

COMPARATIVE ANALYSIS OF THE DENSITY OF NATURAL REGENERATION FOLLOWING THE WOODLAND STAGE OF SEEDLINGS OF HUNGARIAN (QUERCUS FRAINETTO) AND TURKEY OAK (QUERCUS CERRIS)

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ABSTRACT

The density of the naturally regenerated seedlings of Hungarian and Turkey oak diminishes gradually following the woodland stage, simultaneously with their increase in height. The right proportioning of the mixed stands of Hungarian and Turkey oak is achieved during the regeneration process through the guided removal of fully grown trees and planting of seedlings. It is also achieved through the forestry works in their early stages of life. The promotion of the Hungarian oak in these mixed stands, in which it is negatively affected in the process of regeneration due to climatic changes, is a constant concern of forestry, and the study of the process of natural removal in these mixed stands of Hungarian and Turkey oak trees lays the scientific foundations of the method and time of intervention. The research carried out indicates that the Hungarian oak trees are able to prevail and filter out the Turkey oak trees in the same conditions and positions. The proportioning of the mixed stands may be guided through forestry works meant to provide equal opportunities for the Hungarian and Turkey oak trees in their early stages of life, i.e. the thicket, saplings and poles stages. Awareness of the changes occurring in each tree can lead to adequate guidance of the works in space and time so as to enhance the Hungarian oak growth in the competition with the Turkey oak.

INTRODUCTION

The long periods of high temperatures in the dry season and the frequent high temperatures throughout the year and the last decades, followed by dropping temperatures and heavy rainfall, characterize the climatic changes in the western part of the Getic Plateau. The Hungarian and Turkey oak trees rooted in the heavy compact soils and with a very high content of clay, where they created mixed stands. The climatic changes strongly affected the Hungarian oak, leading to its massive wilting between 1989-2004 and to their physiological decline as shown in the lack of fructification and, consequently, their reduced capacity for natural regeneration of the species (Bercea, 2008, 2013, 2014). Meanwhile, the Turkey oak trees withstood the climatic changes and continued to bear fruit at the usual rate (2-5 years). The higher economic value of the Hungarian oak in comparison with the Turkey oak requires forestry measures in the mixed stands of Hungarian and Turkey oak trees, through which the number of Hungarian oak trees could be maintained at the level registered before the climatic changes occurred. Our research aims to highlight the rate and intensity of the natural removal of the seedlings in mixed stands of Hungarian and Turkey oak so as to lay the scientific foundations of the forestry interventions favouring the Hungarian oak.

MATERIALS AND RESEARCH METHODS

The research was conducted in sample areas planted in 1998, located in phytoclimatic average conditions for the Hungarian and Turkey oak trees in the widespread forests in the western part of the Getic Plateau, at Simian, Strehaiia, Filia i, Meline ti, Dr g ani (Bercea , 2007). In the forest of Macrea, the sample unit 82 M (ua) of

the R&D Unit II Argetoaia (U.P.), Filia i Woodland, the Hungarian and Turkey oak trees are mixed in equal proportion stands. The location of the sample areas was decided upon after a long period of observation of the wilting of the Hungarian and Turkey oak trees since 1989, and permanent monitoring of the wilting phenomenon has been carried out in these sample areas. The wilting rate of the Hungarian oak trees is 15% higher than in the case of the Turkey oak trees (Simionescu, 2003). The gaps due to the removal of the wilted or wilting trees were filled with already existing seedlings of the 1994 low fructification of Hungarian and Turkey oak trees, contributing to the establishment of young stands following the regeneration cuts of the last two decades. Research on the natural regeneration of the seedlings was carried out in the permanent sample areas, and the outcomes were published in journals or presented at conferences (Bercea, 2005, 2007, 2008, 2013, 2014); furthermore, research focused on the natural removal of the Hungarian and Turkey oak trees during the first years of the woodland stage.

Measurements and observations were carried out in the former open group cuts during the regeneration process by applying progressive cutting to two 2-metre wide samples, one to the north-south and the other to the east-west. The results of the measurements and observations were recorded in tables for each species and for the whole stand. Tables were processed using Excel, and plotted using the same software.

The density of the seedlings, expressed as the number of seedlings/ m², is influenced by the area in which they were planted (Bercea, 2007).

The lowest density of seedlings was recorded in the centre (C), followed by a steady increase in the number of seedlings in the middle (m) and peripheral area (P). Starting from the peripheral area to the outer area (o) under the woodland, the density of the seedlings increases sharply due to the larger number of fully grown trees able to bear fruit and due to the microclimatic conditions allowing for the planting and growing of seedlings in this area (Figure 1)

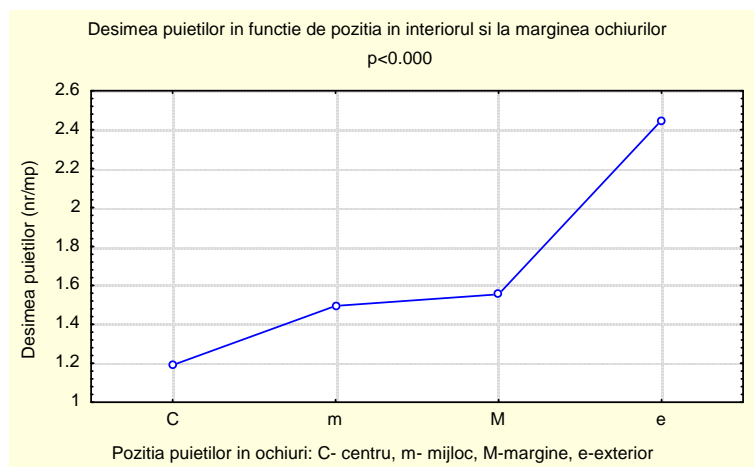


Fig. 1 Density of seedlings according to the position in the group cut (Bercea, 2007)

The result of variance analysis on the density of the Hungarian and Turkey oak seedlings, depending on the area of the group cut, is indicated as significant (p), highly significant (***), and is explained by the negative effect of heat and light the central (C) and middle (m) areas during summertime (Bercea, 2007).

The research which continued in 2012, 2013 and 2014 emphasized the natural removal process characteristic of young trees (Bercea, 2013).

The comparative analysis of the density of natural regeneration and density in the first years of the woodland stage in the mixed stands of Hungarian and Turkey Oak points

out to the different pace of natural removal caused by the growth and development of the two species in the early stages of life.

FINDINGS AND INTERPRETATIONS

The density of seedlings was measured in the permanent sample areas during their natural regeneration and in the first years of the woodland stage. The measurement results were centralized in a table and presented graphically using Excel.

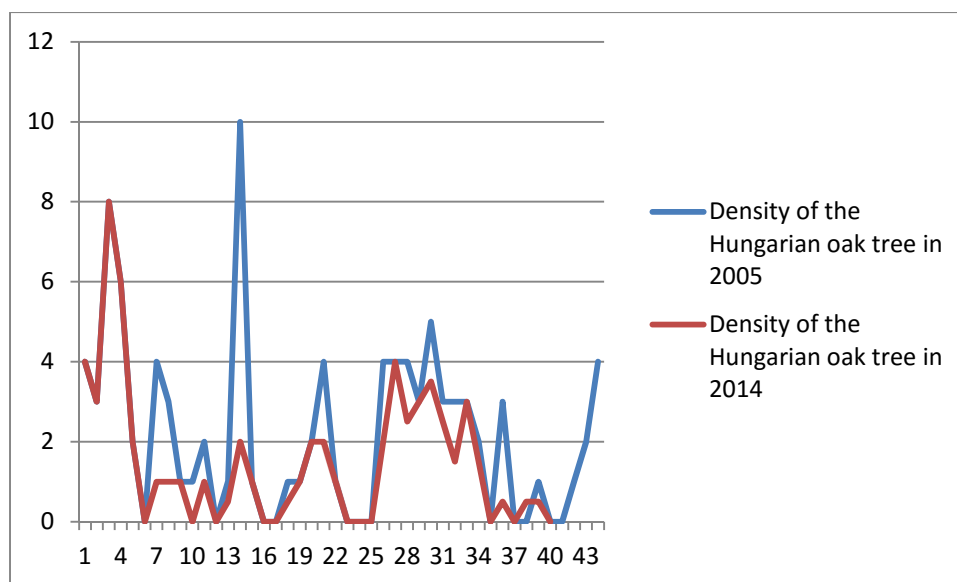


Figure 2. Density of Hungarian oak trees to the north-south

Figure 2 indicates the following:

- in the northern part of the former regeneration group cuts, the density of Hungarian oak specimens decreased due to the increase of seedlings (in height);
- in the middle area, the number is smaller due to natural removal following the significant increase of seedlings (in height);
- in the middle area of the former regeneration group cut, the density of Hungarian oak trees decreased dramatically due to the increase of seedlings (in height);
- in the southern part of the former regeneration group cut, natural removal is moderate due to the less significant increase of the seedlings (in height);
- the density of Hungarian oak trees to the north-south is determined by the rate of the increase of the seedlings (in height);

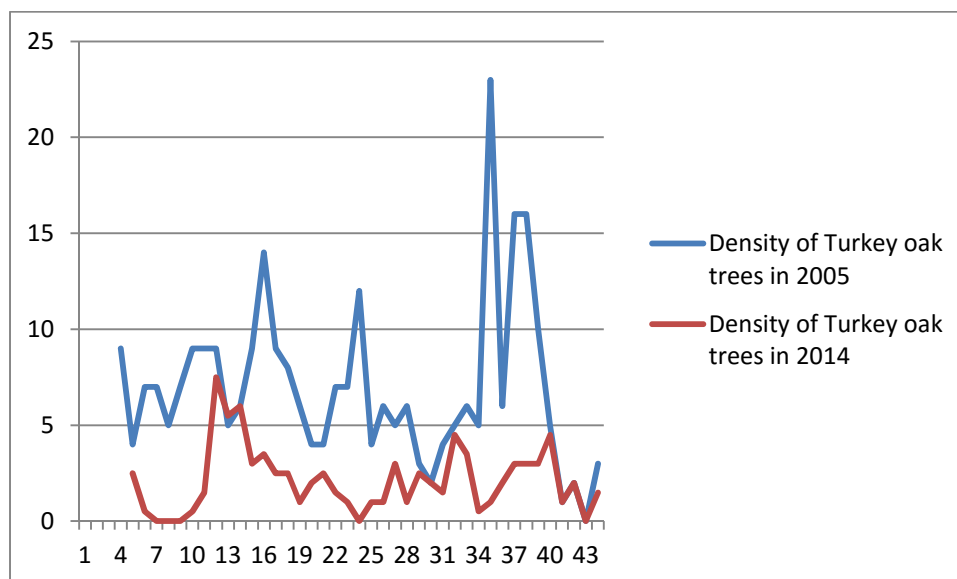


Figure 3. Density of Turkey oak trees to the north-south

By analyzing diagram 3, we notice the following:

- in the northern part of the former regeneration group cuts, the number of Turkey oak specimens, from north to south, decreased dramatically due to the increase of seedlings (in height);
- in the middle area, the number is much smaller in comparison with their density before the woodland stage;
- in the southern part of the former regeneration group cut, the density is much lower in comparison with their density before the woodland stage.

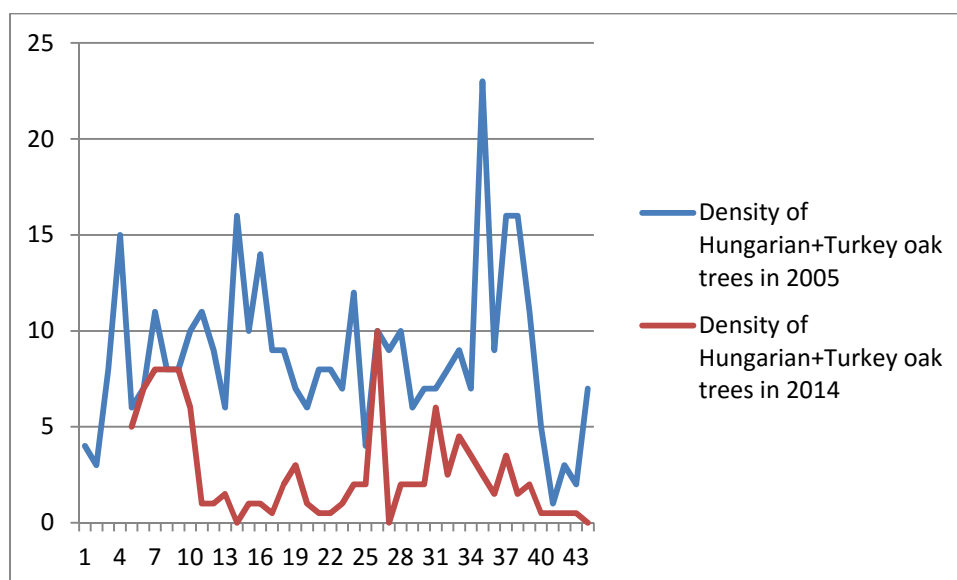


Figure 4. Density of Hungarian and Turkey oak trees to the north-south

The analysis of diagram 4 reveals the following:

- the density of Hungarian and Turkey oak specimens decreased significantly to the north-south except the northern part of the former regeneration group cut due to the increase of seedlings (in height);

- the density of seedlings is lower due to the significant increase in height and the intraspecific and interspecific competition;
- the natural removal to the north-south follows the vertical differentiation through the significant increase in height in the central area of former regeneration group cut.

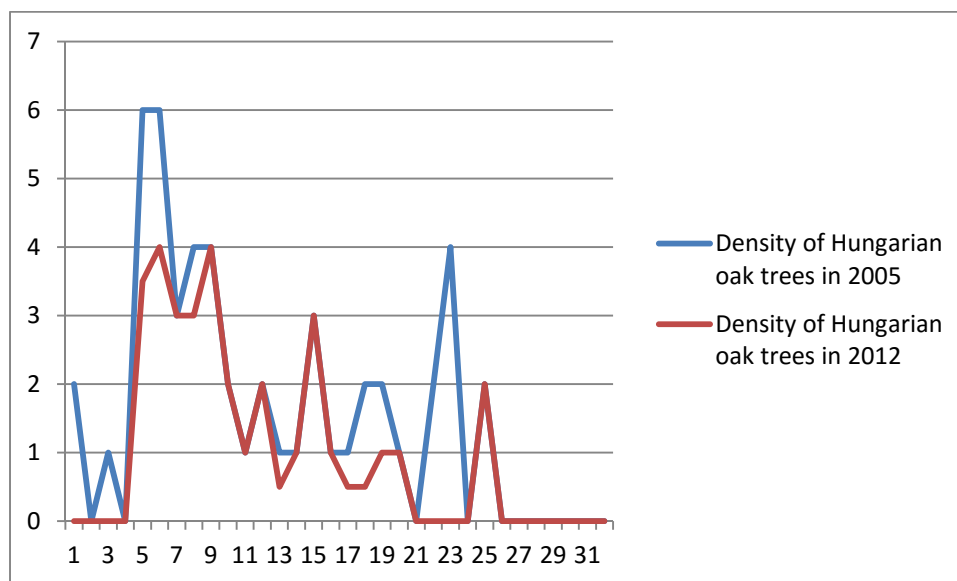


Figure 5. Density of Hungarian oak trees to the east-west

Diagram 5 shows that:

- the density of Hungarian oak specimens decreased significantly in the eastern part of the former regeneration group cuts in comparison with their density before the woodland stage;
- the density of Hungarian oak specimens remained relatively stable in the central part of the former regeneration group cuts in comparison with their density before the woodland stage;
- the density of Hungarian oak specimens decreased significantly in the western part of the former regeneration group cuts in comparison with their density before the woodland stage;

The analysis of diagram 6 reveals the following:

- the density of Turkey oak specimens decreased significantly to the east-west due to natural removal;
- the density of Turkey oak specimens reaches the maximum value in the western part of the former regeneration group cuts due to their increase in height and the high density before the woodland stage;
- to the east-west, the natural removal strongly affected the Turkey oak specimens due to the significant increase in height of the Hungarian and Turkey oak trees and to the high density of Turkey oak trees during the natural regeneration stage;
- the Turkey oak specimens were removed in the competition with the Hungarian oak trees in the same conditions and positions.

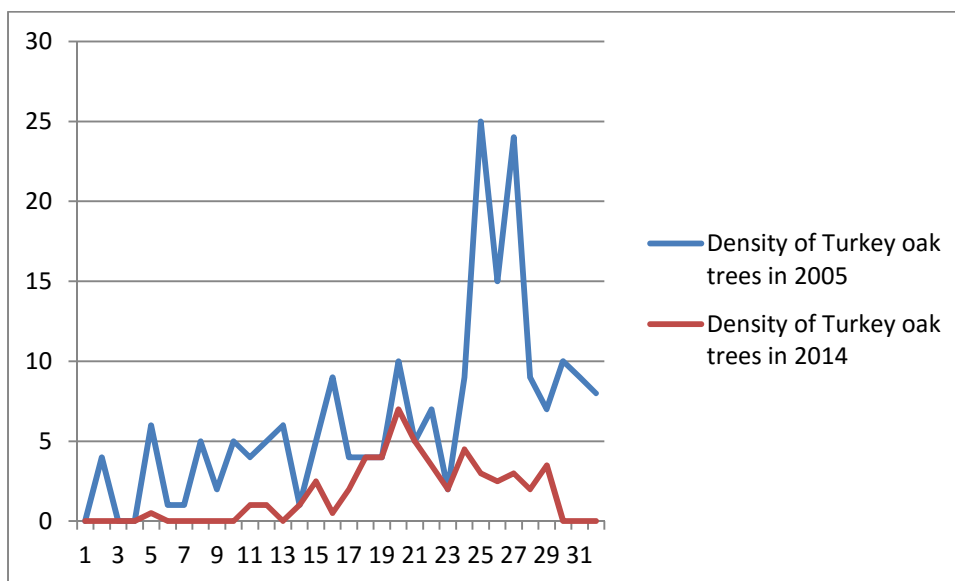


Figure 6. Density of Turkey oak trees to the east-west

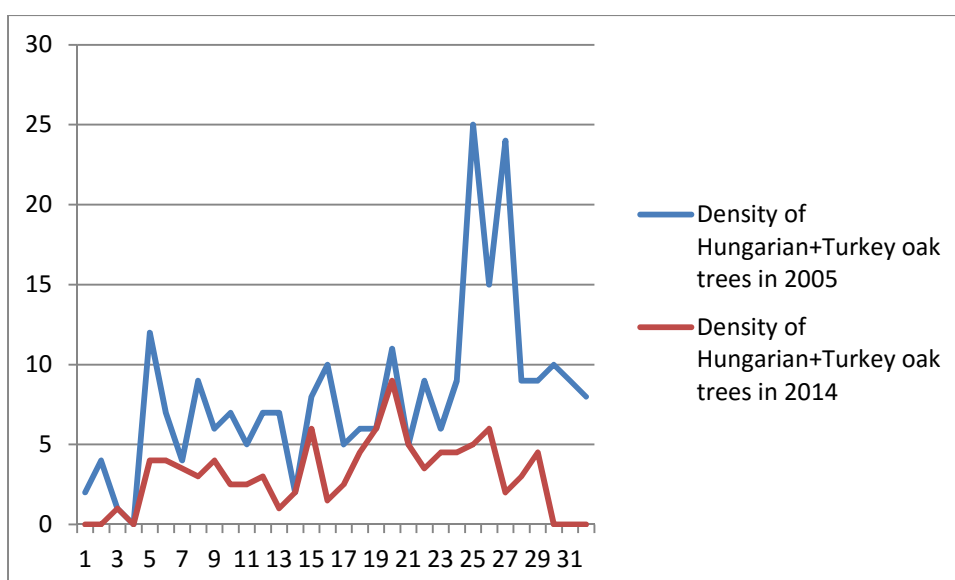


Figure 7. Density of Hungarian and Turkey oak trees to the east-west

Diagram 7 shows that:

- the density of Hungarian and Turkey oak specimens decreased uniformly to the east-west in the eastern and central part of the former regeneration areas in comparison with their density before the woodland stage;
- the density of Hungarian and Turkey oak trees decreased dramatically in the western part on account of the Turkey oak trees, in comparison with their density before the woodland stage, due to their significant increase in height and the high density of the Turkey oak specimens.

CONCLUSIONS

The research findings as reflected in the diagrams above and also deriving from the field trips lead to the following conclusions:

- the density of the Hungarian and Turkey oak seedlings resulting from progressive cuttings remains high in the outer areas of the former regeneration group cuts and preserves a sinuous transversal profile, with lower heights in the peripheral and outer areas;
- during the natural removal process, the Hungarian oak specimens are favoured in comparison with the Turkey oak trees in the same conditions and positions in the stand;
- at the thicket stage, the Hungarian oak specimens branch out and create a protection system, succeeding in overshadowing the Turkey oak trees that are not likely to branch out, instead, we recorded the Turkey oak trees increase in height without any horizontal growth, which caused their removal by the Hungarian oak trees.

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