STUDY OF A VALONIA OAK FOREST IN NORTH ATTICA, GREECE

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Abstract

The scope of the present study is to assess the dynamics of Valonia oak stands in north Attica, Greece. The study site was in the area of the Afidnes municipality. Some accounts suggest that the deciduous oak stands in this area were more extensive in the past and that they have been degraded due to human actions (agriculture, animal husbandry, urbanization, wildfires etc.). Currently the stands are in the pole stage with mean diameter at breast height ranging from 12.2 to 17 cm in the surveyed plots; very few isolated individuals of great age were present. Except from the pure Valonia oak stands mixed stands of Valonia oak – Aleppo pine, Valonia oak – kermes oak and Valonia oak – kermes oak – Aleppo pine were also found. In all mixed stands individuals of almond-leaved pear were present. The dynamics of Valonia oak stands in this area show an invasion of Aleppo pine, which establishes vigorously and could gradually restrict Valonia oak in the near future. Considering that the area is severely affected by wildfires, it is sensible to conserve and foster the Valonia oak stands as well as to control Aleppo pine invasion so as to preserve the broadleaf character of the stands.

Key words: *forest, Valonia oak, Attica, Greece*

1. INTRODUCTION

Deciduous oak forests comprise 22.6% of the Greek forests according to the responsible authorities (Ministry of Agriculture, 1992), or 17% according to Dafis (1989). Approximately 30.000 ha are covered by the Valonia oak silvopastoral system, an economically important vegetation type (Matzanas et al. 2014). The Valonia oak forest protects the soil from erosion, preserves the biodiversity, controls mountain hydrology and regulates carbon sequestration (Pantera et al., 2008). The acorns and the foliage of Valonia oak are used as feed for livestock (Papanastasis, 2002). Its fruit and leaves have pharmaceutically active compounds while acorn caps used to be extensively utilised in tanneries. The Valonia oak forest is a priority habitat of Dir. 92/43 (code 9350).

The geographical distribution of Valonia oak is wide, however the actual cover is small. Isolated individuals are usually what is left of old-growth forests. The presence of this species within or in the margins of rangelands and fields is attributed to human management since the trees provided acorns and shade for livestock (Drosinis, 2003). In many places of the Greek countryside some very old specimens still occur as remnants of oak forests that existed in the past. In the old growth Valonia oak forest of Xiromero in western Greece specimens were found whose age was estimated in the range of 207 to around 428 years (Vlami et al., 2003; Papadopoulos & Pantera, 2013).

The adequate management of the forests or the remaining stands of *Q. ithaburensis* has to aim at conserving, protecting and enhancing natural regeneration (Bartolome et al., 2002). The management of all oak forests as coppices results to a reduction of biodiversity and gradually, with ongoing biomass harvesting, to enhancing soil erosion (Fry, 2002). Nevertheless, the Valonia oak forests in their current form contribute to the creation of a color mosaic of a quite spectacular landscape (Walter, 2005).

The remaining stands are small and often neighboring to – or surrounded by agricultural activities, a fact underlining their ecological and scientific significance. The aim of the present study was to assess the structure of a Valonia oak forest by the Afidnes settlement in N.E. Attica, Greece (Figure 1) in order to understand its dynamics. The site is close to the archaeological site of the acropolis of the

ancient Afidnes settlement. Forests in this area were intensively logged during WWII, while in the decades following the war they came under pressure from intensive grazing and agricultural activities.

2. MATERIALS AND METHODS

Six plots, dominated by Valonia oak, of 0.15 ha each were established in the study site. The positioning of the plots was decided on the basis of the dominant woody vegetation.

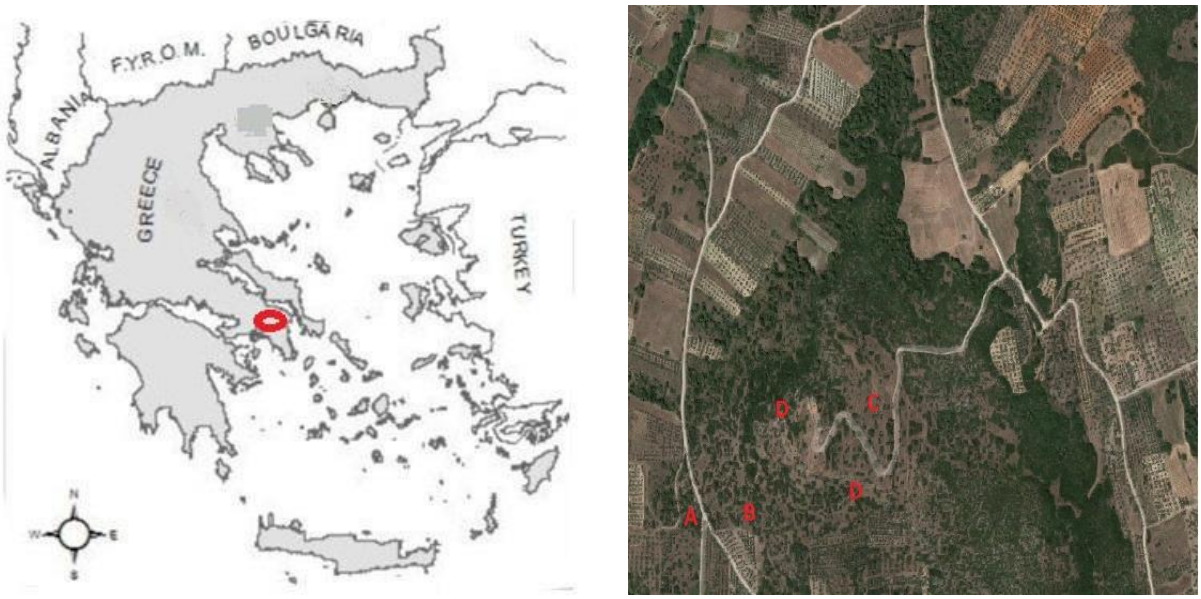


Figure 1. Map of the study area and sample plots (Google Maps).

Mixed Valonia oak stands were categorised based on the tree species, apart from Valonia oaks, present in the stands. In every plot diameter at breast height ($d_{1.30}$) and height (h) of all trees with a stem diameter greater than 4 cm, were measured. In order to better understand the dynamics of the stand, pairs of aerial photographs taken in 1938, 1960, 1987 were studied by means of a stereoscope along with a satellite image of 2015.

3. RESULTS AND DISCUSSION

Following the structure analysis of the plots four stand types were distinguished, one of which was a pure Valonia oak stand. The rest were mixed stands of Valonia oak along with Aleppo pine (*Pinus halepensis*), kermes oak (*Quercus coccifera*), almond-leaved pear (*Pyrus spinosa*, Forssk.). The main attributes of each stand type is outlined in the following.

3.1 Plots of Quercus ithaburensis

Pure stands, density 227 stems/ha, mean $d_{1.30}$ is 17 cm and mean h 6m (Table 1). The position is indicated by "B" in Figure 1.

The $d_{1.30}$ values range from 4.6 cm to 39.8 cm, while the maximum h value was 14.5 m. The complete $d_{1.30}$ distribution is shown in Figure 2.

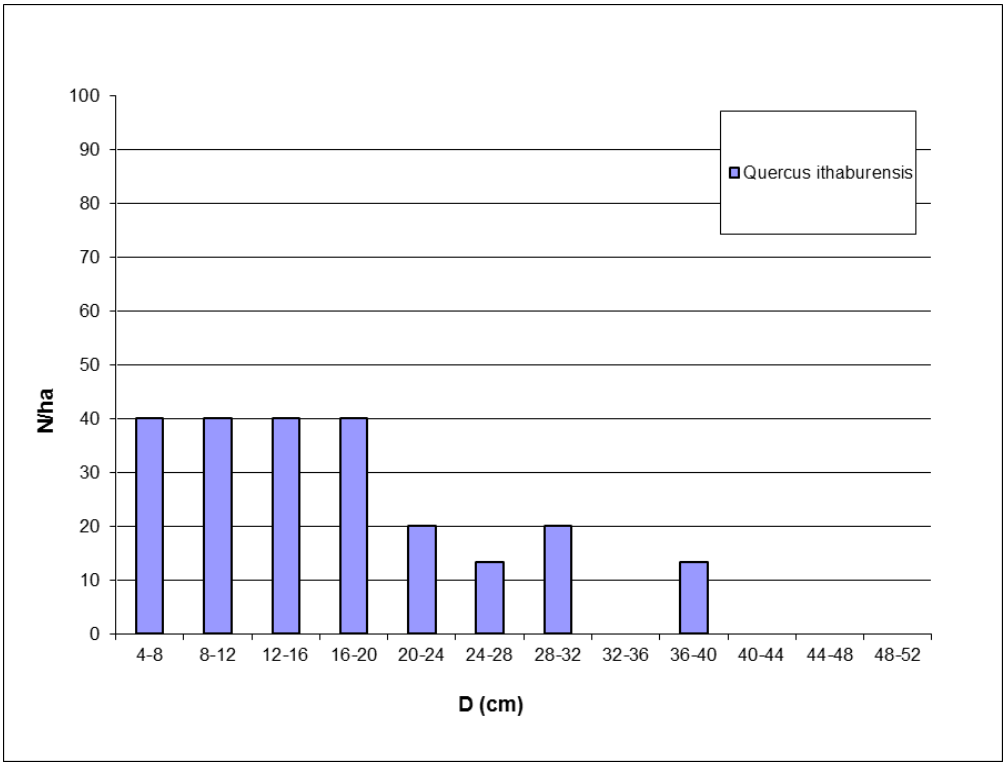


Figure 2. Histogram of $d_{1.30}$distribution of *Quercus ithaburensis* stand type.

Table 1. Structure variables of the pure *Quercus ithaburensis* stand type

Species	**N/ha**	**$d_{1.30}$ mean (cm) (St. Dev.)**	**h mean (m) (St. Dev.)**
Quercus ithaburensis	253	17.00 (9.00)	6.00 (2.60)
Total	253		

3.2 Plots of Quercus ithaburensis & Pinus halepensis

In mixed stands of *Quercus ithaburensis* and *Pinus halepensis*, stem density is 646 stems/ha; the position is indicated in Figure 1 by "A". The mean *Q. ithaburensis* $d_{1.30}$ is 12.3 cm and the mean h 4.9 m, while the mean *P. halepensis* $d_{1.30}$ is 22.6 cm and mean h 6.7 m (Table 2). In these mixed stands *Pyrus spinosa* individuals are also established (Figure 3) with $d_{1.30}$ 7.10 cm and height 3.3 m.

The *Q. ithaburensis* $d_{1.30}$ ranges from από 4.0 cm to 38.0 cm and the *P. halepensis* one from 8.4 cm to 47.0 cm. The complete $d_{1.30}$ distribution is shown in Figure 3. The maximum h value for *Q. ithaburensis* was 9.7 m and for *P. halepensis* 10.5 m.

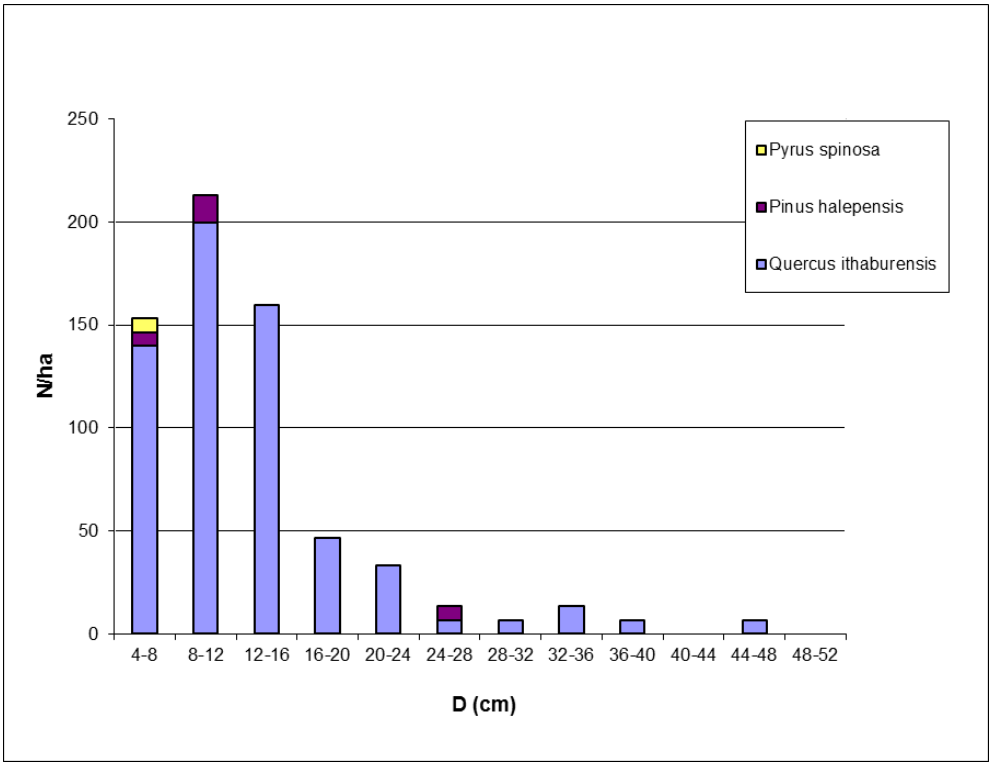


Figure 3. Histogram of $d_{1.30}$ distribution of *Quercus ithaburensis* & *Pinus halepensis* stand type.

Table 2. Structure variables of the mixed *Quercus ithaburensis & Pinus halepensis* stand type

Species	**N/ha**	**$d_{1.30}$ mean (cm) (St. Dev.)**	**h mean (m) (St. Dev.)**
Quercus ithaburensis	619	12.30 (6.30)	4.90 (1.50)
Pinus halepensis	27	22.60 (17.90)	6.70 (2.70)
Total	646		

3.3 Plots of Quercus ithaburensis – Pyrus spinosa & Quercus coccifera

In mixed stands of *Q. ithaburensis* and *Q. coccifera*, stem density is 267 stems/ha; it is indicated by "C" in Figure 1. *Q. ithaburensis* mean $d_{1.30}$ is 13.2 cm and mean h 4.50 m, *Pyrus spinosa* the mean $d_{1.30}$ is 8.10 cm and mean h 2.80 m (Table 3). In these mixed stands *Q. coccifera* individuals have also become established, the one found within the plot had $d_{1.30}$ 4.9cm and h 3.5 m.

The *Q. ithaburensis* $d_{1.30}$ ranges from 4.1 cm to 30.6 cm, *Pyrus spinosa* $d_{1.30}$ ranges from 5.6 cm to 12.0 cm and the maximum h value for *Q. Ithaburensis* was7.0m. The complete diameter distribution is shown in Figure 4.

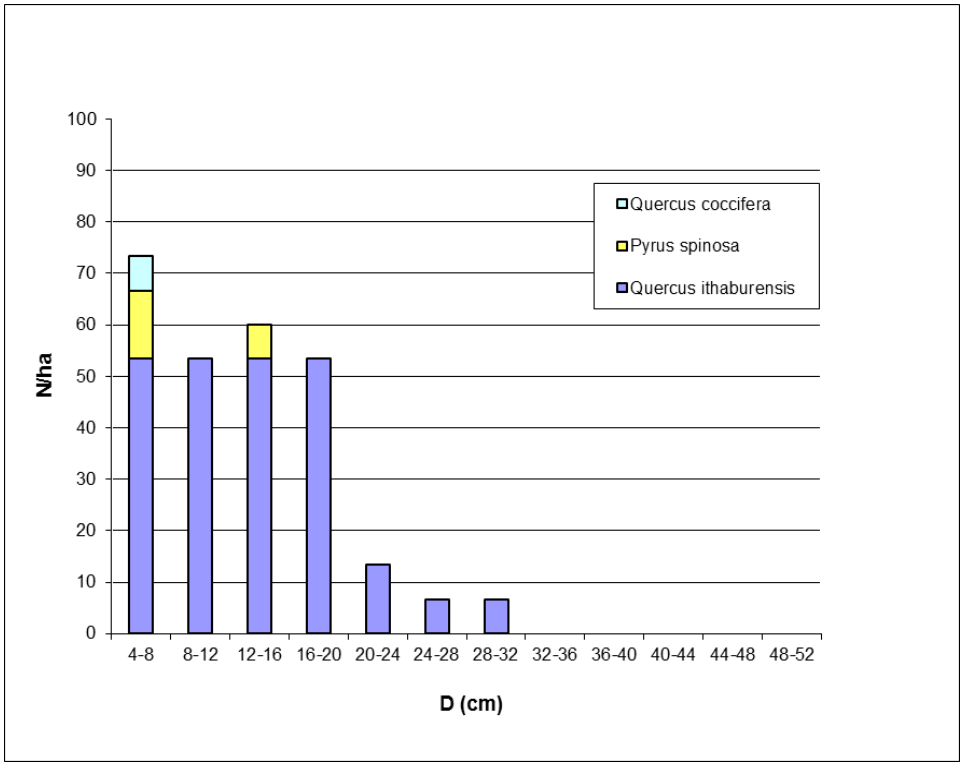


Figure 4. Histogram of $d_{1.30}$ distribution of *Quercus ithaburensis- Pyrus spinosa* & *Quercus coccifera* stand type

Table 3. Structure variables of the mixed *Quercus ithaburensis- Pyrus spinosa* & *Quercus coccifera* stand type

Species	N/ha	D mean (cm) (St. Dev.)	H mean (m) (St. Dev.)
Quercus ithaburensis	240	13.20 (5.90)	4.50 (1.30)
Pyrus spinosa	20	8.10 (3.30)	2.80 (0.50)
Quercus coccifera	7	4,9 (-)	3,5 (-)
Total	267		

3.4 Plots of Quercus ithaburensis – Quercus coccifera & Pinus halepensis

The stem density of mixed *Q. ithaburensis – Q. coccifera* and *P. halepensis* stands is 490 stems/ha, they are indicated by "D" in Figure 1. *Q. ithaburensis* mean $d_{1.30}$ is 12.15 cm and mean h 4.85 m, *Q. coccifera* mean $d_{1.30}$ is 6.10 cm and mean h 4.05 m and *P. halepensis* mean $d_{1.30}$ is 8.80 cm and mean h 3.50 m (Table 4). In these stands *Pyrus spinosa* individuals have become established; the mean $d_{1.30}$ is 8.10 cm and mean h 2.80 m.

The values of *Q. ithaburensis* $d_{1.30}$ range from 4.0 cm to 49.0 cm, *Q. coccifera*$d_{1.30}$ values range from 5.6 cm to 7.0 cm and *P. halepensis* $d_{1.30}$ range from 5.2 cm to 11.0 cm. The complete $d_{1.30}$ distribution is shown in Figure 5.

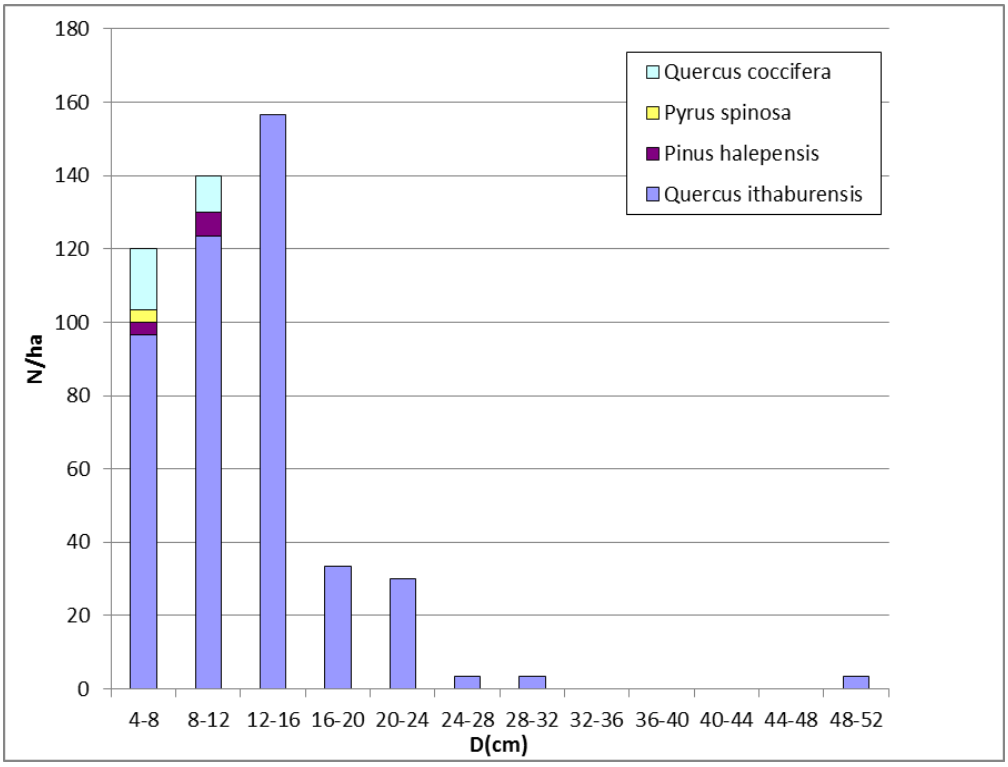


Figure 5. Histogramm of $d_{1.30}$ distribution of *Quercus ithaburensis – Quercus coccifera* & *Pinus halepensis* stand type

Table 4. Structure variables of the mixed stand *Quercusithaburensis–Quercus coccifera* & *Pinus halepensis* stand type

Species	**N/ha**	$d_{1.30}$ **mean (cm) (St. Dev.)**	**h mean (m) (St. Dev.)**
Quercus ithaburensis	450	12.3 (5,4)	5.06 (2,1)
Quercus coccifera	27	6.3 (0,7)	4.0 (1,2)
Pinus halepensis	10	8.7 (1,9)	3.70 (0,7)
Pyrus spinosa	3	7.0 (-)	3.5 (-)
Total	490		

The mean $d_{1.30}$ values suggest that the studied stands are young; the values range from 12.2 cm to around 17 cm, while mean h does not exceed 6 m. Among stand types only the pure *Q. ithaburensis* stand type mean Valonia oak $d_{1.30}$ value differs in statistically significant way from the respective value of the same species in the *Q. ithaburensis– Q. coccifera & P. halepensis* stand type.

With respect to the land use in the study site the interpretation of the aerial photos reveals cultivation and grazing activity in 1938, which is, more or less, carried on throughout the whole period. The main

differences among the dates studied concern the lack of big trees in the 1960 photos, apparently as a result of logging during WWII, the construction of a dirt road crossing the site first seen in the 1987 photos and an increase in natural vegetation density and cover in the same date compared to the previous ones. The satellite image of 2015 reveals an increase in the density of natural vegetation stands compared to the 1987 photos.

The structure of the mixed stand types exhibit a rather aggressive invasion of *P. halepensis* evidenced by an extensive regeneration, while *Q. coccifera* is also present in the low $d_{1.30}$ classes, which does not point to an aggressive invasion, a fact that could be due to the biological attributes of this species. Throughout the wider area, although more often in the mixed stands, isolated specimens of *Pyrus spinosa* were also found.

4. CONCLUSION

To sum up, the structure data suggest a young forest, while the few older specimens seem to have survived from earlier human activities. The occurrence of regeneration and the large number of younger specimens shows that there is a positive dynamic in this forest. A protection of these stands is needed, especially from potential grazing in the future (no grazing is currently practiced), so as to let the Valonia oak stands mature. At the same time the invasion of Aleppo pine should be managed, if the focus is to be the restoration of the Valonia oak forest. Lastly, since our knowledge of these type of forest stands is far from being satisfactory further studies are also needed.

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