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

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 (Doniţă et al., 1990). In this type of forest ecosystem, the core constant species consists of: *Quercus cerris, Q. polycarpa, Q. dalechampii, Q. frainetto, Crataegus monogyna, Fragaria vesca, Lysimachia nummularia, Veronica officinalis, Festuca heterophylla, Poa nemoralis, Veronica chamaedris, Chamaecytisus hirsutus, Campanula persicifolia.*

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

INTRODUCTION

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, 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 2017 and continued in 2018.

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.

RESULTS AND DISSCUSIONS

TYPE OF ECOSYSTEM: 5535 *Sessile oak-Turkey oak-Hungarian oak*, medium and poorly productive, with moder, developed on brownish and reddish-brown soils, pesudogleised, ogliomesobasic, hydric quasi-balanced and alternating on the profile with *Genista-Festuca heterophylla* (regional variant on stagnic luvosoles).

Subtypes: 55352 mid productive subtypes.

Areal distribution: this type of forest ecosystem is distributed in the low hills and in the piedmont plain. We encounter it at the interference between these morphogenetic relief units, at the contact between *Sessile oak-Turkey oak-Hungarian oak* stands. It is spread in: U.P.II - Trup Coltău - Șirinca; U.P.III - Trup Fonău; U.P.V - Trup Hodișel, Trup Măgura.

The features of the ecosystem within research area:

a. Surface: 210,7 ha.

b. Stations:

- Average altitude 203 m (altitude variation 160-250 m);
- Relief: according to the shape - mid slopes and plateau; according to the inclination - moderate and non-inclined slopes; after exhibition – slopes with different exhibitions and plain land;
- Type of rock: clays, pebbles, sands;
- Types and subtypes of soil: stagnic and planic-stagnic luvisol;
- Limiting ecological factors: edaphic medium volume due to the compactness of the soil in Btw horizon. Deficiency of moisture in the second part of the summer.

c. The composition of stands: on the dominant level *Quercus petraea ssp. polycarpa* (in high proportions), *Quercus cerris* şi *Quercus frainetto* (in varying proportions); *Quercus petraea ssp. dalechampii* may occur disseminated*, Quercus robur, Prunus avium* (in few situations); on the dominant level *Carpinus betulus* with a reduced coverage, of maximum 5% of the area. Towards the valleys *Carpinus betulus* may occur up to 0% - 20% in the composition of the arboretum.

d. The composition of sub-stands: *Crataegus monogyna, C. laevigata* (rar)*, C. pentagina* (rar)*, Rubus caesius, R. sulcatus, R. hirtus, Rosa canina, Ligustrum vulgare;* It may be encountered with reduced frequency: *Evonymus europaeus.* The arbustive species are spread unevenly, in groups, with varying coverage of 5% - 30% of the surface.

In some situations, there can also be found *Carpinus betulus, Acer tataricum, Acer campestre, Pyrus pyraster* and *Ulmus procera* within the sub-stands level, from scattered specimens up to a coverage of 5%, maximum 10% of the surface.

e. The composition of the herbaceous layer: *Genista tinctoria, Festuca heterophylla, Genista ovata, Veronica officinalis, V. chamaedrys, Lysimachia nummularia, Poa nemoralis, Potentilla micrantha, P. alba, Carex praecox, Geum urbanum, Lathyrus niger, Mycelis muralis, Campanula persicifolia, Doronicum hungaricum, Lychnis coronaria, Peucedanum carvifolium, Calamintha mentifolia, Fragaria vesca*. It may occur with reduced frequency: *Polygonatum latifolium, Melica uniflora, M. nutans, Lychnis viscaria, Lysimachia vulgaris, Taraxacum officinale.* Out of the subarbustive species it may occur: *Chamaecytisus hirsutus and Cytisus nigricans.*

The herbaceous layer is usually well developed where the shrubs are missing, covering 15% - 30% of the surface.

Correspondence with:

- **Forest types[1]: 7411** – Usual mix of *Sessile oak-Turkey oak-Hungarian oak*; **7412** - Usual mix of hornbeam Garneau and Turkey oak on the plateau;

- **Resort types[2]: 6.3.1.1.** – Hilly mixed oak stand (sessile oak, Turkey oak ± Hungarian oak) Pm, luvisols, including albic luvisols (±hypostagnic) medium edaphic, with gramineae mesoxerophyte; **6.4.1.1.** - Hilly mixed oak stand (hornbeam, Turkey oak, sessile oak, Hungarian oak) Pm, luvisols, including albic luvisols, epihypostagnic-mesohypostagnic, medium edaphic;

- **Vegetable associations[3]:** *Quercetum farnetto - cerris* Georgescu '45, *quercetosum petraeae* Coste '75;

- **Type of habitat[4]:** -.

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

Fig 1: *Sessile oak-Turkey oak-Hungarian oak* stand with hornbeam mixed with *Genista-Festuca heterophylla*, u.a. 84A, U.P.II Sititelec area, (photo - P.T. Moțiu)

[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.

f. Tree structure: In figure 2 it is presented the distribution of the number of trees by categories of diameters, and in figure 3, the vertical and horizontal structure of a representative tree, inventoried in u.a. 84A, U.P.II. Composition of the tree: 7Gâ 3Go dis Ce, 65 years old, number of trees per hectare: Hungarian oak - 232, Sessile oak - 144, Turkey oak - 8.

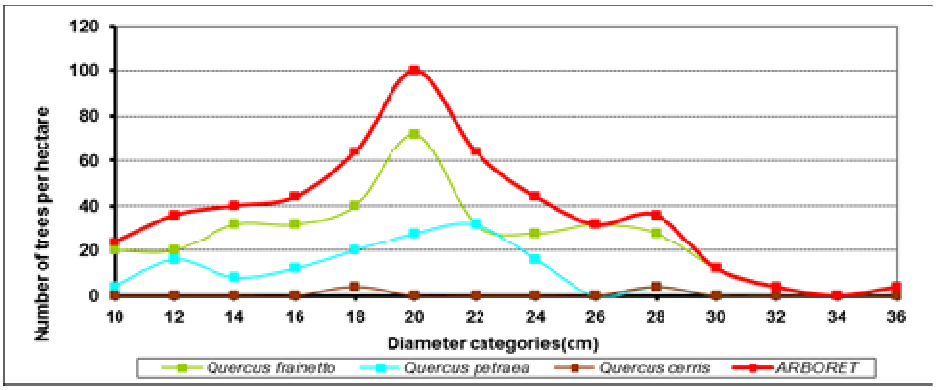
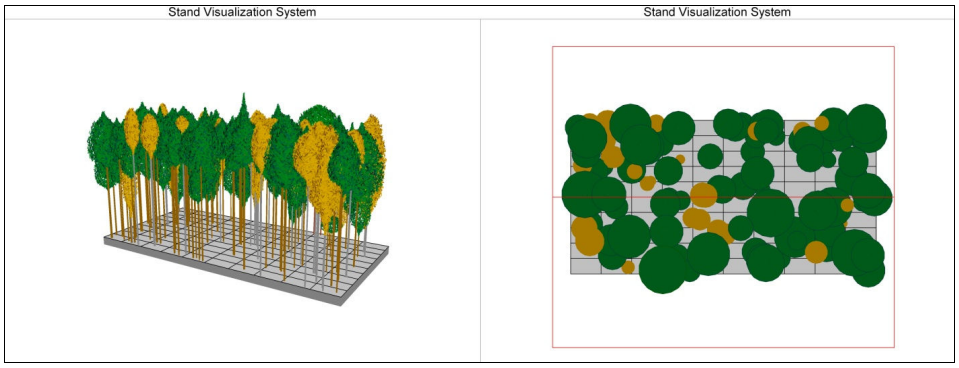


Fig. 2 The distribution of the number of trees per hectare, according to diameter categories, species and arboretum, in u.a. 84A, U.P.II Sititelec area



Legend:

Quercus frainetto *Quercus petraea* *Quercus cerris*

Fig. 3 The diagram of vertical structure (left) and plan projection of the canopy (right) for test plot of 1250 sqm, using SVS software, 3.36 version, in u.a. 84A, U.P.II Sititelec area

g. Distribution by age: 6-10 years old- 8%; 11-20 years old - 8%; 21-40 years old - 26%; 41-80 years old - 52%; over 80 years old - 6%.

h. The origin of the main arboretum elements: Sessile oak - natural sowing 41%, shoots 41%, plantations18%; Turkey oak - natural sowing 13%, shoots 87%; Hungarian oak - natural sowing 17%, shoots 83%.

i. The production class of the main arboretum elements: Hungarian oak cl III/II; Sessile oak cl III; Turkey oak cl II.

j. Natural regeneration by sowing: Sessile oak, Turkey oak, and Hungarian oak regenerates well, the oak, the maple and the hornbeam regenerates weakly, but in more favourable micro-stations – towards the valleys, it regenerates better.

k. The indicated target composition: 4Go 3Gâ 1Ce 2Ju, Ar, Pa, Ca.

l. Management measures on age ranges: 0-5 years - eliminating natural regeneration and/or plantations through works done on time and with perseverance; 6-10 years – promotion of Hungarian oak, Sessile oak, and Turkey oak by applying recesses; 11-20 years - proportioning the mixture according to the set target composition, by cleaning – maintaining of Hungarian oak, Sessile oak, and Turkey oak and the mandatory maintenance of the species of aid; 21-40 years - designating the future trees (from seed) of the main, basic species – Sessile oak, Hungarian oak, and applying combined rarefying around these trees; 41-80 years - continuing future tree promotion by combined rarefying, keeping the rest of the mass closed; over 80 years - applying hygiene cuts.

m. Other management measures: On regeneration the completion with species from the *Quercus* genus and with species of aid, if necessary; the stands from shoots will be gradually converted by natural regeneration (if the tree is at the age of fructification) or by restoration. In case of crops with ecologically unindicated species (spruce), it is recommended the substitution of these with native species adapted to local stationary conditions. Works to help natural regeneration are mandatory in years with abundant fructification in case of: Hungarian oak and sessile oak species.

Indicated forestry measures: the promotion of sessile oak in this type of ecosystem, especially favourable in micro-stations, in the concave areas of the field, considering the mosaic of the flora from the herbaceous – subarbustive layer, the presence of mesoxerophyte flora in higher areas, and the mesophyte flora in lower areas and in concavities.

Unindicated forestry measures: the oak is unindicated to be planted in such stationary conditions (it suffers from summer dryness), introduced eventually at the base of the slopes, where these conditions improve, being more favourable to its installation and development.

n. Variability and successional tendencies (forms of the type, successional tendencies and silvofacies): We differ within this type of forest ecosystem the slope shape and the terrace (plateau) shape. On inclined places – drier and more acid (with more *Festuca heterophyla*), the Hungarian oak predominates, reaching proportions of up to 70% in the composition of the tree. The slope shape presents the same type of grassy flora, but with lower abundance-dominance, so with smaller soil coverage (up to 10% of the total area); from the floristic point of view it is similar to **7135** – Turkey oak with *Genista-Festuca heterophylla*. The shape of terrace shows the mosaic of the grassy flora, this being similar to the type of forest ecosystem **7435** – Turkey oak – Hungarian oak with *Genista-Festuca heterophylla* (shape of terrace).

In the stands of U.P.II, u.a.75 and U.P.III, u.a.65C next to sessile oak, Turkey oak, Hungarian oak, hornbeam it is present in the composition too (in the first case 10%, in the second case 20%), so we have the facies with oak; this represents a form of transition towards the shape of Sessile oak and hornbeam within the type of ecosystem **7435** - Turkey oak - Hungarian oak with *Genista-Festuca heterophylla*.

o. Notes: Although the forests of this type of ecosystem are bright, the layer of shrubs and grasses is less developed than in Turkey oak, Turkey oak - hornbeam, , Turkey oak - Hungarian oak and in Turkey oak – sessile oak, the shrubs and sub-shrubs occupying up to 20% of the area, in some cases almost lacking, and herbs up to 20% of the surface (in some cases only 10%).

Hungarian oak realizes superior production classes than the Turkey oak and Sessile oak (especially on slopes.

In most situations of this type of ecosystem the hornbeam is missing. Exceptions include some trees from U.P.V. - u.a. 36 B, 37 C, 73 B, where hornbeam grows hard and presents badly accommodated trunks.

CONCLUSIONS

The geographical landscape segments differ in climatic variations different in raining, relief, pedogenetic substrates, soils and biocenosis.

Each of these segments has a certain ecological environment that is decisive for the formation of biocenoses and the constitution of ecosystems. Each geographical unit, either it is about zones – subzones, levels-sublevels, regions-provinces have distinct features which causes the existence of some inventory of types, with strong regional features. This moment priority is the tendency to establish types of forests on small geographic units, at the level of landscapes (lands hafts), the typology having thus a strong regional feature.

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 this state and designed to bring a type similar to the natural state.

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.

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 reginal variants of climate and soil – paedogenetic sub-layers.

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, Bucureşti.
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, Bucureşti p. 80.
7. Dănescu F., Costăchescu C., Mihăilă Elena, 2010, Sistematica staţiunilor forestiere, Editura Silvică, Bucureşti, p. 253.
8. Doniţă N., 2004, Tipologia forestieră integrată şi sarcini de viitor ale tipologiei forestiere în România, Revista Pădurilor, No. 2/2004.
9. Doniţă N., Chiriţă C., Stănescu V. et al., 1990, Tipuri de ecosisteme forestiere din România, C.M.D.P.A., I.C.A.S., Bucureşti.
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, Bucureşti.

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. Moţiu, P.T., 2011, *Typological research of forest ecosystems from Crişul Negru Plain and Hills of Tăşad*. „Risk Factors for Environment and Food Safety". EdituraUniversităţii din Oradea, pg. 580 -588.
20. Moţiu P.T., 2011. *Contributions to sustainable management measures, based on the type of forests from Crişul Negru Plain and Hills of Tăşad.* „Risk Factors for Environment and Food Safety". EdituraUniversităţii din Oradea, pg. 589 - 598.
21. Moţiu P.T., Bucur L., Nistor S., 2011, *Contribution to the typological substantiation of the forestry using gis tools in Crişul Negru plain and Tăşadului 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. Moţiu 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. Moţiu 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. Moţiu 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. Paşcovschi S., Leandru V., 1958, *Tipuri de pădure din R.P.R.*, Editura Agro-Silvică, Bucureşti.
31. 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, Bucureşti.
32. Târziu D.R., 2006, *Pedologie şi staţiuni forestiere*, Editura Silvodel, Braşov.
33. Târziu D., Spârchez G., Dincă L., 2004, *Solurile României*, Editura „Pentruviaţă".
34. * * *, 1999, *Amenajamentul O. S. Tinca - Studiul general*, Bucureşti.
35. * * *, 2004, *La typologie des stations forestières. Inventaire Forstier National*.
36. * * *, 2007, *Amenajamentul O. S. Tinca - Studiul general*, Bucureşti.