Annals of the University of Oradea, Fascicle: Environmental Protection, doi.org/10.5281/zenodo.4362307, Vol. XXXV, 2020
Analele Universităţii din Oradea, Fascicula: Protecţia Mediului, doi.org/10.5281/zenodo.4362307, Vol. XXXV, 2020

RESEARCH ON 4636 FOREST ECOSYSTEM TYPE SESSIL OAK-EUROPEAN BEECH MIXED STAND WITH FESTUCA DRIMEJA (REGIONAL VERSION WITH COMMON HORNBEAN AND TURKEY OAK) WITHIN THE SEGMENT OF LANDSCAPE SITUATED ON LOW WESTERN HILLS OF TINCA FOREST DISTRICT

Moţiu Petrică Tudor*

* University of Oradea, Faculty of Environmental Protection, 26 Gen. Magheru St., 410048, Oradea, Romania, e-mail: tudor_motiu@yahoo.com

Abstract

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).

Key words: forest ecosystems, geographical segment landscape, forest typology, sustainable forestry.

INTRODUCTION

The researches were made in Crisul Negru Plain and Tasadului Hills, the forests belonging to Tinca Forest Office. The area is situated in the south-western part of Bihor county and the relief in characterised by plains and small hills (up to 300 m).

The Low Hills, situated in the south western 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 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 is consisted of: *Festuca drymeja, Carex pilosa, Dactylis polygama, Melica uniflora, 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-Festuca heterophylla* type. This characterizes the ecosystems on acid soils, with more a reduced trophic level, and with a quasi-balanced water hydric regime alternating on the profile.

MATERIAL AND METHOD

The locations of the research are the forests administrated by Tinca Forest District; the study has started in 2019 and continued in 2020.

The establishment of typological units (types of ecosystems) was made using the method of synthetic systemic indicators evaluating phytocoenosis, climate indicator forest plants and edaphic conditions: acidity, humidity, humus content, compactness. The use of phyto indicators is based on the principles of modern ecology according to which the plants, as primary producers and the phytocoenosis which they make up, exactly reflects not only the complex abiotic ecological factors, decisive for forest biocoenosis but also the nature and the functionality of these biocoenosises which finally represents the productivity of the forest ecosystem.

The forest ecosystems were analysed 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 analyse 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, taking into account the composition of the trees, the type of grass-subshrub layer, the type of humus. (Moțiu et al., 2011; Moțiu et al., 2012). The delimitation method of the forest ecosystems had as base some typological schemes made for the

study area (for ex forest corps) (Moțiu et al., 2011; Moțiu et al., 2012). The landscaping units with non-native species cultures were classified into types based on the type of resort.

RESULTS AND DISSCUSIONS

TYPE OF ECOSYSTEM: 4636 Highly and medium productive European Beech with sessile oak, with moder (mull-moder), on oligomezobasic, hydric balanced brown luvic soils and luvisols, with Festuca drymeja (regional variant with hornbeam and Quercus cerris**).**

Subtypes: 46361 highly productive subtype;

46362 middle productive subtype.

Spreading: this type of ecosystem is widespread on the low hills, in: U.P.III - Trup Între Pâraie, Trup Gânței; U.P.IV - Trup Miheleu - Topile, Trup Valea Mare, Trup Holod - Hodiș; U.P. V - Trup Măgura.

Characteristics of the type of ecosystem within the researched area:

a. Occupied area: 115,7 ha.

b. Resorts:

- average altitude 215 m (variation difference 170-270 m);
- relief: by shape - middle and lower slope; after inclination - moderate and strong slopes; after the exhibition - especially on shady slopes and a little on partly sunny or sunny;
- rock: sands alternating with sandy clays;
- types and subtypes of soil: Typical and stagnant Luvisol, Typical and mollic Eutricambosoil;
- limiting ecological factors: in some situations soil with medium edaphic volume and medium trophicity; the lower slopes are an exception, where the edaphic volume is higher, the soil moisture regime is balanced and the soil trophicity is increased. Among the limiting factors we also mention the lack of heat in the soil in the winter season.

c. The composition of the stands: in the dominant floor *Quercus petraea ssp. polycarpa and Fagus sylvatica* (in various proportions), sometimes even *Carpinus betulus*; in some cases we find *Quercus cerris* (disseminated or in proportion of facies) and *Prunus avium* (in rare cases); in the dominant floor we find *Carpinus betulus* with variable coverage, of 5% - 50% of the surface, competes and endangers the main basic species. In some situations it can be encountered, with reduced frequency *Pyrus pyraster*.

d. The composition of the subshrubs: *Crataegus monogyna, Rubus hirtus, Ligustrum vulgare; Cornus sanguinea and Rosa canina* may occur

with reduced frequency. Shrubs are generally poorly developed and spread unevenly, depending on the shading of the hornbeam subfloor, with coverage of up to 5% of the surface. *Carpinus betulus* it is also present in the subshrub, with coverage of 5% - 10% of the surface.

The subshrub is poorly developed, with coverage of up to 10% of the surface, depending on the degree of illumination.

e. The composition of the herbaceous layer: *Festuca drymeja*, *Carex pilosa, Dactylis polygama, Melica uniflora, Cruciata glabra, Stellaria holostea, G. schultesii, Geranium robertianum, Mycelis muralis, Viola reichenbachiana, Pulmonaria officinalis, Dentaria bulbifera, D. glandulosa, Stachys sylvatica, Circaea lutetiana, Anemone nemorosa, Carex sylvatica, C. digitata, Fragaria vesca.*

In some situations may be encountered: *Stellaria graminea, Cruciata laevipes, Scrophularia nodosa, Urtica dioica, Brachypodium sylvaticum, Galium molugo, Potentilla micrantha, Veronica officinalis, V. chamaedrys, Carex praecox, Hypericum perforatum.*

Among the subshrub species can be found: *Genista tinctoria, Cytisus nigricans, Chamaecytisus hirsutus and Vinca minor*.

The grass layer is unevenly developed, in patches, depending on the degree of shading, with coverage of 10% - 30% of the surface.

Correspondence with:

- **forest types: 5231** – sessile - beech with *Festuca drymeja* (m); **5311** – sessile oak – forests with beech of higher productivity (situations without lime); **5313** - sessile oak - forests with beech of average productivity (m) (situations without lime);
- **resort types: 6.9.1.1.** - Hilly mixed oak stand with lower limit beeches Pm, luvisols, including whitish luvisols (± **hipostagnic**), medium edaphic; **6.9.1.2.** - Hilly mixed oak stand with lower limit beeches Pm, luvisols, including whitish luvisols (± **hipostagnic**), highly edaphic;
- **plant associations:** -;
- **habitat type: R4129** - Dacian oak forests (*Quercus petraea*) and beech (*Fagus sylvatica*) with *Festuca drymeja*.

The current state of the stands and management measures (particularities):

f. The structure of the trees: in figure 6.14 is presented, the distribution of the number of trees by diameter categories, and in figure 6.15, the vertical and horizontal structure of a representative tree inventoried in the u.a. 93E, U.P.IV. The composition of the stand: 6Fa 4Go disCa, age 105 years, number of trees per hectare: beech - 180, sessile oak - 108, hornbeam - 16.

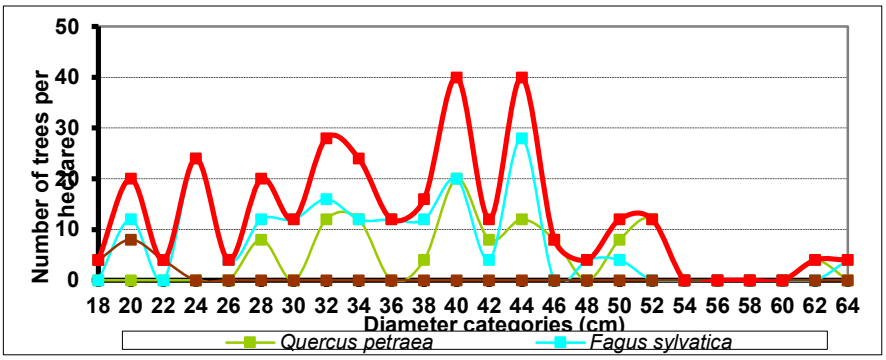
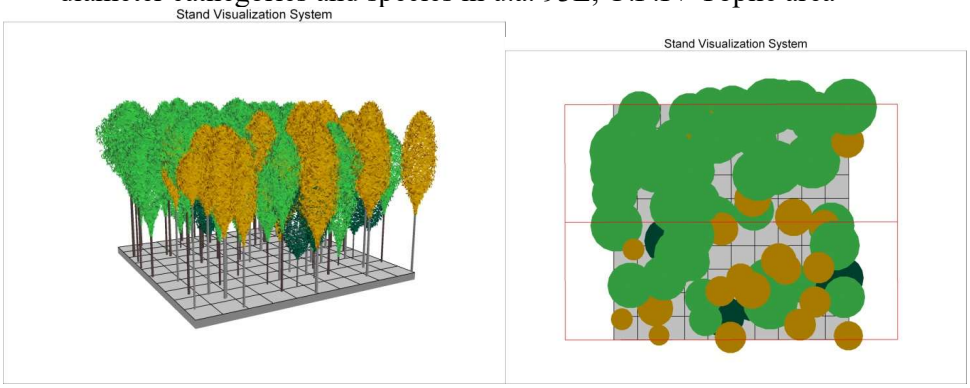


Fig. 1 The distribution of tree numbers per hectar in stand, according to diameter cathegories and species in u.a. 93E, U.P.IV Topile area



Legend:

Fagus sylvatica *Quercus petraea* *Carpinus betulus*

Fig. 2 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. 93E, U.P.IV Topile area

Photo 1: *Sessile oak and European beech mixed stand with Festuca drymeja, u.a. 93E, U.P.IV Topile area (photo - P.T. Moțiu)*

g. Distribution by age range: 5-10 years - 3%; 21-40 years - 1%; 41-80 years - 51%; over 81 years - 45%.

h. The origin of the main elements of the tree: sessile oak - natural sowing 58%, sprout 34%, plantation 8%; beech - natural sowing 96%, sprout 4%; hornbeam - natural sowing 43%, sprout 57%.

i. Production class of the main tree elements: Sessile oak cl II/III; Beech cl III/IV; Hornbeam cl II 25,6%; Hornbeam cl III 34,3%; Hornbeam cl III/IV.

j. Natural regeneration: sessile oak regenerates well, beech regenerates very well, the hornbeam abundantly; the sessile oak encounters difficulties from the hornbeam and beech seed.

k. The indicated target composition: 5Go 2Fa 2Pam,Ci, Fr 1Ca.

l. Age management measures: 0-5 years - clearing of natural regenerations and / or plantations through works carried out on time and with perseverance on age ranges; 6-10 years - promoting vigorous sessile oak and beech specimens, as well as valuable well-formed mixed species, by applying clearances. It is mandatory to maintain the auxiliary species (rowanberries, hornbeam) to create a subfloor; 11-20 years - proportion of the mixture according to the fixed target composition, by cleaning, maintaining valuable specimens of sessile oak, mixed and auxiliary species;

21-40 years - designation of future trees (derived from seed) from the main basic species - sessile oak and beech (derived from seed) and from the main mixed species (mountain maple, field maple) and their promotion by combined thinning; 41-80 years - continuing to promote the future trees, through combined thinning around them, keeping the rest of the massif closed; over 80 years applying hygiene and preparatory cuts. Recommended treatment: progressive cuts.

m. Other management measures: introduction of mixed species (mountain maple) and secondary species (auxiliary) (preferably rowanberries) into the composition of the tree. Keeping the structure of the stands vertically closed. Shrubs from sprouts will be converted gradually, as much as possible by natural regeneration (if the tree is at the age of fruiting) or by restoration. It is recommended to increase the proportion of participation of sessile oak in the composition of trees through plantations in addition to natural regenerations; to control beech and hornbeam, to extract in time (before fruiting) the aspen and the willow, species that tend to eliminate sessile oak and other mixed species. In places with greater abundance of the sub floor and the sub-tree level, the works to help the natural regeneration in the years with abundant fruiting of the sessile oak are mandatory.

It is also recommended to reconstruct the fundamental natural type of forest ecosystem, in the case of stands partially derived with hornbeam by substitution.

n. Variability and successive tendencies (forms of the type, successive tendencies and silvofacies): in the researched territory we meet the geographical variant with hornbeam; within it we distinguish: the situation (form) with dry soils – wet in the summer season (form with less hornbeam) and the situation (form) with loose soils, wet – damp in the summer season, in the upper horizons with glomerular structure and mull type humus (the form with more hornbeam) with Eutricambosoil soil type.

Within this type of forest ecosystem, the natural tendency is to eliminate the sessile oak by beech and hornbeam, producing the succession to beech-hornbeam; in some situations the hornbeam achieves proportions of 70 - 80% in the composition of the stands, tending to eliminate the beech, leading the succession to the hornbeams by substitution.

o. Other type-specific features: the main basic species, sessile oak and beech, but also hornbeam, can achieve the second class of production, differentiating within this type of forest ecosystem and a highly productive subtype.

Artificial sowings are missing and the plantations are few (1.3 ha with sessile oak, 0.7 ha with mountain maple and 0.3 ha with oak), so the

man intervened a little with artificial regenerations, moreover just directed the natural regeneration.

The hornbeam, sometimes also the Quercus cerris - on sunny and partially sunny slopes, makes facies within the type, determining the regional variant of the type.

CONCLUSIONS

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) (Chiriţă et al., 1964; Chiriţă et al., 1977). Therefore, it is evident that the regional variants of forest ecosystem types arise due to the influence of regional variants of climate and soil – paedogenetic sub-layers. The identification and description of types of forest ecosystems on smaller geographical units, from the level of landscapes (landschaft), in order to establish the ecological specificity within a certain territorial unit and the establishment of some sustainable management measures, gives the forest typology a strong regional feature (Doniță, 2004).

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

In this type of forest ecosystem, the core constant species consists of: Fagus sylvatica, Carpinus betulus, Rubus hirtus, Festuca drymeja, Lamium galeobdolon, Galium odoratum, Anemone nemorosa, Asarum europaeum, Dryopteris filix-mas.

Main proposals for forest management on the composition of the investigated stands:

- Increasing proportions of sessile oak in the regeneration from European beech-sessile oak mixed stands up to 40%.
- Maintaining hornbeam in the mixture, wherever presented in proportions of at least 30%.

Regarding forestry measures by type of forest culture have revealed that there were concerns relating to differentiating normal types but not the present state of the as result of more or less proper management methods. Forester practitioner is forced to differentiate based on this action and the current state of forest types that manages them.

REFERENCES

1. Beldie Al., Chiriţă C., 1967, Flora indicatoare din pădurile noastre. Editura Agro-silvică, Bucureşti.
2. Ciocârlan, V., 2000, Flora ilustrată a României. Editura Ceres, București.

3. Chiriţă C., Tufescu V., Beldie Al., Ceucă G., Haring P., Stănescu V., Toma G., Tomescu Aurora, Vlad I., 1964, Fundamentele naturalistice şi metodologice ale tipologiei şi cartării staţionale forestiere, Editura Academiei, Bucureşti.
4. Chiriţă C., Vlad I., Păunescu C., Pătrăşcoiu N., Roşu C., Iancu I., 1977, Staţiuni forestiere, Editura Academiei R.S.R., Bucureşti, p. 518.
5. Cristea, V., Gafta, D., Pedrotti, F. 2004, Fitosociologie, Editura Universitară Clujeană, ClujNapoca.
6. Dănescu F., Costăchescu C., Drăgan Dorina, 2010, Corelarea Sistemului român de clasificare a solurilor cu (SRCS, 1980) cu Sistemul român de taxonomie a solurilor (SRTS, 2003), Editura Silvică, București p. 80.
7. Dănescu F., Costăchescu C., Mihăilă Elena, 2010, Sistematica stațiunilor forestiere, Editura Silvică, București, p. 253.
8. Doniţă N., 2004, Tipologia forestieră integrată şi sarcini de viitor ale tipologiei forestiere în România, Revista Pădurilor, No. 2/2004.
9. Doniță N., Chiriță C., Stănescu V. et al., 1990, Tipuri de ecosisteme forestiere din România, C.M.D.P.A., I.C.A.S., București.
10. Doniţă N., Popescu A., Păucă-Comănescu Mihaela, Mihăilescu Simona, Biriş I., 2005, Habitatele din România, Editura Tehnică Silvică, Bucureşti.
11. Doniţă N., Borlea F., Turcu D., 2006, Cultura pădurilor. Editura Eurobit, Timişoara, p. 367.
12. Florescu I., Nicolescu N., 1996, Silvicultura, Vol. I, Studiul pădurii, Editura Lux Libris, Braşov, p. 210.
13. Florea, N., Munteanu, I., 2003, Sistemul român de taxonomie a solurilor (SRTS), Editura Esfalia, București.
14. Florescu I., Nicolescu N., 1998, Silvicultura, Vol. II, Silvotehnica, Editura Universităţii Transilvania din Braşov, p. 194.
15. Giurgiu V., 2004, Probleme actuale ale tipologiei forestiere Româneşti, RevistaPădurilor, No. 2/2004.
16. Mc.Gaughey, Robert J., 1999, Stand Vizualisation System (SVS vers. 3.36). USDA Forest Service, Pacific Northwest Research Station.
17. Moţiu P.T., 2004, Caracteristici dendrometrice ale unor specii alohtone cultivate în O.S. Tinca, Jud. Bihor, Analele Universităţii din Oradea, Fascicula Silvicultură, pp. 135-144.
18. Motiu P.T., Bartha Sz., 2006, Progresive clear-strip felling simplified in total regeneration stand, The 4thInternatinal Symposium „Natural resources and sustainable development", Annals of the University of Oradea, Forestry Fascicula, University of Oradea Printing House, pp. 407-410.
19. Moțiu, P.T., 2011, Typological research of forest ecosystems from Crișul Negru Plain and Hills of Tășad. „Risk Factors for Environment and Food Safety". EdituraUniversității din Oradea, pg. 580 -588.
20. Moțiu P.T., 2011. Contributions to sustainable management measures, based on the type of forests from Crișul Negru Plain and Hills of Tășad. „Risk Factors for Environment and Food Safety". EdituraUniversității din Oradea, pg. 589 - 598.
21. Moțiu P.T., Bucur L., Nistor S., 2011, Contribution to the typological substantiation of the forestry using gis tools in Crișul Negru plain and Tășadului Hills, "Risk Factors for Environment and Food Safety", Annals of the University of Oradea, Forestry Fascicula, University of Oradea Printing House, pp. 572-579.
22. Moțiu P.T., Bucur L., Nistor S., 2012, Researches on types of forest ecosystems in the Crisul Negru Low Plain, „Risk Factors for Environment and Food Safety", Annals of the University of Oradea, Forestry Fascicula, University of Oradea Printing House, pp. 516-529.

23. Moțiu P.T., Bucur L., Nistor S., 2012, The methodology of elaboration researches regarding typology studies and typological mapping of forest ecosystems in Crisul Negru Plain and Tasadului Hills, „Risk Factors for Environment and Food Safety", Annals of the University of Oradea, Forestry Fascicula, University of Oradea Printing House, pp. 507-516.
24. Moțiu P.T., Bucur L., Nistor S., 2013, Research on 5225 forest ecosystem type sessil oak with common hornbeam with Carex pilosa within the segment of landscape situated on low hills of Tinca forest district. „Risk Factors for Environment and Food Safety". EdituraUniversităţii din Oradea, p. 453 - 462.
25. Motiu P. T., Bucur L., Nistor S., 2013, Research on 7214 forest ecosystem type turkey oak with common hornbeam with Arum-Brachypodium within the segment of landscape situated on high plain of Tinca forest district. „Risk Factors for Environment and Food Safety". EdituraUniversităţii din Oradea, p. 463 - 472.
26. Motiu P. T., 2014, Research of the Main Types of Forest Ecosystems on the West Crişana Low Hills. „Risk Factors for Environment and Food Safety". EdituraUniversităţii din Oradea, p. 503 - 508.
27. Motiu P. T., 2015, Research of the Main Types of Forest Ecosystems on the West Crişana Piedmont Plain. „Risk Factors for Environment and Food Safety". EdituraUniversităţii din Oradea, p. 325 - 332.
28. Motiu P. T., 2016, The importance of knowing geology and geomorphology of a territory regarding typological research on geographical landscape segments. Editura Universităţii din Oradea, p. 437 - 444.
29. Motiu P. T., 2017. Research on 4236 forest ecosystem type european beech stand with Festuca drymeja within the segment of landscape situated on low western hills of Tinca forest district. „Risk Factors for Environment and Food Safety". Editura Universităţii din Oradea, p. 203 - 210.
30. Motiu P. T., 2018. Research on 5535 forest ecosystem type sessil oak-turkey oak-hungarian oak mixed stand with Genista-Festuca heterophylla (regional version on stagnic luvosoles) within the segment of landscape situated on low western hills of Tinca forest district. „Risk Factors for Environment and Food Safety". Editura Universităţii din Oradea, p. 135 - 144.
31. Research on 7135 forest ecosystem type turkey oak with Genista - Festuca heterophylla (regional version with common oak - sessil oak - hungarian oak mixed stand) within the segment of landscape situated on high plain of Tinca forest district, p. 147 -156.
32. Paşcovschi S., Leandru V., 1958, Tipuri de pădure din R.P.R., Editura Agro-Silvică, Bucureşti.
33. Paşcovschi S., Avram C., Constantinescu N., Petrescu L., Popa G., 1964, Complexe de măsuri silvotehnice pentru tipuri de pădure din Republica Populară Română, Editura Agro-Silvică, București.
34. Târziu D.R., 2006, Pedologie și staţiuni forestiere, Editura Silvodel, Braşov.
35. Târziu D., Spârchez G., Dincă L., 2004, Solurile României, Editura „Pentruviață".
36. * * *, 1999, Amenajamentul O. S. Tinca - Studiul general, Bucureşti.
37. * * *, 2004, La typologie des stations forestières. Inventaire Forstier National.
38. * * *, 2007, Amenajamentul O. S. Tinca - Studiul general, Bucureşti.