Current state of quercine forests sourced from shoots: spatial distribution, threats, and risks in NE of Romania

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Abstract. This study examines the quality and threats to quercine forests by analyzing their spatial structure and external defects. A total of 2,593 trees were inventoried in 35 management units, classifying them based on dendrometric properties. Findings reveal that 54% of the trees have less than 15% usable wood volume due to shape and damage defects. Additionally, 25% fall into quality Class III, indicating a lower proportion of usable wood. The prevalence of flaws in shoot-derived specimens is notable, with only 21% belonging to quality groups I and II. The study emphasizes the importance of understanding the natural spatial structure for forest inventories, ecology, and management. It also highlights various threats faced by quercine forests, including defoliators, fungi, xylophagous insects, human activities, air pollution, grazing, climatic stress, and reduced consistency. Effective forest management practices are crucial for promoting natural regeneration and adapting to climate change. In conclusion, this research underscores the need for sustainable forest development and the preservation of ecosystem services. By considering spatial structure and addressing threats, it is possible to enhance the resilience and long-term viability of quercine forests.
Key Words: quercine forests, oak hardwoods, *Quercus petraea*, *Quercus robur*, forest degradation.

Introduction. In recent years, there has been a decline in the vegetation of our nation's woods overall (Piticar et al 2015; Ryan et al 1997), but particularly in those that include a significant amount of quercine from shoots. Although the occurrence appears to be cyclical and governed by climatic circumstances (Alexe 1984), this does not negate the necessity for in-depth investigation of the factors that lead to the emergence of this phenomenon in these forest ecosystems. A variety of causes, including pedological, climatic, hydrological, biological, and anthropogenic ones, which present themselves on the forest ecosystems and irreversibly alter their balance, contribute to the decline of stands of quercinea with provenance from shoots (ACPL). According to the (spiral) Manion method, which is used to explain the phenomena of drying or debilitation, the factors are divided into three categories: triggers (prolonged droughts, higher average annual temperatures, fires, severe and repeated defoliation), favoring (inappropriate stationary characteristics, silvotechnical interventions not performed on time or incorrectly, old age, excessive grazing), and aggravating or accompanying (typically opportunistic insects or fungi).

The development of imbalances in shoot-derived stands is characterized by a decline in tree vitality, the emergence of widespread secondary pathogen infections or graduations that result in widespread drying phenomena, a decline the proportion of the main species (*Quercus petraea* and oak), and finally the impossibility of natural regeneration of these species at the time of exploitation (Barbu 1991). Most frequently, anthropogenic factors either directly or indirectly contribute to the decline in arboretum vitality (Șulea 2014). The structural traits of stands, such as their development and production, composition, qualitative traits of the trees and stands, and structure, are declining. These effects have disrupted the functioning of forest ecosystems and significantly reduced their capacity to defend themselves against environmental aggressors, in addition to the low quality of forestry activities. Knowing the triggers and limiting their effects by strategically planning the arrangements and the way in which the forestry activities are applied will help to improve the vegetative status of ACPL and preserve adequate proportions of these species in the compositions of stands. To prevent the primary species' trees from prematurely drying out, the forester must act at the right moment. It's important to pay close attention to secondary pests that result in widespread infestations during years with less precipitation and higher than ordinary averaging temperatures.

The current situation of the quercine forests in our nation has been the subject of intensive research, leading to the establishment of a number of correlations between age, origin, stationary circumstances, composition, and the emergence of destabilizing forces that cause dryness. The stands with consistency levels over 0.75, ideal compositions, and locations where driving and maintenance tasks were completed were determined to be least affected by drying phenomena. Between 2 and 5% of the total area of quercine forests are affected by drying occurrences. It varies based on the time of year, the pace at which dried specimens are removed to prevent the spread of secondary diseases, and the environmental circumstances.

General considerations. Stands with quercine area of the national forest fund, of which approximately 6.9 million hectares are covered with forest (the remaining being lands being intended for afforestation and other lands), have a more significant share of 24% in the hill and plain areas (IFN - Cycle II 2018). Sessile oak (*Quercus petraea* Liebl.) Figure 1 and pedunculated oak (*Quercus robur* L.) Figure 2 account for a disproportionately large portion of the local quercine (species of the genus Quercus). The value of the wood, which has numerous industrial applications, as well as the fact that this genus predominates in the country's plain and hilly regions make these species particularly significant for Romanian forestry (Şofletea & Curtu 2007). They play a critical role in preserving the arboretum's biological equilibrium because its structure is frequently altered, which has significant economic ramifications. The majority of sessile oak and pedunculated oak stands have excellent bioaccumulation potential, and the trees themselves exhibit high levels of adaptability. Sessile oak and pedunculated oak participation rates in arboretums in the hill and plain area are currently steadily declining for a variety of reasons, running the risk of being replaced by mixed or beneficial species. Because of either the late completion of management and care tasks or the high rate of natural elimination caused by climate stress, this phenomenon is particularly pronounced in forests that have been transferred from state ownership to private property (Simionescu 1991). Due to a lack of security services and illicit cuts made with the extraction of precious specimens as a top priority, the quercine forest also lost its war with the trembling poplar and linden tree.

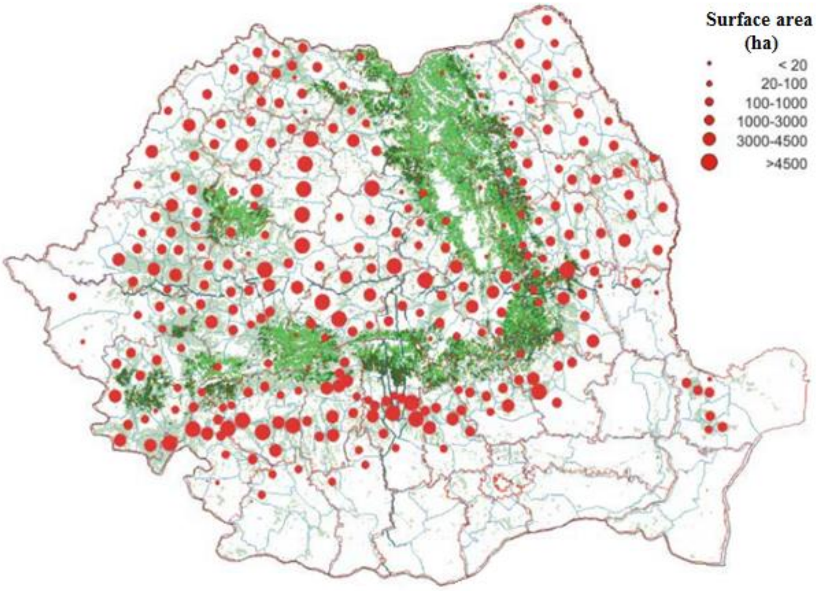

Figure 1. Distribution of sessile oak (*Quercus petraea* Liebl.) in Romania (www.icashd.ro).

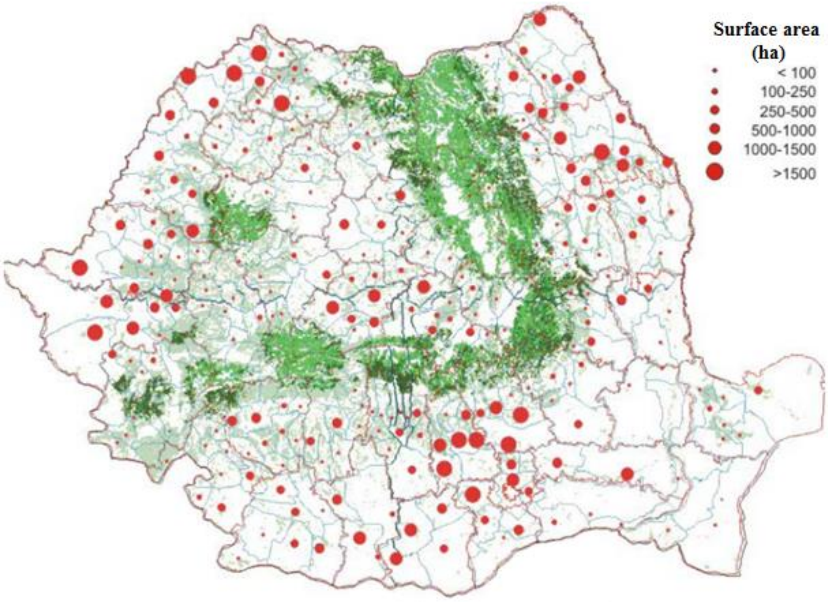

Figure 2. Distribution of pedunculated oak (*Quercus robur* L.) in Romania (www.icashd.ro).

The volume of stands with quercine (sessile oak and pedunculated oak) in our country is on average 264 m^3 ha^{-1}, and Transylvania has the largest average volume of all the regions, at 292 m^3 ha^{-1}, followed by Moldova with 287 m^3 ha^{-1} and Tara Românească with 221 m^3 ha^{-1}. The biggest rise is held by the stands of quercine in Moldova, which have an annual growth rate per hectare of 8.3 m^3 $year^{-1}$ ha^{-1} ha and are the third group of species in terms of their proportion of the total amount of standing wood in Romania (IFN - Cycle II 2018).

The history of the management of the stands with quercine from the north-east of Moldova. The management of Romania's woods during the past century has varied, reflecting the laws of each historical era and various types of ownership, with significant effects on the forests' integrity, production, health, structures, and composition. To illustrate this history, the forests under study are found in the counties of Botoşani, Iași, and Vaslui in the north-east of Moldova. These days, these forests are owned by both people and legal entities (cults, communities, and businesses), many of whom have land holdings of over 100 ha. The commercial societies purchased these regions from a portion of the physical platforms' heirs, who are descended from old boyar families in Moldova. These regions were primarily controlled by Moldavian "boyar" families (Candiani, Calimachi, and Fischer) and sects (Sfantu Spiridon Iași Parish) prior to 1948. These families gained the forests either by royal favors or through outright purchases.

Smallholders, who had a little portion, benefited from a number of land reforms, as follows:

- Law 14/26 August 1864 (Agrarian Reform of A.I. Cuza), also called the Rural Law;
- The Agrarian Reform of 1921, (the Law of July 17, 1921 for the agrarian reform of Oltenia, Muntenia, Moldavia and Dobrogea) which mainly benefited the veterans of the First World War, and some owners bought these areas from the boyar families;
- The Agrarian Reform of 1945 (Law 187 of 23 March 1945 "For the accomplishment of the agrarian reform").

These arboretums were under the forestry administration up until 1920. They were used in accordance with the owner's requirements, and the most of them were used during the First World War by cutting down a basic grove and leaving behind a few uncommon sessile oak and oak trees covering around 30 hectares, taking on economic exploitability when the majority of the trees in a stand grew to the size that provided the most wood for a given usage. Following the passage of the 1920 Forestry Code, harvesting regulations with a 10-year lifespan were created for these forests, providing the following management pillars: the grove regime, the handling of straightforward grove felling, the revolution of 20–30 years, and the possibility was established on the surface. Due to recurrent pruning and grazing, the use of these landscaping bases produced poor-quality stands with excessive amounts of hornbeam and linden, and the quercine species were poorly conformed.

Figure 3. Location of the stands studied in the three counties.

By enacting the Romanian People's Republic Constitution of April 13, 1948, as well as Law No. 119 of June 11, 1948, all the forests examined were nationalized and transferred to the state. The transition into direct management of the communes of the forests that belonged to individuals with areas up to 20 ha and of the bodies dispersed up to 50 ha away from the forest massifs was anticipated by Decision of the Central Committee of the Romanian Communist Party and of the Council of Ministers nr. 2314 of 1954. The forest districts in that region were in charge of managing them, and the Communal People's Councils valued the timber. For the communities within their range, the forests served as a source of essential fuel and wood for rural construction. On the basis of guidelines created in 1949, 1951, and 1953, the first unitary forest management plans for these forests were created between 1952 and 1954. The arrangements were formed without taking into account the ancient forms of property, which were managed unitarily, and were made on ATUs for smaller entities and in Large Forestry Units (M.U.F.) for large properties. Under the direction of the Communal People's Council staff, the forests that were grouped on the Territorial Administrative Unit (U.A.T.) were managed in accordance with the requirements of the residents of these communes. The neighborhood rangers were in charge of keeping these areas secure. Mostly, timber for tiny rural structures and firewood was collected. The evidence was made on the surface; there was no precise record of the amounts taken. The woods included in the M.U.F. were overseen by the forest districts, who later reorganized them into production units in the 1960s.

All of the arrangements included production cycles of between 50 and 60 years, the grove regime, grated pruning on sizable areas, and no intervention in these stands until the subsequent cutting. A treatment of grove pruning with reserves was applied to a portion of the surfaces. Incorrect application of this procedure resulted in completely derived stands (carrpinishes, poplars, tees, etc.) or stands with a very small percentage of sessile oak and oak, and trees of inferior grade. These territories were governed by the local forest district administration and the then-current Ministry of Forestry by decree of the Council of State No. 328 of the 14.10.1986. The development basis for these stands were altered after the changeover to the administration of the forest districts: the forest and conversion regime, the age of exploitability of 100 to 110 years, the treatment of progressive and shaved cut surfaces followed by substitutions and restorations. The basic species of sessile oak, oak, ash, cherry, etc., in accordance with the basic natural type of forest, were promoted by the new development bases, which also had favorable impacts on the structures of the stands and their composition (Forest Management Plan 2015, 2016). All driving and maintenance tasks that improved the composition of stands and the quality of trees were completed (Forest Management Plan 2018).

These territories were eventually reclaimed by the current owners as a result of the implementation of the provisions of the legislation for the restoration of the property right over the forest fund through Law 18/1991, Law 1/2000, and Law 247/2005. Forests have suffered throughout this transitional time, either as a result of illicit logging, particularly of high-value species, or as a result of neglecting management and care tasks in some cases for almost 10-15 years.

The current state of stands with quercine originated from shoots. About 30% of the woods in Moldova's northeast are pure quercine stands or stands mixed with other species, and about 50% of these are made up of shoots. The large percentage of stands that originate from shoots, which is a result of recurrent grove pruning, is typical of the forest regions that belonged to both large and small owners until 1948 (Marcu 1985). Many of these forests currently exhibit poor vegetation, which has been more pronounced in recent years due to an increase in the death of trees between the ages of 50 and 80. This behavior is more pronounced in pure stands with sunny exposures and slopes between 16 and 30 degrees, although it also occurs in stands with less than 30% of quercine on lands with a slope of 16 degrees. With an average consistency of 0.79, the forests are largely anthropogenic, having aberrant structures with trees that grow from old shoots, and delayed natural regeneration (Petritan 2019). They are also at the lower end of the average consistency of the Romanian forests.

Growth, development and productivity of stands with quercine coming from the shoots. The productivity of forests is mainly determined by stationary conditions and is influenced by the climatic conditions, but also by anthropogenic factors that act directly or indirectly. The production of a forest is the result of its increase in volume, which is why the productivity of forests is generally expressed by the increase per year and per hectare (Leahu 2001). The examination of ACPL production must take into account both their existing conditions and the anticipated evolution of these ecosystems, which are impacted by a variety of unstable factors. The primary reasons for productivity declines will next be discussed, along with how they impact growth and development, in an effort to identify solutions that may be put into practice through planning. Due to the low consistency, resulting from repeated extraction of dry specimens, various grassy species are installed, especially from the genera Carex, Poa, Luzula, which hinder the installation of natural regeneration and create a favorable grazing environment. By reducing the competition for light and implicitly limiting height increases, the decrease in uniformity has an impact on arboretum productivity by encouraging the growth of unruly crowns and the emergence of greedy branches. The position of the trees in the stand and the intensity of the drying phenomenon are related, according to research done at the turn of the 20th century. The structure of most stands is equiene (same age) or nearly equiene. According to their placement in the stand, dried trees were categorized by Kraft classes, leading to the conclusion that the proportions of dry specimens are similar in both the upper and lower ceilings (Vlonga 1991). The lower ceiling specimens that naturally dry out are not destroyed, indicating that the upper ceiling trees are also impacted by the abnormal occurrence of drying.

The development of derived stands is favored by the removal of quercine specimens from the stand when they are combined with other species between the ages of 50 and 80 years. The stumps from which these shoots originate are old; the majority of them were treated in the grove for 4-5 cycles, and in the ancient boyar forests for as many as 7-8. As a result, the stumps are devitalized and cannot support the growth of these specimens. Most stumps display severe xylophagous fungus infections or other damage from the irresponsible falling of trees that were harvested on several occasions. Due to repeated regeneration from the shoots, the productivity of arboretums decreased from one cycle to another (Alexe 1984). Currently, most of the stands are of a medium productivity (class III of production) of about 60% and lower (classes IV and V of production) about 10%. The average volume is between 160–210 m^3 ha^{-1} at the age of 50-80 years, achieving average increases of 5.7 m^3 $year^{-1}$ ha^{-1}, much lower than the stands with seed or mixed origin. In pure stands the growth rate is lower. One cause of the ever-decreasing growth rates is the severe and repeated defoliation of recent years caused by *Tortrix viridana*, *Lymantria disappearing*, *Operophtera brumata* and attacks of *Microsphaera abbreviata*, affecting ever-increasing areas (Șimonca 2011). The dynamics of height increases for most stands show a slowdown and in certain stands even a stagnation. These measurements were done during the redevelopments. Following the redevelopments, a percentage of about 10% of the UC's moved from class II production to class III, a phenomenon which was more accentuated in the stands with a consistency ≤0.7, which grow and develop on sunny slopes.

Due to the current structural and compositional conditions, these stands have low growth, accumulation, and stability potential for the remaining trees, manifesting a degradation of the ecological balance of the forest ecosystems and presenting a state of vegetation that is insufficient in terms of bioproductiveness. The current situation is a result of imbalances determined by anthropogenic factors acting on these ecosystems, specifically through past grove exploitation that resulted in a decline in biodiversity and the emergence of nearly pure single-story stands that are extremely vulnerable to pathogen attacks and climate change.

Quality of quercine trees with provenance from shoots. The percentage of working wood is a measure used to evaluate the quality of trees. The grading of trees is done into four quality classes based on how much of the overall height of the shaft is acceptable for working wood. The proportion lowers, changing the quality class, when a piece of the trunk with flaws is subtracted from the category of working wood (Dumitrache 2014). The maintenance and enhancement of tree quality is a priority in forest management, but acquiring high-quality specimens is constrained by a variety of natural and artificial variables that operate continually from the first year of life until harvesting (Deuffic et al 2020). In the case of ACPL, the timing of the tree fellings in the grove, the accuracy of the management and forestry care interventions, as well as the harm done to the standing trees due to the exploitation activity, all have a significant impact on the quality of the trees. The classification of trees into quality classes is one of the most crucial factors in the valuation process because it involves the technical field staff's subjective judgment. The accuracy with which the trees are correctly categorized by the forestry professional into quality classes affects the accuracy of calculating the volumes by assortments. The majority of the stands in the study region are 50 to 80 years old. The majority of the specimens are categorized in quality class III, followed by those in quality class II, according to the study of the Act of Putting into Value (APV) developed for these places. Only dry trees with peeling bark and decay were categorized in the iv quality level. Following the care process conducting, the majority of the poorly conformed specimens are identified; it is necessary to evaluate the qualities of the specimens from the shoots and highlight any flaws. Defects in trees with a provenance from shoots may be grouped into four categories:

1. defects in shape – are the easiest to identify by direct observation. The following defects in shape were encountered:
- curvature – is common in specimens from shoots, represented by the curved deviation of the axis of the tree, in a plane along the entire length, several curvatures in the same plane or a curvature in several planes;
- darbling - is less common in quercine, represents a particular case of curvature consisting in the curved deviation of the trunk axis in the part facing the package;

- conicity – this defect is one of the most common in trees with provenance from shoots, it is an abnormal and continuous decrease of the diameter from the base to the top;
- labing – present in varying degrees in all specimens of shoots, is pronounced thickening at the base of the trunk and can be round or star-studded;
- groove – is a defect encountered especially in the hornbeam, represents the sinuous contour of the cross-section of the trunk, respectively the veiling of its lateral surface;
- ovality – is rarely found in quercine, it is the ovoid shape of the cross-section of the trunk;
- tangling – is present in specimens that have been grazed in the first 10-15 years, consists in its separation at a certain height in two or more main branches, usually as a result of the more active growth of the lateral buds instead of the terminal one;
- growth – is rarely encountered, it is a swelling of various shape, on the trunk, with irregular structure, having knots of various shapes;
- hollow – little present in the stands in the shoots, it is a longitudinal recess that usually appears under the place of penetration into the trunk of a large branch.

2. injury defects – can be observed especially in the lower third of the trunk, they are the following:
- scars – these can have different causes, especially resulting from exploitation or actions of the human factor;
- clogged bark – fragment of the bark of the tree totally or partially embedded in the wood mass;
- dead wood - represents the external rot, it appears as a result of injuries;
- cancer – is an accumulation caused by the bacterium *Agrobacterium radiobacter tumefaciens*;
- Wounds due to inclusions of foreign bodies – most often bullets;

3. cracks – may have different causes, these are the following:
- the bearing - consists in the appearance of one or more cracks in the form of a circle segment along an annual ring, on a portion or its entire length;
- frost cracks – due to frost having a radial direction, along the trunk;
- lightning cracks – they produce cracks along the trunk of the shaft;

4. defects caused by biotic factors – are caused by pests of wood, these are the following:
- defects caused by insects - wood can be attacked by a whole series of insects, called xylophagous insects, as well as by the larvae of butterflies and wasps, these defects can be recognized by the exfoliation of the bark;
- defects caused by fungi – the degradation of standing trees which is caused by xylophagous fungi attacking the wood through the injured parts (carvings, broken branches).

The size of the defective piece and its location along the length of the spindle both affect the quality of the trees; the higher the flaw's location, the lower the impact on the quality (Dumitrache 2014).

The investigation of external faults is particularly significant since it determines the quality class of trees, the most obvious and significant of shape and damage defects. By putting circular sample surfaces with an area of 300 m^2 in a number of 35 management units with provenance from shoots and mixed, the stands in the U.P.I. Dumești were statistically inventoried. In this work, 2593 trees were inventoried, and their diameter and height were measured in order to classify them into quality classes based on their dendrometric properties. The proportion of usable wood is less than 15% of the volume of the tree (class IV) for 54% of the total number of trees inventoried, due to various shape and damage flaws and other quality issues. Trees in class III of quality, representing 25% of the total number, have a lower proportion of working wood than 49%. Only 21% of trees are in quality groups I and II, which shows a significant prevalence of flaws in specimens from shoots (Figure 4).

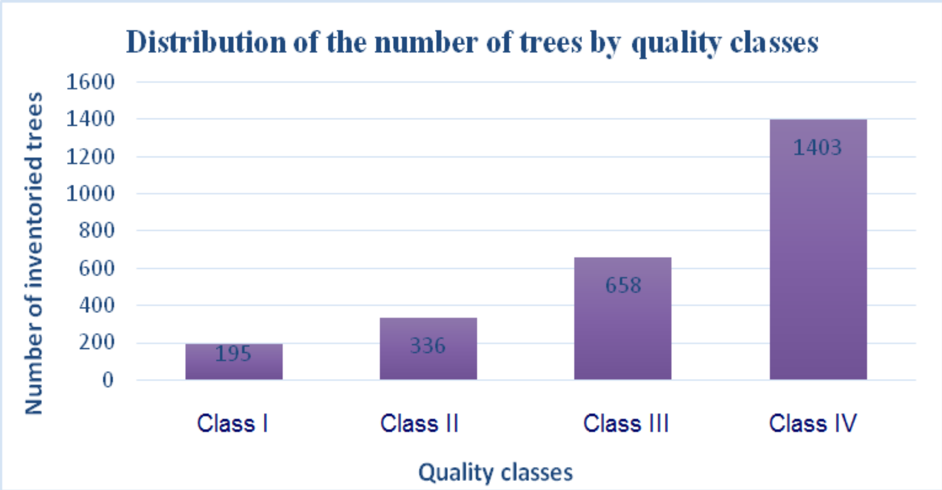

Figure 4. Distribution of the number of trees by quality classes in the Production Unit (U.P.) I. Dumeşti.

Spatial distribution in quercinea stands. Forest processes that control development and ensure the sustainability of forests depend on the preservation of the natural spatial structure. The architectural and functional components that make up the forest are referred to as the stand's structure (Thom et al 2016). It is a key contributor to the development of numerous ecosystem processes and represents the regeneration style, competition, and outcome of forest self-regulation (Thom et al 2016). Therefore, in order to ascertain a wide range of forest traits and biophysical parameters suitable to forest inventories, ecology, and management, understanding of the natural structure is required. Both the geographical and non-spatial structure of forests are included in their structure. According to Thom et al (2016), the spatial structure is crucial because it can give a thorough description of forests and it is a key factor in determining the competitive environment and spatial niches between trees. It also determiness the health, growth potential, and stability of stands.

Natural forces as well as anthropogenic disturbances have resulted in a significant decrease in forest natural resources and in the degradation of their ecological functions. Natural forests are ecosystems that supply society with timber and non-wood products. Therefore, in order to improve the rate of natural forest quality restoration and to maintain the diversity and stability of forest ecosystems, efficient forest management practices must be put into place in order to accomplish sustainable forest development. Numerous studies have demonstrated that forest management can influence the distribution of tree sizes, the density of stands, and the species mix of individual trees (Thom et al 2016). The spatial organization of the forest may be altered as a result of forest management, although the impact may vary depending on the strategy used (Ciubotaru et al 2014). For forest management, it may undoubtedly be required to comprehend changes in the spatial structure of the stand after various forestry treatments. Some of the most significant forest types in Romania include quercine forests that are entirely composed of one species or combinations of several. Such alterations were observed in the ACPLs' spatial organization of trees from one redevelopment to another as a result of the many owners' objectives that over time. For effective forest management, it is crucial to comprehend the characteristics of the spatial structure of the stand in a forest that has undergone a variety of management techniques. Because Quercus petraea and pedunculated oak participated in the intense management of quercine forests and hill slopes in recent decades. They exhibit compositional changes determined by anthropogenic influences, which resulted in a decline in biodiversity. In natural forests, interspecific interactions that produce biological processes unique to forest ecosystems are determined by the spatial distribution of trees. To be able to forecast the evolution, growth, and development of a forest, these processes have been researched.

The forests analysed, in terms of the proportion of quercinea in mixtures, are divided into three categories, depending on the proportion of participation of quercinea:

- below 50%;
- between 50-80%;
- over 80%.

The percentage of cvercines in the examined stands was classified by distribution by county to ensure a more accurate representation of the data. It was decided to separate the species in order to compare their structure, composition, consistency, and proportion—factors that affect the spatial distribution. To ascertain the impact of various forms of forest management used up to 1986 on the present-day structure and composition of forests, a comparison must be made. The Botosani County areas under study were managed as groves for a considerable amount of time; data are only available for the years 1910 to 1986. Following nationalization, the areas became common woods. Due to the more alluring alternative use, agriculture, these forests were more widely spread and subjected to intense grazing.

Vaslui county contains larger and more densely populated areas, despite the fact that until 1948, a "grove" (vegetative regeneration from shoots) rule was in place on a sizable portion of those lands. They were then handled by the M.U.F. before being reorganized into U.P.s in the 1960s.

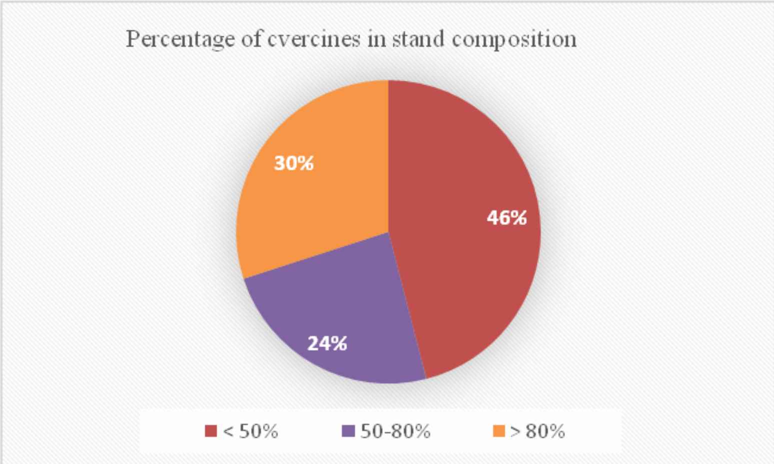

Figure 5. Percentage of quercinea participation in the composition of studied stands in Botoșani County.

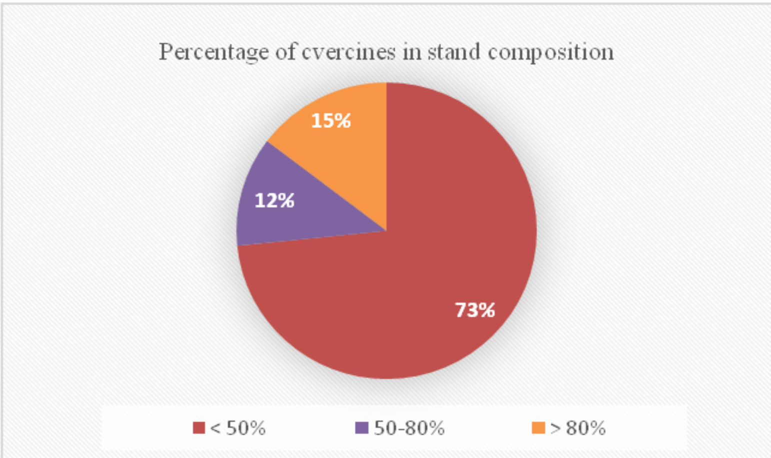

Figure 6. Percentage share of quercine in stand composition studied in Vaslui County.

Because the number of quercinea in the stands varies significantly between the two study regions, we draw the conclusion that management through planning had a significant impact on the spatial distribution of species in the stand. The stand structure is better and the proportion of dominating trees is higher when the stand is more diverse.

Sadly, there has been a reduction in these ecosystems' mixing and helper species populations during the past few years. Small patches of a specific lime and hornbeam species are forming generally, a feature unique to individuals in multi-species stands. A disturbance in the age structure and species composition of the tree caused by both natural and human-caused events is one of the causes of decline.

Consistency is an indicator of the spatial distribution of stands. Inventory results show an average density of 0.85 of stands in the sample areas in Botoșani county and an average density of 0.89 in stands in Vaslui county. Although the visual appearance is of a consistency of at most 0.80, this difference is due to the fact that, as a rule, there are 2-3 specimens per stump. The current decline in biodiversity now threatens the ability of ecosystems to adapt to changing conditions and hinders the provision of ecosystem services. It thus represents one of the greatest challenges for humanity (Thom et al 2016). The majority of research on how climate change affects biodiversity has concentrated on the direct repercussions of the change, i.e. how temperature and precipitation variations affect biodiversity. Indirect consequences, such as the impact of climate change on forest form and composition, species occurrence, and abundance, have received less attention in the literature (Thom et al 2016). While disturbances, such as pulses of tree mortality caused by agents like pest infestations, fire, and wind, can induce rapid and significant changes in the structure and composition of forests, they can also lead forests to respond slowly to environmental change.

Current threats and risks of shoot-derived quercine forests. Sustainable forest management refers to the management of forests so that modern society can take advantage of the goods and services they offer, without making necessary adjustments to their composition, structure, or capacity of production that would have negative effects on the ecological balance of forests (Hlasny et al 2011; Dănilă et al 2016). Based on this, the forester must reevaluate his or her plans for forest management, proposing a model of management that is suitable for the way forests are currently developing in the face of ecological, economic, and societal change. We have discovered a number of dangers and risks to these woods as a result of the existing situation of the ACPL and of the changing environmental circumstances. These forest ecosystems (since they mostly derive from old stump shoots) are extremely sensitive to the effects of biotic, human, and climatic factors, such as:

- defoliators - green oak moth (*Tortrix viridana* L.*),* (*Lymantria dispar* L.) and (*Microsphaera abbreviata* L.*);*
- fungi - *Ceratocystis fagacearum*, *Graphium roborissi*, *Ophiostoma ulmi*, *Ceratocystis roboris*, *Armillaria mellea*;
- xylophagous insects - *Agrilus biguttatus Fabricius*, genera *Trypodendrom*, *Cerambyx*;
- human activities causing tree damage - inappropriate logging technologies and other human activities;
- air pollution - is the most recent debilitating factor on forest vegetation;
- grazing - directly influences mineral nutrition processes by compacting and reducing soil trophicity;
- alternation in a growing season of excess and deficit soil water;
- prolonged drought in recent years;
- reduced consistency - causes microclimate change;
- climatic stress.

All of these elements may work alone or in various combinations; some of them trigger the multiplication of pathogens (secondary pests).

Attacks of *Agrilus biguttatus* have been documented in ACPL more frequently in recent years. In the study locations in Botoșani County, this species is more prevalent. It frequently results in the drying of clusters of trees, from an isolated section to the entire stand. It targets trees of all Kraft classes, and seedlings are found to be more vulnerable. One of the main problems for forestry is the biodiversity loss, since it poses a threat to ecosystems' ability to adapt to the changing climatic circumstances and hinders the provision of ecosystem services.

Conclusions. An examination of the health of the forest reveals that the abnormal drying of the quercine, particularly of the shoots, is a cyclical occurrence. This phenomenon occurred mostly in the years 1955–1961, 1972–1977, and 1984–1988 and it is becoming more pervasive on a national scale, and these years are strongly associated with drought years (Alexe 1984). According to studies, the climatic factor acts as a catalyst, setting off a cascade of biotic factors that are then increased by both direct and indirect human causes. By making poor silvicultural interventions that reduce the consistency to 0.8 or by neglecting management and care tasks, which causes the dominant species to become extinct naturally, human actions have the potential to upset the delicate balance of these ecosystems. Since 2017, abnormal drying of the greenhouses has spread over an expanding area as a result of the drought in 2015 and climate stress. Stands growing in sunny exposures are more prone to drying, where a lack of water and high temperatures encourage pest infestations. To accomplish natural regeneration and the promotion of naturally fundamental species, a reevaluation of the management planning is required for these stands.

Conflict of interest. The authors declare no conflict of interest.

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