

INDICATORS OF BIODIVERSITY FOR NATURAL FORESTS

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REZUMAT

Biodiversitatea este o noțiune globală care cuprinde ansamblul formelor de viață de pe Terra. Omniprezentă, ea se referă la gene, la speciile animale și vegetale, la ecosistemele și peisajele planetei, înglobând astfel toate nivelele de organizare a lumii vii. Orice analiză a biodiversității trebuie să țină seama și să precizeze: nivelul la care se referă (intraspecific, specific, ecosistemic sau peisagistic), teritoriul analizat și data când ea se realizează.

După definirea diversității genetice, specifice și ecosistemice se prezintă o serie de indicatori ai acestei biodiversități proprii pădurilor României (în general) și pădurilor naturale din unele Parcuri Naționale (Tabelul nr. 1). Se insistă asupra indicatorilor specifici pădurilor naturale adoptați în diferite țări în urma conferințelor internaționale de la Rio de Janeiro (1992), Helsinki (1993) și Geneva (1994) și se selectează o serie de indicatori pentru condițiile din țara noastră.

The biodiversity (or the biological diversity) is an aggregate notion, not only with scientific significance, but also with social and economic contents. Generally speaking it include all living forms of the Earth, the component parts of an tremendous interdependent system and describe just the expression of this life variety. Everywhere present, it refers to genes, to the animal and vegetal species, to the ecosystems and landscapes of the planet, including thus all levels of the life organisation, from genes to biosphere.

Taken into the most common sense, the biodiversity is measured by the total number of the living beings (plants, animals; mushrooms, microorganisms) including in the ensemble of terrestrial and aquatic ecosystems of the planet (so called abundance or total richness). However, it the dominance

must be taken in view also, determined by the numerical predominance of one populations or of the few species, in the interior of the same community.

Due to the complexity, dynamics and mobility of life forms, any analysis of biodiversity should take into consideration and to specify, the following:

- the level of reference: infraspecific (genetic), specific, ecosystemic or landscape;

- the analysed space (area): tree, microsite, site, parcel, production unit, forest district, forest massif, region, country a.s.o.;

- the time, that is the date when this analysis is performed.

In the forest ecosystems, the genetic diversity include such categories as individual, population, ecotype, provenance and can be expressed by occurrence and number of populations, ecotypes, biotypes, varieties, forms and phenotypes – extant in the frame of species, in the whole its area, or on a delimited area.

The species diversity of forest is mainly determined by the stand composition, structure and developmental phases. It can be evaluated by the number of species (populations), or by the number of individuals for each species.

The ecosystems diversity is conditioned by the richness of flora and fauna and by the space variability of life environment. It can be expressed by the number of ecosystems types or by the number of species related to a definite, standard area (1,4 or 16 km²).

Characterised by a large space extension, perennity, complexity and stability, the forest ecosystems include specific extremely diversified biocenosis, make up by populations of tree, shrubs, lianas, herbs, mosses, lichens, mushrooms, mammals, birds, amphibians, reptiles, insects, worms, bacterias and other microorganisms (actinomycetes, protozoa). Really, the multitude and diversity of ecological niches offered with generosity by forests to others different categories of living beings is extremely amazing.

The forests of Romania fully illustrates this high diversity. They are make up by 58 native tree species, 118 shrub species, and 1075 herb species (37% of whole flora) and are differentiated into more then 300 natural forests types, in 150 forest ecosystems types, located in some hundreds site types. They show an outstanding variety of compositions, structures, developmental phases and forest landscape types. In these forests take refuge 33 mammal species (32% of total country's number) more than 250 bird species (67% of country's avifauna), 15 reptile species (50%), 16 amphibian species (80%), and 21 fresh water fish species in the mountains rivers (Beldie 1979; Giurgiu, 1995; Bănărescu, 1994; Radu, 1995).

In forest ecosystems and in associated to these areas biotops (clearings, streams, marches, stone a.o.) are located many threatened and rare plant species: 14 relicts and 32 endemic and subendemic species, respectively 40% from the list established by Dihoru and Pârnu, 1989. The woodland area shelter the majority of strictly protected plants, declared or not as „nature monuments", as well as a great number of monumental trees (century-old and/or with record sizes). These specimens have an particularly dendrological, historical, landscape, dendrochronological and memorial values.

The great frequency of natural forest in Romania is completed by their high genetic and by monumentality of some exceptional stands (by Norway Spruce, Silver Fir, Sessile Oak and Beech), well known and certified by european scientists. To these stands must be added the last large quasivirgin (primary) forest still conserved in romanian Carpathian Mts.; such woods are almost extinct in Central Europe and replaced by man-made forests. According to the experts of Council of Europe (Strasbourg, 1987) the natural and ancient forest mean a part of european patrimony, due to their natural, scientific, aesthetic, cultural and instructive values. These forests have fundamental ecological roles and shelter an original flora and wildlife very rich in threatened species.

In the addition to such diversity indices as Simpson's and Shannon Weaver index – widely used in ecology, a lot of special indices for biodiversity for forest ecosystems were elaborated and suggested during the last decade.

After the UN Conference on Environment and Development, Rio de Janeiro, June 1992, and the recommendation for conservation of natural forests and biological biodiversity, which were adopted at this conference, a lot of countries started to elaborate criterions and indicators for biodiversity conservation as a main link of sustainable development.

The criterions used in the sustainable management of forests correspond to some major concern of forests policy and direct the managers in adopting the suitable decisions, while the indicators give us the opportunity to estimate the results of our interventions in forest and to monitor the changes of forests state.

The overall list of sustainable management indicators for forests include, as a component part, the biodiversity indicators for the respective forest.

The meeting of forest experts in Geneva (1994) adopted 6 criterions and 27 quantitative indicators which allow to estimate the forest sustained management. It was agreed that each country need to complete these indicators, according to their essential features and necessities. A number of 5 indicators refer to the forest biodiversity.

An analyses of adopted in France and Canada biodiversity indicators, or selected by Giurgiu give us the possibility to retain the following more important indicators:

- for forest ecosystems: the number of species per unit area or for a certain habitat; the number or percent of endemic, rare or threatened species, related to the total number of species; the number of species with evidently decreasing populations; the volume of dead wood (dead or dying trees, standing or fallen) per ha;

- at the country's or region's level, among the main biodiversity indicators it is necessary to retain the followings: the percent of protected areas, and the proportion of protected ecosystems and species in these areas; the proportion of natural and quasivirgin forest; the percent of mixed unevenaged and many layers stands; the proportion of natural regeneration and of intensive silvicultural systems; the degree of territorial forest fragmentation; the density of access roads and others indicators.

In the case of scientific researches, the biodiversity assessment needs combined – team work of silviculturists assisted by botanists, zoologists, ornithologists and other specialists, having done the forests ecosystems complexity.

In the frame of the sustained management plants, the biodiversity assessment and monitoring at mentioned territorial level (plot, management units, forest district) can be done by forest engineers, after an special training course.

Studying biodiversity in natural forests of some National Park in this country we used also the following indicators: the number of trees and shrubs species; the number of endemic taxa; the number of protected plants and animals; the threatened and vulnerable species of plants, mammals, fishes, birds, reptiles and amphibians; the occurrence of relevant landscapes elements or of characteristic biotops; the number of protected plants and animals; the threatened and vulnerable species of plants, mammals, fishes, birds, reptiles and amphibians; the occurrence of relevant landscapes elements or the characteristic biotops; the number of forest types, sites and ecosystems.

The indicators of forest biodiversity in 7 National Parks are shown in the table 1.

These indicators allow to make an partial hierarchy of studied National Parks but only in the frame of each indicators, due to the fact that as concerning the biodiversity, the landscape value and the occurrence of specific habitats, each National Parks mean an complex singleness, with suitable personality conferred by specific individual, unrepeated and uncomparable features.

REFERENCES

1. Bănărescu, P. 1994. The present – day conservation status of the fresh water fish fauna of Romania. *Ocot. nat. med. înconj.* t.38, nr. 1.
2. Beldie, Al. 1979. Caracterizarea ecologică și fitogeografică a speciilor forestiere din România. ICAS, București.
3. Dihoru, G., Pârvu, C. 1987. Plante endemice în flora României. Ed. Ceres, București.
4. Giurgiu, V. (red.) 1995. Protejarea și dezvoltarea durabilă a pădurilor României. Arta Grafică, București.
5. Radu, S. 1996. Pădurile virgine și cvasivirgine din Carpați – argumente pentru conservare și studiu. Lucrările celei de a treia Conferințe naționale de protecția mediului prin metode și mijloace biologice și biotehnice. Brașov.
6. Radu, S., Coandă, Corina. 1998. În problema indicatorilor biodiversității din ecosistemele forestiere. Comunicare sesiunea șt. ICAS București.
7. Ricklefs, R. 1990. Ecology 3-rd ed. W.H. Freeman&Comp. New York.

SOME INDICATORS OF BIODIVERSITY OF NATURAL FORESTS IN 7 NATIONAL PARKS

Indicators	At the level of		National Parks						
	Romania	Forest ecosystems of Romania	Retezat	Domogled V. Cernei	Apuseni	Călimani	Rodna	Ch. Caraș-Semenic	Ch. Nerei-Beușnița
1. Total number of wooden sp.	176	176	58	106	83	69	73	127	132
of wich: trees	58	58	27	46	36	32	30	43	51
shrubs	118	118	31	60	47	37	43	84	81
2. Glaciar relicts (nr.of sp.)	29+14	10+4	0	0	0	1	7	1	0
3. Number of endemic taxa	128	32	24(+39)	18	16	15	45	7	10
%	100	25	19	14	13	11	35	6	8
4. Number of superior plants sp.	3450	1251	1602	1119	*	*	1123	500	694
5. Protected plants(sp.)	25	23	15	9	6	7	13	7	22
6. Endangered (E) and vulnerable (V) plant sp.	*	60	13	14	10	5	12	13	16
7. Mammals (sp.)	102	33	>26	*	*	*	*	*	*
of wich: endangered, vulnerable and rare	*	19	9	8	3	7	9	7	11
8. Birds (sp.)	375	250	82	49	49	135	*	70	140
of which: E+V+R	*	29	15	22	8	17	21	19	24
9. Reptiles+Amphibians	30+20	15+16	*	*	*	*	*	*	*
of which: E+V+R	*	28	10	17	10	9	9	22	21
10. Site types (nr.)	*	367	19	39	6	11	23	7	9
11. Forest types (nr.)	282	282	26	41	8	10	20	8	7
12. Ground vegetation types (nr.)	0	50	11	7	9	5	12	7	9

Legend: * = incomplete data; 0 = missing data