# RESEARCH ON HIGH CONSERVATION VALUE FORESTS OF PIATRA CRAIULUI MOUNTAINS TO ESTABLISH PROTECTION MEASURES

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***Abstract***

*The aim of the research undertaken in Pădurea Craiului Mountains was to determine high conservation values and the forests embedding such values. We developed a working method deployed in two phases as follows: establishing the high conservation values existing in the afforested territory to be investigated and the selection of forest arrangements of those management units embedding conservation value. The results and discussions present the high conservation value (HCV) of the Dobreşti Forest District i.e. Forest Unit IV Vida, and Forest Unit V Răcaş both within Bihor County territory. These values are represented by 31 endangered, endemic and relict plant species (i.e. HCV 1.2., HCV 1.3.), 45 species of rare animals (HCV 1.2, HCV 1.3.), and 125 rare, threatened and endangered ecosystems.*

**Key words:** forests, high conservation values.

## INTRODUCTION

### 1. Current state of knowledge

#### *1.1. Current state of knowledge regarding the high conservation values (HCV) and the high conservation values forests (HCVF)*

The concept of "high conservation value forests" was first formulated by the Forest Stewardship Council (FSC) in relation to concerns for sustainable management of the forests by means of their certification, embodied and grounded during the last decade of the twentieth century.

For practical application of such criteria there were developed forest certification systems – i.e. Forest Stewardship Council (FSC) and the Pan-European Forest Certification Council (PEFCC) which established the administrative framework according to which one assesses whether forests beneficiate of sustainable management or not.

A toolkit for identifying and managing the high conservation value forests was developed in 2003 by the consulting company Proforest and at the initiative of the international organization World Wild Found (WWF) and IKEA, the latter expecting to practice higher prices for the wood coming from sustainably managed forests in order to foster this type of management.

### *1.2. Defining high conservation values for forests*

One defined the following values requiring conservation by means of the management of the forest embedding such values or which are contributing to their protection:

HCV1 - Significant concentrations of biodiversity values (at species values);

HCV2 – Landscapes where the population of the domestic forests species are present as naturally occurring species, both in terms of distribution and density;

HCV3 – Rare, threatened or endangered ecosystems;

HCV4 – Basic services of nature in critical situations (stream flow regulation, erosion control, climate etc.).

HCV5 – Basic needs of local communities;

HCV6 – Local communities' traditional identity.

Subgroups were defined within the large groups of high conservation values groups afore mentioned where necessary.

Forests containing these six categories of high conservation values and their subgroups are considered "High Conservation Value Forest" (HCVF) having been assigned indicators according to the values they embed, namely: HCVF1 (i.e. HCVF1.1, HCVF1.2, HCVF1.3, HCVF1.4), HCVF2, HCVF3 (i.e. HCVF 3.1, HCVF3.2, HCVF3.3), HCVF4 (i.e. HCVF 4.1, HCVF4.2, HCVF4.3), HCVF5, HCVF6.

## MATERIAL AND METHODS

### 2. Research purpose and objectives

The purposes of our research was to identify and characterize the high conservation values of the forest district lying within Pădurea Craiului Mountains and to identify the forests embedding such high values in order to ensure their inclusion in the share of forests for biodiversity conservation purposes throughout forest certification process .

### 3. Working method and research location

In order to reach the research purposes and objectives we established the following working method structured in two distinct phases:

**Phase I** Procurement of the following information material on the forests of which HCVF is to be established:

- Descriptions and maps of stands, and cultivation and operation works of forestry production units within the region studied i.e. Pădurea Craiului Mountains,
- Practical Guide, Annexes 1B, 2B, Stanciu et al. 2004, Law no. 462/2001 (Annex no. 4), Government Emergency Ordinance no. 57/2007 (Annex no. 4A and Annex no. 4B), IUCN Red List, Flora

României (*Romania's flora*) vol. 13 (1976), and threatened, endangered, rare, relict animals species enclosed in the Annexes 1 and 2 of the Practical Guide on the identification of high conservation value forests,

- Data collected from papers already published or in manuscript (PhD theses) related to such species which presence is reported in forests of which HCVF is to established,
- Data from works already published on forests with high conservation value reported in other geographic regions of Romania and Europe: Abrudan (2001), Abrudan et al. (2006, 2009), Gurean et Parascan (2011), Ioraș et. al (2007, 2008), Jennings et al. (2003), Nicolescu (2000), Rameau (1995), Stanciu et al. (2004), Stăncioiu (2008), Stăncioiu et al. (2010), Șofletea (2005), Șofletea et al. (2002), Biriș (2001), Biriș et al. (2002), Cenușă (1992, 2001), Doniță (2001), Doniță, Biriș (2001), Doniță et al. (1981, 1990, 2005), Giurgiu 2001, Radu (1996, 2001), Radu et al. (2004), Vlad et al. (1997),
- Data from papers published or in manuscript concerning rare, threatened or endangered species for these forests, Bogdan et al. (2009), Gafta et al. (2008), Puia et Soran (1990), Stăncioiu et. al (2008), Schulze et Mooney (1993).

**Phase II** Preliminary assessment of possible HCVF.

Preliminary assessment was done by identifying and listing the management units which, according informative material we procured, could embed HCVF features. The list includes: forest district, production unit, plot, subplot, area, functional zoning, forest type, station type, composition, age.

The selection criteria of management units were the following ones: natural composition of the stand according to the forest type, the old age, usually > 100 years when the forest type related biodiversity is featured, diversified structure, lack of silvicultural interventions, at least in recent decades, the great distance to roadways and approaches which may indicate the lack of silvicultural interventions.

## RESULTS AND DISCUSSION

### 4. Research results

#### *4.1. High conservation values in Pădurea Craiului Mountains*

Within the research conducted in the Pădurea Craiului Mountains one considered some rare, relict, endemic, vulnerable, threatened and endangered species of plants and animals, and ecosystems as well as regional ecosystems not included in the guide.

### *4.2. Rare, threatened, endangered ecosystems, forest ecosystems complexes, open wood (glades) on rocks and/or scree (HCV3) and environmental ecosystems that provide nature basic services in critical situations (HCV4) in Pădurea Craiului Mountains*

1. HCV 3 (B1), Rare forest ecosystems - ecosystems of beech with *Phyllitis scolopendrium* on limestone, wetlands cliffs, some of virgin nature. Such ecosystems have been identified and described by us Burescu (2010) in the Forest district Dobrești, Forestry Production Unit (FPU) IV Vida, management unit (mu) 41, mu 42B, mu 49A, mu 49B, mu 50A, mu 53A, mu 54A, mu 54B, mu 67A, mu 79A, mu 82E, FPU II Răcaș mu 7A, mu 8A, Forest district Beiuș FPU II Roșia, mu 101A, mu 101C, FPU IV Meziad mu 35A, mu 43.

2. HCV 3 (B1), rare forest ecosystems - ecosystems with forests of ash trees and limestone scree specific to gorge areas (3418). Such ecosystems have been identified and described in the Forest district Dobrești, FPU IV Vida mu 26C, mu 30A, mu 42B, mu 42D, FPU VI Răcaș mu 1A, mu 9B, Forest district Beiuș FPU III Sohodol mu 6A, mu 8A, mu 11A, mu 12A.

3. HCV 3 (A3), Complex ecosystems of beech and open wood on rocks and limestone scree with associations of ferns. Such ecosystems have been identified and described by us Burescu (2009) in Forest district Dobrești FPU IV Vida mu 47A, 55A, 83A, Forest district Beiuș FPU III Sohodol mu 40A, FPU IV Meziad mu 81A.

4. HCV3 (A3), Complex forest ecosystems and open wood (glades) of Downy oaks (*Quercus pubescens*) on rocks and limestone scree (4160). Such ecosystems have been identified and described in Forest district Dobrești, FPU VI Răcaș mu 37N1.

5. HCV 3 (A1/C1), Complex forest ecosystems specific to the regional level, mixed foliage forests of *Quercus petraea, Quercus cerris, Fagus sylvatica, Tilia tomentosa, Fraxinus excelsior, Carpinus betulus* in western Romania (C1). Such ecosystems have been identified and described in Forest district Dobrești, FPU VI Răcaș mu 35C, mu 36A.

6. HCV 3(B1), Rare forest ecosystems – beech ecosystems of *Epipactis – Cephalanthera* with virgin forest characteristics on sinkholes and karst plateaus (3374). Such ecosystem type was identified and described in O Forest district Dobrești, FPU IV Vida mu 48A.

### *4.3. Reservation created in Pădurea Craiului Mountains which should be included in the protected areas for biodiversity conservation purposes*

Throughout Pădurea Craiului Mountains there are three natural monuments namely caves in limestone areas belonging to HCV 1.1 and due

to which the neighbouring forests should be included in HCVF 1.1. Specifically it is about the Gruieț Cave, Farcu Cave and Meziad Cave which are catalogued as natural monuments by the Decision no. 19/1995 of Bihor County Council.

The forests around the three caves afore mentioned were included in HCVF 1 as protected areas.

### *4.4. High Conservation Value Forest in Forest district Dobreşti Forestry, FPU IV Vida*

Table 1 hereunder presents data on high conservation value forests in the Forest district Dobreşti, forest production unit IV Vida.

HCVF 3 were included in the protected area encompassing wildlife protection functions (category 1.5. i), virgin forests characteristics (1.5.j) or being located on cliffs, scree, land subject to erosion (category 1.2a). Within the conservation area there are enclosed Virgin HCVF 3 but especially HCVF 4.2 virgin forests on rocks, debris, land subject to erosion by soil with soil protection function (category 1.2a).

In the same table hereunder as in the subsequent tables following the belonging to a particular forest management unit to a certain HCVF area is indicated by registering the area of that HCVF followed by an indication in capturing parentheses on the functional group to which that forest belongs to.

This is the area to be taken into account in the protected area or the conservation area.

If the forest within that forest management unit that may correspond to other HCVF categories, this is indicated by writing its surface once again in other columns of the table but without indicating the functional category of the forest.

### *4.5. High Conservation Value Forest in Forest district Dobrești, FPU VI Răcaș*

Table 2 hereunder presents data on high conservation value forests in Forest district Dobresti, FPU VI Răcaș.

HCVF 3 were included in the protected area encompassing wildlife (1.5i), which have protective function being located on cliffs, scree, land subject to erosion (category 1.2a).

Within the conservation area one includes seed reserves (category 1.5h).

*Table 1*

Landscape units proposed to be established as woods with high preservation value (HCVF) from Dobreşti forest district. FPU IV Vida (surface FPU IV = 2460 ha)

| FPU | Mu | Surface Ha | Ecosystem type | Belonging to one of forests with high conservation values - HCVF (by indicating surface – Ha – and functional zoning) | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | HCVF 1-1 | HCVF 1-2,1-3 | HCVF 3 | HCVF 4-1 | HCVF 4-2 |
| Forest district Dobreşti | | | | | | | | |
| HCVF 5%, protected area (FPU IV Vida) | | | | | | | | |
| IV | 26C | 5.10 | 3418 | | | 5.1(1-2a) | 5.10 | 5.10 |
| IV | 30A | 3.07 | 3418 | | | 3.07(1- 2a) | 3.07 | 3.07 |
| IV | 31C | 8.37 | 5136 | | | 8.37 (1-5j, 1-2a) | 8.37 | 8.37 |
| IV | 41 | 29.8 | - | | | 29.8(1-5j) | 29.8 | 29.8 |
| IV | 42D | 3.16 | 3418 | | 3.16 (1-5i) | 3.16 | | |
| IV | 49A | 2.66 | - | | | 2.66 | | 2.66 |
| IV | 50A | 8.04 | - | | 8.04 (1-5i) | 8.04 | | |
| IV | 53A | 4.91 | - | | | 4.91(1-5j,1-2a) | | 4.91 |
| IV | 54A | 10.2 | - | | 10.2 (1-5i) | 10.2 | | 10.2 |
| IV | 54B | 10.9 | 3374 | | | 10.9(1-5j) | | |
| IV | 55A | 26.1 | 4136 | | | 26.1(1-5j,2a) | | 26.1 |
| IV | 67A | 2.74 | - | | | 2.74(1-5j,2a) | | 2.74 |
| IV | 79A | 3.2 | - | | | 3.2 (1-2a) | | 3.2 |
| IV | 82E | 0.7 | - | | | 0.7 (1-2a) | | 0.7 |
| IV | 83A | 7.08 | 4136 | | | 7.08 (1-2a) | | 7.08 |
| | **Total = 126.03 ha** | | | | | | | |
| HCVF 5%, Conservation surface (FPU IV Vida) | | | | | | | | |
| IV | 19B | 1.0 | 4216 | | | | | 1.0(1-2a) |
| IV | 19C | 4.24 | 4216 | | | 4.24 | | 4.24(1-2a) |
| IV | 24B | 1.15 | 4216 | | | | | 1.15(1-2a) |
| IV | 25A | 1.5 | 4216 | | | | | 1.5(1-2a) |
| IV | 25D | 0.49 | 4216 | | | | | 0.49(1-2a) |
| IV | 27A | 7.18 | 4216 | | | | | 7.18(1-2a) |
| IV | 38E | 4.89 | 4216 | | | | | 4.89(1-2a) |
| FPU | Mu | Surface(Ha) | Ecosystem type | Belonging to one of forests with high conservation values - HCVF (by indicating surface – Ha – and functional zoning) | | | | |
| | | | | HCVF 1-1 | HCVF 1-2,1-3 | HCVF 3 | HCVF 4-1 | HCVF 4-2 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| IV | 42B | 29.7 | 3418 | | 29.7 (1,5i) | 29.7 | | 29.7 |
| IV | 47A | 10.7 | 4136 | | 10.7 (1-5i) | 10.7 | | |
| IV | 48A | 3.7 | 3374 | | | 3.7 (1-5j) | | |
| IV | 49B | 14.1 | - | | 14.1 (1-5i) | 14.1 | | |
| IV | 51A | 4.7 | 4216 | | | | | 4.7(1-2a) |
| IV | 58A | 1.63 | 4216 | | | | | 1.63(1-2a) |
| IV | 59A | 1.39 | 4216 | | | 1.39 | | 1.39(1-2a) |
| IV | 60A | 2.42 | 4216 | | | 2.42 | | 2.42(1-2a) |
| IV | 62A | 1.36 | 4116 | | | 1.36(1-5j,2a) | | |
| IV | 63A | 6.39 | 4216 | | | | | 6.39(1-2a) |
| IV | 65A | 3.14 | 4216 | | | 3.14(1-5j,2a) | | |
| IV | 66A | 3.26 | 4216 | | | 3.26(1-5j,2a) | | |
| IV | 68B | 6.82 | 4116 | | | 6.82(1-5j,2a) | | |
| IV | 78D | 1.08 | 4116 | | | | | 1.08(1-2a) |
| IV | 78E | 1.4 | 5171 | | | | | 1.4(1-2a) |
| IV | 81A | 7.72 | 4216 | | | | | 7.72(1-2a) |
| IV | 82B | 1.01 | 4116 | | | 1.01(1-5j,2a) | | |
| **Total = 120.97 ha** | | | | | | | | |

*Table 2*

Landscape units proposed to be established as woods with high preservation value (HCVF) from Dobreşti forest district. FPU VI Răcaş (surface FPU VI Răcaş = 2357 ha)

| FPU | Mu | Surface Ha | Ecosystem type | Belonging to one of forests with high conservation values - HCVF (by indicating surface – Ha – and functional zoning) | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | HCVF 1-1 | HCVF 1-2,1-3 | HCVF 3 | HCVF 4-1 | HCVF 4-2 |
| HCVF 5% protected area (FPU VI Răcaş) | | | | | | | | |
| VI | 1A | 1.39 | 3418 | | | 1.39(1-5j) | | 1.39 |
| VI | 7A | 10.8 | - | | 10.8 (1-5i) | 10.8 | | 10.8 |
| VI | 8A | 8.57 | - | | 8.57 (1-5i) | 8.57 | | 8.57 |
| VI | 9B | 5.1 | 3418 | | 5.1 (1-5i) | 5.1 | | 5.1 |
| VI | 16A | 19.3 | 4616 | | | 19.3 (1-5h) | | |
| VI | 16C | 4.65 | 4616 | | 4.65 | 4.65 (1-5h) | | |
| VI | 35C | 7.10 | - | | | 7.1(1-2a) | | 7.1 |
| VI | 36A | 1.15 | - | | | 1.15(1-2a) | | 1.15 |
| VI | 37N1 | 0.68 | 4160 | | 0.68 (1-5i) | 0.68 | | 0.68 |
| VI | 39 | 0.5 | 4116 | | | 0.51 (1-5l) | | |
| VI | 44B | 1.51 | 4116 | | | 1.51 (1-5l) | | |
| VI | 44C | 0.86 | 5172 | 0,86(1-5f,2a) | | 0.86 | | 0.86 |
| **Total = 61.61 ha** | | | | | | | | |
| HCVF 5%, conservation surface (FPU VI Răcaş) | | | | | | | | |
| VI | 7E | 0.93 | - | | | | | 0.93(1-2a) |
| VI | 7F | 1.61 | - | | | | | 1.61(1-2a) |
| VI | 11C | 6.01 | 5116 | | | 6.01 (1-5h) | | |
| VI | 17A | 20.1 | 4616 | | | 20.1 (1-5h) | | |
| VI | 26A | 22.5 | 5116 | | | 22.5 (1-5h) | | |
| VI | 30B | 1.52 | - | | | 1.52 | | 1.52(1-2a) |
| VI | 30D | 1.1 | - | | | 1.1 | | 1.1(1-2a) |
| VI | 31B | 1.7 | - | | | 1.7 | | 1.7(1-2a) |
| VI | 31C | 2.67 | - | | | 2.67 | | 2.67(1-2a) |
| VI | 32A | 5.03 | - | | | 5.03 | | 5.03(1-2a) |
| **Total = 63,17 ha** | | | | | | | | |

**5. Discussion**

The theme proposed for scientific research aimed both to reveal high conservation value (HCVF) existing in the forest throughout Pădurea Craiului Mountains and to follow a practical purpose i.e. to select the most representative forests embedding such value namely high conservation value forests (HCVF) to be included in forest certification proceedings in order to preserve and enhance biodiversity.

It was required a technical documentation relating to forests in the region, the types of ecosystems of which the former are made of, their conservation status in order to select during a first phase those forests which may contain high conservation values throughout the region and then through certification, to be totally protected or be managed conservatively in order to have their diversity preserved.

Based on this documentation afore mentioned one was able to identify high conservation values that require specific care to prevent the decreases in the diversity of species and ecosystems within the area studied.

These values are as follows:

In the case of Pădurea Craiului Mountains:

- 31 rare, threatened, endangered, endemic, relict plant species (HCV 1.2 , 1.3 );
- 45 rare, threatened, endangered, endemic, relict animals species (HCV 1.2, 1.3);
- 125 rare, threatened, endangered ecosystems or ecosystems incorporating plants, animals as well as species concentrations which are critical for the former survival;

Through extensive field research in the selected forests identified as potential carriers of high conservation value, one gathered a scientific material from which by means of thorough analysis one could establish ecosystems containing high conservation values within the region and which through their state less modified by forest management are able ensure the HCV preservation in the future.

These scientific data are presented in the paper separately, by forestry ranges and forest production units to be directly used in forest certification.

For each forest district there are provided tables for the high conservation value forests selected after conducting field research and running their ecological analysis in terms of biodiversity, both with the identification of the category the forests belong to and their functional zoning performed by means of forest management works. The management units (plots or subplots

contained and their surface, respectively) are recorded in the tables so as to be catalogued by the two categories of certification envisaged to be protected – i.e. by 5% as protected area and 5% of the surface as conservation area by means of sustainable management conservation.

As it has been noted above, choosing the most representative high conservation value forests was made by forest production units. It was considered that this is a better approach, because if one works on forest districts, as provided in the instructions for certification, the high conservation value forests surface might be clustered only in one area of the range, causing difficulties in the arrangement of the production units of such concentration.

It is worth noting that in the course of research there were highlighted specific ecosystems for:

Pădurea Craiului Mountains:

- Beech forests with *Phyllitis – Lunaria*, on permanently wet, limestone and steep slopes (Association *Phyllitidi – Fagetum*);
- Maple and elm forests on wet, narrow and shaded limestone valleys (*Acereto – Ulmetum* association);
- Acidophil oak forests specific for the Western Romania mountains (Association *Cytiso nigricantis – Quercetum petraeae*);
- Beech open wood on calcareous limestone rocks with limestone fern associations (Associations *Asplenio – Ceterachetum, Ctenidio – Polypodietum, etc.*) and dry-meadow loving fern (Associations *Stipo eriocaulis – Festucetum pallentis*);
- Well-preserved ecosystems consisting of widely spread forests of beech, hornbeam, beech with *Festuca drymeja,* beech with *Vaccinium* at low altitudes.

It is worth noticing that during this research one identified many ecosystems not affected by stands exploitation activities with virgin and quasi-virgin type composition and structure, and thus deserving protection as vestiges of old natural forests.

In addition to proposals for forests to be reserved for certification, proposals were made in terms of the forest management in the future. These proposals relate both to the protection of species with high conservation value and the ecological and protective management mode of stands that may become subject to forestry work designed to ensure the conservation of biodiversity they embed but also to preserve their ecological diversity i.e. the variety of ecosystems types specific for the region where the intervention is made.

Through the research conducted and results obtained one created a pattern for such research which should ensure the best selection of high conservation value forests to be protected by means of forest certification.

**CONCLUSIONS**

1. Through extensive documentation there were established the high conservation values (HCV) for the Piatra Craiului Mountains forests.

2. In the case of Pădurea Craiului Mountains it is about 31 species of plants 45 species of animals which are rare, threatened, endangered, endemic and relict, and 125 rare, threatened and endangered ecosystems containing plants and animals to be protected or temporary concentrations of species which are critical for the region, and for their survival as typical ecosystems.

3. By surveying forest management units there were selected afforested areas that could have contained concentrations of biodiversity or ecosystems typical for the region studied.

4. By means of field research of a part of the areas afore mentioned one chose the most representative in terms of high conservation values for each mountain massif. Of these, a part totalling 5% of the afforested area was designed to be fully protected in protected areas by prohibiting forestry interventions, and another 5% of the afforested area was included in the conservation area which is to be applied special forestry management measures.

5. Through the research carried out one selected the most representative high conservation value forests, namely:

- In Pădurea Craiului Mountains, 563.24 ha included in protected areas which excluded from forestry interventions and 478.84 ha which are managed by special forestry management measures in order to preserve or enhance their biodiversity in conservation areas.

6. In the case the forests channelled towards biodiversity conservation through special forestry management interventions, the related necessary measures were proposed.

7. Using the research data on forest phytocoenoses one performed also a description of the forest vegetation of Pădurea Craiului Mountains, identifying several plants associations which are new for this region.

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