RESEARCH ON 6133 FOREST ECOSYSTEM TYPE *COMMON OAK* WITH *AGROSTIS-CAREX BRIZOIDES* (REGIONAL VERSION WITH *TURKEY OAK*, *HUNGARIAN OAK* AND *SESSIL OAK*) WITHIN THE SEGMENT OF LANDSCAPE SITUATED ON HIGHT WESTERN PLAIN OF TINCA FOREST DISTRICT

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RESEARCH ARTICLE

Abstract

The identification and description of forest ecosystem types on small geographical units, at the landscape level (Landschaft), in order to determine their ecological specificity within a given territorial unit and to establish sustainable management measures, gives forest typology a strong regional character (Doniță, 2004). Forest typology has evolved from the need to differentiate forest management practices according to stand composition, structure, productivity, and other stand characteristics, namely their ecosystemic features (Doniță et al., 1990). In this forest ecosystem type, the nucleus of constant species consists of Quercus robur, Rubus caesius, Crataegus monogyna, C. laevigata, Rosa canina, Prunus spinosa, Frangula alnus, Carex brizoides, Agrostis stolonifera, Polygonum hydropiper, Calamagrostis epigeios, Campanula patula, Myosotis scorpioides, Hieracium umbellatum, Lychnis flos-cuculi, and Galium palustre.

Keywords: forest ecosystems, geographical landscape segments, ecological site conditions, sustainable forest management.

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INTRODUCTION

The high piedmont plain located in the central part of the study area, with average altitudes of 100–200 m and increasing values toward the east, represents a Pleistocene plain unit, largely undulating, formed through the merging of alluvial cones of rivers flowing from the mountains and hills situated to the east.

The transition between the plain and the hills is marked by a morphological threshold of approximately 40–60 m.

The proluvial deposits of the plain consist mainly of clay and silt. On these parent materials, heavy and hydromorphic alternating soils have developed.

The relief is predominantly a gently undulating plateau, slightly dissected by shallow, temporary brooks. The clayey deposits (red clays) form stagnic luvisols on slopes, while on the plateau plani-gleyic and whitish soils occur, characterized by a relatively balanced hydric regime.

The climate is warm and less humid than in the lower hill units, with mean annual temperatures of around 10°C and average annual precipitation of 614.7 mm.

Under these natural conditions, the plateau forest ecosystems are composed of turkey oak, pedunculate oak, sessile oak, and Hungarian oak, typically occurring in mixtures of two or even three species, with common hornbeam present along the small brooks. The indicator species of the herbaceous and shrub layers include *Agrostis–Carex brizoides* and *Genista–Festuca heterophylla* on the plateaus, and *Glechoma–Geum* and *Arum–Brachypodium* associations along the brooks.

MATERIAL AND METHOD

The research was conducted in the forests administered by the Tinca Forest District, beginning in 2024 and continuing throughout 2025.

The identification of typological units (ecosystem types) was carried out using the method of synthetic systemic indicators, evaluating the phytocoenosis, climatic indicator forest species, and edaphic conditions such as soil acidity, moisture, humus content, and compaction. The use of phytoindicators is based on principles of modern ecology, according to which plants, as primary producers, and the phytocoenoses they form accurately reflect not only the complex abiotic ecological factors that

determine the structure and functioning of forest biocoenoses but also the nature and functionality of these biocoenoses, which ultimately define the productivity of the forest ecosystem.

Forest ecosystems were analyzed according to their location within the study area. For each ecosystem type, the following characteristics were assessed: surface area; geographical parameters (mean altitude, altitude range); landforms (types, slope gradient and aspect); lithology; soil types and subtypes; ecological limiting factors; stand structure and composition; description of the herbaceous layer; correspondence with forest types, site types, plant associations, habitat types; the current state of the stands; and management considerations. These included the main features of the type, distribution by age classes, origin of structural elements, natural regeneration, productivity classes, management measures, variability, and successional tendencies (type forms, successional pathways, and forest facies).

Descriptions of forest ecosystems were based on field data collected during the study. Data analysis was performed using software tools such as Excel and ArcGIS.

The vertical and horizontal structure – specifically the crown projection pattern – of a mature stand was assessed through inventories carried out on a 2500 m^2 sample plot (50 m × 50 m), and the diagrams were processed using the SVS software, version 3.36.

After identifying the ecosystem types, mapping was conducted by examining all planning units and classifying them into types based on tree species composition, herbaceous–subshrub layer type, and humus type (Moţiu et al., 2011; Moţiu et al., 2012). The delimitation methodology of forest ecosystems was grounded in typological schemes previously developed for the study area (e.g., forest compartments) (Moţiu et al., 2011; Moţiu et al., 2012). Landscape units with non-native species plantations were classified into types according to the corresponding site type.

RESULTS AND DISCUSSIONS

TYPE OF ECOSYSTEM: 6133 *Common oak* stand with moder, on stagnant luvosols, oligomesobasic, hidric alternating on the surface, oligomezobazice, hidric alternante la suprafaţă, with *Agrostis-Carex brizoides* (regional version with *turkey oak*, *hungarian oak* and *sessil oak*)

Subtypes:

61332 highly productive subtype

61333 poorly productive subtype.

Spreading: this type of ecosystem is found exclusively on the Piedmont plain. It is widespread in U.P.II : Trup Pusta, U.P. III : Trup Belfir.

Characteristics of the type of ecosystem within the researched area:

a. Occupied area: 414,2 ha.

b. Forest sites:

- average altitude 136 m (variation difference 120-150 m);
- relief: by shape - medium and high plains; after inclination - no inclination; after the exhibition - flat terrain;
- type of rock: reddish clay;
- types and subtypes of soil: white-stagnic Luvosols and luvic Stagnosols;
- limiting ecological factors: excessive spring moisture (often with surface waterlogging), in dry years moisture deficit in the second half of summer.

c. The compositions of the stands: *Quercus robur*, in most cases exclusively; *Quercus petraea ssp. dalechampii*, *Quercus cerris*, and *Quercus frainetto* can be found disseminated.

d. The compositions of the understorey: *Frangula alnus, Crataegus monogyna, C. laevigata, Rubus caesius,Prunus spinosa, Rosa canina, Ligustrum vulgare, Evonymus europaeus.*

The understory is developed variably depending on the consistency of the forest, with coverage ranging from 5% to 50%.

e. The composition of the herbaceous layer: *Agrostis stolonifera (dominant), Carex brizoides, Deschampsia caespitosa, Polygonum hydropiper, Galium palustre, Lysimachia nummularia, Juncus effusus, Festuca pratensis, Lychnis flos-cuculi, Hieracium umbellatum, Molinia caerulea, Campanula patula, Veronica chamaedrys, V. officinalis; in some situations, the following species may also be encountered: Glechoma hirsuta, Vincetoxicum hirundinaria, Achillea millefolium, Hypericum hirsutum, Carex hirta, C. tomentosa, Festuca gigantea, Fragaria vesca.*

The herbaceous layer is highly developed, sometimes forming a dense cover, with coverage ranging from 50% to 95% of the surface depending on light availability. *Agrostis stolonifera*, *Carex brizoides*, and *Festuca heterophylla* can become particularly abundant, especially in open patches or in areas where the

stand has been more heavily thinned.

Figure 1: *Common oak stand with Agrostis stolonifera-Carex brizoides, u.a. 127, U.P.V Belfir-Hodişel area, (photo - P.T. Moțiu)*

Correspondence with:

- **Forest types[1]: 6154 -** *Common oak* stand with *Agrostis alba* of lower productivity (i).

- **Resort types[2]: 7.4.1.0 –** Hilly mixed oak stand with common oak (*Pm*), white and typical mesostagnic luvisols (± vertic, ± planic), stagnosols (± vertic, ± planic), planosols (± vertic), and small to medium edaphic soils.

- **Vegetable associations[3]:** - *Querco (robori) - Caricetum brisoidis Rațiu et all. '77; Carici brizoidi - Quercetum roboris Rațiu et al. '77 ;*

- **Type of habitat[4]:** - R4145 - Pannonian forests of pedunculate oak (*Quercus robur*) with *Carex brizoides.*

The current state of stands and management measures (peculiarities):

f. The structure of the stands: Figure 2 shows the distribution of the number of trees by diameters, and Figure 3 shows the vertical and horizontal structure of a representative arboretum, inventoried in 127, U.P.V. Composition of the tree: 10St diss. Ce,Gâ, 100 years old, number of trees per hectare: common oak - 380, tuekey oak - 8, hungarian oak - 4.

g. Distribution according to age intervals: 6-10 years - 13%; 11-20 years 1%; 21-40 years - 57%; 41-80 years - 14%; over 80 years - 15%.

h. The source of the main elements of the stand: Common oak - natural sowing 41%, shoots 3%, plantation and artificial seeding 56%.

[1]Forest types are cited from N. Doniță et al., 2005.
[2]Resort types are cited from F. Dănescu, C. Costăchescu, Elena Mihăil, 2010.
[3]Vegetal associations are cited from N. Doniță et al., 1990, and the types of new ecosystems, after V. Sanda, A. Popescu, D. I. Stanciu, 2001.
[4]The habitat types are cited from N. Doniță et al., 2005.

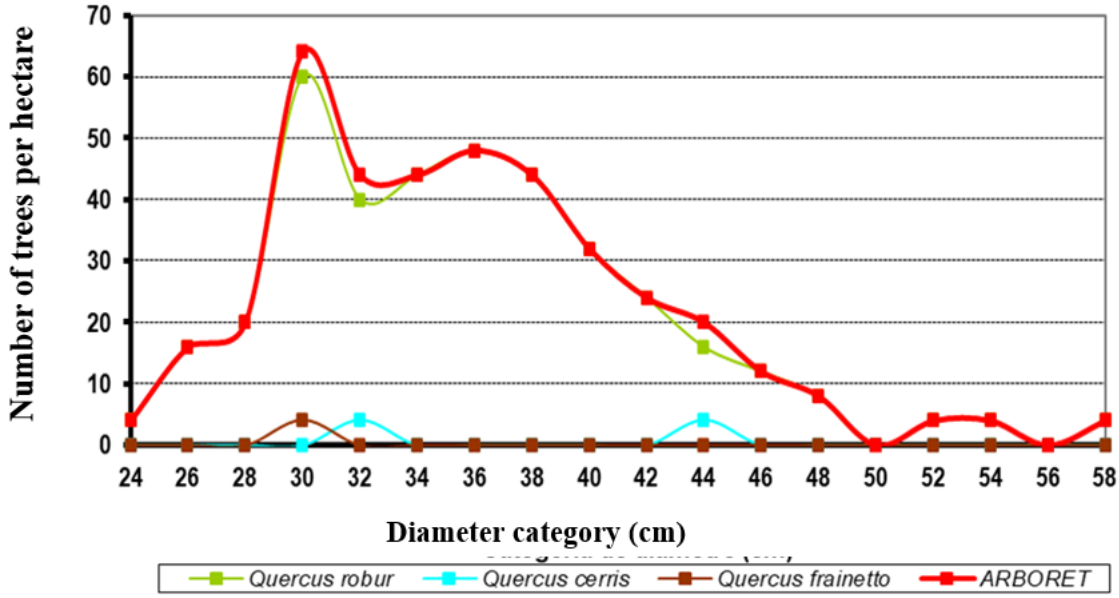
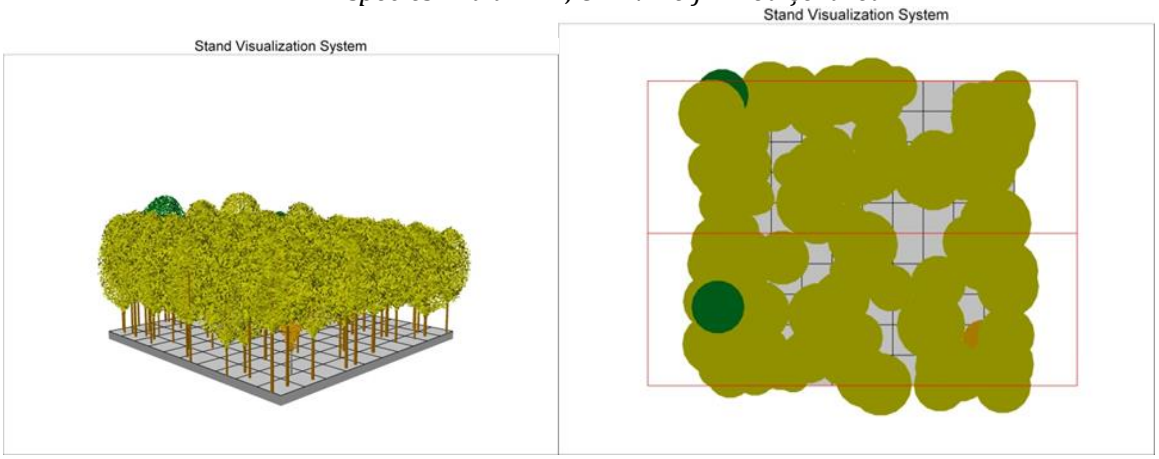


Fig. 2: *The distribution of tree numbers per hectar in stand, according to diameter cathegories and species in u.a. 127, U.P. V Belfir-Hodişel area*



Legend:

Quercus robur *Quercus cerris* *Quercus frainetto*

Fig. 3: *The diagram of vertical structure (left) and plan projection of the canopy (right) for test plot of 2500 sqm, using SVS software, 3.36 version, in u.a. 127, U.P. V Belfir-Hodişel area*

i. Production classes of the main species of the stand: Common oak cl IV/V.

j. Natural regeneration through seeding: pedunculate oak regenerates very slowly and only in more favorable microstations, on elevations (Doniță and co., 1990); the cause lies in poor fruiting and soil compaction by *Agrostis stolonifera*; turkey oak regenerates better, but only in micro-locations with better soil drainage.

k. The indicated target composition: 9 St 1Ju,Ar,Pă,Mă.

l. Management measures on age intervals: 0-5 years - decomposition of natural regenerations and/or plantations; 6-10 years - the preferential promotion of common oak by applying release cutting. It is mandatory to maintain mixed species (field maple, tatarian maple, and wild pear) to create a tree understorey (lower storey); 11-20 years - extraction specimens from shoots that are poorly formed or diseased (weak) by clearing; 21-40 years - designating future trees (grown from seed) of the pedunculate oak specie and

applying thinning combined with maintaining, as far as possible, other species of Quercus in order to increase the biodiversity of the tree layer; 41-80 years - continue promoting oak trees through light thinning combined around future trees, keeping the rest of the forest massif closed; over 80 years - application of hygiene cuts.

m. Other management measures: in pure oak stands, introducing field maple and and wild pear to create a necessary cultural tree understorey. Stands originating from shoots will be gradually converted through natural regeneration, if the stand is at fruit-bearing age, or through restoration. The ecological reconstruction of the fundamental type of natural forest ecosystem by substituting ecologically unsuitable stands of black locust, black pine, and red oak with stands of pedunculate oak, which is better adapted to the local site conditions. It is mandatory to supplement natural regeneration with direct sowing or planting in the case of pedunculate oak.

Recommended silvicultural measures: to prevent the crown-lifting phenomenon, which is frequently encountered in this forest type and caused by the absence of an understorey tree layer, tending and stand-management operations must be of low intensity, or at most moderate in situations where edaphic conditions are more favorable.

Hydrotechnical works are recommended, including the construction of drainage ditches and the clearing of existing ditches, as well as works aimed at improving biological drainage conditions.

n. Variability and successional trends (forms of type, successional tendencies and forest facies): in the surveyed area, this forest ecosystem presents a single form (the typical form); transitions to other types occur abruptly.

o. Observations: the herbaceous layer is composed of *Agrostis stolonifera*, which in most cases forms a continuous cover, interspersed with *Deschampsia caespitosa*, *Carex brizoides*, and patches of *Polygonum hydropiper*. *Frangula alnus* is present in all situations.

The understorey is generally poorly developed, with a cover of approximately 5% of the area.

The pedunculate oak can reach production class III, differentiating within this forest ecosystem type a medium-productive subtype.

The regional variant is determined by the presence of turkey oak, hungarian oak, sessile oak, and a medium-productivity subtype.

CONCLUSIONS

Within this research, we aimed to establish the ecosystem-based forest types existing in a territory that is smaller but representative of the high plain units within the Tinca Forest District, to assess the current status of these types and propose appropriate management measures to bring the forest types as close as possible to their natural state.

On plains with oligo-loamy and oligo-mezo-basic soils, covering large areas and subject to strongly fluctuating moisture both at the surface and within the soil, a well-established biocenosis develops, dominated by pedunculate oak (*Quercus robur*) alongside a few mixed species, with the herbaceous layer rich in swamp species.

The priority is to establish forest types on small geographic units at the landscape level, thereby endowing the typology with a pronounced regional character.

Under these site conditions, particularly due to limiting factors such as excessive spring moisture, often with surface waterlogging, and summer moisture deficits in dry years, pedunculate oak (*Quercus robur*) is the best-adapted species, forming pure or nearly pure stands.

The *Agrostis – Carex brizoides* herbaceous – shrub layer is best adapted to these site conditions; together with other characteristic and frequent accompanying species, it forms the core of constant species, serving as indicators of this forest ecosystem.

To prevent soil drying in the middle and towards the end of the growing season, it is very important to promote the development of the understorey to a cover of up to 30% of the area.

It is very important to promote and maintain biodiversity in the tree layer with species from the genus *Quercus*, up to the level of facies-forming proportions, as well as secondary and supporting species.

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