Final Report
2006-2007

Introduction

Reserve areas are of an increasing importance and interest for biodiversity conservation in the context of the global warming and the incremental environmental destruction.

Măcin National Park is a heterogenous area with a variety of unique biotopes surrounded by agricultural landscape. A highly fragmented land use types represent the matrix of the reserve mosaic of biotopes. One may refer to the reserve as to an island in an agricultural ocean. The protected biotopes are of climax type or close to a climax state surrounded by productive ecosystems in various stages of secondary succession (Hansson and Angelstam, 1991). As a consequence, the reserve margin represents a sharp transition to different types of more or less anthropogenic ecosystems, a fact also reflected in communities' composition (plants, lichens and fungi).

The reserve interior contains rare biotopes that harbor rare or particular communities. With regard to lichens, the key biotope in the area is represented by stones, cliffs or boulders of Paleozoic origin, namely a rare and spectacular substrate. The grasslands which harbours steppic flora represents also a particularly interesting and rare biotope. Still, grasslands are a product of centuries of human activity, and Macin semi-natural steppic grasslands are shaped in many respects by the sheep's grazing .

Methods

Lichens were sampled in several locations in the area of Măcin National Park, corresponding to xeric and relatively humid conditions. Same locations were chosen for fungi and mosses sampling: Chediu canyon and Chediu plateau, Arsu peak, Suluc peak and Suluc foothill, Mary' Rocks, a geological formation of cliffs outside the park perimeter, Căutici Valley (Valea Căutici), Morsu Valley, Chiscura Chelului plateau, Luncavita and Cetatea perimeter, Vrajul peak,Căpuşa peak (Vârful Căpuşa), Valea Fagilor (Valley of beeches), Osmanului plateau, Kervant Priopcea, calcareous rocks, Cheia peak, Echiştea peak, Şerparu saddle (Şaua Şerparu), Caramalău peak (Vârful Caramalău), Stănilă's Hill (Dealul lui Stănilă), Crapcea Peak (Vârful Crapcea), Oancea sheepyard. A series of photographic images was taken to asses lichen species as additional identification tool. Fungi were collected and also a valuable mosses collection was taken for further studies.

Most of the identification effort was directed on lichens as important biodiversity indicators. Fructification in fungi is a fluactuating event depending on climatic conditions consequently, few species were found.

The identification was performed in laboratory conditions, mainly based on microscopic and color reactions in lichens and on several macroscopic characters in fungi. Mosses were identified using microscopic information. The collection material is deposited in the herbarium of Forest Ecology, Entomology and Plant Pathology Laboratory of the Silviculture Department, University of Oradea. For lichen identification various keys were employed and confronted with existing Romanian literature synthesized by Ciurchea (1998).

Results

The identified lichen species and fungi are enumerated according to locations given by their local names and according to their affiliation to substrate type. 97 species of lichens and 57 species of fungi and 14 species of mosses were identified during the first stage of the current study. Previously, 104 sp of lichens were cited for Măcin Mountains and Dobrogea region. Concerning the fungi, the low species numbers are due to extreme drought during the vegetation period characterizing the research period. The list of identified fungal species include mycorrhizal, pathogenic on wood, sapro-pathogenic on wood, degradative and humicolous species. The identification effort was focused on lichens as being most representative organisms for the biodiversity of focal habitats represented in Măcin by rocks, cliffs, wooded plateu pastures, xeric forest types and woodlands (with *Quercus pubescens, Ostrya carpinifolia* and *Fraxinus ornus*). A different category of habitat is represented by rare forest types under Dobrogea climatic conditions such as beech forests (Valea Fagilor).

Frequency distribution of the lichen species corresponding to the number of locations where they were found was empirically similar to a log normal distribution of abundances. This type of distribution is encountered in communities dominated by few species. For instance, lichens that dominate saxicolous communities are in Macin: *Candelariella vitellina, Rhizocarpon geographicum, Xanthoparmelia saxatilis, Melanelia tominii, Xanthoparmelia conspersa, Aspicilia cinerea* and *Aspicilia caesiocinerea*.

The majority of the identified lichens are of crustose type, a consequence of the prevailing substrate investigated, rocks and boulders. From geologiocal point of view, most of rocks are acidic. Devonian calcareous rocks are found at Kervant Priopcea with a characteristic lichen community. In chaolin quarry, the prevailing species is *Lecanora dispersa*.

Several species are included in the IUCN list of vulnerable and endangered species:

- regionally extinct in several countries in Europe are: *Flavoparmelia caperata*, *Umbilicaria grisea.*
- critically endangered: *Ramalina obtusata*
- vulnerable: *Acrocordia gemmata, Pertusaria hemisphaerica, Pertusaria pertusa*
- near threatened: *Pleurosticta acetabulum.*

Fungal species were sampled from different substrates: moribund trees, old living trees, logs, litter and soil. Several rare species were identified: *Omphalina postia* in meadows, *Volvariella bombycina* on rotten *Carpinus betulus* wood in Valea Fagilor forest, *Gastrosporium simplex* in steppic meadows, typical for warm habitats.

Photo. *Omphalina postia*
(photo Bogdan Bejenariu)

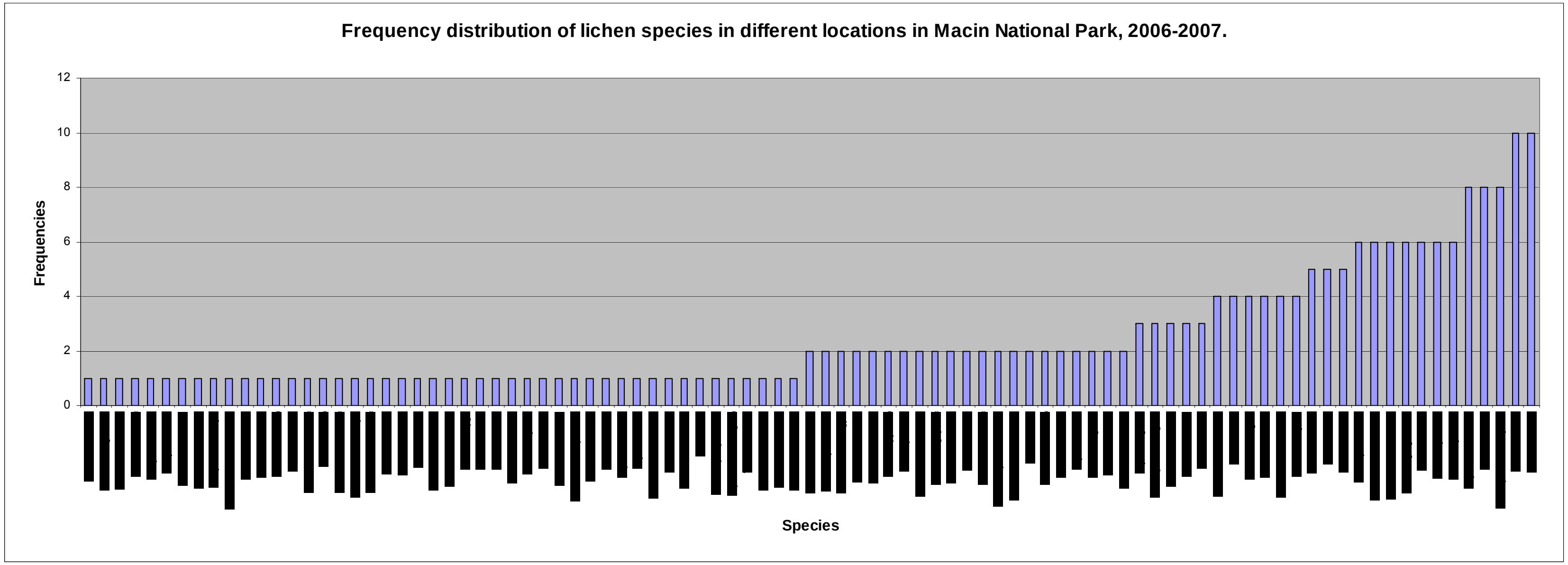
Mycorrizal species are generalists associating with many broadleaved species: *Amanita vaginata*, species of *Russula, Scleroderma verrucosum* and rather peculiar for the area, *Cantharellus cibarius* found in Valea Fagilor (Beeches' valley). There are probably more mycorrhizal species to be found in the future (potential diversity includes species from genera *Lactarius, Xerocomus, Boletus, Tricholoma, Cortinarius, Gyroporus, Amanita*).

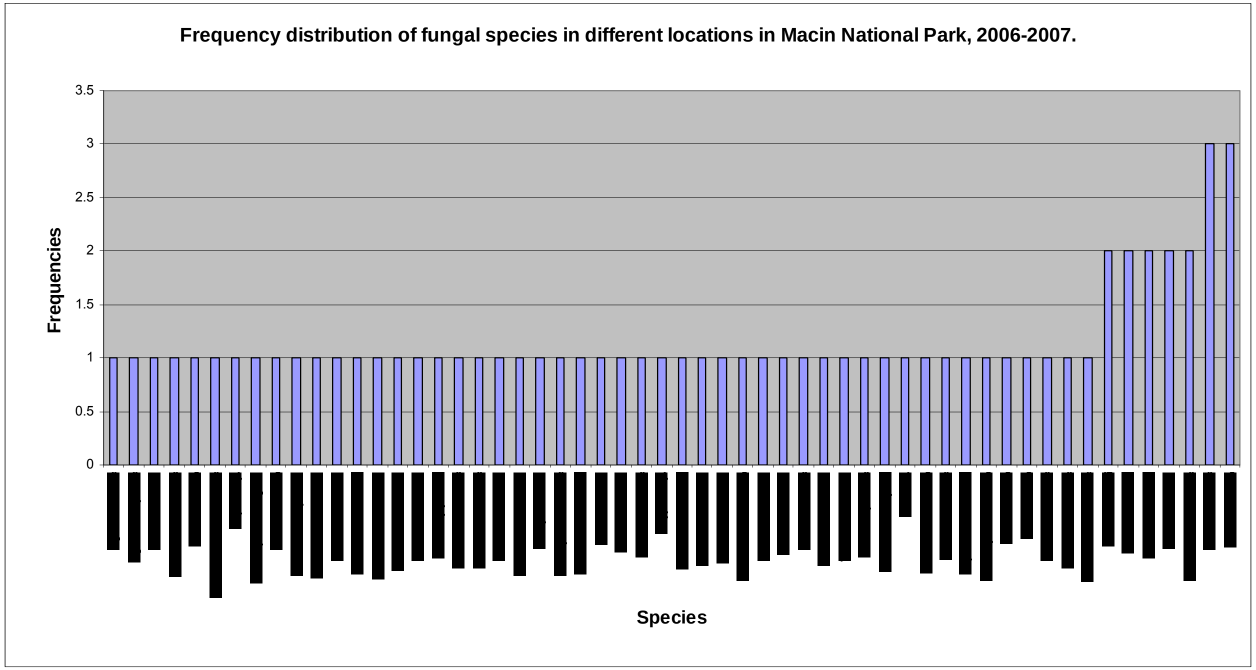
Wood inhabiting fungi (degradative or pathogenic) are considered as biodiversity indicators for forest environment (Berglund and Jonsson, 2005). Several perennial or dry carpophores were sampled belonging to genera *Trametes, Fomes, Ganoderma, Innonotus, Xerula, Volvariella, Oudemansiella, Polyporus, Laetiporus, Stereum* indicating degradative processes progressing probably in more humid seasons (autumn and spring). The majority were found in valleys, where a better mesoclimate characterizes the vegetation period. In woodlands and wooded pastures, on the bark of woody species lichens were abundant and only accidentally carpophores of *Stereum hirsutum* were found.

Steppic and meadow species such as *Vascellum pratense, Langermania gigantea, Bovista plumbea* are correlated with lower anthropogenic stress, mainly represented by cattle and sheep grazing.

Among the identified macrofungal species there are species dependent on agricultural landscape such as *Agaricus campestris, Agaricus arvensis, Coprinus comatus, Stropharia semiglobata* which thrive on cattle manure indicating that, at least in the perimetral zone of the reserve grazing is an important factor for shapping the fungal communities.

Mosses were investigated in a lesser extent: species such as *Tortula muralis* and *Grimmia pulvinata* are adapted to xeric conditions and are frequently found on cliffs and boulders together with lichens or as a component of terricolous associations with *Cladonia rangiformis*, or *Cladonia foliacea*.


Frequency distribution of lichen species in different locations in Macin National Park, 2006-2007.
12
10
8
6
4
2
0
Frequencies
Species


Frequency distribution of fungal species in different locations in Macin National Park, 2006-2007.
3.5
3
2.5
2
1.5
1
0.5
0
Frequencies
Species

Discussions

Because of the slow growth and the environmental sensitivity of most lichen species, a habitat approach to their conservation is a practical approach (Knudsen and Magney, 2006). In what concerns fungi which are substrate dependent (the substrate is at the same time food resource and habitat) same may be said: the conservation of their habitats implies the conservation of fungal diversity. Such rare and particular habitats are one of the main characteristics of Măcin National Park (Paleozoic geological formations, xeric steppes and woodlands, unusual beech forests and so on). Lichen lists are very similar to lists reported from Turkey for Bursa district (Yazici and Aslan, 2006) and Şirvan Mountain (Halici and Askoy, 2006) concerning lichen communities on rocks and woody species.

Among the crustose lithophilous lichens, species display different degrees of tolerance toward anthropogenic stress: *Acarospora fuscata* is tolerant, the infrequent *Melanelia panniformis* is sensitive (Paukov and Trapeznikva, 2004).

For lichens vegetating on acidic rocks, one of the most threatening factors are nitrogen deposits. Nitrogen enrichment is caused by grazing sheep and their excrements. Frequently, in saxicolous lichen thalli were found parasitical Ixodidae demonstrating the intense grazing in the boulders' vicinity. Agricultural activities influence lichen guilds composition directly by destruction or indirectly by eutrophication, consequently lichen communities in agricultural landscapes are severily impoverished (Motiejûnaitë and Faútynowicz, 2005). Most diverse saxicolous lichen communities are associated in Macin with peaks and plateau rocky environment were grazing pressure is not so high. For instance species from genera such as *Parmelia* and *Ramalina* are relativelly indifferent to levels of acidification or nitrogen addition, *Xanthoria parietina* is nitrophyte (Sparrius, 2004) and is found on bark and rocks in most of locations being accordingly, tolerant to stresses induced by anthropogenic activities in the area.

Cliffs and rocks support diverse lichenological guilds together with rare and diverse vascular plants (Matthes et al., 2004). Umbilicate lichens as *Umbilicaria spodochroa, Umbilicaria grisea, Umbilicaria pustulata* or *Dermatocarpon miniatum* are prone to destruction due to climbers (on rocks) and sheep grazing (on boulders).

Lichen guilds cover the substrate in various proportions which is sometimes an indication of successional stage in rock colonization. The cover for different crustose species on rocks depends on life history, initial growth rate, maximal size possible to be attained, maturation, death rate and propagule type. The type of competition governing the assemblage in saxicolous lichen communities is pre-emption competition (Hestmark et al., 2007). Covers in the investigated area differ significantly depending also on exposition and disturbance regime. High mortality was observed on top areas of the boulders (*Melanelia tominii, Xanthoparmelia saxatilis* thalli) where the dessication is most severe proving once more that rocks represent an extreme environment. Lichenometric studies on indicator species *Rhizocarpon geographicum* would be needed to document the disturbance regime.

Corticolous lichens are particurly sensitive to habitat fragmentation mainly due to dessication affecting the marginal trees. Accordingly, corticolous lichens identified in wooded pastures with steppic vegetation on high plateau are cosmopolitan and stress tolerant species as *Evernia prunastri, Xanthoria parietina* and species of *Parmelia*. Frequently corticolous lichens harbor a rich invertebrate community: in our samples psocids were abundant. The majority of the identified species are generalists, frequently encountered. It is worth to make efforts toward corticolous lichens' conservation for their multiple functions in forest and woodland ecosystems: increase of structural complexity, influence on nutrient cycles, providing habitats for various invertebrates and nesting material for mammals and birds (Perez et al., 2004). A correct conservation measure is to preserve old trees as substrates for corticolous lichens and wood inhabiting fungi, also for mosses which almost always are members of epiphytic communities.

A future investigation is needed for assessment of microfungal diversity in forest litter, a habitat which harbors a great diversity of unique and rare species (Moorhead and Reynolds, 1992) and fundamental ecosystem processes: litter decomposition and nutrient cycling, of outmost importance in detritic ecosystems, forest being included in this category.

Advocating lichens' conservation, one argument refers to their scenic beauty, argument that Knudsen and Magney (2006) consider that has been neglected in the past and must be taken in consideration in the present in conservation plans. I add same argument for fungi and the conservation of fungal diversity.

Acknowledgments:

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