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Restoration of lake Volvi riparian forest. The Nea Madytos case

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Abstract

Lake Volvi is a protected area and consists of the western part of the ancient Mygdonia lake, which, according to the testimony of ancient historians, was surrounded by dense riparian forests. Agriculture and other modern activities have significantly reduced the surface of riparian forests. The environmental awareness concerning wetlands lead to the revision of the planning of the protected area management and to setting the protection, restoration and reestablishment of the riparian forest as a priority.

The scope of this work is to study and monitor the current condition of the *Platanus orientalis* and *Populus alba* stand. The arithmetic mean value of *Populus alba* DBH (Diameter at Breast Height) was 35.3 cm and the mean height 27.4 m, while the respective values of *Platanus orientalis* were slightly lower, namely 33.8 cm for the arithmetic mean value of DBH and 24.4 m mean height.

Keywords: restoration, riparian forest, protected area, Volvi lake, Populus alba, Platanus orientalis

1. INTRODUCTION

The riparian forests belongs to wetland ecosystems, which until the last century had suffered from intense degradation and shrinkage because of human activities. Riparian forests are among the most stable and dynamic ecosystems [2] which are in immediate danger of collapsing in case of any external effect [7]. According to Verhöven (1992), wetland vegetation is the main component of a wetland ecosystem, which determines the habitat of other wetland organisms [8].

During the last decades an attempt is made, at European and international level, targeting protection, conservation and rehabilitation of riparian ecosystems and consequently of riparian forests, too. This scientific initiative applies to our country, as well, with several examples across the Greek territory, the most important being the Volvi lake, the Nestos Delta, the Argas lake etc.

The restoration of riparian forests is mandatory, since such ecosystems constitute a natural heritage, which should be maintained and delivered to the next generation. Research in these ecosystems, awareness of which is moderate and sometimes imperfect, is considered a necessary condition for the entry of managed properly.

The aim of this study was the artificial regeneration of a riparian forest located in a protected area, at the Volvi lake. Its restoration was conducted 20 years ago, through the plantation with species of *Populus alba*, and *Platanus orientalis* in pure clumps.

2. MATERIALS AND METHODS

2.1 Sample and data collection

To study the structure of riparian forest in the area of Nea Madytos, experimental sites in planted areas with *Populus alba* and *Platanus orientalis* were measured. Six (6) experimental sites of size

0.05 ha were measured in total. Data and measurements in riparian forests were collected in spring 2013. All trees in these forests, with thickness, height, width and starting point of the crown exceeding 4 cm diameter, have been measured and classified according to the IUFRO classification. The statistical analysis was conducted via the SPSS program.

2.2. Study area

The area of study is the riparian forest reforestation in the riparian area of Nea Madytos, Volvi lake depicted in Fig. 1, which is protected by national, European and international Conventions Specifically [3]. The area of study belongs to the areas of Ramsar Convention on Wetlands, the Convention of Barcelona, the Convention of Bern and the Network of Natura 2000, as special protected area (S.P.A.) with code number GR1220009.

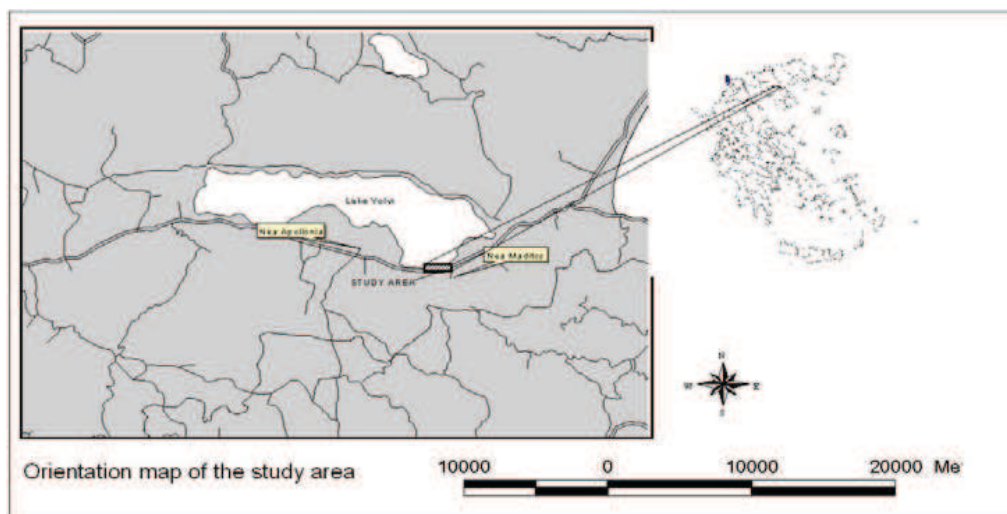


Fig.1. Map of Study area

2.2.1. Vegetation

The dominant riparian vegetation in the extended area of the Volvi Lake is the riparian forest vegetation, which includes tree species (*Alnus glutinosa*, *Platanus orientalis*, *Populus alba*, *Salix alba*, *Salix fragilis*, *Populus nigra ssp nigra*, *Ulmus minor*, *Pyrus amygdaliformis*, *Juglans regia*), shrub species (*Rubus canescens*, *Ruscus aculeatus*, *Rubus hirtus*, *Phytolaca americana*, *Vitex agnus-castus*), climbers species (*Hedera helix*, *Humulus lupulus*, *Vitis sp.*, *Clematis sp.*). At the storey of turfs, *Urtica sp.*, *Solanum dulcamara* and many agrostic species are found.

2.2.2. Fauna

About 248 bird species have been recorded at the Volvi Lake (58.3% of total number of Greek species), 64 of which are included in the red book and 8 are threatened worldwide [3, 4], 19 amphibious and reptile species and 34 mammal species have been recorded [10].

2.2.3. Geology and Soil

The area of the lake was formed 1.8 million years ago, during the lower Pleistocene. A heavy tectonic activity caused the accumulation of water resulting in the formation of lake Mygdonia [1, 9]. In terms of geological composition, the area comes under the zone of Rodopi, consisting of pebbles, sand and argil in the lakeside areas.

The soil of the area under study consists of the alluvial deposits of torrents emptying into the lake and the watershed of the wider area. The soil analyses of samples taken from the area have shown that they are mainly loose soils. The mean pH values for the soil profiles range from 7.0 to 7.5 [3].

3. RESULTS AND DISCUSSION

The object of our investigation was to pure clumps with *Platanus* and *Populus*, in reforested riparian areas of Nea Madytos of the Volvi lake. From the analysis of measurements made in field the following results were found from the clumps structured.

Populus alba clumps. They refer to same-age, unmixed clumps (Fig. 2) which structurally range from thin to medium stage with 35.31 cm mean diameter, 27.41 m average height and density 494 units/ha (Table 1). They are mainly one-storey clumps (Table 2), where the 95% of trees (467 units/ha) are located at overstorey and just 5% (27 units/ha) at middle-storey (Efthimiou G, unpublist data).

Table 1. Structure parameters of the species *Populus alba* and *Platanus orientalis*

Species	N/ha	D mean (cm)	H mean (m)	Length of the stem without branches (m)	Length of Canopy (m)	G (m ² /ha)
<i>Populus alba</i>	494	35.31	27.41	12.69	14.72	51.88
<i>Platanus orientalis</i>	520	33.81	24.41	10.55	13.86	32.57

From older analysis of soil samples, it follows that the *Populus alba* clumps are mainly found on sand-clay soils, where the reaction of the soil is 7.5 [3]. The value of G (circular surface) is 51.88m²/ha (Table 1).

Table 2. Tree distribution per storey of clumps *Populus alba* and *Platanus orientalis*

Species	N/ha	Overstorey (%)	Middlstorey (%)	Understorey (%)
<i>Populus alba</i>	494	467 (95%)	27 (5%)	- (-)
<i>Platanus orientalis</i>	520	490 (94%)	30 (6%)	- (-)

Platanus orientalis clumps. They are one-storey, same-aged unmixed clumps (Fig. 3), which structurally belong to the stage of thin logs with a mean diameter 33.81 cm. Table 1 provides the remaining structurally elements as: 24.41 m average height, density 520 units/ha and G 32.57 m²/ha (Table 1).

They are one-storey clumps because 94% (490 units/ha) - are located in overstorey and the rest 6% (490 units/ha) in middle-storey (Table 2).

The territories, in which clumps of *Platanus orientalis* are planted, have reaction of the soil ranging from 6.8 to 7.6 [3], according to territorial analyses made for the same clumps in earlier research.



Fig. 2. *Populus alba* clumps



Fig. 3. *Platanus orientalis* clumps

4. CONCLUSIONS

The *Populus* and *Platanus* species are fast-growing trees. The measurements have shown that almost 20 years after reforestation with these species at the riparian areas of lake Volvi. The data of structure show that the G are almost double for the *Populus* clumps from the *Platanus* clumps.

Regarding the height of trees, *Populus* outweighs *Platanus*. The highest *Populus* tree measured had height 40.5 m, the lowest one 20 m, while the highest *Platanus* measured 35 m and the lowest one 13 m. Concerning the diameter (D), no differences were observed between the two types. The highest rate d measured was 51 cm and involved both species, while the lowest rate was 14 cm and was measured on *Populus* tree.

4.1 Problems

The riparian forest of Nea Madytos realizes high pressure from human activities, mainly because of its location; it is situated next to the old highway Thessaloniki-Alexandroupoli-Turkey, but also near to the settlement of Nea Madytos.

The area is burdened due to local fishermen, as there is a small port for boats [6]. Soil compaction and destruction of vegetation by the cars carrying the boats and depositional at different points every time is a serious problem for the riparian forest.

Another risk for the region is the existence of street and easy access to area with the proportionate impact of that. Large number of visitors is observed in the region for surfing as the lake offers ideal wave and wind.

The intense grazing in the region observed during the research measurements pose a serious risk and undermine the conservation and development of nature generation in riparian forests.

Concluding, another important problem identified is the illegal logging, which fortunately happens on a small scale so far.

4.2 Suggestions

Principal suggestions relating to the conservation and restoration of riparian ecosystems in our region are the following:

- Controlled and directed access in area.
- The controlled grazing limited only to grassland.
- The fences, where deemed necessary, can retain critical ecosystems.
- The gradual reforestation of land missing woody vegetation, so that riparian forests are gradually restored.
- The future reforestation for extending the riparian forests must be conducted with various diverse riparian sylvan rather than single clumps as was the case in the past.

Applying these or even other proposals, which may arise in the future, requires updated study and scientific documentation reflecting the current situation of the. The management of riparian forest and other ecosystems must be dynamic as is the operation of such ecosystems.

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