BABEŞ – BOLYAI UNIVERSITY OF CLUJ NAPOCA
FACULTY OF BIOLOGY AND GEOLOGY

Oana Viorica DANCI

MARAMUREŞ MOUNTAINS: HABITATS TYPES, CONSERVATION AND THEIR MANAGEMENT

SUMMARY OF PHD THESIS

Scientific Coordinator
Prof. dr. VASILE CRISTEA

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INTRODUCTION

The interactions between man and nature have always been and continue to be permanent; only their type and intensity changes with time. One can say that we witness an involution, or a degradation of the value of nature in human's perception. The pressure on species and ecosystems has gradually increased due to the abandonment of traditional practices and of the traditional land use manner, due to urbanization, atmospheric pollution, habitat fragmentation and their exploitation, not considering their support capacity.

The protected natural areas system was founded as a measure for the *in situ* conservation of species and representative habitat samples. These represent natural and semi-natural ecosystems samples whose main scope is the conservation of biodiversity.

The territory chosen for study is the Maramureş Mountains Natural Park (MMNP). This is a relatively new protected natural area, set up by GD 2151/2004, 30 years after Al. Filipaşcu's recommendation (1975-1976) to "*declare some large and representative natural parks within more significant massifs: Maramureş Mountains, Rodnei Mountains, Călimani, Bucegi and Făgăraş*" (pg. 62).

By means of this PhD thesis, we proposed to meet the following **objectives**:

1. elaboration of a synthesis of the main conservation strategies and of the legislative tools operating in our country, in the field of nature conservation, in order to serve as theoretical framework to the stuff of the park;
2. identification, description and mapping of the types of habitats in MMNP and elaboration of their distribution maps;
3. elaboration of some management tools for some habitats, tools that can easily be applied by the stuff of the natural protected area administrations in order to monitor their conservation state and their management;
4. identification of threats induced to the Natura 2000 habitats in MMNP and the elaboration of some recommendations for their management.

I. Brief physico - geographical characterization of the Maramureş Mountains

Maramureş Mountains represent the highest mountainous massif located at the Romanian national border, convergence point of several ethnographic regions (Romanian Maramureş, Zacarpatia, Southern and Northern Bucovina, Galiția). Maramureş Mountains are located in the Southern part of the Oriental Carpathians, and they border upon Țibăului Mountains in the East, upon Rodnei Mountains and Maramureş Depression in the South, and upon Rahiv and Cernahora (from Ukraine) Mountains in the North.

The entire surface of the massif (including the depression and marginal hills areas) is 1,500 km^2. The area subjected to this study is represented by the territory of the Maramureş Mountains Natural Park (MMNP; fig. 1), with the limits stipulated by GD 2151/2004. These limits comprise a 133,354 ha surface.

The morphological fragmentation of the massif is a peculiarity of Maramureş Mountains, as the hydrographical network determines the separation and fragmentation of massif's high areas. There are two classes of fragmentation depth that prevail within Maramureş Mountains: that of 300-450 m and that of 150-300 m. The highest values are found in metamorphic rocks and in the Toroiaga Massif on volcanic rocks. Over 60% of the surface of Maramureş Mountains has fragmentation depth ranging between 1 and 3 km/km^2 (Mureşan, 2008).

The hydrographical network is highly developed, providing an abundant, permanent water runoff, during the entire year. Maramureş Mountains include three drainage basins: Vişeu (Tisza), Bistrița (Siret) and Ceremuş (Prut). The surface of the region belonging to the Vişeu drainage basin is 1023 km^2, that of the region drained by Bistrița tributaries is 168 km^2 and that of the Ceremuş drainage basin is 25 km^2. The average runoff value specific to Maramureş Mountains is 8.41

l/s/km^2, lower than in Oaş, Gutâi and Ţibleş Mountains, located to the West first in front of the oceanic air masses (Mureşan, 2008).

Fig. 1. Location of Maramureş Mountains Natural Park

Maramureş Mountains are located in the continental moderate climate area, permanently subjected to the influence of Western oceanic air masses advection, whose characteristics reflect into the evolution of all climatic elements (Moldovan, 2000). The month with the lowest average temperatures is January, with values between -6°C and -10°C. July has the average values between 8°C and 12°C. The presented values result in annual average amplitude between 22-24°C, the moderate value highlighting the continental moderate temperate climate nature with significant thermal extreme values between summer and winter.

The rainiest season is summer, when 61% of total rainfall registered. The poorest rainfall season is winter, with only 17% of the total rainfall. The annual number of rainfall days is 150-170. The snow layer occurs in September and the last snow may be recorded as the average data in the last decade of March. The snow layer is maintained between 120-200 days, and the layer thickness ranges between 75 – 150 cm.

From the large soil groups, significant surfaces are covered by districambosoil, prepodzolic soils, litosoils, humisoils and alluvial soils.

Two towns (Borşa and Vişeu de Sus) and 8 communes (Moisei, Vişeu de Jos, Ruscova, Repedea, Poienile de Sub Munte, Leordina, Petrova and Bistra with their villages Valea Vişeului and Crasna Vişeului) are included within the MMNP. These have developed along the courses of Vişeu, Repedea, Ruscova and Tisza rivers.

The population in the 10 localities in the MMNP is approximately 90,000 inhabitants, of which 62,000 are Romanian, 25,000 Ukrainian and 1,774 German, as this is the location of the largest Ukrainian community in Romania and the largest settlement with majority Ukrainian population, Poienile de Sub Munte (10,170 inhabitants).

The evolution of landscape is closely connected to the traditional occupations. Therefore, logging, breeding and mining have affected the landscape and implicitly the natural framework along time. The pre-Christian customs related to nature worship, old and new religious holydays, agricultural customs and traditions related to the human life cycle harmoniously combine in the communities from the MMNP.

II. Global and Local Strategies on Biodiversity Conservation

In the year 1986, the biodiversity term occurs at the National Forum on Diversity held in Washington. By then, only the diversity of the life forms or the diversity of the living beings was used.

Starting with the adoption of United Nation Convention on Biological Diversity, in 1992, in Rio de Janeiro, biodiversity has become a very wide concept used in various fields, other than biology and ecology. One may estimate that during the last 30 years, there was a shift between the simplistic, reductionist approach on biodiversity to a regional and then global and extremely complex approach.

The levels that one should approach biodiversity at, respectively the types of biodiversity are:

- *genetic biodiversity* (intraspecific) represents the variability of genotypes and genofund within the populations of a species, during its entire dispersion area;
- *specific biodiversity* (interspecific) includes the totality of species found in a certain biotope, a certain region, and so forth, approached from the perspective of the biogeographical significance, of population number and covered surfaces;
- *ecological biodiversity* (of ecosystems) concerns the mosaic developed by the various organisms communities, integrated in a certain biotope, but also the functional relations complex governing the present ecosystems;
- *cultural biodiversity* We consider that this reunites all human practices, traditions and creations based or inspired from the components of life, in all its complexity. By these practices and traditions, man has succeeded to create biodiversity (hybrid species, varieties, races) or to conserve certain fragments from the ecosystems closely related to the soul of a human community and during a certain period of society development (Cristea *et* Denayer, 2004).

We consider that biodiversity is the result of evolution processes which enabled life to diversify for the environment occupancy, in all its variety of forms, with which it created interdependence relations, in a dynamic but fragile balance, as compared to the powerful anthropic influence.

The two major biodiversity conservation directions are *in situ* conservation, by means of, but not limited to, protected areas and the *ex situ* conservation*,* which implies conservation in genes banks, *on farm* conservation*,* in botanical and zoological gardens. In this chapter, we considered both conservation directions, as complementary. A more significant focus was placed on *in situ* conservation, considering two things: the first directly related to the topic of the thesis and second related to the increasing significance of *in situ* conservation due to the maintenance not only of the species, but also of the ecological relationships among them.

A series of international agreements and conventions was elaborated in order to reduce the species loss internationally. The most important of these are:

a The Convention on Wetlands of International Importance (RAMSAR);
b The Convention Concerning the Protection of the World Cultural and Natural Heritage;
c The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES);
d The Convention on the Conservation of Migratory Species of Wild Animals;
e The Convention on the Conservation of European Wildlife and Natural Habitats;
f Agreement on the Conservation of Populations of European Bats;
g The Convention on Biological Diversity (CBD);
h The Agreement on the Conservation of African-Eurasian Migratory Waterbirds;
i The Cartagena Protocol on Biosafety;
j The European Landscape Convention;
k The Framework Convention on the Protection and Sustainable Development of the Carpathians.

Also, of great interest for the topic approached in this thesis is the presentation of the global, European, national and local strategies on biodiversity conservation or with a direct impact on biodiversity. Among these, we mention some of the most important:

a Worldwide Conservation Strategy;
b The Global Strategy for Conservation;
c The Global Strategy for Plant Conservation;
d The Seville Strategy For Biosphere Reserves;
e The Environment Action Programme of the European Community;
f The European Strategy for Plant Conservation;
g The European Strategy for Sustainable Development;
h The European Common Agricultural Policy;
i The Water Framework Directive;
j The National Strategy and the Action Plan for the Conservation of Biological Diversity and Sustainable Use of its components in Romania;
k The Maramureş Mountains Nature Park Management Plan.

III Types of Habitats in Maramureş Mountains Nature Park

Starting with the CORINE Programme, the term habitat became familiar in Europe, *stricto senso*, it means place of life, meaning the abiotic environment where a distinct organism or biocenosis. This environment is geotope with a corresponding to ecotope. This ecotope transformed by the biocenosis is a biotope. The habitat is defined by this meaning in the classic biology and ecology works. However, the meaning of habitat given by the CORINE programme and then by the other classification systems which followed, was, in fact, an ecosystem, that is a "habitat" *stricto senso* and the corresponding biocenosis which occupies it (Doniță *et al.*, 2005). This evidently results from the name and description of the habitat types where references are made not only to the features of the ecotope, but especially to those of the biocenoses occupying the respective sites (Gafta *et* Mountford, 2008). In this paper we will use the term habitat with the meaning given by the Habitat Directive and by Doniță *et al*. in the paper Habitats from Romania, 2005.

Methods

Identification of habitat types in the growing stock. For the land surfaces included in the growing stock, sylvic planning was performed, based on which and using the correspondence between the forest types and Natura 2000 habitat types, a map of habitat types distribution can be performed. Also, there is the possibility to achieve a correspondence with the types of habitats from Romania, with a much greater concern for details.

Identification of the other habitat types. Identification of other types of habitats than the forest ones is usually performed by recognition of phytocenoses that characterizes them. That means by considering the significant (generally prevailing) species and ecological and/or cenological markers, as well as by recognition of the characteristics of the site, first by geographical location, altitude, relief, rock and soil. This type of identification may be used also for forest habitats, but also for smaller sites.

Structure description of the identified habitats. In order to describe the types of habitats in Maramureş Mountains Natural Park, we chose the Natura 2000 classification system, performing the correspondence in the system proposed by Doniță *et al.* (2005, 2006). Therefore, for each habitat, a sheet was elaborated, which comprises: name of the habitat in the Natura 2000 classification system, correspondence with the Habitats from Romania and with other classification systems, vegetal associations, phytogeography in MMNP, structure, conservation value, floral composition, representative fauna for the type of habitat and the literature used in elaborating this synthesis sheet.

Habitats mapping. By mapping the types of habitats, regardless of their nature, we used the following cartographical materials: Ortophotoplans, satellite images, topographic maps (1:25.000),

sylvic maps (1:20.000 and 1:50.000). The information on these maps has been transposed into a GIS (Geographycal Information System) system. On these the land use data resulting from the planning of the growing stock were superimposed. Therefore, for the forest habitat types we used the limits of land use units as habitat limits, where the transition to a certain type of habitat (identified based on the forest type) to another type of habitat is performed. In case of the meadow, scrub, swamps and wet land types of habitats, we set the limits of the habitats to the changes of the phytocenoses and sites characterizing them. The positioning of habitats on the map is performed by means of the GPS coordinates collected from the field, by using the GPS Trimble ProXH receptor with a zephir antenna and GPS Trimble ProXT. The data were processed in ArcGIS 9.3 programme.

The analysis of the MMNP management plan and determination of the management/conservation set of measures. After identifying, describing and mapping the types of habitats in MMNP, we considered the analysis of the MMNP management plan to be absolutely necessary, especially of the strategic objective *Maintenance of park biodiversity by conservation of the species, habitats and ecosystems.* We have comparatively analyzed the data presented in the MMNP management plan and in this paper, as well as the biodiversity operational management programme. The scope of this stage is to identify the present management measures, to propose new management measures or actual management tools for the future, where we consider these to be necessary.

Summary of the identified habitats. Using the habitats identification means described in the previous chapter, the existing bibliography and setting the correspondence between the Natura 2000 habitat types and Habitats from Romania (Doniță *et al*., 2005, 2006) and then by correlating them to the field data, we summarized the types of habitats in Maramureş Mountains Natural Park. Thus, 19 Natura 2000 habitat types were identified, of which 6 are priority habitats). 36 habitats correspond to the above mentioned habitats, in the sense of Habitats from Romania (Doniță *et al*., 2005, 2006) and other 6 habitats which do not have a correspondent in the Natura 2000 types of habitats (Table 1.).

We mention that in this summary we included the types of habitats we identified until now, without considering that a comprehensive classification of all types of habitats was performed, and the names used in this summary are the same with those in the Natura 2000 classification system and Habitats from Romania.

Table 1. **Correspondence between the Natura 2000 habitats and the habitats from Romania identified in MMNP**

No.	Natura 2000 Code	Type of Natura 2000 habitat	Romania Code	Type of habitat according to the Habitats from Romania (Doniță *et al*., 2005, 2006)
1.	3230	Mountain rivers and their wood vegetation with *Myricaria germanica*	4415	Dacic shrubs of box thorn (*Myricaria germanica*)
2.	4060	Alpine and boreal pastures	3104	South – Eastern Carpathian rhododendron scrubs (*Rhododendron myrtifolium*), with bilberry (*Vaccinium myrtillus*)
			3108	South – Eastern Carpathian short juniper shrubs (*Juniperus sibirica*)
3.	4070*	Shrubs with *Pinus mugo* and *Rhododendron hirsutum (Mugo-Rhododendretum hirsuti*)	3105	South – Eastern Carpathian juniper tree shrubs (*Pinus mugo*), with rhododendron (*Rhododendron myrtifolium*)
4.	6230*	*Nardus* rich grasslands in terms of species, on the siliceous substrata of mountainous areas	3608	South – Eastern Carpathian grasslands with *Scorzonera rosea* and *Festuca nigrescens*
			3609	South – Eastern Carpathian grasslands with nard grass (*Nardus stricta*) and *Viola declinata*
5.	6430	Woodside associations with tall higrophyle grass from the level of plains to the mountainous and alpine level	3704	South – Eastern Carpathian communities of tall bushes with *Senecio subalpinus* and alpine dock (*Rumex alpinus*)
			3708	Daco-getic communities with *Angelica sylvestris*, *Crepis paludosa* and *Scirpus sylvaticus*
6.	6520	Mountain grasslands	3801	South – Eastern Carpathian grasslands with *Trisetum flavescens* and *Alchemilla vulgaris*
7.	7140	Transition peat swamps and moving peateries (not fixed in the substrata)	5408	South – Eastern oligotrophe Carpathian swamps, with *Carex limosa*
8.	7220*	Petrifying springs with travertine formation (*Cratoneurion*)	5417	Fontinal South – Eastern Carpathian communities with *Cratoneuron commutatum* and *C. filicinum*
9.	8210	Rocky slopes with chasmophytic vegetation	6213	South – Eastern Carpathian communities on rocks with *Saxifraga luteoviridis* and *Silene zawadzkii*
10	9110	*Luzulo-Fagetum* type forests	4102	South – Eastern Carpathian spruce forests (*Picea abies*), beech (*Fagus sylvatica*) and firs (*Abies alba*), with *Hieracium rotundatum*

			4106	South – Eastern Carpathian beech forests (*Fagus sylvatica*) and firs (*Abies alba*), with *Hieracium rotundatum*
			4110	South – Eastern Carpathian beech forests (*Fagus sylvatica*) with *Festuca drymeia*
11	9130	*Asperulo-Fagetum* type of forests	4118	Dacic beech (*Fagus sylvatica*) and hornbeam (*Carpinus betulus*) forests, with *Dentaria bulbifera*
			4119	Dacic beech (*Fagus sylvatica*) and hornbeam (*Carpinus betulus*) forests, with *Carex pilosa*
			4120	Mixed Moldavian beech (*Fagus sylvatica*) silver lime (*Tilia tomentosa*) forests, with *Carex brevicollis*
12	9150	*Cephalanthero-Fagion* type medio-European forests	4111	South – Eastern Carpathian beech (*Fagus sylvatica*) and firs (*Abies alba*) forests, with *Cephalanthera damassonium*
13	9170	Oakery with *Galio-Carpinetum*	4123	Dacic holmoak (*Quercus petraea*), beech (*Fagus sylvatica*) and hornbeam (*Carpinus betulus*) forests with *Carex pilosa*
14	9180*	Slope, detritus or ravines forests composed of *Tilio-Acerion*	4117	South – Eastern Carpathian ash (*Fraxinus excelsior*), sycamore maple (*Acer pseudoplatanus*), elm (*Ulmus glabra)* forests with *Lunaria rediviva*
15	91D0*	Wooded peateries	4412	South – Eastern Carpathian rare tree spruce (*Picea abies*) and/or Scots Pine (*Pinus sylvestris*) forests
16	91E0*	Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae)*	4401	South – Eastern Carpathian grey alder (*Alnus incana*) forests, with *Telekia speciosa*
			4402	Daco-getian forests in hill meadows with black alder *(Alnus glutinosa),* with *Stellaria nemorum*
17	91V0	Dacic beech (*Symphyto-Fagion)* forests	4101	South – Eastern Carpathian spruce (*Picea abies*), beech (*Fagus sylvatica*) and firs (*Abies alba*) forests, with *Pulmonaria rubra*
			4103	South – Eastern Carpathian spruce (*Picea abies*), beech (*Fagus sylvatica*) and firs (*Abies alba*) forests, with *Leucanthemum waldsteinii*
			4104	South – Eastern Carpathian beech (*Fagus sylvatica)* and firs (*Abies alba*) forests, with *Pulmonaria rubra*
			4109	South – Eastern Carpathian beech (*Fagus sylvatica)* forests with S*ymphytum cordatum*
18	91Y0	Dacic oak and hornbeam forests	4128	Daco-getian sessile oak (*Quercus petraea*) forests, with *Dentaria bulbifera*
19	9410	Forests with *Picea* from the alpine – mountainous region	4203	South – Eastern Carpathian spruce firs (*Picea abies*) forests with *Soldanella hungarica*

			4205	South – Eastern Carpathian spruce firs (*Picea abies*) forests with *Oxalis acetosella*
			4206	South – Eastern Carpathian spruce firs (*Picea abies*) and firs (*Abies alba*) forests with *Hieracium rotundatum*
			4207	South – Eastern Carpathian spruce firs (*Picea abies*) and firs (*Abies alba*) forests with *Hylocomium splendens*
			4208	South – Eastern Carpathian spruce firs (*Picea abies*) and firs (*Abies alba*) forests with *Luzula sylvatica*
			4210	South – Eastern Carpathian spruce firs forests with *Sphagnum* sp.
			4214	South – Eastern Carpathian spruce firs (*Picea abies*) and beech (*Fagus sylvatica*) forests with *Hieracium rotundatum*
20		No correspondent	3610	*Poa media* South – Eastern Carpathian forests
21		No correspondent	4129	Dacic holmoak (*Quercus petraea*) and beech (*Fagus sylvatica*) forests with *Festuca drymeia*
22		No correspondent	4209	South – Eastern Carpathian spruce fir (*Picea abies*) forests with *Leucanthemum waldsteinii*
23		No correspondent	4211	South – Eastern Carpathian spruce fir (*Picea abies*) and firs (*Abies alba*) forests with *Pulmonaria rubra*
24		No correspondent	4213	South – Eastern Carpathian spruce fir (*Picea abies*) forests with *Doronicum columnae*
25		No correspondent	5423	South – Eastern Carpathian spring and rivulet communities with *Carex remota* and *Caltha laeta*

Note: *= priority European level habitat.

IV. Conservation and management of habitats in Maramureş Mountains Nature Park

Protected species in the study region

As a result of data centralization from various studies, we reached the conclusion that the ***flora*** investigated in MMNP so far includes 1,509 representatives of the vegetal kingdom, of which 741 cormophyte sp. (table 2). Knowing that the Romanian flora includes a number of 3,759 cormophyte species, of which 3,136 are spontaneous species (Ciocârlan, 2009), the cormophytes identified in Maramureş Mountains Natural Park represent approximately a quarter (23.6%) of the spontaneous cormophytes flora at national level, thus resulting the significance of species conservation in Maramureş Mountains Natural Park, as representative sample for the alpine biogeographical region.

26 plant sp. Were also identified as Carpathian endemites, such as: *Achillea schurii, Aconitum moldavicum, Armeria pocutia, Campanula carpatica, Cardaminopsis neglecta, Centaurea carpatica, Centaurea melanocalathia, Chrysosplenium alpinum, Dentaria glandulosa, Dianthus tenuifolius, Doronicum carpaticum, Festuca carpatica, F. porcii, Heracleum carpaticum, Hieracium kotschyanum, Melamphyrum saxosum, Phyteuma tetramerum, Ph. wagneri, Ranunculus carpaticus, Scabiosa lucida, Silene dubia, Symphytum cordatum, Trisetum fuscum* ş.a.

The geographical area of the flora highlights the prevalence of an Euro Asiatic fund, to which European, circumpolar and central-European elements are added. These elements increase the botanical value of this massif and give a particular shade to the flora of the Maramureş Mountains.

Beside the high specific richness, the flora of this area is valuable also by the floristic elements with different conservation statutes such as: *Trollius europaeus* (VU, LRR, 1994), *Leontopodium alpinum* (VU, LRR, 1994), *Cochlearia borzaeana* (End., LRR, 1994), *Campanula serrata* (DH), *Cypripedium calceolus* (DH, CB), *Ligularia sibirica* (DH, CB), *Drosera rotundifolia* (VU, LRR, 1994) etc.

Table 2. ***Specific and sozologic diversity of the vegetal kingdom (s.l.) in MMNP***

Group	Families	Species	IUCN Red list	National red list	Endemites
Macromycetes	34	169	5	23	1
Lichens	47	123	-	-	-
Bryophytes	80	476	47	2	-
Cormophytes	90	741	7	102	26
TOTAL	**251**	**1509**	**59**	**127**	**27**

The fauna of Maramureş Mountains Natural Park is representative for the Oriental Carpathians, with a high biodiversity and registering a series of endemic or rare species in Romania and in Europe. The fauna partial diversity in MMNP is presented in table 3.

The flora and fauna diversity of the MMNP, although significant, lacks in terms of knowing: the algae groups, number of cormophytes populations sozologically important, the invertebrate groups and biology of conserving some of the target species.

Table 3. ***Fauna (partial) and sozological diversity in MMNP***

Group	No. sp.	Berna Conv.		No sp. included in OUG 57/2007	No sp. on the IUCN red list of which,						
		Annex 2	Annex 3		EX	CR	EN	VU	NT	LC	DD
Lepidoptera	126	-	-	58	1	4	13	30	-	-	-
Diptera	205	-	-	-	-	-	-	-	-	-	-
Fish	24	-	9	16	-	-	1	1	1	9	1
Amphibians	13	6	7	12	-	-	-	-	1	12	-
Reptiles	7	2	5	7	-	-	-	-	-	1	-
Birds	121	72	39	55	-	-	-	-	1	107	-
Mammals	41	6	16	22	-	-	-	-	5	21	-
TOTAL	**537**	**86**	**76**	**170**	**1**	**4**	**14**	**31**	**8**	**150**	**1**

Protected natural areas in MMNP

Due to the presence of the above mentioned flora and fauna species in Maramureş Mountains and to their conservation value, four protected natural areas of national interest were set forth:

Tomnatec Sehleanu narcissus field – has the statute of natural reserve – category IV UICN, surface 100ha and includes the Sehleanu pasture and the forest vegetation area around the Tomnatec peak. The altitude ranges between 1,300 m and 1,618 m. The Tomnatec – Sehleanu narcissus field is located in Repedea commune. The access to this site is possible by marked tourist routes both via Repedea, and via Crasna Vişeului.

The vegetation of the reserve is represented by pastures of *Nardus stricta* and acidofile forest of *Picea abies.* The pasture has a Southern slope, and was founded by the association *Violo declinatae – Nardetum* Simon 1966. Here and there are shrubs of *Juniperus sibirica* and represents the site with *Narcisus radiiflorus,* located to the highest elevation in Maramureş, for this reason the natural reserve regime was given in the year 1994.

Farcău Peak – Vinderel Lake – Mihailecu Peak – This natural protected area includes the area surrounding the Vinderel Lake and the two mountain peaks Farcău (1.957m), the highest in Maramureş Mountains, and Mihailecu (1918m), with a surface of 100 ha, constituted from landscape conservation reasons. This is a natural reserve of category IV IUCN, located on the territory of Repedea and Poienile de Sub Munte communes, The access to this site is possible by marked tourist route via Repedea.

The reserve is composed of a mountain ridge with two prominent peaks (Farcău and Mihailecu), with a glacial relief on the Northern slope (Farcău) and Eastern slope (Groapa Julii, Groapa Bologhii, Groapa Lupilor). The Vinderel lake bears the name of a falco (*Falco tinunculus),* and is located in the passage between Farcău and Mihailecu, as this is a flat area, slightly tilted towards the West, hosting other former lakes. Its length is 155m, maximum width 85m, 0.90ha extension and 5.5m maximum depth.

The vegetation is specific to the siliceous rocks and subalpine pastures with *Nardus stricta.* Near the Vinderel lake there are also fond hydrophilic oligotrof communities with *Carex rostrata* and *Carex pauciflora*. In the water of the lake there are algae such as *Mallomonas actinoloma var. maramuresensis.*

The Sâlhoi-Zâmbroslăviile rock sites – natural reserve located on the administrative territory of Borşa town, between the Măguricei peak and the Sâlhoiului rocks, North-West of the Zâmbroslaviilor ridge, at 1,230m altitude. The surface is 5 ha and includes the rock area

(constituted from almost vertical rock walls formed of Eocene limestone), as well ad the wet area including two surfaces, one of 35x25m and the other of 20x20m, with a *Cochlearia borzaeana* population, glacial relict, endemite, present only in Maramureş and Suceava counties. The natural protected area regime was issued by Decision no. 204/1977 of Maramureş County Council.

The vegetation in the reserve is represented by Southern-Eastern Carpathian communities on calciferousrocks with *Saxifraga luteoviridis* and *Silene zawadzkii* and fontinal Southern-Eastern Carpathian communities with *Cratoneuron commutatum* and *C. filicinum* with *Cochlearia borzaeana.*

One may reach Sâlhoi rock areas from the Sâlhoi forest range, located at the confluence of the two valleys Sâlhoi with Bănării, at approximately 400 m.

The Black Grouse reserve, Cornul Nedeii-Ciungii Bălăsânii – the reserve is located in Borşa and has a surface of 800 ha. It is a natural reserve classified in the category IV IUCN.

The reserve was founded in 1971 and its purpose is to protect the Black Grouse populations (*Lyrurus tetrix, syn: Tetrao tetrix*). The vegetation of the reserve is represented 60% by mountainous pastures and 40% of Common Juniper and juniper tree shrubs. These represent the habitat of the Black Grouse. The first researches on the problem of conserving the junipers in Maramureş were imposed as a result of the studies regarding the ecology of the *Lyrurus tetrix (syn: Tetrao tetrix*) species. These researches were developed during the 1967-1970 period. As a result of these studies, there was issued the Decision of the Maramureş County Council no. 127/1971 regarding the protection of significant natural reserves, among which the black grouse reserve from Cornu Nedeii Ciungii Bălăsânii with a surface of 800ha, which is managed by the Borşa forest range.

Subsequently, the junipers in Maramureş Mountains (the Gărgălău – Prislop – Cearcănu – Cornu Nedeii) and Rodna Mountains area were subjected to extended interdisciplinary researches developed by the Biological Research Centre in Cluj Napoca and the Physical Geography Laboratory within the Geography department of the Babeş – Bolyai University in Cluj Napoca, during the 1974-1977 period. These researches set the basis of the above mentioned decision. The Maramureş County Council Executive Committee has decided to interdict the cutting of the common juniper in the entire country and the extension of the black grouse reserve surface up to 2000ha. This natural reserve is recognized by the Law 5/2000 on the approval of the National land use planning Plan – Section III – protected areas, but only with a surface of 800ha. The access to the reserve is possible through the passage of Prislop at an altitude of 1,416 m.

These natural reserves already instituted have represented the core for the decision that Maramureş Mountains become a natural park, by GD 2151/2004.

The protected natural areas constituted until now in Maramureş Mountains cover almost entirely the most valuable areas in terms of biodiversity conservation. In order to increase the species and habitats protection level in MMNP and in its surrounding area, we consider that the following actions would be beneficial:

a) Expansion of the Natural reserve Sâlhoi – Zâmbroslavele rocks and the issuance of the scientific reserve statute

The botanical reserve Sâlhoi – Zâmbroslavele rocks gathers a few important habitat types *7220* Petrifying springs with travertine formation (Cratoneurion), 8210 Rocky slopes with chasmophytic vegetation,* surrounded by *9410 Acidofile forests with Picea from the alpine mountainous regions*, subtype South-Eastern Carpathian spruce firs forests (*Picea abies*) and fir (*Abies alba*) with *Hieracium rotundatum*. This reserve was constituted for the protection of two parcels with *Cochlearia borzaeana,* periglacial relict, discovered in Sâlhoi by A. Coman, which has described it as *Cochlearia pyrenaica var. borzaeana* Com. et Nyár. In 1946, this variety was recognized as a species itself *Cochlearia borzaeana,* and also for the protection of the protection of the chasmophytic vegetation from the Sălhoi rocks.

In 1978, T. Ştefureac and G. Pânzaru proposed that the temporarily established reserve be extended by comprising also a surface from the upstream forest, with an overall surface of 83ha and declare it as a natural reserve. After the recognition of the natural reserve, it was proposed that the

upstream forest is classified in functional group I – protection role forests, which was achieved but maintained only during the application period of one forest range and the surface acknowledged as natural reserve was only 1ha.

In 2007, there were noticed other two surfaces with *Cochlearia borzaeana*, located on the Sâlhoi rivulet, but not included in the reserve.

We use as arguments for conservation the following aspects:

- The high conservation value of the priority habitat *7220* Petrifying springs with travertine formation (Cratoneurion);*
- The genetic analyses (Kochjarová, 2005) revealing the fact that the population in Sâlhoi belongs to the species *Cohlearia borzaeana;*
- *Cochlearia borzaeana* is an endemic and threatened taxon which vegetates only in Sâlhoi – Maramureş Mountains and Răchitişu Mare – Suceava;
- The high conservation value of the endemic habitat *Rocky slopes with chasmophytic vegetation;*
- The existence of tow more sites with *Cochlearia borzaeana,* not included in the natural reserve,

We hereby propose the expansion of the reserve and the acknowledgment of the scientific reserve statute for all 4 surfaces with *Cochlearia borzaeana* and for the buffer area of 15.5ha, proposed for those in the Sâlhoi rivulet and 91ha for the sites in the riverbed of the Bănării rivulet, especially because these areas are located outside the limits of MMNP and the conservation measures proposed in the MMNP cannot be applied also in there areas. Also, we propose the inclusion of the Sâlhoi – Zâmbroslavele rocks in the scientific reserve.

a. The establishment of the scientific reserve statute for the Toroioaga massif

The conservation value of the Toroioaga massif area consists in the fact that there are samples of the habitats South – Eastern Carpathian juniper tree shrubs (*Pinus mugo*) with rhododendron (*Rhododendron myrtifolium), Alnus viridis* shrubs and South – Eastern Carpathian *Scorzonera rosea* and *Festuca nigrescens* shrubs and the area represents the habitat of many animal species such as: the Wood Grouse (*Tetrao urogallus),* Black Grouse (*Lyrurus tetrix,* syn.: *Tetrao tetrix),* and the Hazel Grouse (*Tetrastes bonasia).*

In this area also, there is, among others, the rare species *Silene rupestris,* mentioned in Romania only in the Cisla, Baia Borşa area. Coldea (1995-1996) mentions the presence in this area of the relict association Sileno rupestris – Sedetum annui Oberd. 57. The characteristic species for the association and usually prevailing is *Silene rupestris,* frequently accompanied by acidofile species *Agrostis capillaris, Thymus pulegioides, Sedum annum, Veronica officinalis, Silene dubia* and *Rumex acetosella,* which confer its ecological peculiarity (Coldea, 1995-1996).

Teppner (1994) mentions the presence of the *Nigritella carpatica* species in the Stâna lui Vârtic – Toroioaga area. This is an endemic species for the North-Wets part of the Eastern Carpathians, known presently as locate din six locations in Romania and Ukraine.

Both proposals require complex documentations and arguments, and the official actions will be applied by AMMNP, with support of the scientific Council of the park.

Analysis of the MMNP management plan

The Management Plan (MP) of the Maramureş Mountains Natural Park is the official document which establishes the general framework for the development of the actions promoted for the achievement of the protected area objectives. This document sets the basis for the activities of the park administration for the next five years, after the approval by Governmental Decision (GD).

The MP of MMNP was elaborated in compliance with the Guide for the Elaboration of the Management Plans for the protected areas in Romania, elaborated by the project *Management of Biodiversity Conservation in Romania, Facilitation and technical assistance in institutional changes RO-GE-44176*, by Michael Appleton under his close supervision.

The plan was completed in October 2008 and was submitted for approval to the Ministry of Environment and Forests, to the National Administration of Forests and to the National Agency for

Protected Areas, institution founded only on paper, but not effectively. The responsibility of not approving the plan until now belongs to the Ministry of Environment and Forests.

We mention that, due to the legislative changes occurred and to the different interpretations of the legislation, in order to approve this management plan, its revision is necessary, together with the observance of the environmental assessment procedure for plans and programme according to GD 1076/2005.

We performed an analysis of the biodiversity operational management programme in the MP due to its relevance to the research topic. Therefore, 3 years after the elaboration of the MP and working on the implementation of an operation programme, we have analyzed the relevance of objectives, established actions, implementation degree and where we considered necessary, we proposed new approaches, which, we hope, will be useful in revising the MP of the MMNP.

As a result of the evaluation of the biodiversity operational management programme, we may conclude the following:

a Even if MP is not approved by GD, a part of the actions are already performed;
b The actions that we proposed in the MP are not appropriately sized according to the 5 years implementation period and the AMMNP stuff (1 biologist and 8 field agents/rangers, according to the stuff organization scheme). Therefore, we consider necessary either the resizing of actions, of the resizing of the stuff scheme, according to the proposed actions;
c The presentation format of the actions and objectives leads more to an ideal situation, towards the accomplishment of the AMMNP vision, not to tangible objectives/actions during the implementation period of the MP;
d The distinction between the conservation and effective management measures is not clearly emphasized ;
e There are not presented actual management measures sets or monitoring and assessment tools of the conservation state of species and habitats tools, annexed to the MP.

Proposals for habitats conservation state monitoring tools

In order to solve the problems identified above, we propose, according to the internal zoning of the MMNP, the grouping of habitat types into two major categories: some that need intervention management, located in the Sustainable Management Area (ZMD) or in the Sustainable Development Area of human activities (ZDD), and others subjected to the non-intervention management, implicitly to conservation, located in the Integral Protection Area (ZPI).

In order to provide actual tools for the monitoring of the habitats conservation state, we have selected the habitat category located in the ZPI, type of habitat shrubs with *Pinus mugo* and *Rhododendron myrtifolium*, and from the category of those situated in the ZMD or the habitat of the alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* for which we will propose monitoring protocols, as effective park management assessment tools. We chose these two types of habitats due to the fact that the first, that of the *Pinus mugo* and *Rhododendron myrtifolium* shrubs represents the fist protected habitat at the level of Maramureş county, as a habitat of the black grouse (*Lyrurus tetrix, syn Tetrao tetrix)*. The juniper (*Pinus mugo)* is a protected species in Maramureş county since 1977, and the habitat of alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* represents, in our opinion, the priority habitat with a high conservation value most exposed to anthropic influences, located in ZMD and even in ZDD, inside human communities.

Therefore, for the conservation state monitoring of the habitat with *Pinus mugo* and *Rhododendron myrtifolium* we elaborated monitoring protocols, which use the following assessment methods: *photography from a fixed point* and *spectral analysis of satellite images*. We chose these two methods due to their applicability to the topographic conditions and specificity of the MMNP.

Considering the specific of the two monitoring protocols and their requirements for field application, the elaboration of a data collection sheet is not necessary, as the work tools are represented by the fixed point images and by the satellite images and/or ortophotoplans. Following

the evolution of the surfaces covered with juniper, one may outline their time evolution and the need to change the measures, from conservation to active management measures.

In order to monitor the alders we have elaborated a monitoring protocol, by which we intend to assess the time evolution of species and conservation state of this type of habitat. The method of point photography might also be used for this type of habitat, but, due to the high anthropic impact on alders, we chose a more sensitive method to better identify the changes of the conservation state of the alders, to enable management interventions in due time.

Due to the high complexity of the data gathered in the field, we have elaborated the field sheet for the collection of data on the assessment of conservation state of the alluvial forests with *Alnus glutinosa* or *Alnus incana* which provides the standardization of the field data gathering format.

All these 3 monitoring protocols were elaborated to serve as conservation state assessment tool of junipers and alders in MMNP and of their trend reported to the anthropic pressures, to provide clear information to serve the management decisions.

Recommendations for MMNP Natura 2000 habitats management

In order to support the activity of AMMNP stuff in future MMNP management actions, we have identified the threats and pressures induced to the Natura 2000 habitats in MMNP and we have elaborated a minimal set of management recommendations. Also, we have elaborated the map of the Natura 2000 habitat types, mapped until now, so that, together, the two elements represent a work tool for the AMMNP stuff in approving the economic activities in MMNP.

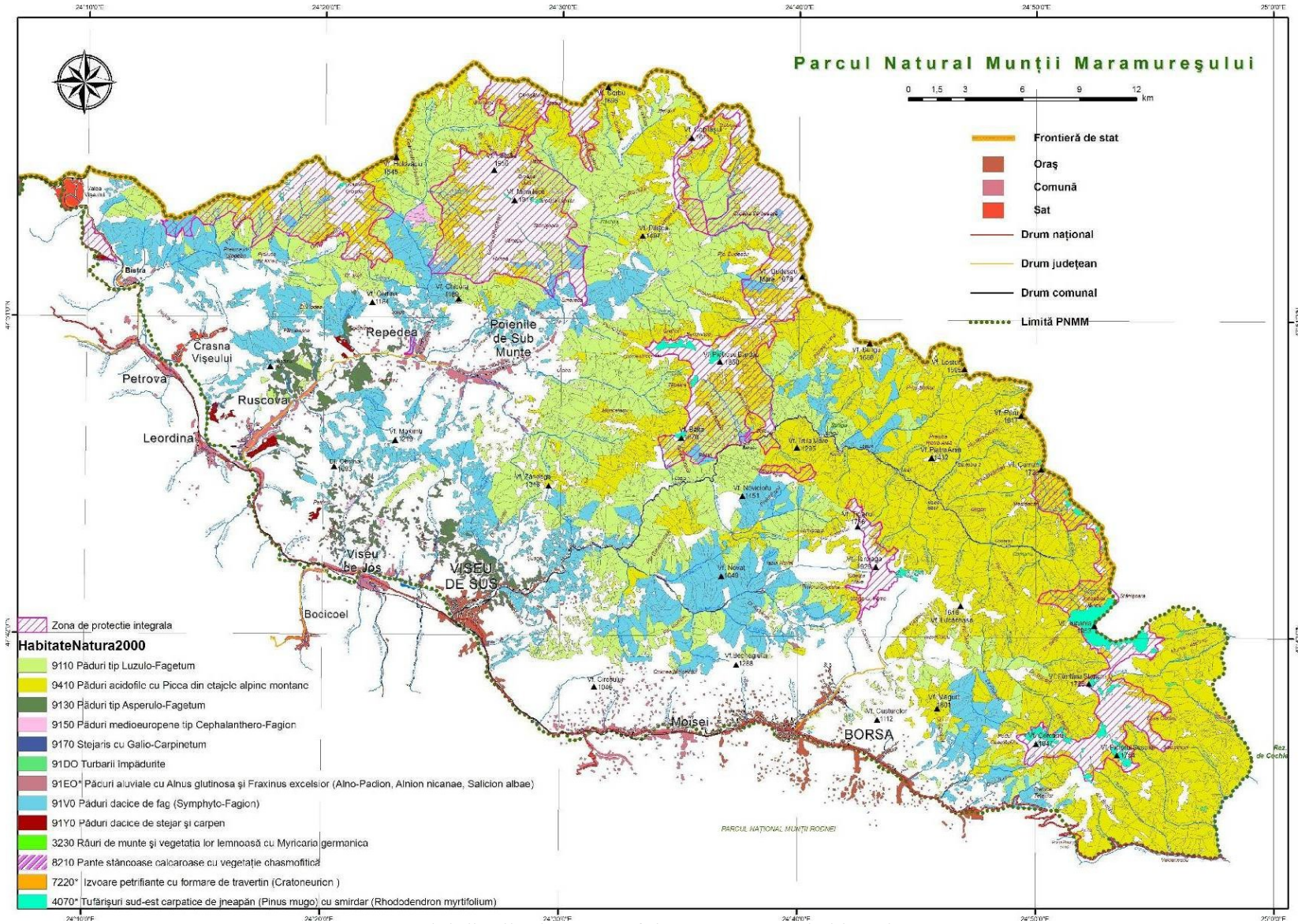

Fig. 2. Partial distribution map of the Natura 2000 habitats in MMNP

CONCLUSIONS AND RECOMMENDATIONS

The studies that we performed in this paper offer a highly complex image of the types habitats in the Maramureş Mountains Natural Park, of their management and conservation measures, and meet the management needs of the Natura 2000 habitats with precise tools and management recommendations.

Based on the data presented above, we may draw the following conclusions and outline the following recommendations:

1. Knowledge of the conservation principles and strategies is absolutely necessary for any person involved in the management of natural resources, in management of protected areas of in sectors intended to provide sustainable development;
2. The present paper is the first attempt to summarize the types of habitats, to describe the structure and phytogeography of those in MMNP, by using the habitats identification methods, the existing bibliography and setting the correspondence between the Natura 2000 habitat types and Habitats from Romania (Doniţă *et al*., 2005, 2006) and then by correlating them to the field data;
3. Thus, 19 Natura 2000 habitat types were identified, of which 6 are priority habitats). 36 habitats correspond to the above mentioned habitats, in the sense of Habitats from Romania (Doniţă *et al*., 2005, 2006) and other 6 habitats which do not have a correspondent in the Natura 2000 types of habitats ;
4. Of these identified habitats, 10 are forest habitats, 3 are shrubs habitats, 2 alpine and subapine grasslands and mezophile pastures, 1 mountainous and subalpine herbs habitat, 1 oligotrophic swamps, 1 rocks and 1 fontinal communities habitat;
5. The highest ecological diversity is found in the habitat type Natura 2000 - 9410 Acidofile forests with *Picea* the alpine-mountainous regions, occupying approx 42% of the surface of forests included in the MMNP and includes 7 subtypes of habitats, according to the classification Habitats from Romania;
6. The distribution maps for 13 types of Natura 2000 habitats in PMMM were performed, using the cartographical basis of AMMNP and the field data that we have gathered;
7. Even if our activity was arduous, only 13 of the 19 types of Natura 2000 habitats in PMMM were mapped and we encourage AMMNP to continue mapping the other types of habitats;
8. For a better biodiversity management we have performed an analysis of the biodiversity operational management programme in the MP of MMNP and have elaborated proposals for its revision;
9. For a better approach of the management/conservation of habitat types in MMNP, the elaboration of management/conservation plans according to the internal zoning of MMNP is necessary;
10. Protected natural area management assessment is necessary, and the elaboration of key species and habitats monitoring plan may represent an important tool in this regard. To meet this necessity, we have elaborated monitoring protocols of the habitat South-Eastern Carpathian juniper shrubs (*Pinus mugo*) with rhododendron (*Rhododendron myrtifolium)* and of the alluvial forests habitat with *Alnus glutinosa* and *Fraxinus excelsior,* which we proposed to be included in the revised form of the MP of MMNP;
11. 70% of the MMNP surface is included in the Natura 2000 RO SCI 0124 Maramureş Mountains site and needs the elaboration of a set of management measures for species and habitats. To fulfil these obligations, we elaborated a set of management recommendations for Natura 2000 habitats in MMNP and a partial distribution map of the these habitats;
12. We consider that the partial distribution map of Natura 2000 habitats in MMNP and the threats and recommendations table may represent an information and awareness tool for the 10 communities in MMNP and we propose the printing and display of these tools in the land use planning offices/departments of city halls and at AMMNP headquarters;

13. Both the management instruments of the habitats in MMNP, and the recommendations that we elaborated for the management of the Natura 2000 habitats, may complete existing management plan elaborated by AMMNP with the Natura 2000 RO SCI 0124 Maramureş Mountains site management component, to be approved by Ministry of Environment and Forests;
14. In order to ensure the favourable conservation state of species and habitats in PNM, both the elaboration and implementation of management plans for habitats, plant and animal species are necessary, as well as the development of an information campaign of communities in the MMNP area, on the role of biodiversity, using the representative image of marker approved species (such as: *Lyrurus tetrix).*

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