SILVICULTURE CONTRIBUTIONS TOWARDS THE ENHANCEMENT OF RECREATIONAL VALUES OF A CHESTNUT GROVE

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EXTENDED ABSTRACT

Nowadays the fact that our planet is facing many ecological problems, the forest's beneficial contribution, through soil protection, recreation and its healthy and hydrological role is of greater importance. The contribution of such multifunctional forest ecosystems presupposes the creation of ecologically healthy stands with desirable structure that can be achieved through the application of appropriate silvicultural treatments. The framework within which silvicultural measures are taken and the forests' potential for cultivation for the fulfillment of the above purposes, are determined by the properties of the tree species, the composition of the stands as well as the site conditions. One of the priorities of silvicultural treatments in many cases is the suitable formation of stands in order to enhance the landscape value of forests for recreation so as the functions of the forest can satisfy as many social needs as possible.

The silvicultural target in the study area is the creation of a forest that fulfils more than one purpose by covering sustainably social needs such as providing recreational areas for visitors in combination with nut production.

As subject of our research was the perennial chestnut grove of Mount Menoikio, in northern Greece selected, which presents special aesthetic, ecological and scientific interest. The effects of the intense regeneration of beech trees in contrast to the lack of regeneration of chestnut trees is the most important reason that dictates the direct silvicultural intervention in order to preserve the chestnut grove.

The aim of this project is to study the qualitative and the quantitative silvicultural characteristics of the stands in the perennial chestnut grove. The main pursuit is to identify the appropriate silvicultural treatments for the rational management of this ecosystem, in order to maintain its identity and protect its regeneration, which will eventually enhance the recreational value of the area and simultaneously create an economic forest with mixed chestnut-beech stands, ecologically managed for a multipurpose usage.

For the fulfilment of this target it is necessary to inhibit the intense spread of beech by both protecting and maintaining the perennial chestnut trees which can be achieved by ensuring that the perennial trees have the essential space to continue their life cycle as well as favoring the natural regeneration of chestnut against beech. This can be achieved with the regulation of the mixture grade, which in this case is suggested at 70% chestnut and 30% beech. In the late pole stage, in which beech is exclusively found in the study area, the cultivation is accomplished with intense positive thinning with ultimate purpose to provide growing space for the regeneration and consolidation of chestnut.

Keywords: regeneration, *Castanea sativa*, *Fagus sylvatica*, silvicultural treatments, landscape value.

1. INTRODUCTION

One of the priorities of silvicultural treatments in many cases is the suitable formation of the stands in order to enhance the landscape value of forests for recreation so as the functions of the forest can satisfy as many social needs as possible (Tsitsoni et al., 2006). These areas should be treated with special care in the framework of an integrated management scheme.

The chestnut forest resources today play a multifunctional role and the wood and nut production is no longer the main function (Bounous et al., 1999). The last twenty years chestnut ecosystem has increased its ecological and landscape importance (Bounous, 2005) as it has elements of high aesthetic value and beautiful landscapes for recreation. Especially in Europe chestnut woods have been revaluing for their role in landscape and quality of life as there is increasing request of natural landscapes (Bounous, 2005).

As subject of the study was the perennial chestnut grove of Mount Menoikio, in northern Greece, selected, which is of special aesthetic, ecological and scientific value. This emanates from the presence of perennial chestnut trees, within the mixed chestnut-beech *(Fagus sylvatica)* stands that are the centre of attraction for many visitors. This study aims at the silvicultural research of the perennial chestnut forest and tries to answer the following questions:

- Which are the structural characteristics of the mixed chestnut-beech grove in the study area?
- Which are the intended silvicultural treatments of the mixed chestnut-beech grove aiming at the maintenance of the perennial chestnut trees and the facilitation of their natural regeneration towards the enhancement of recreational values in combination with nut production?

2. MATERIALS AND METHODS

2.1 Study Area

As a research area there has been the 30 ha perennial chestnut grove selected, which is located on the northeastern slope of Mount Menoikio. The grove is composed of mixed chestnut-beech stands with chestnut constituting the dominating species. The climate is of Mediterranean type with cold winters and a high precipitation rate (Mavromatis, 1980).

2.2 Field data collection

Data collection was accomplished in spring 2008. The selection of the sample plots was based on stratified random sampling (Matis, 1992).

There were 20 circular shaped plots taken, 10 eastern and 10 northern exposed, as the aspect of the area is mainly NE, E, N, each covering 500 m^2 (circle radius r=12.62 m) (Matis, 1992). The sample plots were randomly distributed in the forested area of the stands and were representative as far as the vegetation of the study area is concerned. In all sample plots the silvicultural data measured or calculated for all individuals, were: the number of all individuals, stem density (N/ha), diameter (DBH, cm) at breast height for trees with diameter >4cm, total height (H, m), crown length (C L, m), basal area (G, cm^2) and crown diameter in two directions (EW and NS) for the imprinting of the crown projection (Tsitsoni, 1991; Tsitsoni, 2003; Zagas et al., 2004). Also tree vitality (V) and developmental tendency (DT) were recorded according to IUFRO classification (Tsitsoni & Karagiannakidou, 2000). Tree vitality (V) is classified in three classes: grade 10 for trees of vigorous growth, grade 20 for trees of normal growth and grade 30 for trees of declining growth. Developmental tendency (DT) is classified also in three classes: grade 1 for trees with “upward” tendency, grade 2 for trees with medium growth tendency and

grade 3 for trees with descendant future growth (Dafis, 1990). Stem distribution in diameter classes of 6 cm and in height classes of 2 cm was carried out.

The relationship among the number of individuals, diameter, height and the other parameters on the one hand and the aspect effect on the other was tested by t-test at $p<0.05$ level of significance. Data analysis was carried out using SPSS version 15.0 statistical program software.

3. RESULTS

The perennial chestnut grove comprises a mixed chestnut-beech forest in the northern and eastern aspects. The silvicultural characteristics of the two species in both aspects are shown in Table 1.

Table 1. Silvicultural characteristics of the perennial chestnut forest. Values are means± std. error in parenthesis.

Castanea sativa								
Aspect	**N/ha**	**DBH (cm)**	**Height (m)**	**Crown Length (m)**	**Basal Area (m^3)**	**Develop-mental Tendency**	**Vitality**	**Stem quality**
Northern	130 *	50,2 (0,4)	26,5 (0,9)	20,8 (0,9)	50,4 (0,4)	2,6 (0,9)	22,5 (0,9)	47,9 (0,9)
Eastern	180*	49,9 (0,3)	23,5 (0,4)	19,9 (0,4)	75,7 (0,3)	2,3 (0,9)	22,1 (0,8)	48,2 (0,9)
Fagus sylvatica								
Aspect	**N/ha**	**DBH (cm)**	**Height (m)**	**Crown Length (m)**	**Crown Diameter**	**Develop-mental Tendency**	**Vitality**	**Stem quality**
Northern	73	20,7 (0,1)	19,0 (0,8)	16,1 (0,8)	2,3 (0,3)	1,0 (0,0)	10,0 (0,0)	40,0 (0,0)
Eastern	73	21,0 (0,1)	17,3 (0,7)	15,9 (0,8)	2,9 (0,2)	1,0 (0,0)	10,0 (0,0)	40,0 (0,0)

Means followed by * are significantly different ($P<0.05$).

In northern aspects the density of the chestnut population is distributed almost exclusively in the upper storey. The density of the beech population is distributed in all three storeys (Table 1). From Fig.1 & Fig.2 can be derived that the grove is a mixed irregular group selective forest with 2 even aged cohorts one of chestnut and one of beech trees (Fig.5). Chestnut trees are thereby at the mature stage and beech trees at the pole stage. The chestnut trees appear as a single storey, dominating stand. Beech trees appear in an irregular group selective form with clearly distinguished all 3 storeys, overstorey, middlestorey and unterstorey, where this species appears gradually and asserts its place.

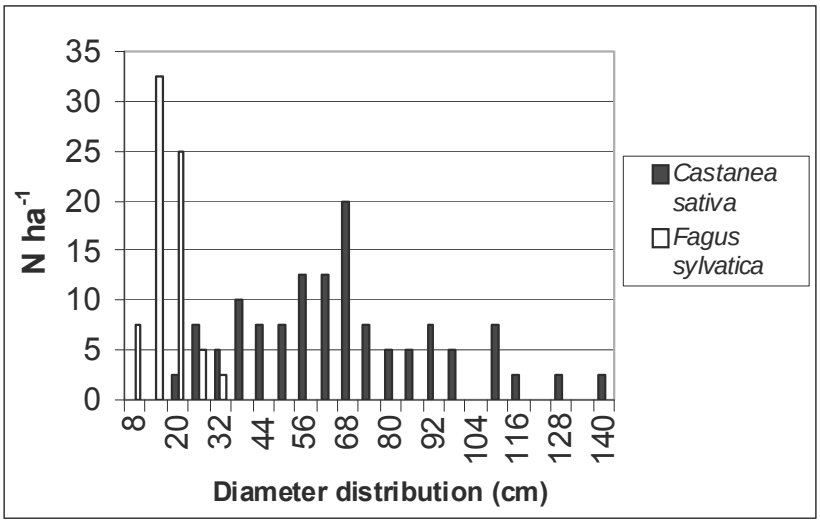

Figure 1: Diameter distribution in the northern aspects of the perennial chestnut forest in diameter classes of 6 cm.

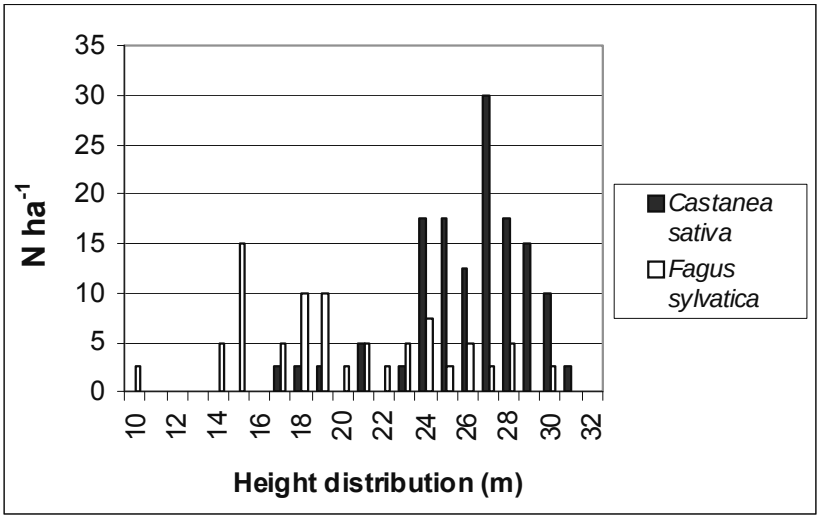

Figure 2: Height distribution in northern aspects of the perennial chestnut forest in height classes of 2 m.

In the eastern aspects the chestnut population is exclusively distributed in the overstorey. The beech population is distributed almost in the overstorey while in the middlestorey the participation percentage of beech trees reaches 20%, as shown in Table 1. From Fig.3 & Fig.4 can be derived that the grove is a mixed irregular group selective forest with 2 even aged cohorts one of chestnut and one of beech trees (Fig.6). Chestnut trees are thereby at the mature stage and beech trees at a late pole stage. Chestnut trees are forming a single storey, dominating stand with greater concentration in the height class of 28 m. Similarly, beech trees are forming an almost single storey stand with greater concentration in the height class of 15 m and comprise the secondary stand of the eastern aspects in the perennial chestnut forest.

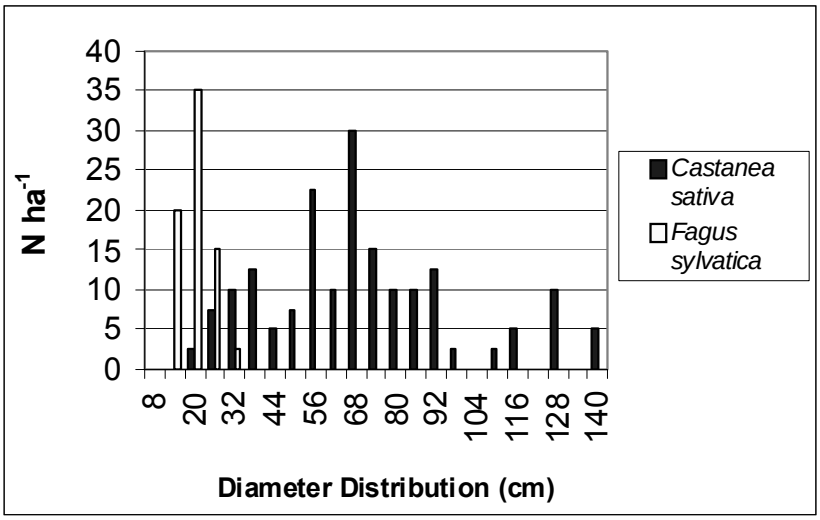

Figure 3: Diameter distribution in the eastern aspects of the perennial chestnut forest in diameter classes of 6 cm.

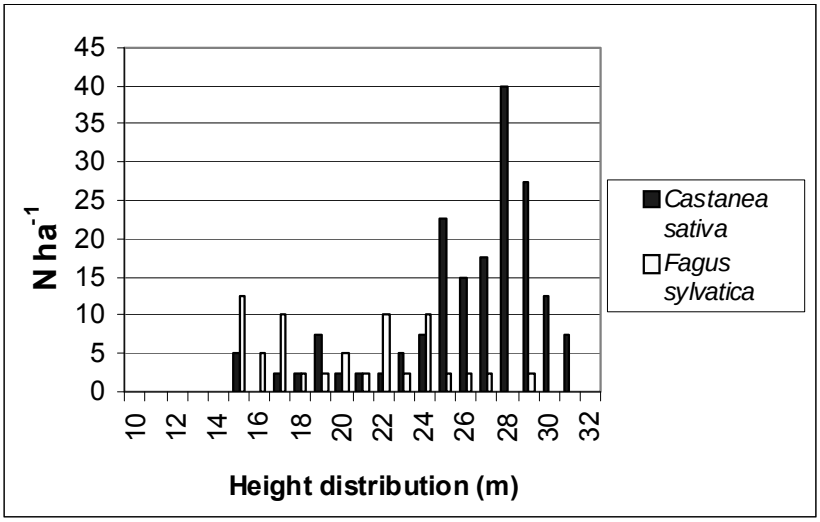

Figure 4: Height distribution in eastern aspects of the perennial chestnut forest in height classes of 2 cm.

4. DISCUSSION

Concerning the landscape value given by a chestnut grove, this is one of the many ways to estimate its touristic potential. Studies on the landscape value of chestnut groves and especially the aesthetical-functional qualities have been carried out by Bounous (1999) and Mattalia (1993) based on the analysis of visual preferences of visitors and showed that chestnut in comparison with other types of wood got a good preference degree by visitors and reached the first position for recreation values. Foresters have also been playing particular attention to the non-material services coming from the woods (Bounous et al., 1999), called also “externalities” (Bounous, 2005). The high landscape value of chestnut forest created by centuries of human activities in mountainous and hilly areas provides an important value of leisure (Bounous et al., 1999) and can be enjoyed nowadays in Europe by low-impact tourism (Bounous, 2005).

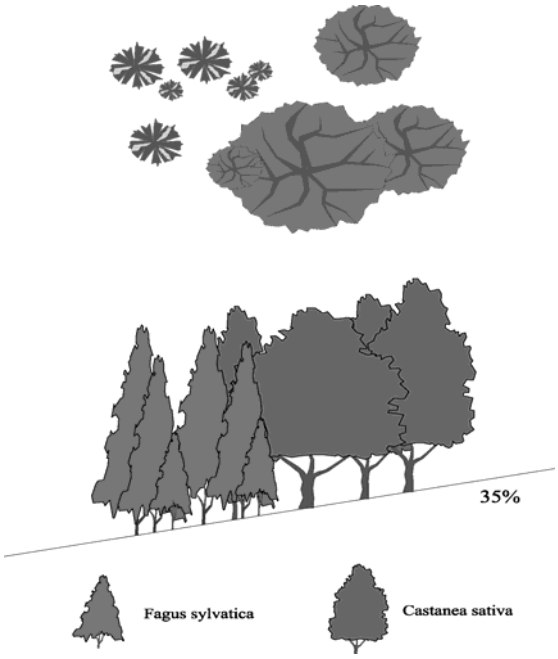

Figure 5: Vertical and horizontal profile on northern exposure

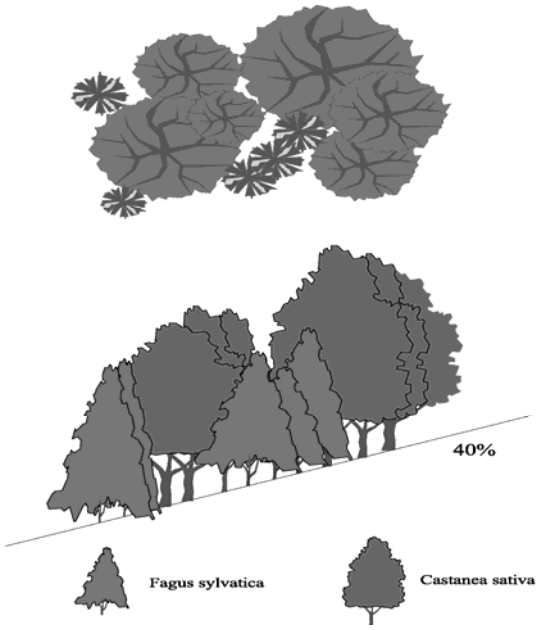

Figure 6: Vertical and horizontal profile on eastern exposure

Studies on a dual-purpose management of chestnut forests have been carried out by Gavaland (2006), which are however focusing on the production of nuts and wood from the same tree. This study identifies the direct linkage of chestnut groves to local traditional and cultural heritage. In traditional areas they provide people with attractive landscapes and tourist appeal and its related incomes. Zagas (2000), who refers to chestnut groves, as the most productive forests in Greece, has concluded that the more intensive the positive selection thinnings at the pole stage, the more timber was produced and the healthier the trees became.

These ecosystems are able to survive in the third millennium only through protection and valorization (Bounous, 2005). In order to resist to destruction and to maintain a biological auto-regulation these ecosystems have to be managed according to the principles of sustainability in order to emphasize their multifunctional role.

Based on the findings of this research on the structural analysis and silvicultural treatments of the perennial chestnut grove it seems that the aspect didn't significantly affect the silvicultural characteristics of the two existing species in the area, which implies homogeneity of the other site parameters. Only the number of chestnut individuals has shown a significant statistical difference. This may be explained by overexploitation of chestnut on the northern aspects, due to better accessibility of area by man.

The structure analysis has shown that chestnut trees are dominating in both aspects as they have greater density, more than twice as big mean diameter and far higher mean height than beech trees. Furthermore the diameter distribution shows greater concentration of chestnut trees at the high diameter class of 68 cm, while beech trees in the low class of 14 cm, that is chestnut finds itself in the mature stage while beech trees at the pole stage. This derives also from the value of the total basal area (G), which is greater for chestnut compared with that of beech. But despite the domination of chestnut trees, the regeneration of this species is low unlike the regeneration of beech, which is very rich. According to IUFRO classification beech presents better values as far as vitality, developmental tendency and stem quality are concerned as it grows in its

geographichal distribution and is also in its early stages. On the contrary chestnut trees have medium to low values of vitality, developmental tendency and stem quality because they are in the over mature stage. Thus, the silvicultural characteristics lead to the fact that beech tends intensively to dominate in the area by suppressing chestnut regeneration.

The silvicultural target in the study area is the creation of a forest that fulfills more than one purpose by covering sustainably social needs such as providing recreational areas for visitors in combination with nut production. For the fulfilment of this target it is necessary to inhibit the intense spread of beech with the following appropriate silvicultural measures that must be applied in the area, which are:

- To protect and maintain the perennial chestnut trees, which create an aesthetical landscape and thus raise the recreational value of the area, and which simultaneously provide a source of nuts.

- To favor the natural regeneration of chestnut against beech. This can be achieved with the regulation of the mixture grade, which in this case is suggested at 70% chestnut and 30% beech. For this purpose, as far as beech is concerned, which is managed as coppice, the silvicultural treatments that are applied depend on the development stage of the beech trees. In the late pole stage, in which they are exclusively found in the study area, the cultivation is accomplished with intense positive thinning with ultimate purpose to provide growing space for the regeneration and consolidation of chestnut.

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