Contribuţii Botanice - 2010, *XLV*: 13-24
Grădina Botanică "Alexandru Borza"
Cluj-Napoca

ASSESSMENT OF SPECIES COMPOSITION: ENDEMICS, RELICTS AND RED-LISTED PLANTS (TRACHEOPHYTAE, BRYOPHYTAE, AND FUNGI) IN FOREST NATURAL HABITATS OF ROMANIA

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Abstract: Our study attempts to complete the description of the forest natural habitats (sensu Habitat Directive 92/43/EEC) recorded in our country, with the rarest, critically endangered, endangered, vulnerable, extinct in the wild, glacial or Tertiary relict species, as well as the endemic or near-endemic plant species and fungi.

230 species of vascular plants, 90 bryophytes and 31 fungi have been identified as being the rarest, the most threatened, relict or endemic/near endemic in the forests of Romania.

Most of the species listed in the Red Data Book and various Red Lists live in deciduous forests – 198 species, especially vascular plants and bryophytes; 81 species (23.07%) are distributed in coniferous forests, while 72 species (20.5%) are located in mixed forest. In Romania the most favourable state of forests in terms of plant conservation (number of threatened, rare, relict, and endemic/near endemic plants) is found on the upper hills, as well as in the lower and middle levels of the mountain areas. But the forests situated in the middle and lower parts of hills, as well as in the plains, have a much more reduced diversity, in terms of number of species of vascular plants, bryophytes and fungi, as a result of strong human impact. Some of the natural habitats that circumscribe Romanian forests (e. g. 91AA, 91V0, 91Y0, 9410, etc), are the most exposed to anthropic-zoogenic pressures of all kinds. The largest number of threatened, rare and endemic/near endemic, or relict species of vascular plants and bryophyte are distributed in the forest-steppe areas in the east, south and south-west part of Romania (Steppe & Continental Bioregions), as well as along the chain of the Carpathian Mountains (Alpine Bioregion).

Key words: Romanian forests, Red-listed species, diversity conservation, Habitat Directive 92/43/EEC, Bern Convention.

Introduction

Earth's forests have an important role in the life of humanity, not only for timber products but also as other vegetal and animal resources and as a part, one that is irreplaceable, of our environment. Nowadays, forests represent *c*.30% of the whole terrestrial surface [18], being an important part of the Biosphere.

A favourable state of the development of forests is found especially in the upper hilly regions, as well as in the lower and middle levels of the mountains. Phytosociological composition of the zonal forest belts is fairly intricate, registering various forest formations: e.g. spruce forests (with *Picea abies*), mixed forests of beech (*Fagus sylvatica* with other broad leaved species or conifers) and various coniferous species, more or less pure stands of beech, more or less pure stands of oaks (*Quercus* spp.) and mixed forests of various species of oaks, stands of Turkey oak (*Quercus cerris*), stands of Hungarian oak (*Q. frainetto*), mixed forests of Turkey and Hungarian oaks, and stands of *Q. pedunculiflora*. Azonal forest formations comprise, for the most part, the riverine forests: with black alder (*Alnus glutinosa*), white alder (*A. incana*), black poplar (*Populus nigra*) and white poplar (*P. alba*), various species of willow (*Salix* spp.), etc. All of these forest types comprise numerous plant and fungal species, some of them being

significant from the point of view of plant conservation diversity. In the forests are, besides the stands of trees, numerous rock formations, small lakes and ponds, also many streams and rivers, all contributing to raising the importance of the forest for biodiversity conservation. Thus, in the Romanian forests, plants and fungi are classified here as: i. *endemic and near-endemic species*; ii. *extinct in the wild, critically endangered, endangered, vulnerable or rare species*; iii. *glacial or Tertiary relic species*, etc. Some of forest species (plants or fungi) are recorded under various international directives, as Romania has already ratified these (EU Habitats Directive, Bern Convention, Bonn Convention, etc.).

Our study attempts to complete the description of the forest natural habitats (sensu Habitat Directive 92/43/EEC) recorded in our country, with the rarest, critically endangered, endangered, vulnerable, extinct in the wild, glacial or Tertiary relict species, as well as those plant species that are endemic or near-endemic.

The importance of our study consists in providing a scientific background for future sustainable forestry management, which could take into account the following issues:

– a major objective of sustainable forest management is the conservation of biodiversity values (vascular plants, bryophytes, fungi, as well as various groups of animals);
– forest habitats assessments give an idea of the conservation plants and fungi *in situ*;
– helping foresters in assessing processes, as well as the management steps taken in preservation of various forest communities.

Important components of forest biodiversity are the plant and fungal species, some of them fairly rare within a particular area. In the flora of Romania *c*. 3,500 spontaneous vascular plant species are listed [3; 19]. Among these species, *c*. 1/3 (in the broadest sense) represents the vascular flora of forests.

Those rare plant species (*endemics and near-endemics*, *species extinct in the wild, critical endangered*, *endangered*, *vulnerable*, *glacial or Tertiary relict species*) are protected in Romania by different regulations, such as:

– some are listed under international regulations, including the Habitats Directive of the European Union [29], Bern Convention [28], World Tree List [15], Fungi of Europe under Bern Convention [1; 5], Red List of European Bryophytes [30], World Red List of Bryophytes [31]
– others are recorded in the various Red Lists and Red Books that exist in the Romanian literature [2, 8, 9, 13, 16], or in specific papers dealing with this topic [8, 10, 14].

The *Red List of Romanian Macrofungi Species* [25] is an essential document for the rational management of natural ecosystems. It provides the critical information necessary for taking political decisions about priorities in nature management, as well as in biodiversity conservation of fungal species in Romania. Other scientific papers deal with other topics concerning bryophytes [26], fungi [17, 21], as well as vascular plant conservation [20, 24].

Material and Methods

For each type of natural habitat [11, 12, 29] we have decided to include, only, those plant species that are recorded in the flora of Romanian forests. Alongside the vascular plants we have added, also, various species of bryophytes and fungi, which complete our overview of the conservation value of Romanian forest habitats. We have listed those species that are threatened or/and endemics/near endemics, and rare, as well as the relict species in the Romanian flora. For this purpose, we have followed international regulations already implemented into Romanian legislation [33, 34], the Romanian *Red Book* [10], the Romanian *Red List* [16] and, also, selected on the basis of the authors' field experience. Some of the plant and fungi species are Critically Endangered, Endangered, Vulnerable or Rare, so we have alloted them these sozological categories from the IUCN guidelines [26, 33].

For bryophytes we have used the manuscript *Red List* proposed by Ştefănuţ & Goia, 2006 [23], *Red List of European Bryophytes* [30] and the *World Red List of Bryophytes* [31]. The occurence of these species in different habitats has been established following Dierßen [7] and the field experience of the authors.

In order to harmonize the preservation of fungi with the other groups of species, as well as making comparisons between the various continents of the world, key targets have been identified, compatible with those targets already established through the *Global Strategy for Plant Conservation*. The plant strategy under the *Convention on Biological Diversity Conservation* is similar to that for the conservation of fungi, thanks to the interrelationships existing between fungi and plant diversity [1, 21]. Dahlberg & Croneborg (2003) [5] proposed to include 33 macrofungi species at the European level, under various threat categories in Annex I of the *Bern Convention* [28]. The representatives of this professional body appreciated this step as necessary, but until now no progress has been made, although this document has been achieved as a co-operative tool among mycologists from different European countries. Some of the species are registered under two different regulations (international and national, respectively), which is indicated in this paper as follows: EU DG/R RO.

Some of the forest natural habitats, analyzed here, do not have any characteristic species of bryophytes or fungi recorded as yet, or the authors consider that other detailed field studies are necessary in the near future. Furthermore, one special habitat – 9260 *Castanea sativa* woods – does has not have any characteristic vascular plants. We can assume that this is a particular case in Romania, as well in the whole of Europe, since this habitat is represented by old-established plantations, even if sweet chestnut was planted here a long time ago [27].

We have avoided giving the general description of each forest natural habitat, since these aspects are already described in detail in other publications dealing with this topic, e.g. "Interpretation Manual of European Union Habitats" (EUR 27/2007), Doniţă *et al.* [11], Gafta *et al.* [12]. Also, the plant communities assigned to a certain forest natural habitat registered in Romania are to be found in Gafta *et al.* [12].

Abbreviations used in the text: EX – extinct in the wild; CR – critically endangered; EN – endangered; VU – vulnerable; LC – least concern; I – indeterminate; NT – not threatened; DD – data deficient; END – endemic; nEND – near endemic; R – rare (sensu Dihoru & Negrean, 2009); VR – very rare (for fungi only); LR – Romanian Red List; WLT98 – World List of Trees, 1998; HD Ann IIB, VB – Habitats Directive, Annex IIB, Annex VB; BC – Bern Convention; ERL – European Red List of Bryophytes; EU DG – European Union/Directorate General for Environment; WRL2000 – World Red List, 2000 (for bryophytes only); RO – Red List of Romanian Macrofungi Species.

I. CONIFEROUS FORESTS & MIXED FORESTS

A. PRIORITY HABITATS TO BE PROTECTED IN EUROPEAN COUNTRIES (*) (and also in Romania)

91D0* Bog woodland

a. Vascular plants: *Andromeda polifolia* glacial relict/R; *Betula humilis* glacial relict/CR; *B. nana* glacial relict/ CR; *Campanula abietina* BC/LC; *Drosera longifolia* glacial relict/VU; *D. intermedia* glacial relict/CR; *D. rotundifolia* glacial relict/R*; Pedicularis sylvatica* CR; *Salix bicolor* CR; *Trientalis europaea* glacial relict/CR; *Vaccinium oxycoccos* glacial relict/R; *Viola epipsila* glacial relict/CR; *V. palustris* glacial relict/CR.

b. Bryophytes: *Amblystegium saxatile* EN*; Anastrophyllum hellerianum EN, Barbilophozia attenuata* VU; *Bryum creberrimum* EN; *Buxbaumia aphylla* VU; *Cephaloziella elegans* CR; *Cynodontium bruntonii* EN; *Dicranum spurium* EN; *D. viride* HD/BC/EN; *Entodon cladorrhizans* CR; *Fabronia ciliaris* EN; *Frullania parvistipula* BC/ERL/CR; *Hypnum jutlandicum* EN; *Lophozia ascendens* VU;

Oxymitra incrassata EN; *Sphagnum fimbriatum* VU; *S. wulfianum* CR; *Tayloria acuminata* EN; *T. splachnoides* ERL/CR.

c. Fungi: *Amanita regalis* RO/NT; *Bovista paludosa* EU DG/VR RO/EN; *Galerina sphagnorum* EU DG/R RO/NT; *Hebeloma helodes* EU DG/R RO/NT; *Hericium erinaceum* EU DG/VR; RO/VU; *Lactarius picinus* RO/NT; *L. uvidus* RO/NT; *Suillus flavidus* EU DG/VR RO/VU; *Tephrocybe palustris* EU DG/R RO/NT.

9530* (Sub-)Mediterranean pine forests with endemic black pines.

a. Vascular plants: *Campanula crassipes* EN*; Corylus colurna* VU*; Genista radiata* CR-DD; *Primula auricula* subsp. *serratifolia* VU.

b. Bryophytes and c. Fungi: information not available.

B. NON-PRIORITY HABITATS TO BE PRESERVED IN EUROPEAN COUNTRIES

9110 *Luzulo-Fagetum* beech forests

a. Vascular plants: *Botrychium multifidum* BC/R; *Daphne blagayana* VU*; Diphasiastrum complanatum* HD Ann VB/R*; Dryopteris borreri* R*; Campanula abietina* BC/LC*; Epipogium aphyllum* R.

b. Bryophytes: *Anacamptodon splachnoides* VU; *Brachythecium geheebii* VU; *Calypogeia integristipula* EN; *Cephalozia loitlesbergeri* CR; *Dicranum tauricum* VU; *D. transsylvanicum* CR; D. *viride* BC/HD/EN; *Eurhynchium pumilum* VU; *Frullania jackii* VU; *Geocalyx graveolens* EN; *Lescuraea mutabilis* VU; *Metaneckera menziesii* CR; *Metzgeria fruticulosa* EN; *Neckera pumila* VU; *Odontoschisma denudatum* CR; *Orthotrichum patens* CR; *Pseudoleskea saviana* CR; *Pterogonium gracile* EN *Rhynchostegiella tenella* VU; *R. tenuicaulis* VU; *Rhynchostegium rotundifolium* VU; *Ulota coarctata* EN; *Zygodon dentatus* EN.

c. Fungi: information not available.

9130 *Asperulo-Fagetum* beech forests

a. Vascular plants: *Campanula abietina* BC/LC*; Cephalanthera rubra* R; *Daphne blagayana* VU*; Lysimachia nemorum* CR*; Platanthera chlorantha* R.

b. Bryophytes: *Anacamptodon splachnoides* VU; *Brachythecium geheebii* VU; *Cephalozia loitlesbergeri* CR; *Dicranum tauricum* VU; *D. transsylvanicum* CR; *D. viride* BC/HD/EN; *Eurhynchium pumilum* VU; *Frullania jackii* VU; *Geocalyx graveolens* EN; *Lescuraea mutabilis* VU; *Metaneckera menziesii* CR; *Metzgeria fruticulosa* EN; *Neckera pumila* VU; *Odontoschisma denudatum* CR; *Orthotrichum patens* CR; *Pseudoleskea saviana* CR; *Pterogonium gracile* EN; *Rhynchostegiella tenella* VU; *R. tenuicaulis* VU; *Rhynchostegium rotundifolium* VU; *Ulota coarctata* EN; *Zygodon dentatus* EN.

c. Fungi: *Amanita strobiliformis* RO/NT; *Hapalopilus croceus* EU DG/VR; RO/EN; *Laricifomes officinalis* EU DG/VR; RO/EN.

91K0 Illyrian *Fagus sylvatica* forests (*Aremonio-Fagion*)

a. Vascular plants: *Acer monspessulanum* R; *Campanula grossekii* R*; Cardamine enneaphyllos* CR; *Corylus colurna* VU; *Daphne laureola* VU; *Laburnum anagyroides* R; *Lactuca aurea* EN; *Luzula forsteri* R; *Orchis pallens* CR; *Ruscus aculeatus* HD Ann VB/R; *Ruscus hypoglossum* R.

b. Bryophytes: *Anacamptodon splachnoides* VU; *Brachythecium geheebii* VU; *Cephalozia loitlesbergeri* CR; *Dicranum tauricum* VU; *D. transsylvanicum* CR; *D. viride* BC/HD/EN; *Eurhynchium pumilum* VU; *Frullania jackii* VU; *Geocalyx graveolens* EN; *Lescuraea mutabilis* VU; *Metaneckera menziesii* CR; *Metzgeria fruticulosa* EN; *Neckera pumila* VU; *Orthotrichum patens* CR; *Pseudoleskea saviana* CR; *Pterogonium gracile* EN; *Rhynchostegiella tenella* VU; *R. tenuicaulis* VU; *Rhynchostegium rotundifolium* VU; *Ulota coarctata* EN; *Zygodon dentatus* EN.

c. Fungi: information not available.

91Q0 Western Carpathian calcicolous *Pinus sylvestris* forests

a. Vascular plants: *Arctostaphylos uva-ursi* VU*; Astragalus pseudopurpureus* BC/END/EN; *Campanula carpatica* nEND/R; *C. serrata* HD Ann IIB/NT; *Daphne blagayana* VU*; Epipactis microphylla* R; *Goodyera repens* R*; Iris aphylla* subsp. *hungarica* HD Ann IIB/NT*; Monotropa hypopitys* R*; Pinus sylvestris* R; *Silene nutans* subsp. *dubia* END/R; *Sorbus dacica* END/EN.

b. Bryophytes and c. Fungi: information not available.

9410 Acidophilous *Picea* forests of the montane to alpine levels (*Vaccinio-Piceetea*)

a. Vascular plants: *Amelanchier ovalis* R; *Botrychium matricariifolium* CR; *Campanula abietina* BC/LC; *Chimaphila umbellata* CR; *Crepis sibirica* R*; Corallorhiza trifida* R*; Daphne blagayana* VU; *Diphasiastrum tristachyum* HD Ann VB/R*; Dryopteris borreri* R*; Empetrum nigrum* subsp. *hermaphroditum* glacial relict/R; *Epipogium aphyllum* R; *Goodyera repens* R*; Hepatica transsilvanica* END/Tertiary relict/NT; *Hieracium borbasii* END/R; *H. kotschyanum* END/R; *Leontodon repens* R*; Lonicera caerulea* R; *Melampyrum herbichii* nEND/R; *M. saxosum* nEND/R; *Microstylis monophyllos* R; *Monotropa hypopitys* R*; Pulmonaria filarszkiana* nEND/NT*; Ranunculus carpaticus* nEND/R*; Trientalis europaea* glacial relict/CR.

b. Bryophytes: *Anastrophyllum hellerianum EN*; *Athalamia hyalina* VU; *Aulacomnium androgynum* VU; *Barbilophozia attenuata* VU; *B. kunzeana* CR; *Brachythecium erythrorrhizon* VU; *B. geheebii* VU; *B. oedipodium* VU; *Bryum creberrimum* EN; *Buxbaumia viridis* ERL/BC/CR; *Calypogeia integristipula* EN; *Cephalozia loitlesbergeri* EN; *Cephaloziella elegans* CR; *Cynodontium bruntonii* EN; *Dicranodontium asperulum* VU; *Dicranum spurium* EN; *D. transsylvanicum* CR; *D. viride* BC/HD/EN; *Entodon cladorrhizans* CR; *Fabronia ciliaris* EN; *Frullania parvistipula* BC/CR; *Geocalyx graveolens* EN; *Jungermannia subulata* CR; *Lophozia ascendens* VU; *Orthotrichum rogeri* ERL/BC/CR; *Oxymitra incrassata* EN; *Plagiothecium ruthei* VU; *Pseudobryum cinclidioides* VU; *Scapania apiculata* EN; *S. verrucosa* VU; *Sphagnum angustifolium* VU; *S. fimbriatum* VU; *S. riparium* CR; *S. subnitens* VU; *S. wulfianum* EN; *Tayloria acuminata* EN; *T. splachnoides* ERL/CR.

c. Fungi: *Amanita regalis* RO/NT; *Elaphomyces asperulus* RO/CR; *Geastrum quadrifidum* RO/NT; *Gomphus clavatus* EU DG/VR; RO/NT; *Gyromitra gigas* RO/EN; *Hygrophorus purpurascens* EU DG/VR; *Sarcosphaera coronaria* DG/R; RO/NT.

9420 Alpine *Larix decidua* and/or *Pinus cembra* forests

a. Vascular plants: *Campanula abietina* BC/LC*; Larix decidua* subsp. *carpatica* WLT 98/R; *Pinus cembra* R*; Ranunculus carpaticus* nEND/R; *Rhododendron myrtifolium* VU.

b. Bryophytes: information not available.

c. Fungi: *Suillus plorans* RO/VU.

II. DECIDUOUS FORESTS

A. PRIORITY HABITATS TO BE PROTECTED IN EUROPEAN COUNTRIES (*)

9180* *Tilio-Acerion* forests of slopes, screes and ravines

a. Vascular plants: *Adenostyles alliariae* subsp. *hybrida* R; *Centaurea maramarosiensis* nEND/R*; Corydalis capnoides* R*; Lunaria annua* subsp. *pachyrhiza* R*; Pleurospermum austriacum* R*; Ribes alpinum* R*; Sorbus chamaemespilus* EN*; S. dacica* END/R*; Taxus baccata* VU.

b. Bryophytes: *Brachythecium erythrorrhizon* VU; *Frullania jackii* VU; *F. parvistipula* BC/ERL/CR; *Lescuraea mutabilis* VU; *Orthotrichum gymnostomum* CR.

c. Fungi: information not available.

91E0* Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae*)

a. Vascular plants: *Angelica palustris* HD Ann IIB/glacial relict/CR; *Carex strigosa* LR; *Dryopteris cristata* glacial relict/R; *Euonymus nana* R*; Euphorbia carpatica* CR; *Ligularia sibirica* HD Ann IIB/glacial relict/R; *Lysimachia nemorum* CR; *L. thyrsiflora* glacial relict/VU; *Poa remota* R; *Polemonium caeruleum* glacial relict/R; *Ribes nigrum* R; *R. spicatum* CR; *Salix aurita* R; *S. daphnoides* CR; *Senecio rivularis* R; *Syringa josikaea* HD Ann IIB/BC/Tertiary relict/LR; *Tulipa sylvestris* subsp. *australis* VU.

b. Bryophytes: *Amblystegium fluviatile* VU; *Aulacomnium androgynum* VU; *Dichelyma capillaceum* BC/ERL/CR; *Ditrichum cylindricum* VU; *Fissidens exiguus* VU; *Myrinia pulvinata* EN; *Nardia insecta* CR; *Orthotrichum gymnostomum* CR; *O. philibertii* VU; *O. scanicum* WRL2000/ERL/CR; *O. stellatum* CR; *Plagiothecium ruthei* VU; *Pseudobryum cinclidioides* VU; *Sphagnum angustifolium* VU; *S. fimbriatum* VU; *S. papill*osum CR; S. *subnitens* VU; *Ulota coarctata* EN.

c. Fungi: information not available.

91H0* Pannonian woods with *Quercus pubescens*

a. Vascular plants: *Acanthus balcanicus* VU*; Allium paniculatum* subsp. *fuscum* R; *Amygdalus nana* VU*; Anthericum liliago* R; *Echinops bannaticus* EN*; Globularia punctata* CR; *Limodorum abortivum* R*; Orchis purpurea* R; *Serratula lycopifolia* HD Ann IIB/VU.

b. Bryophytes: *Brachythecium geheebii* VU; *Bryohaplocladium angustifolium* CR; *Cephaloziella baumgartneri* CR; *Fabronia ciliaris* EN; *F. pusilla* EN; *Haplohymenium triste* CR; *Leptodon smithii* CR; *Lunularia cruciata* CR; *Mannia triandra* BC/CR; *Riccia ciliata* VU; *R. gougetiana* CR; *R. papillosa* EN; *Tortula princeps* CR.

c. Fungi: *Amanita caesarea* RO VU.

91I0* Euro-Siberian steppic woods with *Quercus* spp.

a. Vascular plants: *Amygdalus nana* VU*; Bulbocodium versicolor* VU; *Corydalis intermedia* DD*; C. pumila* DD; *C. solida* subsp. *slivenensis* R; *Galanthus elwesii* R; *Malus praecox* EN; *Tulipa sylvestris* subsp. *australis* VU.

b. Bryophytes and c. Fungi: information not available.

91X0* Dobrogean Beech forests

a. Vascular plants: *Doronicum orientale* CR; *Galanthus elwesii* R; *G. plicatus* VU*; Smyrnium perfoliatum* R; *Symphytum tauricum* VU.

b. Bryophytes: *Eurhynchium pumilum* VU; *Metzgeria fruticulosa* EN; *Orthotrichum patens* CR; *Pterogonium gracile* EN; *Rhynchostegiella tenuicaulis* VU.

c. Fungi: information not available.

91AA* Eastern white oak woods

a. Vascular plants: *Achillea clypeolata* CR; *Allium paniculatum* subsp. *fuscum* R; *Alyssum wierzbickii* CR; *Amygdalus nana* VU; *Asperula rumelica* R; *Asphodeline lutea* R; *Astragalus dasyanthus* R; *A. ponticus* VU; *Asyneuma anthericoides* CR; *Cardamine graeca* R; *Carex depauperata* R; *C. hallerana* R; *C. liparocarpos* R; *Celtis glabrata* VU; *Chamaecytisus danubialis* R; *Colutea arborescens* R; *Coronilla coronata* EN; *C. emerus* subsp. *emeroides* VU; *Crocus chrysanthus* VU; *Crucianella angustifolia* R; *Delphinium fissum* R; *Dianthus collinus* subsp. *glabriusculus* R; *Elymus panormitanus* VU; *Epipactis microphylla* R; *Gagea granatellii* VU; *Galanthus elwesii* R; *G. plicatus* VU; *Geranium asphodeloides* subsp. *asphodeloides* CR; *Globularia punctata* CR; *Gymnospermium altaicum* subsp. *odessanum* CR; *Hierochloë australis* R; *H. repens* R; *Himantoglossum hircinum* subsp. *caprinum* HD Ann IIB/R; *Hypericum rochelii* EN; *Iris sintenisii* LR; *Jasminum fruticans* VU; *Lathyrus laxiflorus* CR; *Limodorum abortivum* R; *Malus dasyphylla* DD; *Mercurialis ovata* R; *Myrrhoides nodosa* R; *Ononis pusilla* VU; *Onosma arenaria* EN; *Opopanax bulgaricus* VU; *Orchis pupurea* R; *O. simia* EN; *Ornithogalum fimbriatum* R; *O. sibthorpii* VU; *Paeonia mascula* subsp. *mascula* CR; *P. officinalis* subsp. *banatica* HD Ann IIB/BC/CR; *P. peregrina* VU; *Paliurus spina-christi* VU; *Physospermum cornubiense* R; *Potentilla emilii-popii* HD Ann IIB/VU; *Pyrus elaeagrifolia* EN; *P. nivalis* DD; *Rosa turcica* VU; *Ruscus aculeatus* HD Ann VB/R; *Saponaria glutinosa* LR; *Scutellaria velenovskyi* CR; *Sison amomum* VU; *Sophora jaubertii* VU; *Symphytum ottomanum* R; *S. tauricum* VU; *Vicia sativa* subsp. *amphicarpa* CR.

b. Bryophytes: *Brachythecium geheebii* VU; *Bryohaplocladium angustifolium* CR; *Haplohymenium triste* CR; *Lunularia cruciata* CR; *Mannia triandra* BC/CR; *Tortula princeps* CR.

c. Fungi: information not available.

B. NON-PRIORITY HABITATS TO BE PROTECTED IN EUROPEAN COUNTRIES

9140 Medio-European subalpine beech woods with *Acer* and *Rumex arifolius*

a. Vascular plants: *Adenostyles alliariae* subsp. *hybrida* R.

b. Bryophytes: *Anacamptodon splachnoides* VU; *Brachythecium geheebii* VU; *Cephalozia loitlesbergeri* CR; *Dicranum tauricum* VU; *D. transsylvanicum* CR; *D. viride* BC/HD/EN; *Eurhynchium pumilum* VU; *Frullania jackii* VU; *Geocalyx graveolens* EN; *Lescuraea mutabilis* VU; *Metaneckera menziesii* CR; *Metzgeria fruticulosa* EN; *Neckera pumila* VU *Odontoschisma denudatum* CR; *Orthotrichum patens* CR; *Pseudoleskea saviana* CR; *Pterogonium gracile* EN; *Rhynchostegiella tenella* VU; *R. tenuicaulis* VU; *Rhynchostegium rotundifolium* VU; *Ulota coarctata* EN; *Zygodon dentatus* EN.

c. Fungi: information not available.

9150 Medio-European limestone beech forests of the *Cephalanthero-Fagion*

a. Vascular plants: *Cephalanthera damasonium* NT; *C. longifolia* NT; *C. rubra* R; *Epipactis microphylla* R; *Neottia nidus-avis* R; *Omphalodes scorpioides* R.

b. Bryophytes: *Anacamptodon splachnoides* VU; *Brachythecium geheebii* VU; *Cephalozia loitlesbergeri* CR; *Dicranum tauricum* VU; *D. transsylvanicum* CR; *D. viride* BC/HD/EN; *Eurhynchium pumilum* VU; *Frullania jackii* VU; *Geocalyx graveolens* EN; *Lescuraea mutabilis* VU; *Metaneckera menziesii* CR; *Metzgeria fruticulosa* EN; *Neckera pumila* VU; *Odontoschisma denudatum* CR; *Orthotrichum patens* CR; *Pseudoleskea saviana* CR; *Pterogonium gracile* EN; *Rhynchostegiella tenella* VU; *R. tenuicaulis* VU; *Rhynchostegium rotundifolium* VU; *Ulota coarctata* EN; *Zygodon dentatus* EN.

c. Fungi: *Boletus satanas* RO/VU; *Cantharellus friesii* RO/VU; *Catathelasma imperiale* RO/VU; *Cortinarius bulliardii* RO/VU; *Gyroporus castaneus* RO/NT.

9160 Sub-Atlantic and medio-European oak or oak-hornbeam forests of the *Carpinion betuli*

a. Vascular plants: *Agrimonia pilosa* HD Ann IIB/R; *Epipactis microphylla* R; *Fritillaria orientalis* BC/VU; *Luzula forsteri* R; *Omphalodes scorpioides* R; *Ranunculus flabellifolius* VU; *Rosa caryophyllacea* R; *R. elliptica* R.

b. Bryophytes: information not available.

c. Fungi: *Boletus radicans* RO/VU; *Cortinarius orellanus* RO/VU; *Phylloporus pelletieri* EU DG/VR; RO/VU.

9170 *Galio-Carpinetum* oak-hornbeam forests

a. Vascular plants: *Agrimonia pilosa* HD Ann IIb/R; *Amygdalus nana* VU; *Epipactis microphylla* R; *Fritillaria orientalis* BC/VU; *Lathyrus transsilvanicus* nEND/R; *Luzula forsteri* R; *Omphalodes scorpioides* R; *Rosa elliptica* R.

b. Bryophytes: information not available.

c. Fungi: *Boletus queletii* RO/VU; *Hericium erinaceum* EU DG/VR; RO/VU.

9190 Old acidophilous oak woods with *Quercus robur* on sandy plains

a. Vascular plants and b. Bryophytes: information not available.

c. Fungi: *Grifola frondosa* RO/NT; *Leucopaxillus compactus* EU DG/VR; RO/VU.

91F0 Riparian mixed forests of *Quercus robur, Ulmus laevis* and *Ulmus minor, Fraxinus excelsior* or *Fraxinus angustifolia,* along the great rivers (*Ulmenion minoris*)

a. Vascular plants: *Chartolepis glastifolia* CR; *Euonymus nana* EN; *Leucojum aestivum* VU; *Periploca graeca* R; *Ranunculus constantinopolitanus* R; *Serratula bulgarica* VU; *S. wolffii* R*; Vicia biennis* VU.

b. Bryophytes and c. Fungi: information not available.

91L0 Illyrian oak-hornbeam forests (*Erythronio-Carpinion*)

a. Vascular plants: *Acer monspessulanum* R; *Campanula grossekii* R; *C. lingulata* R; *Cephalorrhynchus tuberosus* R; *Daphne laureola* VU; *Geranium purpureum* R; *Laburnum anagyroides* R; *Lamium bifidum* subsp. *balcanicum* R; *Ruscus aculeatus* HD Ann VB/R; *Scutellaria columnae* R; *Senecio cacaliaster* R; *Stipa bromoides* R.

b. Bryophytes and c. Fungi: information not available.

91M0 Pannonian-Balkanic turkey oak-sessile oak forests

a. Vascular plants: *Campanula grossekii* R; *Digitalis ferruginea* VU*; Galanthus plicatus* subsp. *plicatus* VU; *Lathyrus laxiflorus* CR; *Luzula forsteri* R; *Nectaroscordum siculum* subsp. *bulgaricum* R; *Paeonia officinalis* subsp. *banatica* HD Ann IIB/BC/CR; *Physospermum cornubiense* R; *Sedum cepaea* R; *Smyrnium perfoliatum* R; *Verbascum glabratum* subsp. *brandzae* VU; *Vicia sparsiflora* VU.

b. Bryophytes and c. Fungi: information not available.

91V0 Dacian Beech forests (*Symphyto-Fagion*)

a. Vascular plants: *Aconitum moldavicum* nEND/LC; *Agrimonia pilosa* HD Ann IIB/R; *Campanula abietina* BC/LC; *Cardamine glanduligera* nEND/LC; *Cephalanthera damasonium* NT; *C. rubra* R; *Corydalis solida* subsp. *slivenensis* R; *Cypripedium calceolus* HD Ann IIB/BC/VU; *Dactylorhiza sambucina* R; *Delphinium simonkaianum* END/R; *Dryopteris borreri* R; *Epipactis leptochila* R; *E.*

purpurata R; *Euphorbia carpatica* CR; *Galanthus nivalis* HD Ann VB/NT; *Galium baillonii* END/R; *Hepatica transsilvanica* END/Tertiary relict/NT; *Hypericum umbellatum* CR; *Ilex aquifolium* VU; *Lathyrus transsilvanicus* nEND/R; *Leucanthemum waldsteinii* nEND/R; *Microstylis monophyllos* R; *Monotropa hypopitys* R; *Orchis mascula* subsp. *signifera* R; *O. pallens* CR; *Orobanche salviae* R; *Peltaria alliacea* R; *Primula elatior* subsp. *leucophylla* nEND/R; *Ranunculus carpaticus* nEND/R; *Rosa glauca* R; *R. villosa* subsp. *coziae* END/R; *Saxifraga bulbifera* R; *S. cymbalaria* subsp. *cymbalaria* EN; *Scrophularia vernalis* R; *Smyrnium perfoliatum* R; *Tanacetum macrophyllum* R; *Taxus baccata* VU; *Waldsteinia geoides* R; *W. ternata* R.

b. Bryophytes: *Anacamptodon splachnoides* VU; *Brachythecium geheebii* VU; *Cephalozia loitlesbergeri* CR; *Dicranum tauricum* VU; *D. transsylvanicum* CR; *D. viride* BC/HD/EN; *Eurhynchium pumilum* VU; *Frullania jackii* VU; *Geocalyx graveolens* EN; *Lescuraea mutabilis* VU; *Metaneckera menziesii* CR; *Metzgeria fruticulosa* EN; *Neckera pumila* VU; *Odontoschisma denudatum* CR, *Orthotrichum patens* CR; *Pseudoleskea saviana* CR; *Pterogonium gracile* EN; *Rhynchostegiella tenella* VU; *R. tenuicaulis* VU; *Rhynchostegium rotundifolium* VU; *Ulota coarctata* EN; *Zygodon dentatus* EN.

c. Fungi: information not available.

91Y0 Dacian oak and hornbeam forests

a. Vascular plants: *Agrimonia pilosa* HD Ann IIB/R; *Amygdalus nana* VU; *Cardamine quinquefolia* R; *Carex brevicollis* I; *Cephalanthera damasonium* NT; *C. longifolia* NT; *Corydalis intermedia* DD; *Dianthus giganteus* subsp. *banaticus* nEND/R; *Doronicum orientale* CR; *Fritillaria orientalis* BC/VU; *Gagea spathacea* R; *Galanthus elwesii* R; *Himantoglossum hircinum* subsp. *caprinum* HD Ann IIB/R; *Inula bifrons* R; *Lathyrus transsilvanicus* nEND/R; *Listera ovata* R; *Nectaroscordium siculum* subsp. *bulgaricum* R; *Orchis pupurea* R; *Ornithogalum sphaerocarpum* CR; *Peucedanum officinale* R; *Pyrus elaeagrifolia* EN; *Rosa elliptica* R; *Spiraea crenata* R; *Symphytum ottomanum* R; *Waldsteinia geoides* R; *W. ternata* R.

b. Bryophytes and c. Fungi: information not available.

91Z0 Moesian Silver lime woods

a. Vascular plants: *Nectaroscordium siculum* subsp. *bulgaricum* R; *Scilla autumnalis* CR.

b. Bryophytes and c. Fungi: information not available.

9260 *Castanea sativa* woods

a. Vascular plants: information no available.

b. Bryophytes and c. Fungi: information not available.

92A0 *Salix alba* and *Populus alba* galleries

a. Vascular plants: *Asparagus verticillatus* R; *Leucojum aestivum* VU; *Periploca graeca* R.

b. Bryophytes: *Cinclidotus aquaticus* VU; *C. nigricans* VU; *Fissidens incurvus* CR; *Orthotrichum gymnostomum* CR; *O. pulchellum* EN; *O. rivulare* CR; *O. stellatum* CR; *Pterogonium gracile* EN.

c. Fungi: information not available.

92D0 Southern riparian galleries and thickets (*Nerio-Tamaricetea* and *Securinegion tinctoriae*)

a. Vascular plants: information not available.

b. Bryophytes: *Bryum calophyllum* CR; *B. versicolor* CR; *Dicranella crispa* VU; *D. grevilleana* VU; *Funaria microstoma* CR; *Harpanthus flotovianus* CR.

c. Fungi: information not available.

DISCUSSION

We recorded 230 different taxa, categorized into various sozologic categories (according to Dihoru & Negrean [10], Oltean *et al.* [16], and the authors' field experience) in the forest natural habitats of Romania. All the values are stated in the next figure, having as significations: VU=39 species; EN=5 species; NT=7 species; EX=1 species; DD=1 species; I=1 species; LC=5 species; the most numerous group belong to the large category of rare species (R), namely 171 taxa, according to various Romanian Red Lists.

Some of these plants are registered under the *Bern Convention* (6); one is on the *World List of Endangered Trees*; 16 are registered under the *Habitats Directive of the European Union*;

only 9 are strictly endemics in the vascular flora of Romania, while another 12 are near-endemics; 17 species are glacial relicts, and only two are Tertiary relicts.

All of these sozological categories were reconsidered in the *Red Book of Romanian Vascular Plants* [10], accordingly to the IUCN criteria and methodology [33].

The rarest vascular plant species in the forest priority natural habitats (*) in Romania (each species is accompanied by the natural habitat where it belong to, and the sozologic category or the European Directive) are as follows: *Allium paniculatum* subsp. *fuscum* (*91AA; *91H0 R); *Astragalus ponticus* (*91AA VU); *Astragalus pseudopurpureus* (*91Q0 VU); *Acanthus balcanicus* (*91H0 VU); *Betula humilis* (*91D0 EN); *B. nana* (*91D0 VU); *Bulbocodium versicolor* (*91I0 EN); *Corydalis intermedia* (*91I0 R)*; C. pumila* (*91I0 R); *Doronicum orientale* (*91X0 R)*; Euphorbia carpatica* (*91E0; 91V0 R); *Galanthus plicatus* (*91AA; 91M0; *91X0 R)*; Globularia punctata* (*91AA; *91H0 R); *Gymnospermium altaicum* subsp. *odessanum* (*91AA EN); *Himantoglossum hircinum* subsp. *caprinum* (*91AA; 91Y0; HD Ann IIb R)*; Hypericum rochelii* (*91AA R); *Ligularia sibirica* (91E0; HD Ann IIB R); *Malus praecox* (*91I0 EN); *Paeonia mascula* (*91AA VU); *Paeonia officinalis* subsp. *banatica* (*91AA; 91M0; HD Ann IIB/BC R)*; Pedicularis sylvatica* (*91D0 R); *Pyrus nivalis* (*91AA R); *Ruscus aculeatus* (*91AA; 91K0; 91L0; HD Ann VB R); *Serratula lycopifolia* (*91H0; HD Ann IIb VU); *Sison amomum* (*91AA R); *Sophora jaubertii* (*91AA VU); *Trientalis europaea* (91D0*; 9410 R); *Tulipa sylvestris* subsp. *australis* (*91E0; *91I0 VU); *Vicia sativa* subsp. *amphicarpa* (*91AA R); *Viola epipsila* (*91D0 VU); *Viola palustris* (*91D0 R), etc.

The rarest plant species in those non-priority natural habitats in Romania are: *Arctostaphylos uva-ursi* (91Q0 VU); *Cardamine enneaphyllos* (91K0 R); *Chartolepis glastifolia* (91F0 VU); *Daphne laureola* (91K0; 91L0 VU)*; Doronicum orientale* (91Y0 R)*; Epipactis leptochila* (91V0 R); *Euphorbia carpatica* (91V0 R); *Pulmonaria filarszkyana* (9410 NT); *Ranunculus flabellifolius* (9160 R)*; Saxifraga cymbalaria* (91V0 R); *Scilla autumnalis* (91Z0 VU); *Scutellaria columnae* (91L0 R); *Senecio cacaliaster* (91L0 R); *Serratula bulgarica* (91FO VU); *Syringa josikaea* (91E0 VU); *Vicia biennis* (91F0 R); *Vicia sparsiflora* (91M0 VU), etc.

90 bryophytes are Red-listed species being distributed in the forest natural habitats of Romania; among these, 35 species are CR, VU are 32 species, while other 23 species are EN. Another five bryophyte species are recorded under the *Red List at European Level* (ERL) [7; 23; 30]; six species are protected by *Bern Convention* [28], and only one is registered under the *Habitat Directive 92/43/EEC* [29].

Among those 31 rare species of fungi dependent on forest natural habitats of Romania, one is CR, 13 are VU, 4 are EN, and 12 are NT. Only a single species, *Hygrophorus purpurascens*, is mentioned under the *European Union/Directorate General for Environment* [21], as being very rare.

According to the occurence of threatened, endemic/near-endemic, relict and other rare species of vascular plants, bryophytes, and fungi in the main categories of forest natural habitats in Romania 56.4% (i.e. 198 species) are distributed in deciduous forests; 23.07% (i.e. 81 species) are distributed in coniferous forests, while 20.5% (i.e. 72 species) are located in mixed forests.

The most favourable state of forests in terms of plant conservation (numbers of threatened, rare, relict and endemic/near endemic plants) is found on the upper hills, as well as in the lower and middle levels of the mountain areas of Romania. But the forests situated on the middle and lower parts of hills and in the plains have in general a much more reduced diversity, as a result of strong human impact. This idea is sustained, also, by other studies [4], in which the authors confirm a positive correlation between the number of endemics plants and altitude (in temperate regions of the world, in our opinion). They explain this fact through geographical isolation, as well as by a higher rate of polyploidy in the plant populations, as they are at higher altitude.

Some of the natural habitats of Romanian forests (e. g. 91AA, 91V0, 91Y0, 9410, etc.), are the most exposed to anthropic-zoogenic pressures of all kinds (clearings, fires, grazing, various forest operations, changes in their floristic structure, new and invasive plant species, etc.) or occurence of certain natural disasters (storms and hailstorms, wind throw, diseases, aggressive pests, landslides, etc.).

The largest number of threatened, rare and endemic/near endemic, or relict vascular plants and bryophyte species are distributed in the forest-steppe area in the eastern, southern and south-western part of Romania (Steppe & Continental Bioregions), as well as along the Carpathian Mountains (Alpine Bioregion).

A great number of the above-mentioned species are still protected thanks to their occurence inside the already existing national network of protected areas in Romania.

There are some institutions responsable for the elaboration and implementation of forests management measures in Romania, concerning vascular plants, bryophytes, and fungi (as well as other living organisms categories inside of forests): *Ministry of Forestry*; *local forest administrations* (county forest administrations, forestry wards, etc.); *forest owners*; *local administrations which have forests on their property*; *local NGOs*; *others* (administrators, private owners, churches, monasteries, etc.). An efficient forestry management should take into account both forestry and the plant and fungi species, in order to preserve at least some of them [22], paying special attention to those species (in terms of population availability and quality) that occur in the natural habitats that would be reduced in the next period by forest interventions, and species already known to be sensitive or at risk from other stress factors [6].

Conclusions

Within the forest natural habitats of Romania, 230 different vascular plants, 90 bryophytes and 31 fungi have been identified as being the rarest, most threatened, relict or endemic/near endemic species.

The most favourable, in terms of plant conservation (number of threatened, rare, and endemic/near endemic plants – 198 taxa) are the deciduous forests (especially various oak forests of the forest-steppe area), followed by coniferous forests (81 taxa); the last category is represented by mixed forests (72 taxa).

Some of the natural habitats, namely 91AA, 91V0, 91Y0, 9410, etc., from Romania require the strongest and most urgent conservation measures, since these habitats are the most exposed to the human impact or to certain natural disasters and/or diseases, which could occur at any time.

Acknowledgments: This study has been supported by the project 9E0710.03 – 01 IKEA III. Project Name: *Promote Responsible Forest Management to Support Sustainable Development in the Danube – Carpathian Ecoregion – Romania*. We are grateful to Mr G. Dinicu and Mr R. Vlad, from WWF Romania, for their technical assistance in our field survey of various forests.

REFERENCES

1. Arnolds, E., de Vries, B., 1993, Conservation of fungi in Europe. In: Pegler et al. *Fungi of Europe – investigation recording & mapping*, Royal Botanic Gardens, Kew: 231-238.
2. Boşcaiu, N., Coldea, G., Horeanu, C., 1994, Lista roşie a plantelor vasculare dispărute, periclitate, vulnerabile şi rare din flora României, *Ocr. nat. med. înconj*., **38** (1): 45-46.
3. Ciocârlan, V., 2000, Flora ilustrată a României. Pteridophyta et Spermatophyta. Ed. a doua revăzută şi adăugită, Bucureşti: Edit. Ceres.
4. Cristea, V., Gafta, D., Pop, I., 2002, Bogăţia specifică şi proporţia endemitelor în fitocenozele lemnoase din judeţul Cluj, *Argesis, Stud. Comunic. Ser. Şti. Nat*., **IX-X**: 25-32.
5. Dahlberg, A., Croneborg, H., (eds.), 2003, *33 threatened fungi. Complementary and revised information on candidates for listing in Appendix 1 of the Bern Convention*. EU DG.

6. D'Eon, R., 2008, Identifying Rare Species in a Forest Management Area, *Sust. For. Manage. Network, Res. Note Ser*., **32**: 1-4.
7. Dierβen, K., 2001, Distribution, ecological amplitude and phytosociological characterisation of European bryophytes, *Bryophytorum Bibliotheca*, Stuttgart, 56: 1-289.
8. Dihoru, G., Pârvu, C., 1987, *Plante endemice în flora României*, Edit. Ceres, Bucureşti.
9. Dihoru, G., Dihoru, A., 1994, Plante rare, periclitate şi endemice în flora României – lista roşie, *Acta Bot. Horti Bucurestiensis* /1993-1994: 173-179.
10. Dihoru, G., Negrean, G., 2009, *Cartea roşie a plantelor vasculare din România*, Edit. Acad. Române, Bucureşti.
11. Doniță, N., Popescu, A., Paucă-Comănescu, M., Mihăilescu, S., Biriş, I.A., 2006, *Habitatele din România. Modificări conform amendamentelor propuse de România şi Bulgaria la Directiva Habitate (92/43/EEC)*, Edit. Tehnică Silvică, Bucureşti, 95 pp.
12. Gafta, D., Mountford J.O. (coord.), 2008, *Manual de interpretare a habitatelor Natura 2000 din România*. Edit. Risoprint, Cluj-Napoca.
13. Morariu, I., Beldie, A., 1976, *Endemismele din flora R. S. R.*, In: T. Săvulescu (sub red.), *Flora R. S. R.*, **XIII**, pp. 97-105, Edit. Acad. Române, Bucureşti.
14. Negrean, G., Oltean, M., 1989, Endemite şi zone endemoconservatoare din Carpații Sud-Estici, *Ocr. nat. med. înconj*., **33**(1): 15-25.
15. Oldfield, S., Lusty, C., MacKinven, A., 1998, *The world list of threatened trees*, World Conservation Press, Cambridge.
16. Oltean, M., Negrean, G., Popescu, A., Roman, N., Dihoru, G., Sanda, V., Mihăilescu, S., 1994, Lista roşie a plantelor superioare din România, *Stud., Sint., Doc. Ecol*., Inst. de Biol., Acad. Română.
17. Pop, A., Tănase, C., Negrean, G., 1999, La préservation des champignons en Roumanie, *Studii şi Comunicări*, Compl. Muz. Şti. Nat. Bacău, **17**: 71-75.
18. Popescu, G., 1985, *Pădurea şi Omul*, Edit. Albatros, Bucureşti.
19. Săvulescu T. (ed.), 1952-1976, *Flora R.P.R. – R.S.R.* **I-XIII**, Edit. Acad. Române, Bucureşti.
20. Sârbu, A., Sârbu, I., Oprea, A., Negrean, G., Cristea, V., Coldea, G., Cristurean, I., Popescu, G., Oroian, S., Tănase, C., Bartók, K., Gafta, D., Anastasiu, P., Crişan, F., Costache, I., Goia, I., Maruşca, Th., Oțel, V., Sămărghițan, M., Hentea, S., Pascale, G., Răduțoiu, D., Baz, A., Boruz, V., Puşcaş, M., Hiriţiu, M., Frink, J., 2007, *Arii speciale pentru protecția şi conservarea plantelor în România*, Edit. Victor B. Victor, Bucureşti.
21. Senn-Irlet, B., Heilmann-Clausen, J., Genney, D., Dahlberg, A., 2007, *Guidance for Conservation of Macrofungi in Europe*, Prepared by for the European Council for Conservation of Fungi (ECCF) within the European Mycological Association (EMA).
22. Stăncioiu, P.T., 2008, *Silvicultura şi două concepte noi referitoare la conservarea biodiversității*: *„Pădurile cu valoare ridicată de conservare" şi „Rețeaua ecologică Natura 2000"*, World Wide Fund for Nature, Danube-Carpathian Programme.
23. Ştefănuț, S., Goia, I., 2009, *Lista roşie a briofitelor din România* (manuscript).
24. Ştefureac, T., Tăcină, A., 1978, Unele considerații asupra endemismelor şi corologia taxonilor endemici în România, *Stud. cerc. Biol., Ser. biol. veget*., **30**(1): 85-92.
25. Tănase, C., Pop, A, 2005, Red List of Romanian Macrofungi Species. *Bioplatform – Romanian National Platform for Biodiversity*, Edit. Acad. Române, Bucureşti: 101-107.
26. Walter, K. S., Gillet, J.H. (eds.), 1998, *IUCN Red List of Threatened Plants*. Compiled by the World Conservation Monitoring Centre. IUCN – The World Conservation Union, Gland and Cambridge.
27. Werner, D., Maurer, Fernandez Lopez, J., 2001, Establishing an international sweet chestnut *Castanea sativa* Mill., provenance test: preliminary step, *Forest Landscape Research*, **76**(3): 482-486.
28. ***1979, Convention on the Conservation of European Wildlife and Natural Habitats + Appendices I-IV. Bern.
29. ***1992, Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora. European Commission, DG Environment, Nature, and Biodiversity. (http://www.internationalwildlifelaw.org/EUCouncilDirective92.html).
30. E.C.C.B., (ed.), 1995, *Red Data Book of the European Bryophytes*, Comitetul European de Conservare a Briofitelor, Trondheim.
31. ***2000, The IUCN *World Red List of Bryophytes*. http://www.artdata.slu.se/guest/SSCBryo/WorldBryo.htm
32. ***2003, *IUCN. Guidelines for Application of IUCN Red List Criteria at Regional Levels: Version 3.0.* IUCN Species Survival Commission. IUCN, Gland and Cambridge.
33. ***2005, *Ordin nr. 1198. Monitorul Oficial, Partea I, nr. 1097 pentru actualizarea anexelor nr. 2, 3, 4 şi 5 la ordonanța de urgență a Guvernului nr. 236/2000 privind regimul ariilor naturale protejate, conservarea habitatelor naturale, a florei şi faunei sălbatice, aprobată cu modificări şi completări prin Legea nr. 462/2001*. Ministerul Mediului şi Gospodăririi Apelor.

34. ***2007, *Ordonanța de Urgență nr. 57 din 20 iunie 2007 privind regimul ariilor naturale protejate, conservarea habitatelor naturale, a florei şi faunei sălbatice, Anexele 3b, 4Ab, 4Bb, 5A*. MO nr. 442/29 iunie.

EVALUAREA COMPOZIȚIEI SPECIFICE: ENDEMICE, RELICTE ŞI DIN ALTE CATEGORII SOZOLOGICE (TRACHEOFITE, BRIOFITE ŞI FUNGI) DIN HABITATELE NATURALE FORESTIERE DIN ROMÂNIA

(Rezumat)

Prin studiul de față se aduc contribuții la completarea descrierilor existente ale habitatelor naturale forestiere inventariate în România (Directiva Habitate 92/43/EEC) cu speciile de plante vasculare, briofite şi fungi, din categoriile sozologice: rare, critic amenințate, amenințate, vulnerabile ori extincte, cu relictele terțiare ori glaciare, dar şi cu speciile endemice şi/sau subendemice existente în flora pădurilor.

Importanța studiului constă în furnizarea unei baze ştiințifice pentru un management durabil al pădurilor, ținându-se cont şi de următoarele aspecte:

– unul dintre obiectivele majore ale managementui durabil al pădurilor este conservarea biodiversității în ansamblu (incluzând şi principalele grupe de organisme analizate în prezenta lucrare: plante vasculare, briofite, fungi etc.);

– evaluarea habitatelor forestiere din punct de vedere al grupelor de organisme prezentate în această lucrare oferă datele necesare în vederea conservării diverselor specii de plante ori fungi *in vivo*;

– acest studiu este util inginerilor şi tehnicienilor silvici, atât în activitatea de evaluare a resurselor forestiere, cât şi în etapizarea planurilor de management pentru conservarea variatelor tipuri de păduri.

Pentru fiecare tip de habitat natural forestier sunt date acele specii de plante vasculare, briofite şi/sau fungi cu valoare sozologică, prezente în flora României. Toate speciile sunt însoțite de trimiterile la acele documente interne sau/şi internaționale în care se găsesc incluse, precum şi categoria de vulnerabilitate în acord cu Listele Roşii şi cu experiența de teren a autorilor.

În lucrare sunt evidențiați 230 taxoni de tracheofite, 90 briofite şi 31 fungi cu valoare sozologică, relictare sau endemice/subendemice, ce cresc în pădurile din România. Majoritatea speciilor de pe listele roşii se află în pădurile caducifoliate – 198 specii; 81 de specii se regăsesc în pădurile de conifere şi doar 72 de specii se află în pădurile de amestec. Cele mai favorabile păduri din punct de vedere al conservării plantelor (cu număr ridicat de taxoni periclitați, rari şi endemici/subendemici) sunt cele situate pe dealurile înalte sau în etajul montan inferior şi mijlociu. Se constată că pădurile din zonele deluroase joase sau cele din zona de câmpie au o diversitate mult redusă, ca rezultat al impactului uman mai puternic. Unele habitate naturale forestiere (e. g. 91AA, 91V0, 91Y0, 9410 etc), sunt cele mai expuse presiunii antropo-zoogene. Cel mai mare număr de plante vasculare periclitate, rare, endemice-subendemice sau relictare sunt răspândite în pădurile stepice din estul, sudul şi sud-vestul României (Bioregiunile Stepică şi Continentală) şi în lungul lanțului Munților Carpați (Bioregiunea Alpină).

Received: 16.09.2009; Accepted: 2.09.2010