OAK FOREST FROM ROMANIA'S WEST PLAIN UNDER CONSERVATION REGIME

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Abstract. *The present paper reunites in a subjective synthesis data from forest management plans from the West Plain realized during 1995-2008. The study was focused on stands under conservation regime that have in their composition one of the most important tree species from Romania: oaks. The research method has involved extracting from the data base the sub-compartment belonging to the 1-3C functional category. As such, the following elements were analysed: the surface occupied by oak stands in the West Plain, the species included on their composition, age, pruning, field inclination, altitude, flora, forest type, soil and forest site. According to the Forest Management Technical Norms, namely to the framing of forests in groups, subgroups and functional categories, the 1-3 functional category is represented by Forests with protection functions against climatic and harmful industrial factors and belongs to the 3^{d} functional subgroup (Forests with protection functions against climatic and harmful industrial factors) from the 1st functional group (Forests with special protection functions). The research's results show that oak forests under conservation regime represent over 1/3 of the entire surface of forest with protection functions against climatic and harmful industrial factors from the West Plain. Pedunculate oak (Quercus robur L.) is the most widespread species from these types of stands, covering a total area of 1370 ha. Red oak (Quercus rubra L.) is another oak species that can be found in a significant percentage in the West Plain forests. The altitude at which stands under the conservation regime can be found on the West Plain range between 110 and 340 m. The specific fields are plane while the soils are mostly situated in the stagnic luvisol category. Carex brizoides-Agrostis alba is the most widespread type of flora from these stands. This paper's results can be a pillar for an adequate management of these stands as well as for their conservation and for the perpetuation of their protection role.*

Key words: *oak stands, West Plain, altitude, aspect, field slope.*

INTRODUCTION

The West Plain extends on the west from the Western Carpathians and the West Hills and is the second plain as surface after the Romanian Plain. It is also known as Banato-Crisana Plain. On the north side, it extends up to the sub mountain margin of the Southern Carpathians (Oaş, Gutâi), up to the Nera's discharge in the Danube in the South and up to the country's border in the west. On the east side, it is framed by the West Hills (penetrating the golf basins with them) and directly with the Western Carpathians on small portions (near Zarandului and Locvei Mountains) (http://www.geocities.com).

With a different orientation (predominantly on the north-south direction) than all other national plains (that have an east-west orientation), the West Plain presents an exceptional horizontality within which a separation of distinct altitudinal levels can be remarked (tall, intermediary and lowered piedmont with a quasi-depression, divagation aspect). This appears as deep penetrations of the plain in mountains and sub-mountains, under the shape of river basins similar with fiords. These basins are strong, fragmented, in inter-fluvial sectors, sometimes with a graben aspect, with low altitudes (predominantly under 100 m). The phreatic

water level is close to the surface (generally between 0.5-3 m) while the soils are heavy and loamy, predominantly hydromorphic and rarely automorphic, with a very reduced permeability and a deficitary hydrologic regime (un-percolate) (DINCĂ et al 2019).

Oaks are among the most important broad-leaved species in Romanian forests from both an economic and socio-ecological point of view (Popa et al. 2013). *Quercus* is the only continental deciduous tree that has maintained a high abundance throughout the entire Holocene. Members of this genus demonstrated high resilience to climate changes and disturbances; it was capable of recovery after a period of decline during subsequent intervals of warm conditions or disturbance (FEURDEAN at al. 2011).

Amongst all oak species, sessile oak (*Quercus petraea* (Matt.) Liebl.) is the most important Quercus species in Romania, covering over 700000 ha. Sessile oak is established in Romania by natural seeding following a mixed uniform-group shelter wood system as well as by manual seeding or planting (NICOLESCU, 2010).

Among all Quercus species, one of the most important species from the economic view point is Q. robur, being one of the most economically important forest species in Romania (ENESCU, M. C. et al. 2010).

Turkey oak (*Quercus cerris* L.) is another species that is well represented in Romania and in the West Plain. Turkey oak is included in the stand structure of 162 forestry administrative units. Their effective surface occupied by turkey oak amounts to 185000 ha which represents a 3% share from the forests' composition (ADAM, 2009).

Another important species is the Northern red oak (*Quercus rubra* L.) which is one of the first North American forest species cultivated in Europe. Forests with northern red oak are located between the pedunculate oak (*Quercus robur* L.) zone and the lower limit of European beech (*Fagus sylvatica* L.) zone (up to about 700 m in elevation), where it performs reasonably well on both fertile and deep soils as well as on heavy clays (SANDI and NICOLESCU, 2011).

Nature conservation has appeared in Romania more connected with the conservation of forests while the idea of forest conservation has appeared together with silviculture. In regard with the conservation of the country's forest fund, the forestry code contains special stipulations regarding the forests that fulfil special protection functions for the genofund and ecofund or for forests declared as reservations and natural monuments. Furthermore, the code also includes conservation methods for the conservation of the genofund and for the forests' biodiversity in general (RUSU et al. 2016).

MATERIALS AND METHODS

The forests from our country are classified based on their functions in two functional groups: Group 1 – Forests with special protection functions and Group 2 – Forests with production and protection functions. As for, the 1st functional group is divided in 5 subgroups, among which the third one is named *Forests with protection functions against climatic and harmful industrial factors.* This group was divided in 11 functional categories that include the 1-3C category = *Oak forests from the plain area under the conservation regime*. The object of this article is represented by the forests from the West Plain situated in this category.

The article is based on data from forest management plans realized in this area during 1995-2008 (management plans from 13 forest districts - *** Forest management plans). Sub-compartment belonging to the 1-3C functional category were extracted from this data base. Site and stand data were taken into account for each sub-compartment. In the end, the following elements were analysed: the surface occupied by these forests, the species from their

composition, the stand's age, composition and mixture, the pruning, the field's altitude and slope, the flora, soil and site type as well as the characteristic forest type.

RESULTS AND DISCUSSION

The **surface** occupied by oak forests in the plain area under the conservation regime from the West Plain: Forests from *Subgroup 3. Forests with protection functions against climatic and harmful industrial factors* occupy on the West Plain a total surface of 7059 ha. Amongst them, 3911 ha are occupied by 1-3A functional category (*Steppe forests from the limit between steppe and silvosteppe, with the exception of parks and meadow forests), 1*970 ha by 1-3C and 1178 ha by 1-3G (*Dispersed forests with surfaces under 100 ha, located in plain areas*). As such, oak forests from the West Plain are under the conservation regime and occupy approximately 1/3 of the total surface occupied by forests with protection functions against climatic and harmful industrial factors (fig. 1).

Figure. 1. The surface occupied by forest functional categories in the West Plain from the subgroup of *Forests with protection functions against climatic and harmful industrial factors*

The most widespread **species** from this forest category in the West Plain are: pedunculate oak (*Quercus robur* L.) = 1370 ha, ash (*Fraxinus excelsior* L.) = 249 ha, hornbeam (*Carpinus betulus* L.) = 240 ha, black alder (*Alnus glutinosa* (L.) Gaertn.) = 54 ha. and aspen (*Populus tremula* L.) = 30 ha (fig. 2).

Other species present in these forests are: field maple (*Acer campestre* L.), walnut (*Juglans regia* L.), Norway maple (*Acer platanoides* L.), black locust (*Robinia pseudoacacia* L.), red oak (*Quercus rubra* L.), lime (*Tilia cordata* Mill.) and field elm (*Ulmus minor* Mill.).

The presence of other species besides oak (which covers 70% of the surface) on these stands is explained by the nature of the oak stands which are not generally pure but mixed with other broad-leaved species adapted to the local climatic and edaphic conditions. This explains for example the high percentages of trees adapted to a temporary excess of soil humidity such as black alder and ash or species that coexist well with oaks having smaller heights and creating a lower vegetation level such as hornbeam and aspen.

Figure. 2. The surface occupied in the West Plain by species from the oak stands located in plain areas under the conservation regime

The stand **age** is relatively young with only a few stands having advanced ages (only 5 have 120 years, 3 have 110 years and 2 have 105 years). The majority of stands range between 20 and 40 years (fig. 3). The reduced percentage of old oak stands on this area is explained by the fact that this forest protection category was introduced relatively late in the Romanian silviculture and the trees did not have time to reach advanced ages.

Fig. 3. The age of oak stands from the West Plain under the conservation regime

Stand composition is generally mixed (72% of the surface occupied by these stands) with one or more species participating in a stand (fig. 4). As individual percentage, the most widespread stands are the ones in which the dominant species occupies 100% (398 ha), 70% (331 ha) and 60% (227 ha) of the composition.

Pure stands are mainly composed of oaks while alder and aspen never form pure stands on this area but are included in the composition of other stands. Alder is widespread

both in the plain and mountain areas (Blaga et al., 2019), playing an extremely important hydrologic role (Constandache et al., 2018). Oak stands are not so affected by grazing in Romania's West Plain when compared with other European areas (HINKOV et al., 2018); they play an extremely important ecologic purpose against landslides and erosion (Dincă and Achim, 2019). Most of these stands have advanced ages (Cântar et al., 2019) and can be situated in the smart forests category (DINCĂ et al., 2019).

Figure. 4. The stand composition of oak forests in the West Plain under the conservation regime

The mixture between these stands species is a mixed one (meaning an intimate mixture combined with grouped mixture) = 287 ha, or intimate = 239 ha.

Pruning ranges between 0.4 and 0.7, with a majority for the 0.6 and 0.5 category (fig. 5).

Figure. 5. Tree pruning for oak forests from the West Plain under the conservation regime.

The average **altitude** of stands from this area is represented by a small altitude, specific to plain areas. The smallest altitude is of 110 m, while the highest is of 340 m.

Field inclination: all compartments in which oak stands from the field area under conservation regime are present are plane and lacking slopes.

The flora specific to these stands is *Carex brizoides-Agrostis alba*, which is widespread on 1171 ha. Significant surfaces are also occupied by *Poa pratensis* (602 ha), while *Carex pilosa* and *Erachypodium-Geum-Pulmonaria* occupy restricted area, namely 186 ha and 10 ha.

The most common **soils** for these stands are soils with a temporary excess of humidity in the argic horizon (stagnic luvisol = 1597 ha; gleic albic luvisol = 121 ha; stagnic albic luvisol = 169 ha), together with soils normally supplied with water (luvisol = 23 ha) or with water excedent all year long (mollic gleysol = 53 ha). Besides the well water provisioning (DINCĂ et al., 2018), these soils are rich in humus and nutritive elements (CHISĂLIȚĂ et al., 2015; SPÂRCHEZ et al., 2017; DINCA et al., 2019), being in general favourable to forest vegetation.

The site types characteristic for these stands are the following, in a decreasing order: Low forest plain of oak stands, Bm stagnic preluvisol with hydrophilic flora = 1428; Forest plain with profound preluvisol II/I = 167 ha; Forest meadow or highroad plain with Bs high edaphic stagnosol = 167 ha; Low forest plain of oak stands, Bs high edaphic stagnic eutric cambisol = 140 ha; Forest plain, meadow highroad, Bm high edaphic stagnosol = 44 ha.

The most representative **forest types** are the following: Oak stand with Rhamnus frangula and medium productivity = 1428 ha; Normal field oak stand-highroad with medium productivity = 178 ha; Meadow highroad oak stand = 151 ha; High plain oak stand = 140 ha; Meadow highroad oak stand with average productivity = 51 ha.

CONCLUSIONS

Forest areas from the Romanian Plain shelter important oak forests situated in the 1st Group (Forests with special protection functions), 3d Subgroup (*Forests with protection functions against climatic and harmful industrial factors*), 1-3C functional category. These forests are as such under the conservation regime.

From the entire surface of *forests with protection functions against climatic and harmful industrial factors* that amounts to 7059 ha in the West Plain, 1-3C category occupies 1970 ha. We can conclude that oak forests from the West Plain under conservation regime occupy 1/3 of the entire surface of forests with protection functions against climatic and harmful industrial factors.

The most widespread species from these forests is pedunculate oak (*Quercus robur* L.), which covers 1370 ha. Significant percentages of oak species from the West Plain are represented by red oak (*Quercus rubra* L.), as well as other broad-leaved species that have adapted to the local climatic and edaphic conditions. This fact is explained by the nature of oaks stands that are generally not pure, but mixed.

The stands under conservation regime from the West Plain can be found at altitudes between 110 and 340 m, on plane fields and preponderantly stagnic luvisol soils (1597 ha). The *Carex brizoides-Agrostis alba* flora is specific for these stands, this being the most widespread flora in this area.

The results of this paper reunite important data from a qualitative and quantitative point of view regarding oak stands from the West Plain that are under the conservation regime. In addition, they represent a good basis for establishing adequate management measures for

these stands in order to conserve them and to ensure that they successfully fulfil their protection role.

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