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

Moţiu Petrică Tudor*, Bucur Liviu**, Nistor Stelian***

*University of Oradea, Faculty of Environmental Protection, 26 Gen. Magheru St., 410048 Oradea, Romania, e-mail: tudor_motiu@yahoo.com
**University of Oradea, Faculty of Geography Tourism and Sport, 1 University St., Oradea, Romania, e-mail: liviubucur@yahoo.com
***University of Oradea, Faculty of Geography Tourism and Sport, 1 University St., Oradea, Romania, e-mail: snistor@uoradea.ro

Abstract
*   The identification and description of types of forest ecosystems on smaller geographical units, at 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.*

Key words: forest typology, forest ecosystems, management measures, sustainable forestry.

INTRODUCTION
Forest typology evolved from the necessity of differenciating management measures of the forests according to composition, structure, productivity, features of the stands ie after their eco-systemical features.

Forest typology have a strong geographic features because different forest types cannot be determined solely on the large areas where the repetability of some biocoenosys is evident, determined according to some species which occupying a certain ecotop.

The aim of the study was to establish the types of forest ecosystems from the Low Plain of Crisul Negru river and to esteblish the state of these ecosystems in order to fiind the best management solution for a sustainable use but preserving and conservation of the optimum biodiversity of the forest. The aim of the research was also the scientific fundamentation very usefull both in forest management and in applied forestry in order also to fiind the best management solutions for a sustainable use.

STUDY AREA - PHYSICAL AND BIO-GEOGRAPHICAL CONDITIONS

High piemontan plain situated in the center of the study area, with average altitudes of 100-200 m., with increasing values eastward, is a Pleistocene plain unit, largely folded, resulted from the connection of the alluvial cones of the river flowing from the mountains and hills situated eastward.

The connection between the plain and the hills is marked by a morphological threshold of about 40-60 m.

The provulial deposits from the plain are consisted of clay and silt deposits. On these materials heavy and alternant hydric soils forms.

The relief in dominantly a plateau, slightly folded and fragmented by some shallow, temporary brooks. The clays (red clays) are the base of stagnic luvisoils on the slopes, planic and whitish soils on the plateau, with a well balanced hydric regime.

The climate is warm, less humid as in the low hill unit (mean average temperatures of 10°C, average rainfall quantities of 614.7 mm).

Within these natural conditions the plateau ecosystem is consisted of turkey oak, pedunculate oak, sessile oak, hungarian oak, usually the mix of two even three species, with the presence of the common hornbeam along the small brooks. The soil indicators herbaceous and shrub layer is consisted of *Agrostis-Carex brizoides*, *Genista-Festuca heterophylla* on the plateaus, *Glechoma-Geum* and *Arum-Brachypodium* along the brooks.
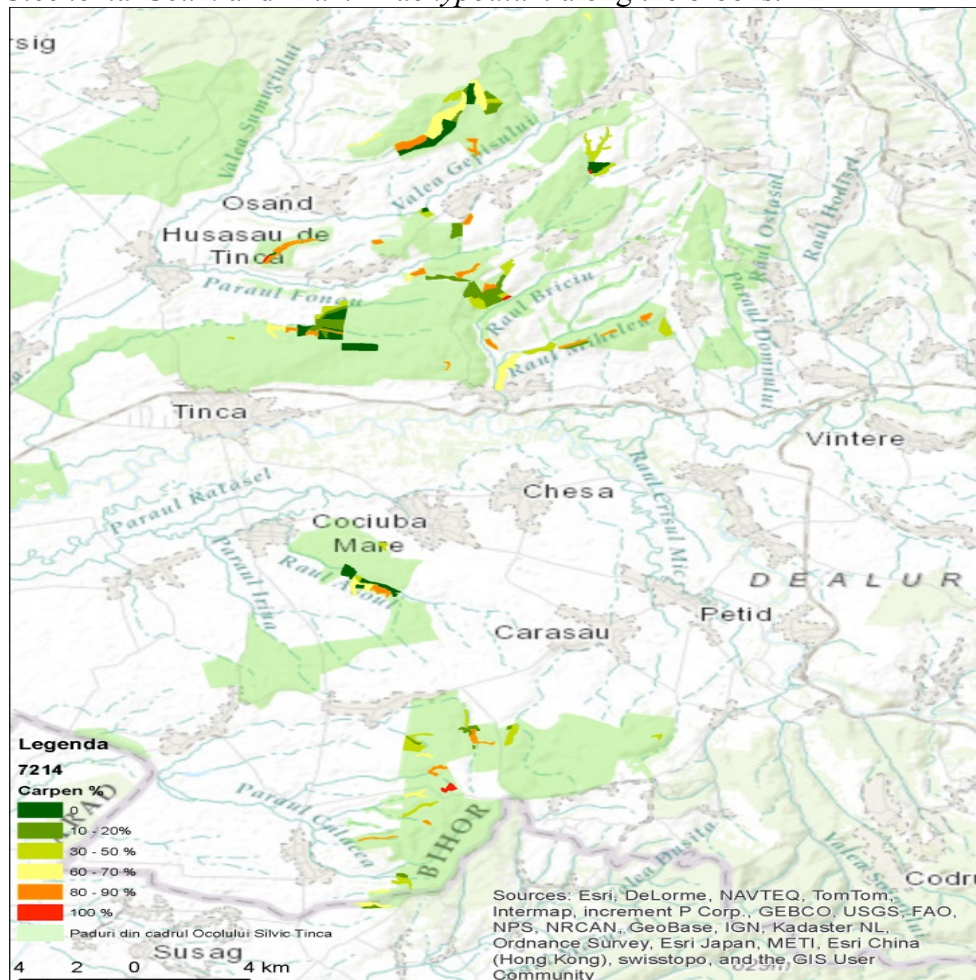
Fig. 1 The territorial repartition of the 7214 forest ecosystem type presenting the percentage within the composition of hornbeam trees

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MATHERIAL AND METHOD

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.

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

RESULTS AND DISSCUSIONS

TYPE OF ECOSYSTEM: 7214 turkey oak with common hornbeam, hid and highly productive, with mull, developed on gley brown and reddish-brown luvic soils, well balanced from hydric point of view, with *Arum-Brachypodium* (the regional type on stagnic luvisoils).

Subtypes: 72141 highly productive subtype
72142 mid productive subtype

Spread: this ecosystem type is spread within the high plain and low hill units - U.P.III - Pădurea Gorunului, Şoima, Fonău Gânţei, U.P. IV - Tinca - Topile, Dumbrava, Râpa, U.P.V - Măgura, Belfir.

The main features of the ecosystem type:

    a. Surface: 655.1 hectars

    b. Forest sites:
        - mean altitude 193 m (mean altitude variation 130-280 m)
        - relief: according to the shape – mid and low sectors of the slopes or plateaus; according to the inclination – slightly or heavily inclined slopes or flat surfaces; according to orientation – sunny, half sunny or shady slopes on flat surfaces
        - type of geological formations: sand, clay, gravel

- soil type and subtype: ordinary luvosoil, ordinary and molic eutricambosoil;

- limitative ecological factors: during short periods of time excess water in soil

c. Compositions of the stands: *Quercus cerris* within the dominant layer (in high proportion, sometimes even dominant); disseminate may occur *Quercus petraea ssp. polycarpa*; *Carpinus betulus* within the dominant layer with a coverage percentage of 30%, sometimes *Acer campestre* and *Acer tataricum.*

d. Composition of the underwood: *Crataegus monogyna, Ligustrum vulgare, Rubus hirtus. The underwood is developed according to the degree of shading of the higher layer, with a degree of coverage between 10-25% of the area. Carpinus betulus, Quercus cerris, Acer tataricum and Acer campestre* are represented also within the underwood with a degree of coverage between 30-50% of the area.

The underwood is well developed with a degree of coverage between 60-70% of the area.

e. Composition of the herbaceous layer: *Brachypodium sylvaticum, Polygonatum latifolium, Galium mollugo,Scrophularia nodosa, Melica uniflora, Viola reichenbachiana, V. oficinalis, Vincetoxicum hirundinaria, Geum urbanum, Fragaria vesca, Lysimachia nummularia, Carex pilosa.* Mai pot fi întâlnite: *Myosotis sylvatica, Cruciata laevipes, Euphorbia amygdaloides, Calamagrostis epigeios, Festuca heterophylla, Lapsana communis, Poligonum hydropiper, Acinos arvensis.*

In some cases *Genista tinctoria* could be also found within the study area.

The herbaceous layer could cover 10-20% depending on the degree of shading.

Correspondence with:

- **type of forests[1]: 7515** – mid productive hill mixed hardwood-turkey oak stands (m); **7516** - mid productive hill mixed hardwood-turkey oak stands (s) **7522** – plain mixed hardwoof stands (s); **7525** - plain mixed hardwoof stands (m);
- **type of forest sites[2]: 7.4.1.2.** – hilly with oak stands Ps(m), typical luvisoils and redish luvisoils, mid and highly edaphic;
- **plant associations[3]:** *Querco cerris - Carpinetum (*Boşcaiu et all. 1966);
- **type of habitats[4]: R4152** - Turkey oak stands belonging to dacian Province (*Quercus cerris*) and common hornbeam (*Carpinus betulus*) mixed with *Digitalis grandiflora.*

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[1] Forest types are defined according to N. Doniţă et al., 2005.
[2] Types of stands are defined according to F. Dănescu, C. Costăchescu, Elena Mihăil, 2010.
[3] Plant associations are defined according to N. Doniţă et al., 1990, the new types of ecosystems according to V. Sanda, A. Popescu, D. I. Stanciu, 2001.
[4] Types of habitat are defined according to N. Doniţă et al., 2005.

g. The structure of the stands: in fig. 1 is presented the distribution of the number of trees according to the diameter, fig. 2 presents the vertical and horisontal structure of the stands from u.a. 121A, U.P.IV. The composition of the stand is the following: 9Ce 1Ca disSt, 100 years old, number of trees/hectar: turkey oak – 204, common hornbeam – 28, common oak – 4.
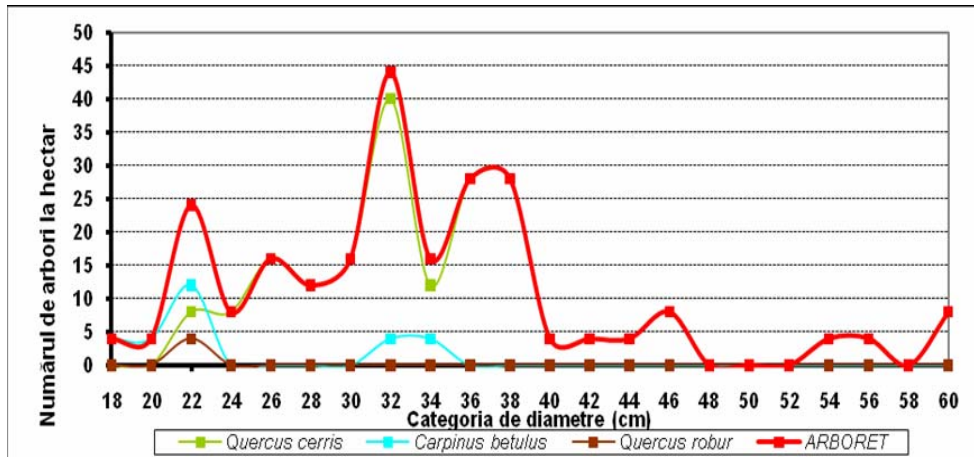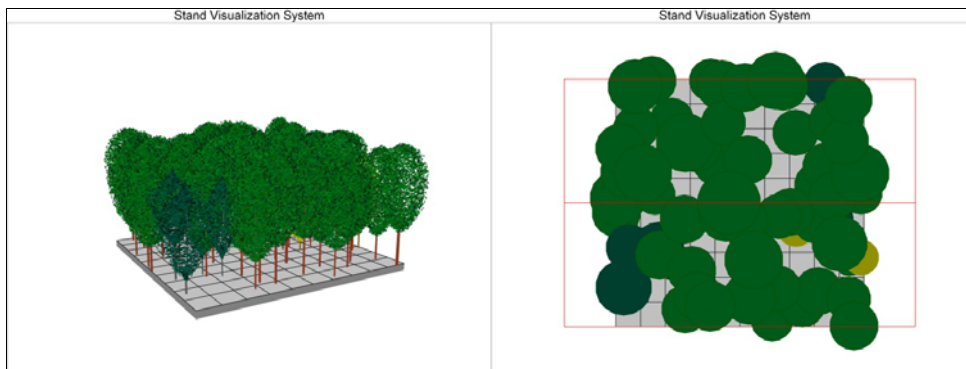

Fig. 1: The distribution of tree number per hectar, according to diameter categories and species within 121A, U.P.IV Topile area

Legend:

Quercus cerris   *Carpinus betulus*   *Quercus robur*

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, within u.a. 121A, U.P.IV Topile area

Fig. 3 Turkey oak and common hornbeam with *Arum-Brachypodium*, within u.a. 121A, U.P.IV Topile area,(sources - P.T. Moțiu)

h. Distribution according to age intervals: 6-10 years - 5%; 11-20 years - 24%; 21-40 years - 38%; 41-80 years - 38%.

i. The source of the main elements of the stand: turkey oak – natural seeding 26%, sprouts 57%, afforestation 17%; common hornbeam – natural seeding 28%, sprouts 72%.

j. Production classes of the main species of the stand: turkey oak III/II; common hornbeam III/IV.

k. Natural regeneration through seedind: the turkey oak and the other species (ex. field maple) are regenerating very well, the common hornbeam is even abundant. The oak (artificially introduced) regenerates with difficulty because of the seeds of the other species; The sessile oak regenerates well giving evidence of high competitiveness. The intense shading of the common hornbeam lead to the rapid elimination of the seeds of the installed oak species.

l. Indicated composition: 4Go 2Ce 2Ci,Pa,Fr 2Ca,Sb.

m. Management measures on age intervals: 0-5 years – the cleaning of the natural regenerations and/or carefully made plantations; 6-10

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years – the protection of the vigurous of turkey oak and sessile oak trees and cleanings of the other species if it is possible, favoring mainly the field maple to the detriment of common hornbeam. It is absolutely necessary the preservation of secondary (help) species such as field maple, common hornbeam, tartarian maple in order to creata a sublayer; 11-20 years – proportioning the mix according to the desired composition through cleanings; 21-40 years – the selection of the reproduction   sessile oak and turkey oak trees and the removal of mainly the common hornbeam; 41-80 years – the continuatin of preservation of reproduction trees mainly through cleanings around them, keeping close the rest of the stand; over 80 years - hygiene cuts.

n. Other management easures: the introduction within the regenerated composition of the sessile oak and other mixed species (ash, sweet cherry). The stands from sprouts will be gradually converted through natural regeneration (if the trees are at fructification) or recovery. It is recommended the replacement of the unindicated ecological species (acacia, red oak, black pine, spruce) with native species well adapted to local conditions. The only exception is the duglas, which, in pure stands, during favourable conditions, could have excellent growth rates and a very good quality of the wood (Motiu, 2004). It is recommended to keep under controll the common hornbeam, the poplar and the acacia, which, in terms of favourable conditions are supposed to eliminate the turkey oak and the other mixed species. Are required to assist natural regeneration works during the fructification years within the main species (sessil oak, turkey oak) in order to promote them in the future.

o. Variability and successional trends (forms of type, succesional tendencies and forest facies): there are two types of facies, the typical one and the facies with sessil oak ans also a transition facies towards 5724 ecosystem type – turkey oak sessil oak mixed with common hornbeam and *Glechoma-Geum*. Forest facies: with oak (mixed in groups with a degree of covering of 30-40%); after the introduction of the oak on sunny or partially shady slopes (in some cases of the sessil oak on partially shady slopes) it is made the artificial succesion towards the 6925 forest ecosystem type – mixed oak, common hornbeam with *Arum-Brachypodium*.

In many cases the common hornbeam covers 60-70% (in some cases even 80-100%) of the total composition, tending to eliminate the turkey oak thus occurring sequence towards the dominance of the common horbeam.

p. Observations: although the natural conditions are favorable within this forest ecosystem type one could notice the scarcity of the herbaceous species. The cause is given by the high density of the trees (0.9-1), the presence of the lower storey (in most cases), with a degree of

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coverage up to 30% and the presence of the underwood with a degree of coverage up to 60-70%.

One could notice the fierce competition between the turkey oak and the mix and helping species after which the sequence of causes, more or less natural, occurred in favor of the turkey oak.

CONCLUSIONS

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

We tried, within this research, to establish ecosystem-based forest type existing in a territory smaller but representative for the high plain units within Tinca Forest District, to state the current status of types and propose appropriate management measures to bring forest types as close as possible to the natural state.

The typological research using GIS tools is usefull in practical forestry, being the base for sustainable forestry. The variability of general conditions (climatic, geologic) is very high and this variability induces a high variability of forest types. 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.

REFERENCES

1. Bartha, Sz., Dorog, L. S., Moțiu, P. T., 2011. *Researches regarding the presence of the sweep of Turkey oak (Quercus cerris), in the oak tree forest from Boboștea forest (Bihor)*. Faipar, Sopron.
2. Bica A. M., Curilă M., Curilă S., 2006, "*Optimal Piecewise Smooth Interpolation of Experimental Data*", ICCCC 2006, International Journal of Computers, Communications & Control, p. 74-79, ISSN 1841-9836.
3. Beldie Al., Chiriță C., 1967. *Flora indicatoare din pădurile noastre*. Ed. Agro-silvică, București.
4. Ciocârlan, V., 2000. *Flora ilustrată a României*. Editura Ceres, București.
5. Chiriță, C., Tufescu, V., Beldie, Al., Ceucă, G., Haring, P., Stănescu, V., Toma, G., Tomescu, Aurora, Vlad, I., 1964. *Fundamentele naturalistice și metodologice ale tipologiei și cartării staționale forestiere*. Editura Academiei, București.
6. Chiriță, C., Vlad, I., Păunescu, C., Pătrășcoiu, N., Roșu, C., Iancu, I., 1977. *Stațiuni forestiere*. Editura Academiei R.S.R., București, p. 518.
7. Cristea, V., Gafta, D., Pedrotti, F. 2004., *Fitosociologie*. Editura Universitară Clujeană, Cluj Napoca.
8. Dănescu, F., Costăchescu, C., Mihăilă, Elena, 2010. *Sistematica stațiunilor forestiere*. Editura Silvică, București, p. 253.

9. 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.

10. Doniță, N., Chiriță, C., Stănescu, V. și colab. 1990. *Tipuri de ecosisteme forestiere din România*. C.M.D.P.A., I.C.A.S., București.

11. Doniță N., 2004. *Tipologia forestieră integrată și sarcini de viitor ale tipologiei forestiere în România*. „Revista Pădurilor", Nr. 2/2004.

12. Doniță, N., Popescu, A., Păucă-Comănescu, Mihaela, Mihăilescu, Simona, Biriș, I., 2005. *Habitatele din România*. Editura Tehnică Silvică, București.

13. Doniță, N., Borlea F., Turcu D., 2006. *Cultura pădurilor*. Editura Eurobit, Timișoara, p. 367.

14. Florea, N., Munteanu, I., 2003. *Sistemul român de taxonomie a solurilor (SRTS)*, Editura Esfalia, București.

15. Florescu, I., Nicolescu, N., 1996, *Silvicultura, Vol. I, Studiul pădurii*. Editura Lux Libris, Brașov, p. 210.

16. Florescu, I., Nicolescu, N., 1998, *Silvicultura, Vol. II, Silvotehnica*. Editura Universității Transilvania din Brașov, p. 194.

17. Giurgiu V., 2004. *Probleme actuale ale tipologiei forestiere Românești*. "Revista Pădurilor", Nr. 2/2004.

18. Leahu, I., 2001. *Amenajarea pădurilor*. Editura Didactică și Pedagogică, București.

19. Măhăra, Gh., 1977. *Câmpia Crișurilor, Crișul Repede, Tara Beiușului*. Editura Științifică și Enciclopedică, București.

20. Mc.Gaughey, Robert J., 1999. *Stand Vizualisation System (SVS vers. 3.36)*. USDA Forest Service, Pacific Northwest Research Station.

21. Moțiu, P.T., 2004. *Caracteristici dendrometrice ale unor specii alohtone cultivate în O.S.Tinca, Jud. Bihor*. Analele Universității din Oradea, Fascicula Silvicultură, p.135 - 144.

22. Moțiu, P.T., 2011. *Typological research of forest ecosystems from Crișul Negru Plain and Hills of Tășad*. „Risk Factors for Environment and Food Safety". Editura Universității din Oradea, pg. 580 -588.

23. 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". Editura Universității din Oradea, pg. 589 - 598.

24. 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". Editura Universității din Oradea, pg. 572 -579.

25. 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". Editura Universității din Oradea, p. 507 - 516.

26. 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". Editura Universității din Oradea, pg. 516 - 529.

27. Pașcovschi, S., Leandru V., 1958. *Tipuri de pădure din R.P.R.* Ed. Agro-Silvică, București.

28. 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.
29. Posea, G. 1997. *Câmpia de vest a României.* Editura Fundaţiei „România de Mâine", Bucureşti.
30. Târziu, D. R., 2006. *Pedologie şi staţiuni forestiere.* Editura Silvodel, Braşov.
31. Târziu D., Spârchez G., Dincă L., 2004. *Solurile României.* Editura „Pentru viaţă" 2002.
32. *** 1999. *Amenajamentul O. S. Tinca - Studiul general.* Bucureşti.
33. *** 2004. *La typologie des stations forestières. Inventaire Forstier National,* 2004.
34. *** 2007. *Amenajamentul O. S. Tinca - Studiul general.* Bucureşti.
35. *** www.esri.com.