RESEARCH ON 5225 FOREST ECOSYSTEM TYPE SESSIL OAK WITH COMMON HORNBEAM MIXED STAND WITH CAREX PILOSA (REGIONAL VERSION WITH TURKEY OAK AND WITH A HIGHLY PRODUCTIVE SUBTYPE) WITHIN THE SEGMENT OF LANDSCAPE SITUATED ON LOW WESTERN HILLS OF TINCA FOREST DISTRICT

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RESEARCH ARTICLE

Abstract

The problem of establishing regional typological units is now the order of the day, but through new approaches, both theoretically and methodologically. In the research undertaken, the concept and method of establishing the types and their regional variants existing in Romanian works was adopted, but with more depth regarding the study of soils and phytocenoses.

Forest typology evolved from the necessity of differentiating management measures of the forests according to composition, structure, productivity, features of the stands, i.e. after their eco-systemic features (Doniță et al., 1990). In this type of forest ecosystem the nucleus of constant species consists of: Quercus petraea ssp. Polycarpa, Quercus petraea ssp. dalechampii, Carpinus betulus, Quercus cerris, Crataegus monogyna, Rubus hirtus, Ligustrum vulgare, Cornus sanguinea, Rosa canina, Carex pilosa, Dactylis polygama, Melica uniflora, Cruciata laevipes, Stellaria holostea, Galium schultesii, Ajuga reptans, Geranium robertianum, Stachys sylvatica, Mycelis muralis, Euphorbia amygdaloides, Lapsana communis, Veronica officinalis, Festuca heterophylla, Glechoma hirsuta, Carex sylvatica, C. divulsa, Fragaria vesca, Hypericum perforatum, Campanula persicifolia, Fagopyrum convolvulus.

Keywords: forest ecosystems, geographical segment landscape, ecological landscape environment, sustainable forestry

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INTRODUCTION

This priority of this period is to establish types of forests ecosystems on small geographic units, at the level of landscapes, the typology having thus a strong regional feature.

We tried, as the research of this paper to establish ecosystem-based forest type principal existing in a territory smaller but representative low western hill within Tinca Forest District, to state the current status of types and propose appropriate management measures this state and designed to bring a type similar to the natural state.

The Low Hills, situated in the southwestern part of the study area, have average altitudes of 200-300 m, have reduced vertical fragmentation, with flat or slightly curved interfluves, elongated slopes and mid values inclinations. The valleys are rare, the clay deposits conditioning the formation of heavy soils, and on slopes the clay-loam deposits, with alternation of sand and gravel deposits, conditioning the formation of normal hydric soils.

The relief is fragmented by valleys, the slopes being the main relief form, but also extended plateaus. On slopes, the sedimentary formations of sand, loam, clay, gravel, caused the formation of basic stagnic luvisols, at most mid basic, with a well-balanced hydric regime and on few areas eutricambosoils, more fertile and with a well-balanced hydric regime.

The aim of the study was to establish the main forest ecosystem type within Tinca Forest District and to establish the state of these ecosystems in order to find the best management solution for a sustainable use, preserving and conserving the optimum biodiversity of the forest. The aim of the research was also the scientific fundamentation, very useful both in forest management and in applied forestry, in order to find the best management solutions for a sustainable use.

The soil indicators herbaceous and shrub layer consists of: *Festuca drymeja, Carex pilosa, Asperula-Asarum-Stellaria.* These types characterize stationary low-hill ecosystems where there are also soils with higher trophic levels, with balanced hydric regime, due to richer precipitation and permeable soils. Also, in the western low hills we meet: *Genista-Glechoma-Geum* type. This characterizes the ecosystems on moderately acid - weakly acid soils, with more a medium trophicity and with a quasi-balanced water hydric regime.

MATERIAL AND METHOD

The locations of the research are the forests administrated by Tinca Forest District; the study has started in 2023 and continued in 2024.

The forest ecosystems were analyzed according to **location** within the study area; **the features of the ecosystem type**: surface area, geographical parameters (average altitude, altitude range); relief forms: types, inclination of the slopes, slope exposition, lithology, soil types and subtypes, ecological limitative factors); the description of the stands, the description of the herbaceous layer; the **correspondence with**: types of forests, types of stations, plant associations, types of habitat, **present state of the stands and management measures (particularities)**: main features, distribution according to age classes, the source of main elements, natural regeneration, productivity classes, management measures, variability and succession tendency (forms of type, successional tendencies and forest facies).

The description of the forest ecosystem was made based on collected field data. In order to analyze the collected data were used different softwares, such as Excel, ArcGis.

After determining the types, they were mapped by researching all the planning units and classifying them into types, considering the composition of the trees, the type of grass-subshrub layer, the type of humus (Moţiu and co., 2011; Moţiu and co., 2012). The delimitation method of the forest ecosystems had as base some typological schemes made for the study area (for ex forest corps) (Moţiu and co., 2011; Moţiu and co., 2012). The landscaping units with non-native species cultures were classified into types based on the type of resort.

RESULTS AND DISCUSSIONS

TYPE OF ECOSYSTEM: 5225 Sessil oak with common hornbeam mixed stand medium-productive, with mull-moder, on stagnant luvosols, meso- and oligo-mesobasic, hydric quasi-equilibrium and alternating on profile, with Carex pilosa (regional variant with Turkey oak and a highly productive subtype)

Subtypes:

52251 highly productive subtype

52252 mid productive subtype.

Dispersion: this type of forest ecosystem is distributed in the low hills within: U.P.III - Trup Pădurea Gorunului, Trup Gânţei; U.P.IV - Trup Miheleu - Topile, Trup Dumbrava, Trup Valea Mare, Trup Holod - Hodiş, Trup Forosig Trup Cărăndeni, Trup Bicăcel, Trup Miheleu; U.P.V - Trup Hodişel, Trup Măgura.

Characteristics of the type of ecosystem within the researched area:

a. Surface: 787 ha.

b. Forest resorts:

- average altitude 219 m (altitude variation 155-280 m);
- relief: by shape - middle and lower slope; by slope: moderate and steep slopes; after the exhibition - mostly shady or partly sunny slopes, rarely on sunny slopes;
- type of rock: sands alternating with sandy clays; clays, gravels, sands; red clay, gravels, sands;
- types and subtypes of soil: Typical and stagnant Luvosol, very little typical and molic Eutricambosol;
- limiting ecological factors: on steeper slopes medium edaphic volume, higher compaction in the Btw horizon, on partly sunny and sunny slopes low humidity in the second part of summer.

c. Compositions of the stands: in the dominant floor of *Quercus petraea ssp. Polycarpa* (in high proportions), disseminated may appear *Quercus petraea ssp. dalechampii, Quercus cerris* and *Prunus avium;* in the dominated floor it is met *Carpinus betulus* varied coverage of 5% - 80% of the area. In some situations Sorbus torminalis may occur with low frequency.

d. Compositions of the sub-stands: *Crataegus monogyna, Rubus hirtus, Ligustrum vulgare, Cornus sanguinea* and *Rosa canina* may occur less frequently. Shrubs are generally variably developed and unevenly scattered, depending on the shading of the hornbeam understory, with 5% to 25% cover. *Carpinus betulus* is also present in the understory; *Ulmus procera* can also be found in some situations.

The subtree is variably developed,

covering 10% - 50% of the surface, depending on the degree of illumination.

e. Composition of the herbaceous layer: *Carex pilosa, Dactylis polygama, Melica uniflora, Cruciata laevipes, Stellaria holostea, Galium schultesii, Ajuga reptans, Geranium robertianum, Stachys sylvatica, Mycelis muralis, Euphorbia amygdaloides, Lapsana communis, Veronica officinalis, Festuca heterophylla, Glechoma hirsuta, Carex sylvatica, C. divulsa, Fragaria vesca, Hypericum perforatum, Campanula persicifolia, Fagopyrum convolvulus.*

Among the sub-shrubs are *Chamaecytisus hirsutus* and *Genista tinctoria*.

In some situations they can also be found: *Viola reichenbachiana, Poa nemoralis, Festuca drymeja, Potentilla micrantha, Lychnis coronaria, Calamagrostis epigeios, Veronica chamaedrys, Agrostis stolonifera, Lysimachia nummularia, L. vulgaris, Carex praecox, Peucedanum carvifolium*.

The grass cover is developed unevenly, in patches, depending on the degree of shading, covering 20-30% of the surface.

Figure 1: *Sessil oak with common hornbeam mixed stand with Carex pilosa in u.a. 72B, U.P.V Belfir-Hodișel area, (photo - P.T. Moțiu)*

Correspondence with:

- **Forest types[2]: : 5323** - *Sessil oak mixed stand* medium productivity (m)(situations without Tilia);

- **Resort types[3]: 6.3.1.1.** – Hilly oak (Sessile oak, Quercus cerris **±** Quercus frainetto) Pm, luvosols, including whitish luvosols (**± hypostagnic**) medium edaphic, with mesoxerophyte grasses; **6.3.1.2.** - Quercus frainetto (Quercus petraea, Quercus petraea - elms, hilly elm with Sessile oak **± Quercus cerris, Quercus frainetto)** Ps, luvosols (**± hypostagnic**), highly edaphic, with mesoxerophytic grasses and elements of mull flora;

- **Vegetable associations[4]:** *Lathyra (hallersteinii) - Carpinetum Coldea '75;*

- **Type of habitat[5]: R4132** - Dacian forests of sessile oak (*Quercus petraea*), beech (*Fagus sylvatica*) and hornbeam (*Carpinus betulus*) with *Carex pilosa*.

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 u.a.72B, U.P.V.

g. Distribution according to age intervals: 0-5 years old - 1%; 6-10 years old - 13%; 11-20 years old - 30%; 21-40 years old - 33%; 41-80 years old - 21%; over 80 years old - 2%.

h. The source of the main elements of the stand: sessile oak - natural sowing 8%, shoots 33%, plantation 59%; common hornbeam - natural sowing 15%, shoots 85%;

[2]Forest types are cited from N. Doniță et al., 2005.

[3]Resort types are cited from F. Dănescu, C. Costăchescu, Elena Mihăil, 2010.

[4]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.

[5]The habitat types are cited from N. Doniță et al., 2005.

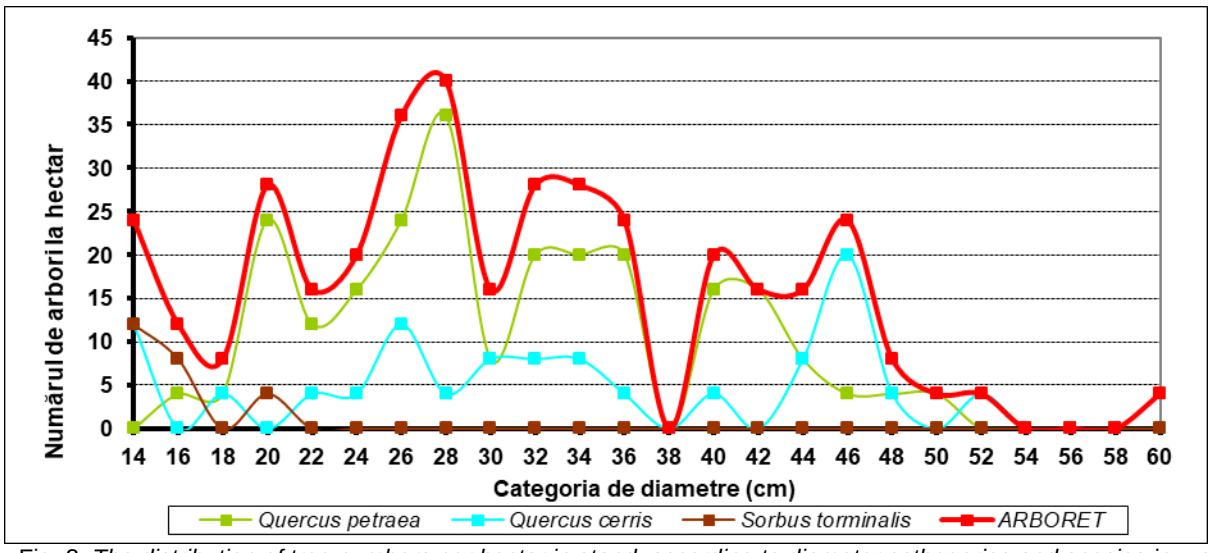
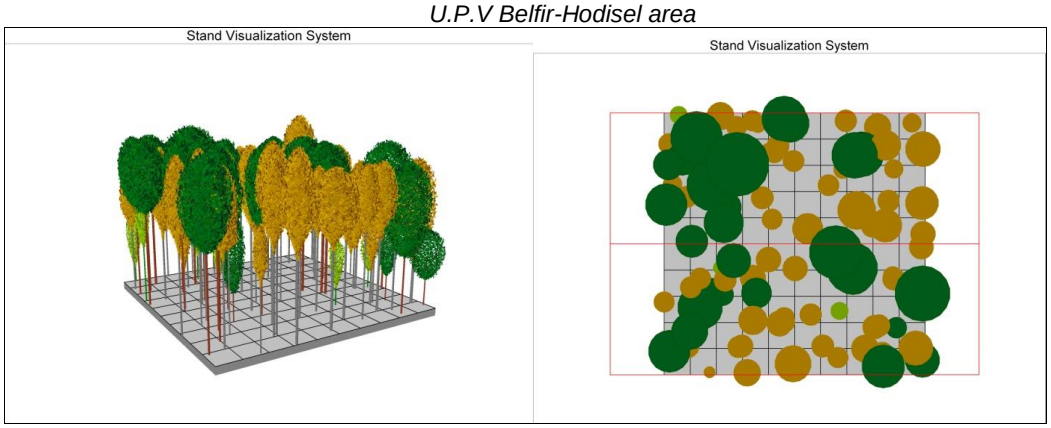


Fig. 2: *The distribution of tree numbers per hectar in stand, according to diameter cathegories and species in u.a. 72B, U.P.V Belfir-Hodisel area*



Legend:

Quercus petraea *Quercus cerris* *Sorbus torminalis*

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. 72B, U.P.V Belfir-Hodisel area*

i. Production classes of the main species of the stand: Go cl III; Ca cl III/IV; Ce cl III.

j. Natural regeneration through seeding: the sessil oak regenerates very well, the turkey oak and the other species regenerate well, the hornbeam abundantly; the quercines encounter difficulties from the hornbeam seed. We encounter situations with total regeneration in sessil oak (Moţiu and Bartha, 2006), but the lack of sufficient light and fierce hornet competition lead to the complete elimination of the sessil oak seed.

k. Indicated composition: 7Go 1Ci,Pa 2Ca.

l. Management measures on age intervals: 0-5 years - uncovering natural regenerations and/or plantations; 6-10 years – the promotion of vigorous, well-conformed gorun specimens and valuable mixed species through the application of removal. It is obligatory to maintain the species of help (field maple, beam tree, hornbeam) in order to create a vegetation layer; 11-20 years - the proportioning of the mixture in accordance with the set target composition, through cleanings, the maintenance of valuable sessile oak specimens and of the mixture and aid species; 21-40 years - designation of future trees (from seed) of the main basic species – sessile oak, but also of the main mixed species (sycamore maple, plane maple tree) in order to increase the biodiversity of the tree stand and the application of combined thinning around these trees; 41-80 years - continue to promote the trees of the future by combined light intensive

thinning around them, keeping the rest of the stand closed; over 80 years - applying hygiene cuts.

m. Other management measures: keeping the stand structure closed.

Shoots should be converted gradually, as far as possible by natural regeneration (if the stand is of fruiting age) or by restoration. In the case of crops with ecologically non-indicated and seasonally unsuitable species (European black pine, Scots pine, acacia, American red oak, spruce, European larch), and pioneer species (European aspen, goat willow, European white birch); ecological reconstruction of the basic natural forest ecosystem type is recommended, by replacing them with native species adapted to local seasonal conditions. The only exception is Douglas fir, which in pure cultures, under favorable seasonal conditions, achieves very good growth and excellent wood quality (Moțiu, 2004). It is recommended to keep the hornbeam under control, to extract in time (before fruiting) the European aspen and the goat willow, which tend to eliminate the sessil oak and other mixed species. On sites with a greater abundance of undergrowth, work to aid natural regeneration is mandatory in years with abundant sessile oak fruiting.

It is also recommended to reconstruct the basic natural type of forest ecosystem in the case of partially or totally derived stands of hornbeam by substitution.

n. Variability and successional trends (forms of type, successional tendencies and forest facies):

in the situations with trophic soils - Eutricambosols (in the lower third of the slopes) the sessil oak is in the second production class, (in places) the succession to ecosystem type 5216 – Sessil oak stand with hornbeam, with Asperula-Asarum-Stellaria; the turkey oak is in some situations in the facies proportion.

o. Observations: gorun, but also the sky (present in the sky facies) can realize class II production, differentiating within this type of forest ecosystem also a highly productive subtype.

The ecosystem type 5225 – Sessil oak with hornbeam with Carex pilosa, is a stable type, the sessil oak regenerates very well from seed - stands with total regeneration (Moțiu and Bartha, 2006). In the investigated territory the regional variant with turkey oak and a highly productive subtype are formed.

CONCLUSIONS

The regional variants of forest ecosystem types arise due to the influence of regional variants of climate and soil – pedogenetic sub-layers. Knowing the physical-geographical conditions of the territory in which researches were carried out, are important for knowing the ecological complex of factors and determinants of the forest ecosystem biotope (forestry resort). The present work is a case study for the development of the regional ecosystem forest typology.

Regarding the regional particularities of ecosystem type

The regional variant of the sessile oak ecosystem type with hornbeam with Carex pilosa is given by the presence of the turkey oak in the dominant stage, from disseminated to facies proportion and by the existence of a highly productive subtype, where the sessil oak realizes the second production class, in forest resorts with trophic soils - Eutricambosols (in the lower third of the slopes).

Silvicultural recommendation

Keeping hornbeam regeneration under control, within the application of silvicultural treatments, to achieve the succession of stands in good conditions, with optimal compositions for the type of forest ecosystem. Preparatory cuts are mandatory to extract badly shaped hornbeam specimens with defects, especially those originating from shoots; thus avoiding the transmission of their genetic characteristics in the future stand, improving the gene pool of the hornbeam population and at the same time, maintaining the desired proportion of hornbeam.

It is recommended to reconstruct the basic natural type of forest ecosystem in the case of partially or totally derived stands of hornbeam by substitution. Ecological reconstruction of the basic natural forest ecosystem type is recommended, replacing ecologically unsuitable and seasonally unsuitable species (European black pine, Scots pine, acacia, American red oak, spruce, European larch) and pioneer species (European aspen, goat willow, European white birch) with native species adapted to forest resorts conditions.

Regarding forestry measures by type of forest culture have revealed that there were concerns relating to differentiating normal types but not about their current condition as a result of more or less proper management

methods. Forester practitioner is forced to differentiate on the basis of this action and the current state of forest types that manage them.

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