RESEARCHES REGARDING THE BIODIVERSITY OF SOME FOREST ECOSYSTEMS FROM VI UNIT PRODUCTION – HIDIŞEL (O.S. ORADEA) IN ORDER TO UNDERLAY SCIENTIFICALLY THE MEASURES WHICH ARE ON THE BASIS OF BIO-DISTINCTIVE CONSERVATION AND LASTING PROCESSING OF NATURAL RESOURCES

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Abstract:

Bio-distinctiveness is an actual ecologic reality, although dynamic, which depends on the multitude of conditions from different biotopes – which can be explained through the number and relative frequency of species from a given surface or from optimistic bio system content.

In order to sum up the specific distinctiveness on the level of studied ecosystems there were determined the following indicator categories: indicators of species' richness, types of species' abundance, indicators of species' relative abundance.

In the temperate area, area including the Romania's forests too, the majority of forestry ecosystems have a specific low diversity, characteristic which is followed to be maintained by adequate careful management measures (applying the cultural operations and the caring works, creating pure cultures, etc.). *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.*

Key words: biodiversity, forestry ecosystem, silvicultural adequate measures.

INTRODUCTION

The bio-distinctive conservation of vegetal species and animals represents a beneficiary invention which has the role of planet's resources and alimentation resources conservation, as well as the role of a stable ecological balance.

The concept of bio-distinctiveness it is included, usually, in the "theory of systems", the live material organization in harshly organized, independent and adaptable subsystems, which represent the integrate character and a kind of directivity, which is included in the assembly of universal link.

Biodiversity or bio-distinctiveness is a component of the whole biosphere, includes ecosystems, different genres, species and their relative frequency.

The existence of biodiversity and its conservation it is as important for the environment as for the human society, a reason why it is necessary its conservation.

On the General Union of United Nations from 28th of November 1982, the governments have explained their accord for the conservation of bio-distinctiveness, called „World Charter for Nature", through which it is acknowledged that "human being is a part of nature, that every form of life it is unique and life, generally, depends on the normal functioned, unharmed natural systems, which assure the food and energy supply" and living in harmony with nature can be achieved the best opportunities for the development of creativity, recreation and rest.

The biodiversity it is important on every level, not only for the individual species but also for the integrity of communities and ecosystems.

A consistent answer of ecosystems for the big variety of disturbing factors represents the disappearance of species' diversity, the alteration among the species' diversity represents a young stress indicator on ecosystem.

MATERIAL AND METHODS

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 hills of Tăşad – in which to be continued the investigations. There were chosen 2 types of ecosystems according to classification (Donita and co., 1990):

7724 ~ Sessile-turkey oak stand, highly and medium productive, with mull earth, on brown and brownish – red low-medium luvic, mezzo-basic, hidric quasi balanced soil with Glechoma–Geum.

5416 ~ Mixture of Sessile forest (silver lime, common hornbeam) highly and medium productive with mull, on brown typical and brown luvic, eubasic, hidric balanced soil with Aspenda-Asarum-Stellaria.

These types are really well represented in the studied territory and so they are relevant from the research's point of view.

Because of this there were used information collected directly from site on the occasion of recognizing the site as well as those offered by the assembly of IV U.P. – Hidişel.

The main static conditions of the studied brush are presented in table 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. Oradea U.P. VI-Hidisel u.a. 8B	230-280	Slope	Stagnic Luvosoil (Brown luvic pseudogleic)	Carex caryophyllea-Poa pratensis	Sessile- turkey oak stand of medium productivity
O.S. Oradea U.P. VI-Hidisel u.a. 30B	160	Slope	Tipical Luvosoil (Brown luvic tipical)	Asperula-Asarum	Normal sessile oak with mull flora
O.S. Oradea U.P. VI-Hidisel u.a. 30C	120	Slope	Stagnic Luvosoil (Brown luvic pseudogleic)	Asarum-Brachypodium	Sessile- turkey oak stand of medium productivity

The accomplished works have the role of:

a) Site

b) Office

The completed works on the site had the role of analyzing specific biodiversity of the studied type of ecosystem. Choosing the brushes fated for the study of fitocetonic biodiversity there were taken into account the following criteria: natural degree of the brushes, structure, age and content.

Regarding natural degree, a priority was given to basic brushes in cases of which the entropic impact generated by human activities to be reduced as much as possible. In a structural rapport there were chosen brushes with a relatively even-aged stand

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

structure, this ascendant in the studied unity production. Another criterion taken into account was that of age, the best being those relatively mature ones, in case of which to be applied hygienic cuts.

Regarding consistency there were preferred those with a full or almost full consistency. The entry of the studied plant formation characteristics in order to assess diversity it was made through the partial inventorying of these. It was adopted randomized quartation which consisted in the variants lay-out of trial surfaces in the case of chosen brushes for study. In case of diversified plant formation it is recommended to work with same individuals, that is why an option was made to separate three kinds of soils:

- Arborescent stratum in which there were included all the individuals having a higher diameter than 4 cm and height of 7 m;
- Shrubby stratum in which there were included all individuals with a height over 1 m;
- Sub shrubby stratum in which there were included all herbal plants and sub shrubbiest.

As you can observe seeding there were taken into account just brushes having ages between 65 and 80 years being not capable of fructification. 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.

On the occasion of site works there were registered numerous categories like:

- in case of brushes:

- Existent species
- Number of individuals belonging to each species
- Diameter of brushes
- Height of brushes
- Diameter of the crown on two perpendicular directions
- Coordinates of each brush on the trial surface (x, y) for the accomplished structure of the brush

- in case of shrubbery:

- Existent species
- Number of individuals belonging to each species

- in case of grassy stratum :

- Existent species
- Number of individuals belonging to each species

In case of species with a vegetative multiplication (stolons, rhizomes) it was considered a specific individual in case of each sub ground base.

In case of shrubbery it was considered separate individual each base from the surface of the soil and in case of brushes each base or branch of the base starting from a height situated under 1.3 m over the soil.

Office works consisted in the processing and interpreting of data collected from the site, data lying on the basis of this work.

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:

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

Where:

$$P_i = n_i/N \qquad (2)$$

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 (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:

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

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).

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

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:

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

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 (D_{max}) in this case it is calculated by the following formula:

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

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

REZULTS 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 3, 4 and 5 and on graphics 1, 2, 3.

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. Oradea U.P. VI-Hidisel u.a. 8B	1000 mp	2	48	480	0,68967	0,99498	0,50243
O.S. Oradea U.P. VI-Hidisel u.a. 30B	1000 mp	2	48	480	0,45056	0,65002	0,72164
O.S. Oradea U.P. VI-Hidisel u.a. 30C	1000 mp	3	51	510	0,31902	0,29039	0,85284

Table 3

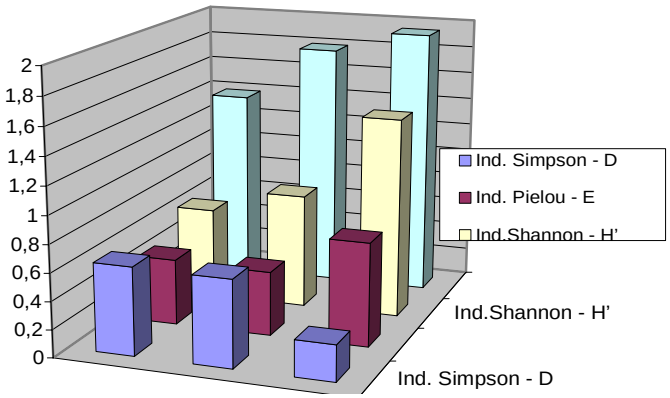
Biodiversity indicators on the shrubby layer level

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. Oradea U.P. VI-Hidisel u.a. 8B	90 mp	6	460	51100	1,61671	0,90230	0,22402
O.S. Oradea U.P. VI-Hidisel u.a. 30B	90 mp	8	625	69438	1,68254	0,80913	0,23864
O.S. Oradea U.P. VI-Hidisel u.a. 30C	90 mp	9	748	83102	1,54365	0,70254	0,31792

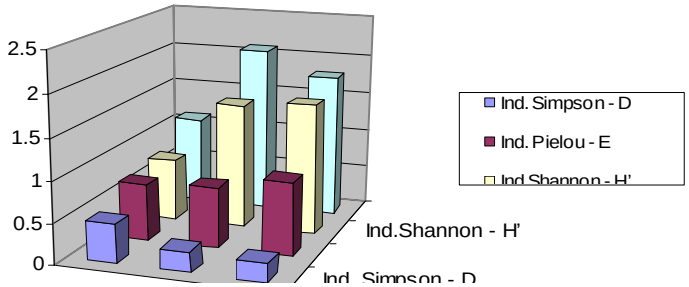
Table 4

Biodiversity indicators on the herbal flora level

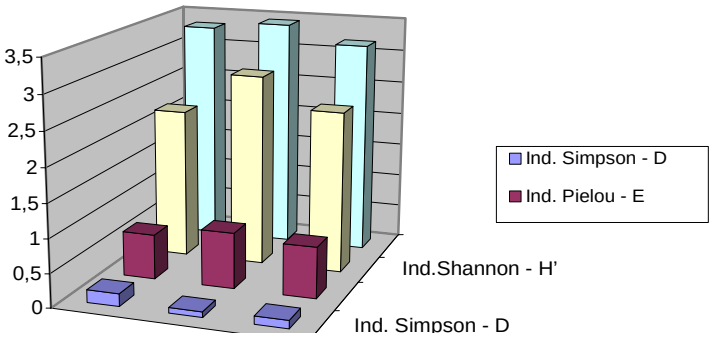
Location	Inventoried surface SP	No of species/SP -S-	No of index/SP -N-	No of index/ha	Shannon index -H'-	Pielou index -E-	Simpson index -D'
O.S. Oradea U.P. VI-Hidisel u.a. 8B	10 mp	29	466800	4668000	2,77490	0,82407	0,08299
O.S. Oradea U.P. VI-Hidisel u.a. 30B	10 mp	29	451800	4518000	3,00346	0,89195	0,06271
O.S. Oradea U.P. VI-Hidisel u.a. 30C	10 mp	32	232550	2325500	2,43002	0,70115	0,11964



Graph no. 1 The biodiversity indexes at the arborescent stratum leve



Graph no. 2 The biodiversity indexes at the shrubby stratum level



Graph no. 3 The biodiversity indexes at the herbose stratum level

Analyzing the tables and graphics above we can observe that on the level of Arborescent stratum the diversity of species is variated, the dominant species in all the three brushes are the Sessile oak and the Turkey oak (*Quercus petraea and Quercus cerris* L.) associated with the common hornbeam and the European sweet cherry (*Carpinus betulus and Prunus avium*) in case of brush from 8B compartment, with the silver lime, the European sweet cherry, the European mountain ash and the common hornbeam (*Tillia tomentosa, Prunus avium, Sorbus torminalis and Carpinus betulus*); with the silver lime, the common hornbeam, the field maple, the European sweet cherry and the European mountain ash (*Tillia tomentosa, Carpinus betulus, Prunus avium, Acer campestre şi Sorbus torminalis*).

The Shannon index (H') takes the value of 0,66251 in accordance with a maximum possible diversity of 1,386294 in case of brush from 8B compartment, in case of brush from 33B compartment has the value of 0,83179 in accordance with maximum possible diversity of 1,791759, and in case of brush from u.a. 33 C the Shannon diversity index has the value of 1,45497 in accordance with a maximum possible diversity of 1,94591. The Simpson index (D) takes the values of 0,63574 in case of brush from 8 B compartment, of 0,62679 in case of brush from 33B compartments and of 0,25990 in case of brush from 33 C 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 near-by values in case of brushes from those 3 studied compartments, so in 1 compartment this is 1,61671 in accordance with the maximum possible diversity of 1,79175; in 8 compartment has the value of 1,68254 in accordance with the maximum possible diversity of 2.07944. In the brush from 154B compartment this index has the value of 1,54365 in accordance with the maximum possible diversity of 2,19722. The Simpson index (D) takes its values of 0,48661 in the brush from 8B compartment, of 0,25164 in the brush from 33B compartment and of 0,22270 in brush from 33C compartment.

On the herbal flora level the Shannon index (H') takes the value of 2,23172 in accordance with the maximum possible diversity of 3,33220 in brush from 8B compartment, in brush from 33B compartment this has the value of 2.85499 in accordance with the maximum possible diversity of 3,433986 and in brush from 33C compartment the Shannon index diversity takes the value of 2.41103 in accordance with the maximum possible diversity of 3,178054. The Simpson index takes the value of 0,18723 in brush from 8B compartment, 0,08288 in brush from 33B compartment, respective 0,11964 in brush from 33C compartment.

Any kind of human sustained activity determines the modification of natural environment. This modification will affect the relative abundance of species, and in extreme cases can bring the disappearance of some species.

The main cause of the species disappearance results from the fact that the habitat became unsuitable for the species in case (for example the race cutting of forests). Keeping a meaningful proportion of biological diversity seems to be possible only by maintaining the organism in their "wild" habitat and in their existing landscape.

Regarding the measures which are meant to stand on the basis of biodiversity conservation and long term administration of forests a big importance will be given to choosing the forestry treatments. So the most indicated, in case of unity production VI - Hidişel, are those with repeated cutting and submassive regeneration, namely the progressive cutting treatment and the successive cutting treatment.

Together with the introduction of the long term administration concept of forests, which refers to conservation too and improvement of biodiversity, increased very much the importance accorded to natural regeneration, on European level this being recommended unanimous whenever they are possible, accountable fact if we have in view that these

methods of regeneration mainly assure the descending conservation of original genetic structure, but also that of ecosystem, having the capacity to ameliorate them, in those cases when the treatments are chosen unsuitable (Giurgiu, V.).

Next it will be presented some tendencies that are present in some countries of the European Community and which can be taken into account in our country too:

- On the genetic diversity level:

- extension of natural regeneration with artificial filling, using reproductive material based on strict local source
- conservation of ecotypes belonging to conservation networks of genetic resources
- restraining the race cuttings.

- On the species diversity level:

- formation of mixed brushes, giving attention to all the species, including those that form sub brush and herbal flora
- maintaining in brush a limited number of old brushes (1-3 brush / ha) taking imposed phytosanitary measures.

- On the ecosystem diversity level:

- reducing the compartment surface to 6-7 ha (in accordance with maximum 50 ha existing in present)
- restraining race cuttings
- forming of brushes with strong mosaic horizontal structures
- delimitation and conservation of key – biotope
- Distinctive administration of forest edges and sides settled along hydro graphic network
- introducing in specific conservation regime of susceptible brushes in order to be included in the protected system areas.

CONCLUSIONS

From the above mentioned results that in our region of study, a big part of treatments coming to be applied have a partial or integral renewing character, similar to this a big part of brushes, coming from off springs need to be placed in the forest.

In other situations will be applied the treatment of repeated cutting and mixed renewing under shelter; through the adopting of these kinds of treatments there will be changed the structural and functional balance of ecosystems in which the interventions are made, this will be balanced in short time and the brushes can exert in normal conditions.

Applying correctly the nursing works, choosing correctly the silvicultural treatments and applying them on the site with full responsibility are vital in the lasting processing of forest ecosystems and biodiversity conservation of these.

In the tempered area, area where the forests of Romania are included, the majority of forest ecosystems have a low specified diversity, which characteristic is followed to be high through adequate housing.

- applying the adequate silvicultural treatment and tending operations
- adopting some regenerating technologies of the stands based on natural regeneration, when it is necessary, mixed regeneration: natural with artificial completition, using reproduction material based on local source.
- creating mixed stands paying attention to all species including those form substands and herbaceous stratum.
- creating stands with strong mosaic horyzontal structure
- favoring all kinds of stand species
- favoring the development of herbaceous stratum
- the ecological reconstruction of destroyed ecosystems
- using biological ways for forest production

• stopping the clearing, preventing the dezasters in the forest

It is required in these conditions to determine the particular measurements of housing which prove to be necessary and enough for assuring stability and production at an optimistic level of the forest cultures generated anthropologically.

The forests from the investigated ecosystems: "High and medium productive Sessile-turkey oak stand, with Glecoma – Geum", „Mixture of Sessile forest (silver lime, common hornbeam), with Aspenda-Asarum-Stellaria", „Turkey oak stand-Sessile oak stand with common hornbeam, with Aspenda-Asarum-Stellaria" are formed from stands in which the basic species is the sessile oak, which appears in the mixture in different propotions with the common hornbeam, and the European sweet cherry in the 8B compartment, with the turkey oak, lime, common hornbeam, European sweet cherry, common maple, and the European mountain ash in the 33B compartment, with with the turkey oak, lime, common hornbeam, European sweet cherry, common maple, and the European mountain ash in the 33C compartment.

Speaking about mixtures being very complex structurally and functionally from our country's forest flora, the leadership of traces come to claim the highest attention and the most advanced technique. The promotion of sessile oak and it's maintaining in judicious proportion of other species from the mixtures, raises a series of delicate problems which are difficult to solve.

In U.P. VI Hidişel, the brushes wholly derived occupy 13%, those partially derived 30%, and those artificial 9%. When the basic species are missing from the stands or these appear in reduced proportion and can't be assured even the soil protection, and the young stands which are introduced in the mixture, it is necessary to proceed to integral restoration of these stands. It is indicated to return to the natural fundamental types, the best adapted to local conditions, using reproduction material based on strictly local source. It is indicated to do in case of these stands complex mixtures paying attention to all species, including those which form underwood and herbaceous stratum, getting diversified structures (horizontal and vertical).

But when the actual stands can assure through their crown layer the necessary shelter for the soil and for the youngsters, and in these stands are present the indicated species we should take the future stands, in high proportion, it is recommended to quit the whole series of pretentious and extremely expensive work. In this situation it is necessary to use a mixed regeneration, natural part for the existent species in the exploited stand and artificial part for introducing new species, so to a new improvement of actual stand.

In the actual coppice stands, in relation with their state it is very necessary to apply conversion treatment, parallel with their restoration; for this it is indicated to apply mixed conversion treatment, avoiding as much as possible the use of integral restoration, which is so expensive, and through which highly disrupts the balance of forest ecosystems.

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