STRUCTURAL AND FLORISTIC CHARACTERIZATION OF THE OULED BECHIH FOREST (ALGERIA)

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ABSTRACT

The objective of this study is the rational management of forest ecosystems for sustainable conservation of floristic biodiversity. Two types of analysis are carried out: structural analysis and analysis of the main species. A total of 22 families were identified, divided among 32 species. The dominant woody species are *Quercus suber* and *Quercus canariensis*. Fagaceae is the most represented family. The average values of species richness and Shannon diversity index are 4 ± 1.8 and 0.9 ± 0.30 species/plot respectively. The average density of woody species in the Oueld Bechih forest was 158 ± 28 tree/ha with an average basal area of 32.67 ± 0.74m²/ha. The height structure shows that trees in height classes is ≥ 6 has very high density, evidence of almost no natural regeneration. The total structure indicates that larger trees are more abundant. In effect, this work provides a database for the forest, but it represents only one facet to be considered in protecting and restoring it.

Keywords: *Q. suber, Q. canariensis, diversity indices, height and diameter structure*

INTRODUCTION

In Algeria, cork oak and zea oak forests are particularly important as they constitute an essential element of the physical, climatic and especially socio-economic balance in rural areas [1]. From an ecological point of view, the cork oak and the Zea oak are the most important forest formations in Algeria and cover more than 278.000 ha [2]; their abundance, importance, distribution and their relatively unknown ecological value are major assets for their conservation. The present study focuses on the Ouled Bechih open forest, located in eastern Algeria. As this forest is used for cork production, the local populations cannot help but illegally take the various forest resources they need. Its conservation is thus compromised. In the context of the development and sustainable management of natural forest ecosystems in general and the Ouled Bechih clear forest in particular, this study is therefore necessary.

MATERIAL AND METHODS

Forest of Ouled Bechih is located north of Souk Ahras (Algeria). The study area is located between the coordinates 36°21'26" north latitude and 7°50'08" East

longitude (Figure 1). It covers an area of 6582 ha, mainly composed of Zea oak and cork oak [3]. This forest accounts for more than 50% of the Souk Ahras subterranean forest. This region is characterised by a sub-humid climate. The average annual temperature is 16°C and the average annual rainfall is 625 mm, with an atmospheric humidity of 68%. The altitude of the Ouled Bechih forest varies from 790 m to 1050 m, with slopes of over 15% [4]. The hydrographic network is very important. Several wadis and watercourses cross this forest massif: Oued Hemimine, Oued El Ouarida and Oued Medjerda.

Fig. 1. *Area of study*

The plots chosen for this work have dimensions of 30 m x 30 m, which are in line with those recommended by Fonton [5] for spatial structure analysis studies in forest ecosystems. Measurements were made of trees with a diameter (at 1.30 m above ground level) greater than or equal to 5 cm. This includes their location, diameter and species. The ecological characterization of each plot was carried out using density, basal area and diversity indices: species richness (S), Shannon diversity index (H) and Piélou equitability (EQ). The density (N), for all species, is obtained with the formula:

$$N = 10000n/s$$

Where n is the total number of trees and s is the plot area (in m²).

The basal area (G, in m²/ha) is the sum of the cross-sectional area at 1.30 m above the ground of all trees with a diameter greater than 5 cm within the plot.

The species richness (S) is determined for each plot. It expresses the total number of woody species with a diameter greater than 5cm counted on each plot. The Shannon diversity index (H in bits) is obtained by the formula:

$$H' = 1 - \sum_{i=1}^{k} pi.log_2 pi$$

pi = (ni/N) the proportional abundance or percentage abundance of a species present.

ni = the number of individuals counted for a species present.

N = the total number of individuals counted, all species combined.

S = the total or cardinal number of the list of species present.

The Shannon index is used to express the specific diversity of a stand studied. As a reminder, the specific diversity characterises the greater or lesser number of species present in a stand. If it is homogeneous (made up of one and the same species), then the H' index = 0.

Piélou's equitability index (EQ) is given by the relationship:

$$EQ = H/log_2 S$$

where Log_2S is the maximum diversity.

RESULTS AND DISCUSSION

The inventory of the Ouled Bechih forest revealed 32 species belonging to 22 families. Angiosperms form the most important systematic group; they are presented by: Quercus suber and Quercus fagina. The most common families are the Asteraceae, Fabaceae and Fagaceae. These families represent 50% of the total number of species encountered (Table 1). The species inventoried represent the floristic procession of *Quercus suber* and *Quercus fagina* such as: *Asphodelus ramosus, Charybdis maritima, Calicotume spinosa, Phillyrea media, Rosmarinus officinalis,…*

Table 1. *Floristic diversity.*

Species	Family	Species	Family
Arum italicum	Araceae	*Galactites tomentosus*	Asteraceae
Asphodelus ramosus	Xanthrrhoeaceae	*Hypochaeris glabara*	Asteraceae
Bellis prennis	Asteraceae	*Hyoseris radiata*	Asteraceae
Bellis sylvestris	Asteraceae	*Lotus corniculatus*	Fabaceae
Calicotome spinosa	Fabaceae	*Quercus ilex*	Fagaceae
Calystegia sepium	Convolvulaceae	*Quercus fagina*	Fagaceae
Carataegus monogyna	Rosaceae	*Phillyrea media*	Oleaceae
Charybdis maritima	Asparagaceae	*Pteridium aquilinum*	Dennstaedtia
Cyclamen hederifolium	Primulaceae	*Notobasis syriaca*	Asteraceae
Cytisus villosus	Fabaceae	*Ranunculus muricatus*	Ranunculaceae
Daphne gnidium	Nanophanérophytes	*Romulea bulbocodium*	Iridaceae
Daucus carota	Apiaceae	*Rosmarinus officinalis*	Lamiaceae
Erica arborea	Ericaceae	*Rubus ulmifolius*	Rosaceae
Euphorbia peplus	Euphorbiaceae	*Silene coronaria*	Caryophyllaceae
Ficaria verna	Ranunculaceae	*Stellaria media*	Caryophyllaceae
Gagea pratensis	Liliaceae	*Theligonum cynocambe*	Rubiaceae

The management objective of modern forestry is to reconstruct the structure of artificial forests by simulating the structure of forests. For this purpose, the first question is how to express the characteristics of the forest structure. But it seems impossible to describe the structure of forests well by using only one parameter because of their complexity. Therefore, a system used to assess different aspects of spatial stand structure was created by combining a few indices: species richness, Simpson index, Shannon and Weaver index, relative density, relative basal area and Pielou segregation index in this study. A number of studies have indicated that they are available and can effectively interpret the spatial characteristics of different forest types. The results obtained show that basal areas vary from 25.71m^2/ha in plot 4 to 49.17m^2/ha in plot 1. The lowest average DBH of all living trees was found in plot 3 ($d_{1.3}$ = 38.30cm) and the highest in plot 1 ($d_{1.3}$ = 78.07cm). The highest average height was also found for cork oak in plot 1 (14.19m) and the lowest in plot 3 (Table 2).

Table 2. *Characteristics of the species studied.*

Parcelles	D	H(m)	N/ha	G (m^2/ha)	V (m^3/ha)
P1	78.07	14.19	89	49.17	369.81
P2	40.34	10.91	200	29.77	172.18
P3	38.30	9.38	178	26.14	129.97
P4	42.04	13.54	167	25.71	184.50

The distribution of individuals by diameter class was fitted to a polynomial function (Figure 2). This figure shows a high proportion of individuals with dbh between 27.5 and 47.5cm. This actually reflects the heterogeneity of dry forests with respect to woody diameters. However, it was observed that there are dry forests with many small-diameter trees and dry forests with very few large diameter trees. The vertical distribution is given by the distribution of the number of stems in all plots per hectare for each height class, and provides information on the vertical stratification of the stand [6]. A large proportion of the trees are between 10 and 15 m tall (low perch stage); this class has a large number of individuals due to regeneration, which remains fairly low (Figure 3). The 0-5m class has a smaller number of trees and the 20-25m class is the lowest.

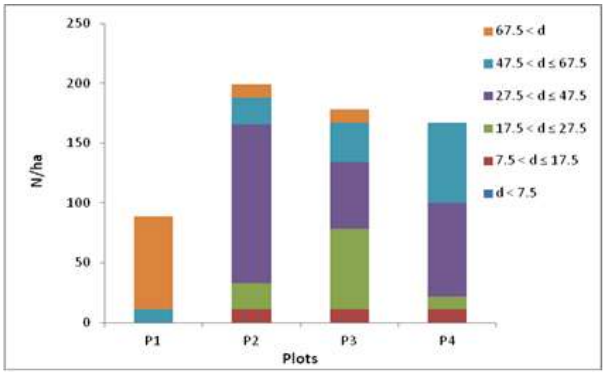

Fig. 2. *Density by diameter classes.*

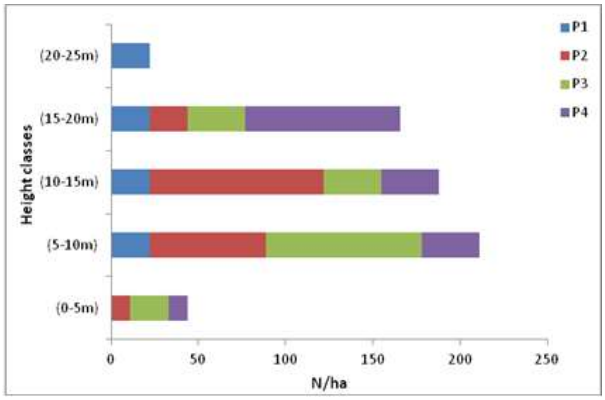

Fig. 3. *Density by height classes.*

CONCLUSION

The structural study and the floristic composition of the forest allowed knowing the diversity of the plant groups of this ecosystem. The forest of Chettaba functions today as an isolated ecosystem undergoing pressures at its periphery and justifies the need to conserve this ecosystem. The evaluation of the specific diversity by the index of Shannon index and equitability shows a certain relationship with the disturbance of the environment. In spite of a relatively average density of woody plants, the woody flora of the forest massif presents species with a strong socioeconomic use that is a priority for revalorization. These assets militate in favor of strengthening the strategies of development and sustainable management of the forest massif.

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