CHARACTERISTICS AND DISTRIBUTION OF XEROTHERMIC OAK ECOSYSTEMS IN SCI "ZAPADNA STARA PLANINA I PREDBALKAN" AS SUBJECT OF FUNCTIONAL RESEARCH

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Aim:
The present study was aimed to describe the distribution and ecological structure of xerothermic oak ecosystems in SCI "Zapadna Stara planina i Predbalkan", which are dominated by *Quercus cerris* L. and *Q. frainetto*Ten.
Material and Methods:
The information from forest management plans was analyzed. The minimum and maximum altitude of distribution, the main soil types and the average parameters for the age, DBH and height of forest stands were defined. A comparison was made between the data of forest management plans and data collected during field inventory.
Results:
The xerothermic oak ecosystems occupy the altitude zone of 200 to 400 m in SCI, mostly northern exposure with slope up to 10 degree. The oak forests are mainly developed on gray forest soils and on sandstone and conglomerate as rock foundation. The average forest inventory parameters are: 11 m height, 14 cm DBH and about 50 years age.
Conclusions:
The most appropriate forests for functional researches are the forests with representative ecological status - to have a typical habitat species composition, canopy, floor structure and representative average data for the tree layer. About the SCI "Zapadna Stara Planina i Predbalkan" these forests are with distribution around 300 m altitude, northern exposure and on gray forest soils and also with about 50 years average age of stands.

Keywords: xerothermic oak ecosystems, distribution, structural parameters, SCI

Introduction:

Oak forests occupy the largest share (32.2%) of the forest lands of Bulgaria [5]. The xerothermic oak ecosystems dominated by Turkey and Sessile oak, are protected habitat according to the Biological Diversity Act, Annex 1 [14] and also they are endangered habitat according to The Red Data Book of the Republic of Bulgaria, vol. 3 [2]. The unfavorable growth conditions, the disturbance reproductive process of oak trees and the anthropogenic pressure make the xerothermic oak ecosystems susceptible to destruction and easy to turn to grass-shrubs habitats [1]. The rich biodiversity and environment-forming functions of the oak forests define them as important conservation site. This conservation status has caused the scientific interest in the structure and function of xerothermic oak ecosystems with intent to improve and preserve the oak habitat.
The present study describe the distribution and ecological structure of xerothermic oak ecosystems in SCI "Zapadna Stara planina i Predbalkan", which are dominated by *Quercus cerris* L. and *Q. frainetto*Ten. The main aim of the research is to characterize the oak forests by structural indicators, also to define conservation status before their use for functional researches. The surveys of the xerothermic oak ecosystems in the studied area were conducted by Lalova [9] and Lyubenova [10, 11, 12].

Material and Methods:

The studied oak forests are a part of habitat G1.768 Moesio-Danubian termophilous oak forest according to EUNIS classification [4] or 91M0 Pannonian-Balkanic turkey oak-sessile oak forests according to Natura 2000 classification [8]. The xerothermic oak ecosystems in Site of Community Importance (SCI) "Zapadna Stara planina i Predbalkan" are a part of the Illyrian (Balkan) province of the European deciduous forest region dominated by European and Euro-Asian floral elements according to geobotanical regioning of Bulgaria [3]. The distribution of the habitat in the SCI is mainly in the low mountain and foothill areas within State Forestry (SF) Govejda and SF Chuprene. The climate is characterized as temperate continental with extended temperature (min (-1.5)-0^0C and max 22-24 ^{0}C) and 750-1000 mm average annual rainfall [15]. The studied area is a part of Carpatho-Danubian soil region according to soil zoning of Bulgaria with mainly *Cambisols*, *Luvisols, Rendzinas* and *Rankers* [13].

The distribution of xerothermic oak ecosystems was studied based on the data in Forest Management Plan (FMP) of State Forestry (SF) Govejda [6] and SF Chuprene [7]. A map of distribution of xerothermic oak forests in SCI was prepared and the polygons suitable for functional modeling are valued based on calculated average indicators of altitude, exposure and slope, soil type and bedrock and according to ownership and use of the forests. Ecological structure of xerothermic oak ecosystems have been investigated on the basis of information collected for age and structural characteristics of the tree layer set out in both FMP. The averaged parameters obtained after statistical processing were compared to treated similarly terrain inventory data collected from 4 sampling areas set out at the end of the growing season of 2012. The sampling areas were near the village Protopopintsi, Chuprene municipality and village Gavril Genovo, George Damyanovo municipality.
At last, Statistica 7 program was used to analyze the information from FMP of both SF and the terrain data. The Spearman Rank Order Correlations between age as an independent variable, the height of the trees and the diameter at breast height (DBH) as dependent variables were determined.

Results:

The territory of SCI "Zapadna Stara planina i Predbalkan" was 219753.26 ha. The xerothermic oak ecosystems occupied 5% (11042.02 ha) of the whole territory of the site. The studied habitat 91M0 in SCI, represent about 0,2% of the national distribution of this habitat in Bulgaria by its national assessment.

The statistical analysis found that the 70% of the polygons of the xerothermic oak forests are state-owned, 25% are private and 5% - municipal and with other property. The main purpose of oak ecosystems is wood production (92.5%); the remaining 7.5% are forests of green belts in urban areas, forests with aesthetic value and historical sites. The xerothermic oak ecosystems of the study area are with mixed (coppice-seed) origin (97%), 2% are tall seed forests, and 1% are low-growing coppices. The xerothermic oak forests of SF Govejda and SF Chuprene occupy the elevation range from 0 to 650 m with maximum density about 300 m and the slope range from 0 to 40 degree with maximum density about 15 degree.

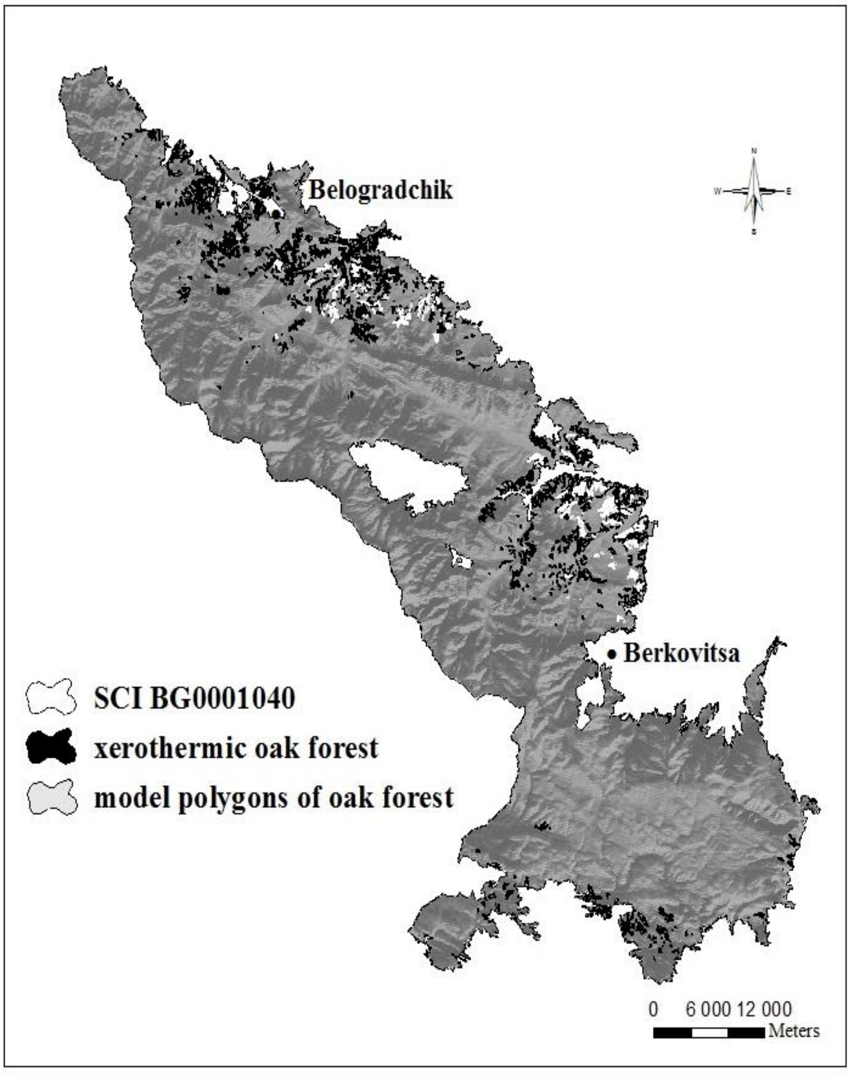

Figure 1. Distribution of xerothermic oak forests in SCI "Zapadna Stara planina i Predbalkan"

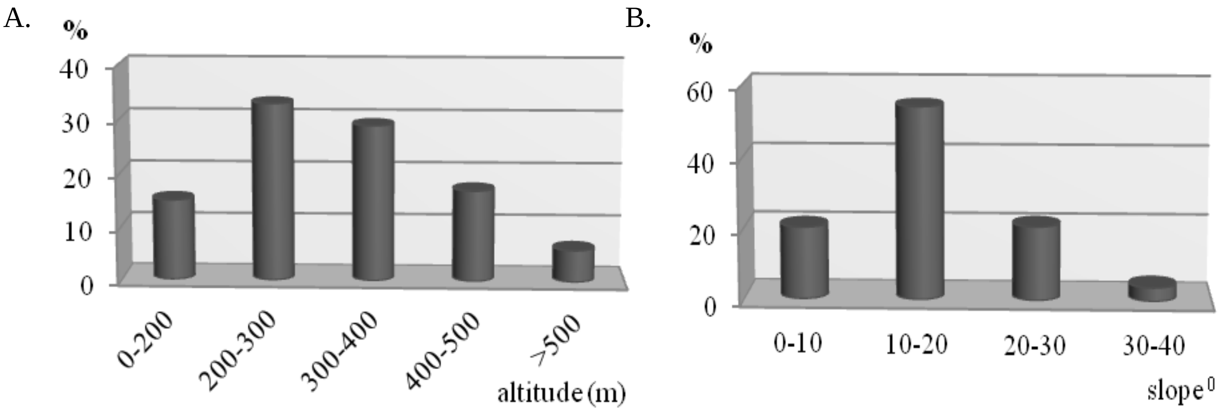

Figure 2. Distribution of xerothermic oak communities by altitude (A) and slope (B) by FMP

There is a high correlation between diameter and height of trees, which is modeled on the Fig. 3 A, RS = 0.83. Marked correlations are significant when P <0.05. Spearman rank order correlations of the height and DBH from the age (Fig. 3 B) are respectively: RS = 0.75 and RS = 0.84, e.g. high correlation dependences.

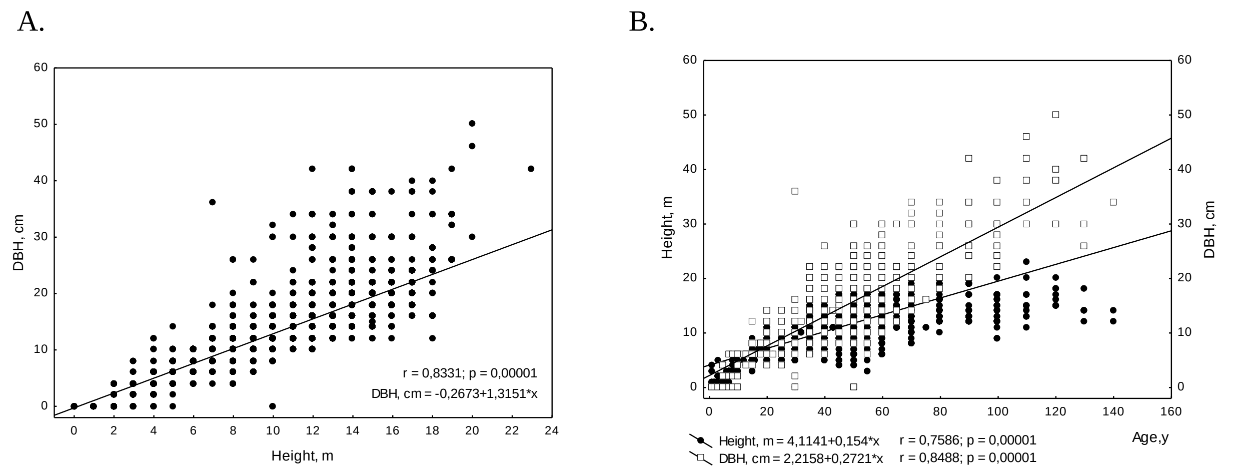

Figure 3. Regression dependences of the height and diameter (A) and dependences of the height and diameter from the age (B)

The oak forests thrive on gray (*Luvisols*) and brown (*Cambisols*) forest soils and humus carbonate soils (*Rendzic Leptosols*). They grow mainly on sedimentary rock as sandstone, conglomerate and limestone.

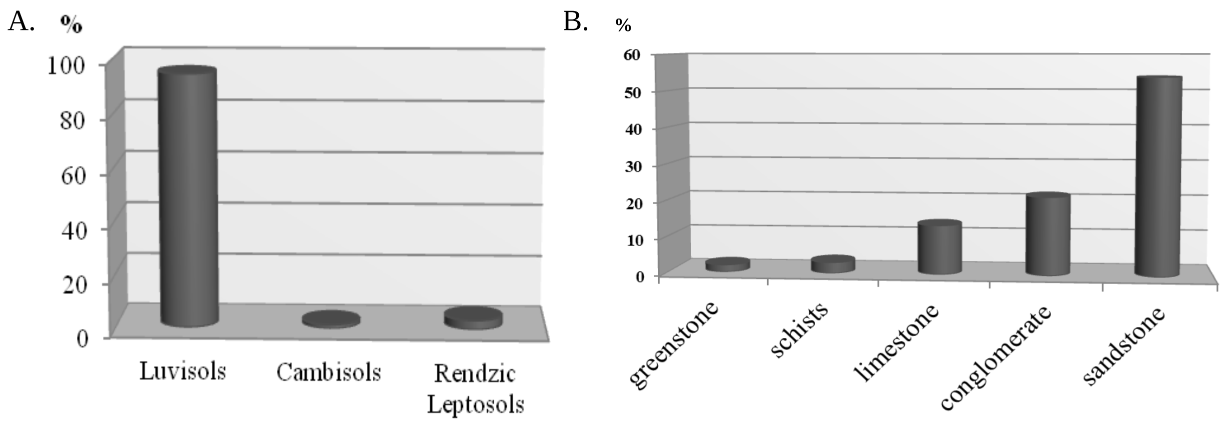

Figure 4. Soil (A) and rock (B) types occupied by the xerothermic oak forests by FMP

The ecological structure of xerothermic oak forests, defined by indicators of tree layer inventory, are represented by data from FMP. The average values for height and diameter of tree layer are calculated as follows: 11.0 ± 0.1 m height (min 5 m and max 23 m), for a DBH - 14.3 ± 0.2 cm (min 2 cm and max 50 cm). The average age of the established tree layer is 44 years (min 5 years and max 140 years).

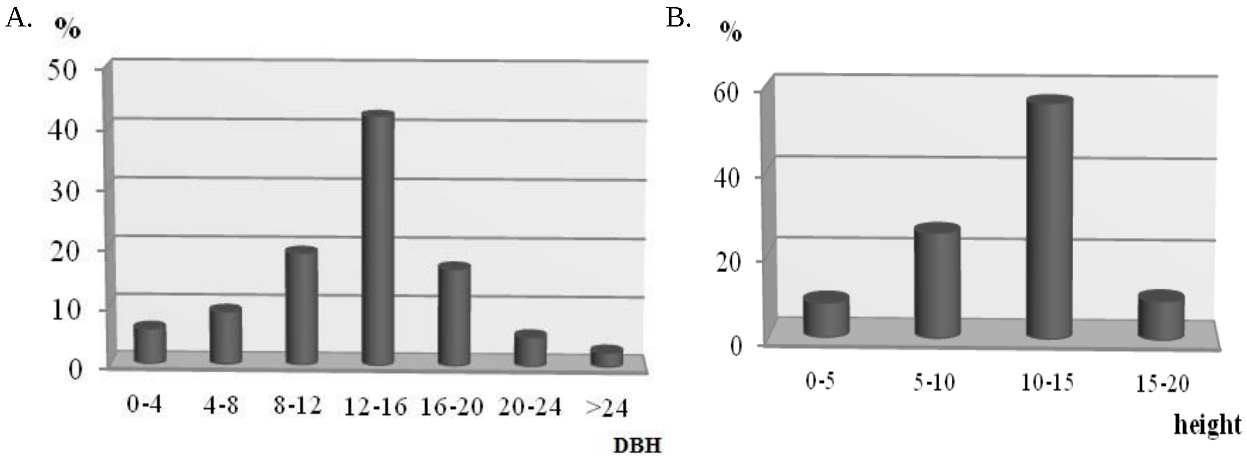

Figure 5. Percentage of communities based on average DBH (cm; A) and height (m; B) of tree stands by FMP

The average indicators of tree layer inventory for sampling areas are: DBH - 21.3 cm (min 4.4 cm and max 36.2 cm) and average tree height - 22.5 m (min 5 m and max 27 m). The average age of the tree layer in the sampling areas is around 45 year.

Discussion:

Moderate correlation was found between geographical parameters altitude, slope and aspect following a correlation analysis. There was a low correlation between altitude, soil and bedrock. The situation was similar in the analysis of biotic parameters such as age, height and diameter (Fig. 3). Good results were not obtained in a study of the correlation between biotic and geographical parameters. Moreover, there was a high variation in the performance of indicators of tree layer inventory of oak communities in the area, which determines the differences in their ecological status. The typical degradation processes and the course of succession of different stages are going on because of excessive human pressure for much of the oak communities. As a result of this variation in performance it is observed that there are differences between the calculated average indicators of tree layer inventory, using data from FMP and the measurements in sampling areas. So the sampling areas for structural and functional studies were selected in forests that are relatively steady state in their nature environment. These were forests with good ecological status that ensures that the research results will represent the studied ecosystems in the area and can be used to estimate the anthropogenic impact.

In the process of data analyzing and preparation of a map of the xerothermic oak forests distribution in SCI "Zapadna Stara planina i Predbalkan" were differentiated 0.6% (1,415.36 ha) of polygons of the habitat, which meets the requirements for the representation of performed structural and functional tests – to have a typical habitat species composition, canopy, floor structure and representative average data for tree layer. The differentiated polygons are with average geographic parameters, state-owned, coppice-seed origin and with tree stands from fifth age class.

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