Old Forests from Dobrogea's Plateau

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Abstract: From the oldest times, the forest has been the main food, shelter and energy source, playing an essential role in the development of human societies. Old stands are characterized by their long life, large heights and diameters and by their help in conserving biodiversity. The surfaces occupied by old stands have decreased lately because of their wood mass high value which leads to exploitation. This is furthermore coupled with climate changes, urbanization and human influences. These stands occupy a surface of 128.500 ha in the forests from Dobrogea's Plateau, where broad-leaved species are preponderant (*Quercus* sp., *Fraxinus ornus*, *Tilia tomentosa*, *Acer* sp.). As such, the present paper intends to characterize the oldest stands from Dobrogea's Plateau with the help of forest management plans realized during 1993-2007. The main characteristics analyzed in this study for stands older than 120 years were: location, surface, height, diameter, structure, forest type, soil type, altitude, exposition, slope and consistency. Stand older than 100 years occupy only 4% of the total surface and are composed of linden, brown oak and pedunculate oak which grow and develop on common luvisols.

1. Introduction

Forests gain a special importance because of their ecosystem services such as conserving biodiversity, wood production, supplying water, recreational functions, non-wood products and air quality [1, 2, 3, 4, 5]. Old trees are characterized by their long life, large heights and diameters and by their role in conserving biodiversity [6]. More than this, old trees influence hydrologic regimes, species distributions and have numerous ecological purposes [7, 8, 9, 10] as well as cultural ones as they appear in movies, books, art etc. [11]. However, the surfaces occupied by old trees are decreasing as their wood's mass high quality makes them highly exploitable. This is furthermore correlated with climatic changes, urbanization and human influences [8, 12, 13, 14].

Dobrogea's Plateau is situated in south-east Romania, being the most arid area from our country. The climate is temperate-continental, with a low quantity of annual average precipitations (<400 mm/year) [15, 16].

According to INSSE, Romanian forests occupy in 2019 a surface of 6.427.000 ha. From this total, 128.500 forest ha are located in Dobrogea's Plateau where 2.400 ha are resinous forests and 126.100 ha are broad-leaved ones [17]. Being a steppe and silvosteppe area, the main forest species present in the region are: *Quercus* sp., *Fraxinus ornus*, *Tilia tomentosa*, *Acer* sp., *Carpinus orientalis* [15, 18].

The purpose of this paper is to characterize the oldest forest stands from Dobrogea's Plateau, similar with identifying the oldest stands from Banatului Mountains [19] or from Romanian's Western Plain [20].

2. Materials and Methods

The main material that was used for this study is represented by data from forest management plans realized in the studied area during 1993-2007 [21]. Therefore, these data were centralized from the 10 forest districts present in Dobrogea's Plateau (Fig. 1). Management works are realized at a distance of 10 years, which includes the determination of the trees' ages.

Figure 1 Distribution of forests district from Dobrogea's Plateau

The main stand elements included in the data taken from forest management plans correspond to an Excel data base and amount to 16 items (species, origin, surface, age, average diameter, average height, production class, volume, altitude, soil type, flora, forest and station, structure, exposition and slope).

The main characteristics analyzed in this study were: location, surface, height, diameter, structure, forest type, soil type, altitude, exposition, slope and consistency. These characteristics were mainly studied for trees older than 120.

3. Results and Discussion

According to the analyzed data, the total surface of forests belonging to public forest districts from Dobrogea's Plateau is of 103.491 ha. Table number 1 presents these forest districts and the main species from this region.

Table 1 Surface of forest districts from Dobrogea's Plateau

Forest district	Surface (ha)	Predominant species
Babadag	13902	Fraxinus ornus L. Manna ash
Baneasa	10815.3	Robinia pseudacacia L. Black locust
Casimcea	8203	Quercus pedunculiflora K.
Cerna	12297.4	Tilia cordata Mill.
Cernavoda	6838.9	Robinia pseudacacia L. Black locust
Ciucurova	15619.2	Tilia cordata Mill
Constanta	8516.1	Robinia pseudacacia L
Harsova	3321.5	Robinia pseudacacia L
Macin	11429.9	Tilia cordata Mill
Niculitel	12547.9	Tilia cordata Mill

The main specieses found in Dobrogea's Plateau based on the data extracted from forest management plans and reported for each forest district are rendered in Figure number 2. As it can be seen, linden (TE) and locust (SC) are the most widespread species. They are accompanied by brown oak (STB), manna ash (MJ) and willow (SA). The area's climate favourizes the presence of these species. As such, linden occupies a total surface of 16.935 ha, followed by locust with 6120 ha. Locust is one of the species that was first cultivated throughout the country for ornamental purposes. Later it was naturalized, becoming subspontaneous from the plains to the mountains [22].

Figure 2 Main species found in Dobrogea's Plateau

Figure number 3 showcases the repartition of trees from Dobrogea's Plateau. This distribution was realized on age categories at an interval of 20 years. Altogether, the distribution of stands on age categories is relatively uniform for the ages between 0-100

years. Within this distribution it can be seen that stands older than 100 years occupy only 4% of the total surface, namely 3846.1 ha.

Figure 3 Distribution of stands from Dobrogea's Plateau on age categories

The data centralization and analysis has shown that Dobrogea's Plateau has 786 stands with ages between 120-160 years. The majority of these stands belong to OS Ciucurova (386 stands), followed by OS Cerna (198 stands), while the fewest ones are present in OS Babadag and Baneasa (Fig. 4)

Figure 4. The number of stands older than 120 years

The following table (Table 2) presents an excerpt from the database with 12 stands older than 120 years, together with their main characteristics which will be studied in detailed in the following pages.

Table 2. The characteristics of old stands from Dobrogea's Plateau

Forest district	Species	Age	Surface (ha)	Average diameter (cm)	Average Height (m)	Altitude (m)	Soil type	Flora	Forest type	Structure	Exposition	Inclination (°)	Origin
Babadag	TE	120	22.6	35	18	192	2401	61	5331	3	V	10	RN
Casimcea	STB	140	1.5	47	17	278	1210	-	8115	1	V	10	RN
Cerna	TE	150	19.5	53	24	264	2401	61	5331	3	NE	6	RN
Cerna	STB	140	2.5	41	18	245	2401	61	5323	3	S	11	RN
Cerna	STB	130	6.1	38.5	16	185	2401	65	6321	2	V	12	RN
Cerna	STB	120	5.8	35	14	219	2201	61	5323	3	S	18	RN
Ciucurova	STP	160	1.5	34	9	320	1703	72	8223	3	S	35	RN
Ciucurova	STP	140	3.6	24	10	165	9101	-	8223	3	E	25	RN
Ciucurova	STP	120	13.3	38.4	15	273	1701	63	5333	2	V	20	RN
Macin	TE	130	8.6	34	23	220	3101	61	5324	4	NE	25	RN
Niculitel	TE	160	3	52	25	250	2407	52	5322	3		0	RN
Niculitel	TE	150	4.4	56	19	185	2204	52	5333	3	NE	6	RN

The meaning of the terms from the above table is as follows:

Species: TE= linden, STB= brown oak, STP= pedunculate oak

Structure: 1= even-aged stand; 2= relatively even-aged stand; 3= relatively uneven-aged stand, 4= uneven-aged stand

Flora: 61= Asarum-Stellaria; 52 = Carex pilosa; 63= Carex pilosa; 65= Festuca altissima; 63= Carex pilosa; 72= Poa pratensis.

Soil type: 1210= vermic-stagnic chernozem; 1701= rendzina; 1703= lythic rendzina; 2201= preluvisol; 2204= gleyc preluvisol; 2401= luvisol; 2407= stagnic luvisol; 3101= eutric cambisol; 9101= lithosol;

Forest type: 5322= Hill tug with holm of superior productivity; 5323= Holm stand tug of average productivity; 5324= Hill tug with holm of average productivity; 5331= Dobrogean hill tug of average productivity; 5333= Dobrogean tug of inferior productivity; 6121= Meadow oak stand from the hill region; 8115= Brown oak from the Dobrogean hill silvosteppe of average productivity; 8223= Soft oak from the Dobrogean silvosteppe with superficial soil.

Origin: RN=Natural regeneration;

The oldest stands from the studied area are located in O.S. Ciucurova (a pedunculate oak stand) and in O.S. Niculitel (a linden stand). Both of them are 160 years old. The stand's age is expressed as an average of all the trees that form the stand.

The main species that are found in old stands are: brown oak (*Quercus pedunculiflora* K. Koch), pedunculate oak (*Quercus robur* L.) and linden (*Tilia cordata* Mill.). These species have annual fructifications which ensure their natural regeneration from linden seeds and from oak fruits and sprouts [22].

The average diameter of old brown oak stands ranges between 35-47 cm, with an average height between 14-18 m. For the linden stands, the average diameter ranges between 35-56 cm while the average heights are situated between 18-25 m.

Stands with different structures can be found in this area. However, the majority of old stands have a relatively uneven-aged structure. This means that they have different ages, higher than 5 years for trees originating from sprouts and higher than 20 years for trees originating from seeds.

Asarum-Stellaria is the main type of flora from these stands. This type of flora is characteristic for oak/holm stands. *Carex pilosa* is also present in these stands.

Old stands from Dobrogea's Plateau prefer sunny expositions (south ones), partially sunny (west) and rarely the shadowed ones (north-east).

The field's slope ranges between 6-35°. As it can be seen in figure number 5, the majority of stands have a slope between the 0-10° intervals, while the least stands have

a slope between 31-40°. These slopes are characteristic for the studied area as Dobrogea's Plateau is characterized by low altitudes.

Figure 5. Distribution of old stands on the field's slope categories

The most widespread type of soil for these stands is common luvisol. This type of soil can be found in plains, hills and plateaus and generally occupies plain fields [23, 24, 25].

The types of forests spread within these stands are the following: Holm stand tug of average productivity; Dobrogean hill tug of average productivity; Dobrogean tug of inferior productivity and Pure soft oak from the Dobrogean silvosteppe with superficial soil.

4. Conclusions

Even though the surfaces covered by old stands are decreasing in the last years due to their wood mass high value, or because of anthropic and climatic changes, these types of forests can still be found in our country. In Dobrogea's Plateau for example, stands older than 100 years occupy a surface of 3846.1 ha, approximately 4% of the total surface covered by forests in this region. The most widespread species of old stands from this area are brown oak (*Quercus pedunculiflora* K. Koch), pedunculate oak (*Quercus robur* L.) and linden (*Tilia cordata* Mill.). The stands comprising these species have a relatively uneven aged structure and are widespread on fields with a variable slope ranging between 6-35°, while the most of them are situated between 0-10° due to the mild relief that characterizes this area. The forest types found in this area are: Dobrogean hill tug of average productivity; Dobrogean tug of inferior productivity; Holm stand tug of average productivity; Pure soft oak from the Dobrogean silvosteppe with superficial soil that grown and develop of common luvisols.

References

1. Tognetti, R. Climate-Smart Forestry in Mountain Regions-COST Action CA15226, Impact 2017, (3), 29-31 <https://doi.org/10.21820/23987073.2017.3.29>.
2. Tiwary, A.; Vilhar, U.; Zhiyanski, M.; Stojanovski, V.; Dinca, L. Management of nature-based goods and services provisioning from the urban common: a pan-European perspective. *Urban Ecosystems* 2020, 23(3), 645-657 <https://doi.org/10.1007/s11252-020-00951-1>.
3. Pleşca, I. M.; Blaga, T.; Dincă, L.; Breabă, I.G. Prioritizing the potential of non-wood forest products from Arad county by using the analytical hierarchy process. *Present Environment and Sustainable Development* 2019, 13(2), 225-233 <https://doi.org/10.2478/pesd-2019-0038>.
4. Tudor, C.; Constandache, C.; Dincă, L. Benefits brought by the abundance and importance of forest fruits from Satu Mare county, Romania. In *Book of Proceedings of the X International Scientific Agricultural Symposium "Agrosym 2019"* 2019, 1920-1925. <https://doi.org/10.15835/buasvmcn-hort:2019.0024>
5. Ciontu, C.I.; Dincă, L.; Enescu, C.M.; Onet, A.; Onet, C. Analyzing the importance of game species from Argeş County. *Natural Resources and Sustainable Development*, 2018, 8(2): <https://doi.org/10.138-147.10.31924/nrsd.v8i2.015>
6. Wan, J. Z.; Li, Q. F.; Wei, G. L.; Yin, G. J.; Wei, D. X.; Song, Z. M.; Wang, C. J. The effects of the human footprint and soil properties on the habitat suitability of large old trees in alpine urban and periurban areas. *Urban Forestry & Urban Greening*, 2020, 47, 126520. <https://doi.org/10.1016/j.ufug.2019.126520>
7. Liu, J.; Lindenmayer, D. B.; Yang, W.; Ren, Y.; Campbell, M. J.; Wu, C.; ... Yu, M. Diversity and density patterns of large old trees in China. *Science of The Total Environment* 2019, 655, 255-262 <https://doi.org/10.1016/j.scitotenv.2018.11.147>
8. Jones, G. M.; Keane, J. J.; Gutiérrez, R. J.; Peery, M. Z. Declining old-forest species as a legacy of large trees lost. *Diversity and Distributions* 2018, 24(3), 341-351 <https://doi.org/10.1111/ddi.12682>
9. Constandache, C.; Dinca, L.; Tudose, N.C.; Panaitescu, C. Protecting surface water resources through silvicultural methods. *International Symposium "The Environment And The Industry", SIMI 2018, Proceedings Book Section Pollution Assessment & Management Systems*, 2018, 276-284. <http://doi.org/10.21698/simi.2018.fp33>
10. Kachova, V.; Dincă, L. Establishment of agro-forestry systems along river basins-Functions and features. *Revista de Silvicultură şi Cinegetică* 2015, 20(36), 64-68.
11. Blicharska, M.; Mikusiński, G. Incorporating social and cultural significance of large old trees in conservation policy. *Conservation Biology* 2014, 28(6), 1558-1567. <https://doi.org/10.1111/cobi.12341>
12. Huang, L.; Tian, L.; Zhou, L.; Jin, C.; Qian, S.; Jim, C. Y.; ... Yang, Y. Local cultural beliefs and practices promote conservation of large old trees in an ethnic minority region in southwestern China. *Urban Forestry & Urban Greening* 2020, 49, 126584. <https://doi.org/10.1016/j.ufug.2020.126584>
13. Lindenmayer, D. B.; Laurance, W. F.; Franklin, J. F. Global decline in large old trees. *Science* 2012, 338, 1305-1306. <https://doi.org/10.1126/science.1231070>
14. Căntar, I.C.; Dincă, L.; Chisăliţă, I.; Crişan, V.; Kachova, V.; Identifying the oldest stands from the Southern Carpathians together with their main characteristics. *Proceedings of the Multidisciplinary Conference on Sustainable development, Filodiritto International Proceedings* 2019, pag. 186-193.
15. Grindean, R.; Nielsen, A. B.; Tanţău, I.; Feurdean, A. Relative pollen productivity estimates in the forest steppe landscape of southeastern Romania. *Review of Palaeobotany and Palynology* 2019, 264, 54-63. <https://doi.org/10.1016/j.revpalbo.2019.02.007>
16. Vorovencii, I. Assessing and monitoring the risk of desertification in Dobrogea, Romania, using Landsat data and decision tree classifier. *Environmental monitoring and assessment* 2015, 187(4), 204. <https://doi.org/10.1007/s10661-015-4428-3>
17. Institutul Naţional de Statistică <https://insse.ro/> (Accesed: 20 November 2020)

18. Dincă, L.; Vechiu, E. Intelligent pubescent oak forests (*Quercus oubescens* Wild.) from Dobroudja Plateau, Romania. *Sustainable Development Research* 2020, 2(1): 1-9. <https://doi.org/10.30560/sdr.v2n2p1>
19. Timiș-Gânsac, V.; Dincă, L.; Cheregi, G. Considerations concerning the oldest stands from Banatului Mountains, Romania. *Sustainable Development Research* 2020, 2(1): 64-71. <https://doi.org/10.30560/sdr.v2n1p64>
20. Dincă, L.; Bratu, I. Assessment of the distribution and characteristics of the oldest forests stand from the Romanian's Western Plain. *Bulletin UASVM series Agriculture* 2020, 77(2): 9-14. <https://doi.org/10.15835/buasvmcn-agr:2020.0024>
21. Amenajamentele ocoalelor silvice: Babadag (1994), Baneasa (2005), Casimcea (2007), Cerna (2001), Cernavoda (1994), Ciucurova (2004), Constanta (1994), Harsova (1993), Macin (1995), Niculitel (2001).
22. Șofletea, N.; Curtu, L. *Dendrologie*, Ed. "Pentru Viață", Brașov, Romania, 2008, 418 p.
23. Spârchez, G.; Târziu, D.R.; Dincă, L. *Pedologie cu elemente de Geologie și Morfologie*. Editura Universității Transilvania din Brașov, 2013, p. 348.
24. Crișan, V.; Dincă, L.; Onet, A.; Onet, C.; 2017. The description of forest soils from Brăila county. *Natural Resources and Sustainable Development* 2017, 21-26.
25. Dinca, L., Chisalita, I., Cantar, I.C. Chemical properties of forest soils from Romania's West Plain. *Revista de Chimie* 2019, 70(7): 2371-2374.

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