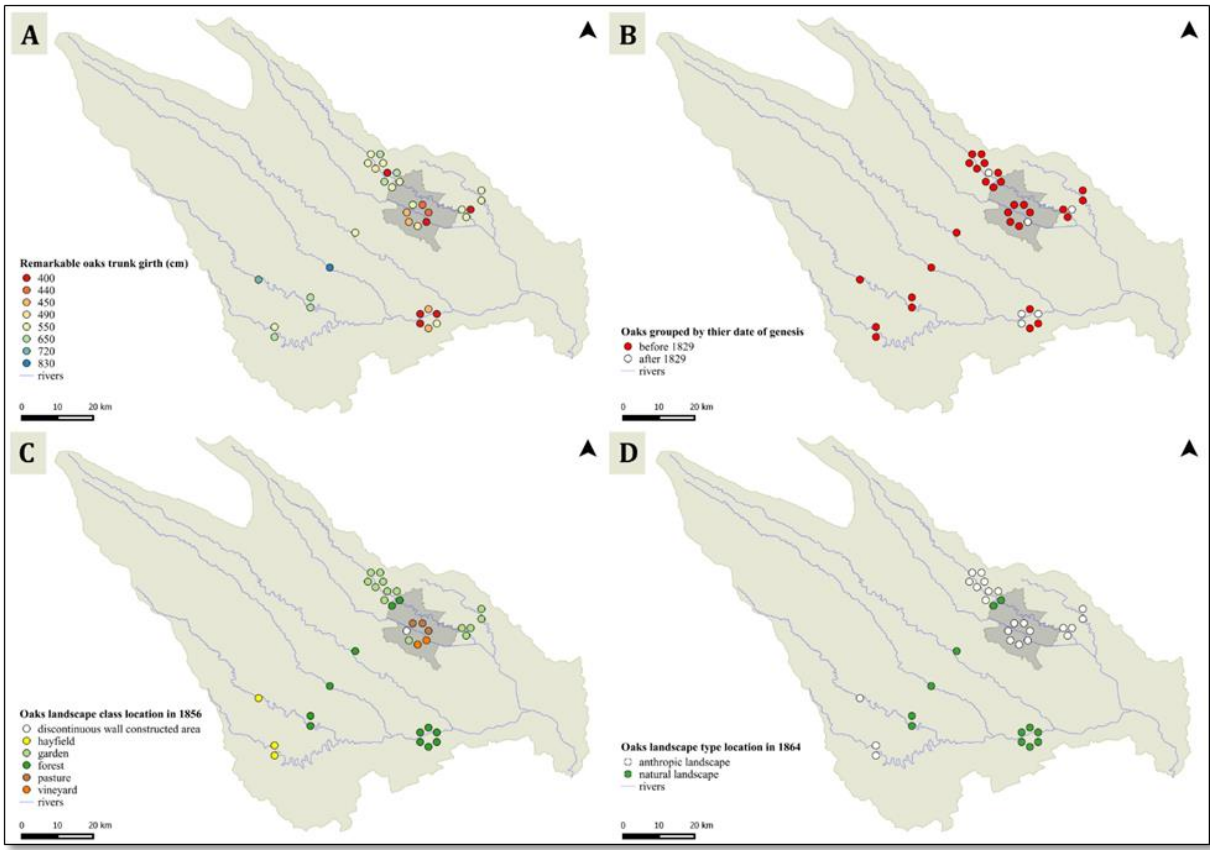


Fig. 2 – A – Oaks measured chest height trunk girth (cm), B – Oaks estimated age divided by the 200 year-old threshold, C – Oak land-use class inclusion on the Charta României Meridionale (1856), D – Oak reclassified land-use class inclusion on the Charta României Meridionale (1856).

Table 1

Reclassification of the Charta României Meridionale land-use classes.

Land-use classes on the Charta României Meridionale	**Categories resulting from reclassification**
Discontinuously built wall areas/ Hayfields/ Gardens/ Pastures/ Vineyards	Anthropic land-use classes
Forests	Natural land-use classes

Finally, we made a gradient classification of the remarkable oak potential of being initial forests remains based on the two selection criteria proposed in Table 2. Therefore, the remarkable oaks fully meeting both criteria were classified as having a high potential and considered to be probable remains, the ones having at least one of the two criteria were modelled as having a medium potential and considered to be possible remains, while the ones lacking any of the two criteria were assessed as having a low potential and characterized as being improbable remains.

Table 2

Gradient classification of the oak potential of being intact forests remains.

Oak potential of being intact forests remains	**Oak status**	**Criteria a): age over 200 years**	**Criteria b): listing within forests, or other natural land-use classes, on the Charta Romaniei Meridionale**
Low	Improbable	–	–
Medium	Possible	+/ -	-/ +
High	Probable	+	+

3. RESULTS AND DISCUSSIONS

Based on the previously-mentioned objectives, we obtained tree results (Fig. 3 A, B, C). Also, for a better understanding of the individual physical and spatial characteristics of the thirty-five discussed oaks, an auxiliary table (Table 3) is provided. All the analyzed oaks have been coded with numbers from 1 to 35 and are explicitly presented in the table. The order of oaks in the discussions section does not necessarily reflect the order of the oaks on the table.

The first result is represented by the map of remarkable oak locations within the Argeş River basin (Fig. 3A). Out of all the thirty-five remarkable oaks identified, eight are located in the gardens of the historical mansions of Buftea and Mogoşoaia, seven in the city of Bucharest, six in the forest of Comana, five in the gardens of the Cernica and Pasărea monasteries and just two in forest of Letca Nouă. Several territorial administrative units are characterized by the presence of only one remarkable oak, such as Ţegheş, Bulbucata, Drăgăneşti-Vlaşca, Videle and Târnava.

The second result is represented by the map of the remarkable oaks estimated age (Fig. 3B). In this case, out of all the thirty-five remarkable oaks, only one is over 600 years old (the giant oak at Bulbucata), seven are aged between 400 and 600 years (Videle, Drăgăneşti-Vlaşca, Buftea, Letca Nouă and Mogoşoaia), while seventeen scored between 200 and 400 years. Only six oaks (in Bucharest, at Mogoşoaia, Cernica and Comana) had an estimated age of under 200 years old.

The third result is shown on the map of the oak potential of being remains of intact forests (Fig. 3C). The map indicates that only three of the remarkable oaks identified are improbable remains of pristine forests (low potential), and they occur in Bucharest, and in the communes of Cernica and Mogoşoaia. On the other hand, nine oaks are considered probable remains of initial forests (high potential), and are the ones found in the communes of Chitila, Bulbucata, Letca Nouă, Ţegheş and Comana. The

remaining oaks maintain the possibility of being remains of primeval landscapes (medium potential), and are recorded in Bucharest, and in the communes of Buftea, Mogoşoaia, Cernica, Păsărea, Comana, Târnava, Drăgăneşti-Vlaşca and Videle.

The oaks in the Câlnişte River meadow are situated in the communes of Drăgăneşti-Vlaşca (No. 1) and Târnava (No. 2) as follows: the first on a pasture, in the proximity of the forest known as "The oaks of Grozea", the name of a famous 17th century outlaw, while the second in the village of Târnava, on a private property (Stângă & Dobrescu, 2011). Even if both were located in hayfields on Charta României Meridionale, the presence of forests in their proximity, correlated with their age, suggests that they could have been part of those extended forests before 1829. Yet, in the absence of concrete cartographical evidence, the oaks are considered as being just possible primary.

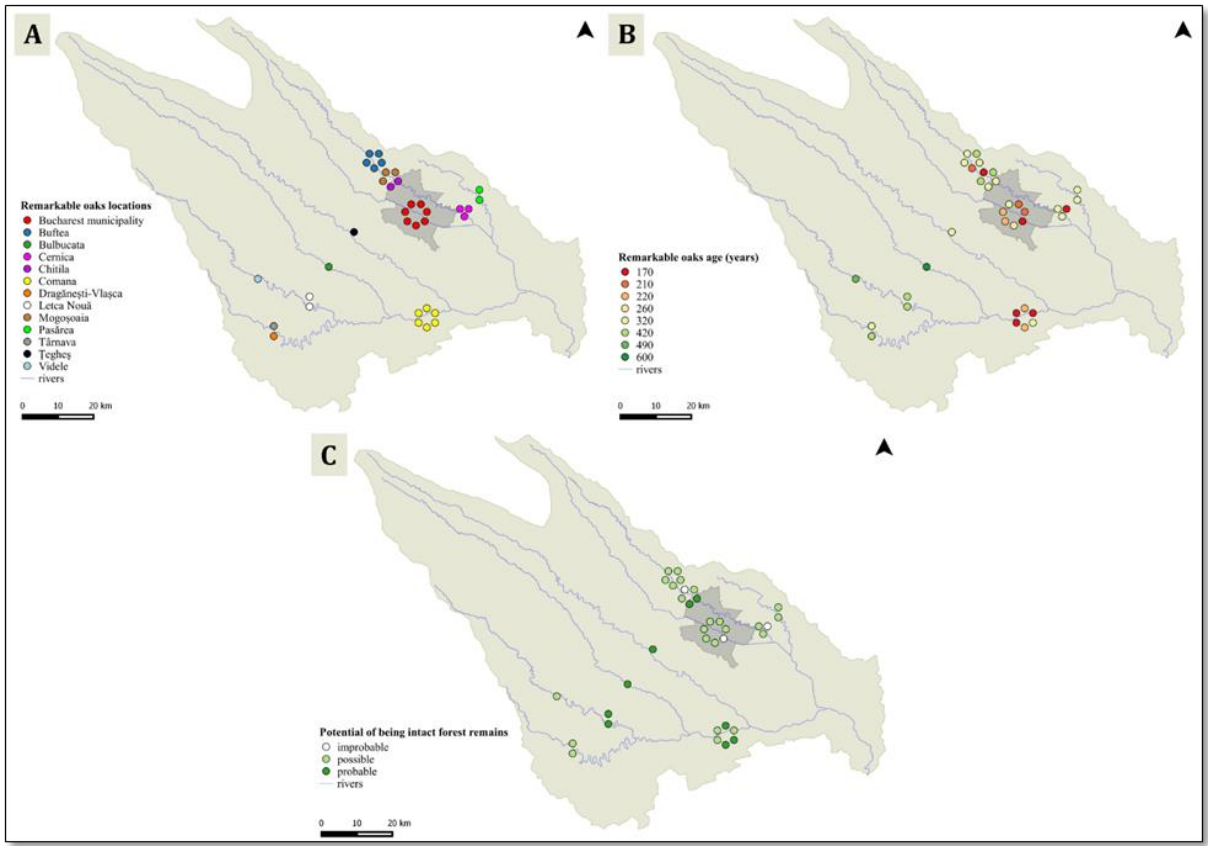


Fig. 3 – A – Oak chest height trunk girth (cm), B – Oak age estimation (years),
C – Oaks potential of being remains of intact forests.

The remarkable seven oaks in the Dâmboviţa River basin, are located in Bucharest as follows: one in a public space on Horei Street (No. 3), one on a private property on Ipoteşti Street (No. 22), three at the "Dimitrie Brânză" Botanical Gardens (Nos. 4, 5, 6), and two in the garden of the Romanian Academy Observatory, on Cuţitul de Argint Street (Nos. 23, 24). All these oaks were placed on the Charta României Meridionale in anthropic landscape classes (built-up areas of walls, gardens, pastures or vineyards), but since six of them are older than 1829, they could be primary oaks, while the 170 year-old oak at the Astronomic Observatory (No. 24), being younger, it is highly more probable to have been planted after great intact forests had existed.

Two remarkable oaks in the Colentina River meadow (Nos. 7, 8) are now located in the proximity of the Chitila Forest, while on the Charta României Meridionale they appear within the same extended forest (which was then part of the once great "Râioasa Forest", known for the sick look of its trees) (Grigoresu, 2010). Based on their age, they are the only probable primary trees identified on the Colentina River meadow. The five oaks at Buftea (Nos. 16, 17, 18, 19, 20), as well as the oak trees at Mogoşoaia (Nos. 9, 10, 11) are situated in the gardens of old historical mansions in the Colentina River meadow (Bahmuţeanu, 1977). They had the same location on the Charta. Based on their estimated age, all of them could be trees which were once part of virgin oak forests, except for a single 170 year-old oak at Mogoşoaia (No. 11), which is younger than 1829. The five oaks at Buftea represent the largest concentration of remarkable oaks in the entire study-area. The oaks in the gardens of the old monasteries of Pasărea (Nos. 25, 26) and Cernica (Nos. 12, 13, 14) lie in the Colentina River basin, in the proximity of the Cernica Forest massive 2,000 hectares, as they appear on the Charta (Grigoresu, 2010). Based mainly on their approximated age, which exceeds 300 years, these oaks are also considered as being possible remains of old forests, except for a single oak at Cernica, which has an estimated age of only 170 years old (No. 14). Cernica Monastery, founded in 1604, is considerably older than the three oaks (Bahmuţeanu, 1977). Based on this aspect, all the three oaks should be considered as being improbable remains of the Cernica Forest. Yet, the lack of conclusive cartographical evidence forces us to reconsider the matter. On the other hand, Pasărea Monastery was founded in 1813, one hundred years after the estimated genesis of its two oaks (Bahmuţeanu, 1977). The only oak identified in the Argeş River meadow is the 320 year-old one at Ţegheş (No. 27). It rises at the southern side of the Codalbi Forest. The oak was situated in the same forest on the Charta României Meridionale. Based on its size, age and location, it is one of the few probable remains of the intact oak forests in the area.

The oak at Bulbucata rises in the Neajlov River meadow, in the forest of Nebuna de Jos, as it was on the Charta; when compared to the rest of the oaks, this one was already much older. The oak is known by the locals as "The old mother of the forest", or "The thick old woman", and has an estimated age of an exceptional 600 years, with a record girth of 830 cm (No. 15). Based on our field experience, we consider it as the largest and oldest documented life-form located in a forest of Romania. It is by far the oak with the highest probability of being the remain of once primeval forests. Even if they are considerably smaller compared with the Bulbucata oak, the oaks at Comana are still massive trees, the largest reaching 550 cm in girth (No. 30), with two other smaller oaks reaching girths of 450 cm (Nos. 31, 32), and another three just over 400 cm (Nos. 33, 34, 35). All the oaks are probable remains of the once intact forest of Comana, which, together with the great forests of Snagov, Bolintin and Cernica, form the largest present-day continuous lowland forested areas in the entire Romanian Plain (Grigorescu, 2010; Dumitraşcu *et al.*, 2016).

Some of the largest oaks in the study-area are in the Glavacioc River basin, one stands outside the town of Videle and two others in the large forest of Duşani, on the road connecting the villages of Letca Veche and Letca Nouă. The oak at Videle, known as the "The oak of Michael the Brave", has a 720 cm-girth trunk, being the second largest tree in the entire study-area (No. 21) (Stângă & Dobrescu, 2011). Even if the oak is shown in a hayfield on the Charta României Meridionale, yet based on its remarkable age (490 years), it could have risen a longer time ago in an intact forest. On the other hand, the two oaks at Letca Nouă were located in the same forest on the Charta as they are now (Nos. 28, 29).

Our results indicate that these oaks represent isolated specimens; the only locations characterized by notable concentrations are the parks of the old historical mansions in the Colentina River meadow, such as those at Buftea or Mogoşoaia. Another exception is an isolated forest patch located in the northern part of the Comana Forest and bordered by the Neajlov wetland. Consequently, popular beliefs saying that numerous present-day forest patches spread all over the Argeş River basin are entirely remains of primeval forests proved to be exaggerations, probably for increasing the low tourist value of these areas.

Table 3

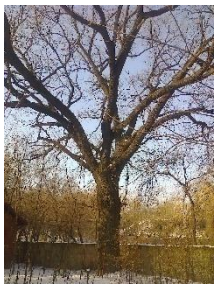
The remarkable common oaks potential of being remains of once primeval forests.

No. 1
Location: Drăgănești-Vlașca
Data: January 2015
Girth: 6.50 m
Estimated age: 420 years
Landscape in 1856: hayfield
Status: possible

No. 2
Location: Târnava
Data: January 2015
Girth: 5.50 m
Estimated age: 320 years
Landscape in 1856: hayfield
Status: possible

No. 3
Location: Bucharest
Data: February 2015
Girth: 4.5 m
Estimated age: 220 years
Landscape in 1856: city
Status: possible

No. 4
Location: Bucharest
Data: February 2015
Girth: 5.5 m
Estimated age: 320 years
Landscape in 1856: pasture
Status: possible



No. 5
Location: Bucharest
Data: February 2015
Girth: 4.4 m
Estimated age: 210 years
Landscape in 1856: pasture
Status: possible

No. 6
Location: Bucharest
Data: February 2015
Girth: 4.4 m
Estimated age: 210 years
Landscape in 1856: pasture
Status: possible

No. 7
Location: Chitila
Data: March 2015
Girth: 5.5 m
Estimated age: 320 years
Landscape in 1856: forest
Status: probable

No. 8
Location: Chitila
Data: March 2015
Girth: 5.5 m
Estimated age: 320 years
Landscape in 1856: forest
Status: probable

No. 9
Location: Mogoșoaia
Data: April 2015
Girth: 6.50 m
Estimated age: 420 years
Landscape in 1856: garden
Status: possible

No. 10
Location: Mogoșoaia
Data: April 2015
Girth: 6.50 m
Estimated age: 420 years
Landscape in 1856: garden
Status: possible

No. 11
Location: Mogoșoaia
Data: April 2015
Girth: 4 m
Estimated age: 170 years
Landscape in 1856: garden
Status: improbable

No. 12
Location: Cernica
Data: April 2015
Girth: 5.5 m
Estimated age: 320 years
Landscape in 1856: garden
Status: possible

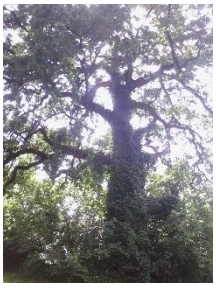
No. 13
Location: Cernica
Data: April 2015
Girth: 5.5 m
Estimated age: 320 years
Landscape in 1856: garden
Status: possible

No. 14
Location: Cernica
Data: April 2015
Girth: 4 m
Estimated age: 170 years
Landscape in 1856: garden
Status: improbable

No. 15
Location: Bulbucata
Data: May 2015
Girth: 8.3 m
Estimated age: 600 years
Landscape in 1856: forest
Status: probable

No. 16
Location: Buftea
Data: June 2015
Girth: 5.5 m
Estimated age: 320 years
Landscape in 1856: garden
Status: possible

No. 17
Location: Buftea
Data: June 2015
Girth: 5.5 m
Estimated age: 320 years
Landscape in 1856: garden
Status: possible



No. 18
Location: Buftea
Data: June 2015
Girth: 5.5 m
Estimated age: 320 years
Landscape in 1856: garden
Status: possible

No. 19
Location: Buftea
Data: June 2015
Girth: 6.5 m
Estimated age: 420 years
Landscape in 1856: garden
Status: possible

No. 20
Location: Buftea
Data: June 2015
Girth: 4.9 m
Estimated age: 260 years
Landscape in 1856: garden
Status: possible

No. 21
Location: Videle
Data: June 2015
Girth: 7.2 m
Estimated age: 490 years
Landscape in 1856: hayfield
Status: possible

No. 22
Location: Bucharest
Data: October 2015
Girth: 4.5 m
Estimated age: 220 years
Landscape in 1856: garden
Status: possible

No. 23
Location: Bucharest
Data: October 2015
Girth: 4.9 m
Estimated age: 260 years
Landscape in 1856: vineyard
Status: possible

No. 24
Location: Bucharest
Data: October 2015
Girth: 4 m
Estimated age: 170 years
Landscape in 1856: vineyard
Status: improbable

No. 25
Location: Pasărea
Data: May 2015
Girth: 5.5 m
Estimated age: 320 years
Landscape in 1856: garden
Status: possible

No. 26
Location: Pasărea
Data: May 2016
Girth: 5.5 m
Estimated age: 320 years
Landscape in 1856: garden
Status: possible

No. 27
Location: Țegheș
Data: June 2016
Girth: 5.5 m
Estimated age: 320 years
Landscape in 1856: forest
Status: probable

No. 28
Location: Letca Nouă
Data: July 2016
Girth: 6.5 m
Estimated age: 420 years
Landscape in 1856: forest
Status: probable

No. 29
Location: Letca Nouă
Data: July 2016
Girth: 6.5 m
Estimated age: 420 years
Landscape in 1856: forest
Status: probable

No. 30
Location: Comana
Data: February 2017
Girth: 5.5 m
Estimated age: 320 years
Landscape in 1856: forest
Status: probable

No. 31
Location: Comana
Data: : February 2017
Girth: 4.5 m
Estimated age: 220 years
Landscape in 1856: forest
Status: probable

No. 32
Location: Comana
Data: : February 2017
Girth: 4.5 m
Estimated age: 220 years
Landscape in 1856: forest
Status: probable

No. 33
Location: Comana
Data: : February 2017
Girth: 4 m
Estimated age: 170 years
Landscape in 1856: forest
Status: possible

No. 34
Location: Comana
Data: : February 2017
Girth: 4 m
Estimated age: 170 years
Landscape in 1856: forest
Status: possible

No. 35
Location: Comana
Data: : February 2017
Girth: 4 m
Estimated age: 170 years
Landscape in 1856: forest
Status: possible

4. CONCLUSIONS

The central part of the Romanian Plain was once dominated by vast compact forests spreading from the northern hills to the southern steppes. The common, or English oak had then been the central element of those primeval woods. Starting with 1829 the forests were extensively cleared out to make way for agricultural land. Yet, several forest remains were preserved, as a testimony of that mediaeval landscape.

Our study, based on field measurements, was aimed at identifying large oaks of higher ecological and cultural value, known as remarkable specimens. Based on their measured girth and using statistical modelling, the age of remarkable oaks was estimated by the causal relation: age = (girth – 2.271) / 0.009. The equation was built by statistically analyzing fifteen other large oaks located in three different regions of Romania, and featuring girths between 400 and 1,100 cm and ages previously estimated by the carbon dating method, the largest being approximately 800 years old. Also, by using the map overlapping method, the oaks standing in the Argeș River basin, in the midst of forests, or in other land-use classes on old maps (such as the Charta României Meridionale) could be outlined. By correlating oak-age with past location we determined their potential of being remains of the once pristine forest which covered the study-area.

The results materialized in the identification of 35 remarkable oaks distributed mainly in the central and eastern part of the Argeș River lower basin. Furthermore, the oak measured girth varied between 400 and 830 cm and at an estimated age between 170 and 600 years. Only two of them have girths over 700 cm and are 490 year-old. Six oaks are between 500 and 700 cm and potentially over 400 years old, while the largest majority (counting twelve) have approximately 550 cm girths and between 300 and 400 years old. The remaining fifteen show imposing trunk girths larger than 400 cm, but their estimated age does not considerably exceed the 200-year threshold. Consequently, from the total of 35 trees analyzed, thirty are over 200 years old. By modelling the old location of the trees, we could determine that only twelve were located in the forests presented on the Charta României Meridionale. The others were distributed as follows: three in hayfields, fourteen in old gardens administred by monasteries or historical mansions, another tree on pastures, two in vineyards and just one within a public space surrounded by walled areas. Finally, the oaks with the highest potential of being initial forest remains are located especially in the central part of the study-area and are usually the same ones found in the forested landscapes around 150 years ago. Conversely, the oaks with the lowest potential lie in the eastern part of the area, being located in anthropic land-use classes on the

Charta României Meridionale. Research findings indicate that the Argeş River basin lacks forest patches with notable old oak specimens and that such individuals represent rare and usually scarce examples. The only potential exceptions are the historical gardens of several old mansions located in the Colentina River meadow, and a small isolated forest patch situated in the northern part of the Comana Forest.

Combining various methods in a geographical approach can provide a better understanding of the natural history of the remnants of an ancient lowland landscape, such as the remarkable common oaks. Yet, it is important to notice that there is no specific approach that can justify with certainty that some oaks are initial trees, while others are the result of anthropic actions. Moreover, the best approach so far, is to determine their potential of being primary trees, in an as best as possible conclusive manner, relying on the rigour of our methods. The outcome represents a useful basis for devising various modelling techniques of the primary common oaks distribution under different past, present and future climatic scenarios on the area in question. Nevertheless, such assessments prove to be valuable for further researches on the reconstruction of ancient natural landscapes. Moreover, studies on the relationships between the social and the cultural perception of oak trees by the locals could also rely on research findings.

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