THE BIODIVERSIFICAL STUDY OF SOME FOREST ECOSYSTEMS FROM THE III UNITY OF PRODUCTION – GEPIŞ (O.S. TINCA), IN ORDER TO GROUND THE SCIENTIFICAL VALUES WHICH ARE MEANT TO STAND AS A BASIS FOR BIODIVERSIFICAL CONSERVATION AND LONG TERM ADMINISTRATION OF NATURAL RESOURCES

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Abstract

The biological diversity refers to the variety of living world. The term "biodiversity" usually it is used to describe the number, the variety and variability of living organisms. The diversity of life it is indeed by that makes it last in time; when the conditions are changing some individuals from the population can possess characteristics which will help them to survive and reproduce.

Applying the suitable caring works, choosing the adequate forestry treatments and applying them in land with maximum responsibility are very important in the long time administration of forestry ecosystems and at the same time in the biodiversity conservation of these.

Regarding the measures laying on the basis of bio-distinctive conservation and lasting processing of forests, a big importance will be given to the choice of silvicultural treatments. It is imposed in these conditions to indicate the particular housekeeping methods which are proved to be necessary and enough to assure the stability and productivity at an optimistic level of forest cultures generated entropic.

Key words: forest ecosystems, biodiversity,

INTRODUCTION

In practice "biodiversity" it is defined according to gene, species and ecosystems, according to 3 fundamental levels of biological organization which are connected hierarchically: genetic level, level of species, level of ecosystems. All these 3 levels are interconnected. The genetic level defines the variability regarding species, the level of species defines the variability regarding biocoenosis and ecosystem, and the community level defines the variability regarding landscape.

The biological diversity it is important at all levels, not only for individual species but for the integrity of community and ecosystem. A good answer of ecosystems for the large variety of stressing factors represents the disappearance of the diversity of species, modification regarding diversity of species represent an early sign of stress on ecosystem.

MATHERIAL AND METHOD

The type and place of investigations

The performed work on the site had as a main goal the investigation of biodiversity, specific to the studied type of ecosystem. First of all there were stated the main types of ecosystems from the studied unity of production, - the Lower Plain of Crisul Negru – in which to be continued the investigations. There were chosen 2 types of ecosystems according to classification (Donita and co., 1990):

- 5416 Mixed sessile oak (silver lime, common hornbeam) high and middle productive, with mull, on typical brown and brown - luvic, eubazic, hydric balanced soils, with Asperula-Asarum-Stellaria.

Subtype: 54 162 middle productive subtype

The main static conditions of the studied brush are presented in table no 1 – The static conditions of the studied brush.

Table 1

The static conditions of the studied brush

Location	Altitude (m)	Relief	Type of soil[1]	Type of indicator flora	Type of forest
O.S. Tinca U.P. III – Gepiş u.a. 93B	180	Middle undulated slope	Mollic-Gleyic Fluvisols	Asperula-Asarum	Hill mixed hardwood forest with middle productive sessile oak (m)
O.S. Tinca U.P. III – Gepiş u.a. 49F	240	Undulated slope	Mollic-Gleyic Fluvisols	Asarum-Brachipodim	Hill mixed hardwood forest with middle productive sessile oak (m)
O.S. Tinca U.P. III – Gepiş u.a. 49B	250	Middle undulated slope	Mollic-Gleyic Fluvisols	Asarum-Brachipodim	Hill mixed hardwood forest with middle productive sessile oak (m)

The brush from the 93 B compartment it is characterized by composition: 4 hornbeam, 3 sessile oak, 2 turkey oak, 1 silver lime – 75 years old, firmness – 0.8, III production class; the brush from 49 F compartment is characterized by composition: 6 silver lime, 2 sessile oak, 2 common hornbeam – 50 years old, firmness – 0.9, II production class; the brush from 49 B compartment it is characterized by composition: 4 silver lime, 3 sessile oak, 3 common hornbeam, 50 years old, firmness 0.7, II production class.

[1]After WRB-SR, 1998 – World Base Reference for Soil Resources, 1998

The recorded characteristics of studied phytocenosis according to the diversity evaluation were made by partial inventory of these. It was adopted the randomized sample, which included the set up by chance of the sample surfaces in the chosen brushes for study.

In every compartment was set up a surface of 1000 mp (25x40m) for the brush inventory, 10 rectangular surfaces of 9 mp (3x3 m), for the brush inventory and 40 rectangular surfaces of 0.25 mp (0.5x0.5 m) for the inventory of herbal flora.

The brush biodiversity, sub brush as well as of the herbal flora in the studied types of ecosystems, was settled through the inventory of numbered individual of each species, after which it were calculated the diversity index of Shannon (H') and Simpson (D), as well as the equity index of Pielou (E).

These indexes are based on the suspect that the diversity of a natural system can be measured in the same way as the contained information in a message. They take into account as well as the number of species as the number of individuals of each species and they are divided in two groups:

- Fundamental indexes based on the theory of information
- Fundamental indexes based on the abundance of dominant species.

Fundamental indexes based on the theory of information are the most in common in measuring the diversity and it is based on the suspect that diversity or information of a natural system can be measured in the same way as the information contained in a message.

The most common index from this category is the Shannon index (H') which expresses the diversity degree for informational and structural unity of the plants community (Stugren, 1992) suspecting that the individuals are extracted by chance and all the species are represented by sample. The index summary is made by the relation:

$$\mathbf{H' = -\sum p_i \, l_n \, p_i} \qquad \mathbf{(1)}$$

Where:

$$\mathbf{P_i = n_i/N} \qquad \mathbf{(2)}$$

In which:

S – Represents the number of species

p_i – the proportion representing each species

n_i – number of individuals which belong to the I species.

N – Total number of individuals of S species.

The maximum possible diversity ($\mathbf{H_{max}}$) realizable in case that all the existing species in biocoenosis are presented in an equal number of individuals, it is calculated by the relation:

$$\mathbf{H_{max} = InS} \qquad \mathbf{(3)}$$

Equity it is an index which expresses the modality how it is distributed the relative abundance within the species of a biocoenosis, so it

given by the ratio between the value of diversity (H') and the maximum possible diversity of the community in case (E).

$$\mathbf{E = H/H_{max} = H/InS} \qquad \mathbf{(4)}$$

The equity Pielou index (E) can take values from „0" to „1". "0" it is when the Shannon diversity index (H') it is zero, namely when biocoenosis it is composed by single number of species, and the value is "1" when the species are represented through the same number of individuals.

The indexes based on the abundance of dominant species are based on different territories like the probability theory, the theory of Euclidian space, etc. The most used index belongs to the above mentioned Simpson index (D).

The Simpson index (D) results applying the probability theory; which is the probability of 2 individuals chosen by chance from a biocoenosis to belong to 2 different species. This probability it is equal with the value of appearance probabilities of those "i" species and it is given by the following relation:

$$\mathbf{D = \sum ni(ni-l)/N(N-l)} \qquad \mathbf{(5)}$$

The terms have the same meaning as in the 1 relation.

Because D it is falling together with the increasing diversity in practice it is used the form l-D or l/D.

The maximum possible diversity ($\mathbf{D_{max}}$) in this case it is calculated by the following formula:

$$\mathbf{D_{max} = N/S-l/N-l} \qquad \mathbf{(6)}$$

The terms have the same meaning as in the 1 relation.

RESULTS AND DISCUSSION

The values of Shannon (H') and Simpson (D) diversity indexes, as well as for the Pielou equity index (E), calculated for the investigated ecosystems, separately on levels are presented in tables 2, 3 and 4.

Table 2

Biodiversity indicators on the arborescent layer level

Location	Inventoried surface SP	No of species/ SP -S-	No of index/SP -N-	No of index/ha	Shannon index -H'-	Pielou index -E-	Simpson index -D'-
O.S. Tinca U.P. III – Gepiş u.a. 93B	1000 mp	6	66	330	1,22376	0,68299	0,36354
O.S. Tinca U.P. III – Gepiş u.a. 49F	1000 mp	4	141	705	0,92525	0,66742	0,47644
O.S. Tinca U.P. III – Gepiş u.a. 49B	1000 mp	4	80	400	1,16535	0,84062	0,33114

Table 3

Biodiversity indicators on the shrubby layer level

Location	Inventoried surface SP	No of species/SP -S-	No of index/SP -N-	No of index/ha	Shannon index -H'-	Pielou index -E-	Simpson index -D'
O.S. Tinca U.P. III – Gepiş u.a. 93B	90 mp	5	22	2430	1,40309	0,87178	0,29256
O.S. Tinca U.P. III – Gepiş u.a. 49F	90 mp	6	53	5960	1,17733	0,65708	0,39467
O.S. Tinca U.P. III – Gepiş u.a. 49B	90 mp	5	14	1540	1,4944	0,92852	0,24440

Table 4

Biodiversity indicators on the herbal flora level

Location	Inventoried surface SP	No of species/SP -S-	No of index/SP -N-	No of index/ha	Shannon index -H'-	Pielou index -E-	Simpson index -D'
O.S. Tinca U.P. III – Gepiş u.a. 93B	10 mp	25	3914	3914000	2,57304	0,79935	0,12018
O.S. Tinca U.P. III – Gepiş u.a. 49F	10 mp	25	6472	6472000	2,38958	0,74236	0,13404
O.S. Tinca U.P. III – Gepiş u.a. 49B	10 mp	20	6072	6072000	2,41407	0,80583	0,12409

Analyzing the above presented tables we can observe that on the arborescent layer level the diversity of species it is variable, the present species in all 3 brushes are the sessile oak, the silver lime and the common hornbeam (Quercus petraea, Tillia tomentosa şi Carpinus betulus) associated with turkey oak, common oak, commom maple(Quercus cerris L., Quercus robur şi Acer campestre) în arboretul din u.a.93B; cu cireşul (Prunus avium) from the u.a. 49F brush; with the common oak (Quercus robur) from the u.a. 49B brush. The Shannon index (H') takes the value of 1,22376 in accordance with a maximum possible diversity of 1,791759 from 93B compartment, in case of brush from 49F compartment has the value of 0,92525 from the maximum possible diversity of 1,386294 and from the brush of 49B compartment the Shannon index diversity (H') takes the value of 1,16535 from a maximum possible diversity of 1,386294. The Simpson index (D) takes its values of 0,36354 in case of brush from 93B compartment, of 0,47644 in case of brush from 49F compartment and of 0,33114 in case of brush from 49B compartment.

On the shrubby layer level the values of diversity indexes are determined mainly by the stative conditions, age and the composition of brush. The Shannon index (H') has apropriate values in case of brushes from 93B compartment and from the 49B compartment, so this is 1,40309 from a maximum possible diversity of 1,609438, and 1,4944 from a maximum possible diversity of 1,609438. In the brush from 49F compartment this index has the value of 1,17733 from a maximum possible diversity of 1,791759. The Simpson index (D) takes its values of 0,29256 in the brush from 93B compartment, of 0.12651 in the brush from 49F compartment and of 0.27216 in brush from 49B compartment.

On the herbal flora level the Shannon index (H') takes the value of 2,57304 from a maximum possible diversity of 3,2188758 in brush from 93B compartment, in brush from 49F compartment this has the value of 2,38958 from a maximum possible diversity of 3,2188758 and in brush from 49B compartment the Shannon index diversity takes the value of 2.41407 from a maximum possible diversity of 2,9957323. The Simpson index takes the value of 0,12018 in brush from 93B compartment, 0.13404 in brush from 49F compartment, respective 0.12409 in brush from 49B compartment.

CONCLUSIONS

After processing the obtained data from the observations made on the field in U.P. III – Gepis and the calculation of specific wealth-, species abundance- and species relative abundance indicators, we obtained the following conclusions:

- Specific density on the level of phytocoenosis is influenced especially by the brushes' structure and the local conditions, by the microclimate generated by the structure of brush level. This varies from 36 species in the brush from u.a. 93B, up to 35 species in the brush u.a. 49F and to 29 species in the brush 49B from U.P. III - Gepiş, O.S. Tinca.
- The Shannon (H') diversity index's value for the tree layer is of 1,22376 for the brush from u.a. 93B, of 0,92525 for the brush from u.a. 49F and of 1,16535 for the brush from u.a. 49B. The Simpson index takes values of 0,36354 from the brush from u.a 93B, of 0,47644 for the brush from u.a. 49F and of 0,33114 for the brush from u.a 49B.
- The Shannon (H') diversity index's value for the shrub layer is of 1,40309 for the brush from u.a. 93B, of 1,17733 for the brush from u.a. 49F and of 1,4944 for the brush from u.a. 49B. The Simpson index takes values of 0.29256 for the brush from u.a 93B, of 0,39467 for the brush from u.a. 49F and of 0,24440 for the brush from u.a 49B.

On the shrub layer the diversity index's value are determined especially by the stationary conditions, age and the consistence of brush.

- On the herbaceous surface level the Shannon (H') index takes values of 2,57304 in the brush from u.a. 93B, in brush from u.a. 49F this has the value of 2,38958, and in the brush from u.a. 49B the Shannon diversity index takes the value of 2,41407. The Simpson index has the value of 0,12018 in the brush from u.a. 93B, 0,13404 in the brush from u.a. 49F , respectively 0,12409 in the brush from u.a. 49B.

The studied brush belonging to the forest formation „Traces of oak hill", ecosystem type „Holm plainly(silver lime, common hornbeam) with Asperula-Asarum-Stellaria" are of the most complex in our country from a structural and functional point of view. Through cultural operations and appropriate forestry treatments the complex mixture should be maintained, the basic as well as mixture and helpful, paying adequate attention to each species.

In order to elaborate forestry measures which to stay on the basis of biodiversity conservation and persistent management of natural resources it is advisable to take into account the actual state of knowledge in the field worldwide, the studies' result of some researchers who approached this theme. Also we shoul take into account the forestry measures adopted by Romanian forestry and used in forestry practice. The basic forestry measures are a useful typology in the conservation of forestry phytocoenosis biodiversity. These measures are the most appropriate in order to have a persistent management of forestry ecosystems and implicitly in maintaining their biodiversity.

In the temperate zone, zone in which are included Romania's forests, most of the forestry ecosystems have a specific low diversity, characteristic which is followed to be raised through adequate management (applying appropriate works of care and management of the brushes, choosing adequate forestry treatment, diversification of horizontal and vertical brush structures, favoring all brush species, reconstruction of destroyed ecological ecosystems, conservation of genetic structures, etc). It is required in these conditions to establish particular management measures which seem to be necessary and enough to assure stability and productivity on an optimistic level of the forestry cultures generated anthropogenically.

REFERENCES

1. Beldie, A., Chiriță, C., 1967 - Flora indicatoare din pădurile noastre, Ed. Agro - Silvică, Bucureşti
2. Biris, L - Metode de studiu si evaluare a diversității, Referat, 1999
3. Botnariuc, N , Vadineanu, A, 1982 - Ecologie, Ed. Didactică şi pedagogică, Bucureşti
4. Ciocârlan, V, 2000 - Flora ilustrata a României, Editura Ceres, Bucureşti
5. Chiriță, C., şi colb., 1977 - Stațiuni forestiere, Ed. Acad. Bucureşti
6. Doniță, N., şi colab., 1990 - Tipuri de ecosisteme forestiere din România, Ed. Agr. Bucureşti
7. Enescu, V., şi colab., 1997 - Conservarea biodiversității şi a resurselor genetice forestiere, Agriş, Bucureşti
8. Florescu I., Nicolescu N., Silvicultura Vol II Silvotehnica, Editura Universității Transilvania din Braşov 1998
9. Giurgiu, V., şi colab., 1972 - Biometria arborilor şi arboretelor din România
10. Geambasu, T., 2002 - Aspecte teoretice privind biodiversitatea. Metode de studiu a biodiversității, - referat, 2002
11. Schulze, E.D., Mooney, H.A. - Biodiversity and Ecosystem Function,Springer - Verlag Berlin Heidelberg New York
12. Stugren, B. - Ecologie teoretica, 1994 - Ecologie teoretică, Casa de editură Sarmis, Cluj Napoca
13. x x x - Amenajamentul U.P. III - Gepiş, O.S. Tinca