

ASSESSMENT AND CONSERVATION STATUS OF FERNS FROM BUILA-VÂNTURARIȚA NATIONAL PARK

ONETE Marilena

Abstract. Scarce flora and vegetation studies were developed long time ago in the area occupied today by Buila-Vânturarița National Park. The paper represent a biginning and a base for the future assessment studies and monitoring for framing the requirement of Habitat Directive for species conservation. The assessment of 25 species of ferns from the Park revealed that still there are sufficiently large habitats and low impact to maintain ferns' populations on a long-term basis if the impact is kept at least at the present intensity (2011). The well represented diversity, frequency, development and distribution of the ferns' species from Buila-Vânturarița National Park demonstrate the favourable conservation status of ferns and of all integrating habitats.

Keywords: ferns, assessment, conservation, Buila-Vânturarița, specific diversity.

Rezumat. Evaluarea și statutul de conservare al ferigilor din Parcul Național Buila-Vânturarița. De-a lungul timpului au fost realizate doar câteva studii privind flora și vegetația din teritoriul ocupat astăzi de Parcul Național Buila-Vânturarița. Lucrarea reprezintă un început și o bază pentru viitoarele studii de evaluare și monitoring în vederea aplicării cerințelor Directivei Habitare pentru conservarea speciilor. Evaluarea a 25 specii de ferigi din parc a evidențiat că există încă habitate suficient de mari și impact încă scăzut pentru a menține populațiile de ferigi pe termen lung dacă impactul este menținut cel puțin la intensitatea actuală (2011). Diversitatea bine reprezentată, frecvența, dezvoltarea și distribuția speciilor de ferigi din Parcul Național Buila-Vânturarița demonstrează statutul de conservare favorabil al ferigilor și al habitatelor integratoare.

Cuvinte cheie: ferigi, evaluare, conservare, Buila-Vânturarița, diversitatea specifică.

INTRODUCTION

According to Habitat Directive 92/43/CEE on the conservation of natural habitats and of wild fauna and flora, conservation means a series of measures required to maintain or restore the natural habitats and the populations of species of wild fauna and flora at a favourable status.

There are few studies in Buila-Vânturarița National Park concerning flora and vegetation (BUIA & PĂUN, 1956; PĂUN & POPESCU, 1971; 1978). Due to its floristic and faunistic ownness the Government Decizion declared Buila-Vânturarița National Park in 2004 and ROSCI0015 in 2008.

Our study is the base for the future assessment and monitoring for framing the requirement of the Habitat Directive that define the conservation status of a species as the sum of the influences acting on the species concerned that may affect the long-term distribution and abundance of its populations within the territory.

MATERIAL AND METHODS

Buila is a montanous Massif spread between Olănești (East) and Bistrița (West) rivers going toward South as steep slopes by Oltenian subcarpathian depression. Oriented from North-East to South-West, Buila Massif is dominated by cretaceous limestone (PĂUN & POPESCU, 1978).

Data were collected using GPS, during field trips in the Park. The former distribution sites (mentioned in literature) of the species were confirmed, other new sites were added in the data base. The entire distribution areas of the species were difficult to be established with high accuracy due to the fragmented and irregular habitat. Itinerary research perpendicularly or along contour lines in accordance with accesibility (less difficult climbing) were performed in order to determine the populations limits. The observations included the factor affecting ferns' populations. Biological and ecological traits are presented according to CIOCĂRLAN (2009).

RESULTS AND DISCUSSIONS

We identified 25 fern species on the teritory ROSCI0015 Buila-Vânturarița. In accordance with their distribution recorded in 2011 in the field on Buila-Vânturarița National Park territory, are highlighted their frequency and the sinergetic impact of the environmental factors (including the most important- anthropic one) (Table 1).

The distribution and frequency at the country level (CIOCĂRLAN, 2009) of the identified ferns reveal that most of them are frequent and sporadic and none of them are rare or occasional (Table 2).

In Vb Annex of Habitat Directive and 5A Annex of Romanian Government Ordonance 57/2007 all species of *Lycopodium* genus are taken into account as species with European concern/interest. Thus, the key and indicator species were established both according to the conservation importance at the European level (Habitat Directive) and their ecological treats, mainly based on substrate (Table 3).

Table 1. Ferns' frequency on Buila-Vânturarița National Park territory and the intensity of the environmental factors.
 Tabel 1. Frecvența ferigilor de pe teritoriul Parcului Național Buila-Vânturarița și intensitatea factorilor de mediu.

No.	Species	Frequency	Impact intensity
1.	<i>Asplenium ruta-muraria</i> L.	Rare	Low
2.	<i>A. scolopendrium</i> L.	Frequent	Low
3.	<i>A. trichomanes</i> L.	Very frequent	Low
4.	<i>A. viride</i> HUDS.	Rare	Low
5.	<i>Athyrium filix-femina</i> (L.) ROTH	Frequent	Low
6.	<i>Blechnum spicant</i> (L.) ROTH	Rare	Low
7.	<i>Botrychium lunaria</i> (L.) SW.	Rare	Low
8.	<i>Ceterach officinarum</i> DC.	Rare	Low
9.	<i>Cystopteris fragilis</i> (L.) BERNH.	Frequent	Low
10.	<i>Dryopteris affinis</i> (LOWE) FRASER-JENK.	Rare	Low
11.	<i>D. dilatata</i> (Hoffm.) A. GRAY	Rare	Low
12.	<i>D. filix-mas</i> (L.) SCHOTT	Very frequent	Low
13.	<i>Gymnocarpium dryopteris</i> (L.) NEWMAN	Rare	Low
14.	<i>G. robertianum</i> (HOFFM.) NEWMAN	Rare	Low
15.	<i>Huperzia selago</i> (L.) BERNH. ex SCHRANK & MART	Rare	Low
16.	<i>Lycopodium annotinum</i> L.	Rare	Low
17.	<i>L. clavatum</i> L.	Rare	Low
18.	<i>Phegopteris connectilis</i> (MICHX.) WATT	Frequent	Low
19.	<i>Polypodium vulgare</i> L.	Frequent	Low
20.	<i>Polystichum aculeatum</i> (L.) ROTH	Rare	Low
21.	<i>P. lonchitis</i> (L.) ROTH	Rare	Low
22.	<i>P. setiferum</i> (FORSSK.) WOYN	Rare	Low
23.	<i>Pteridium aquilinum</i> (L.) KUHN	Frequent	Low
24.	<i>Selaginella helvetica</i> (L.) SPRING	Rare	Low
25.	<i>S. selaginoides</i> (L.) P. BEAUV. ex SCHRANK & MART	Rare	Low

Table 2. Fern species identified on the territory of Buila-Vânturarița National Park, their distribution and frequency at national level, biological and ecological traits. / Tabel 2. Specii de ferigi identificate pe teritoriul Parcului Național Buila-Vânturarița, distribuția și frecvența lor la nivel național.

No.	Species	Frequency	Distribution	Biological traits	Ecological traits
Family Aspleniaceae					
1.	<i>Asplenium ruta-muraria</i>	f	On cliffs in grasslands	perennial, hemicytophyte, polyploid (2n=143)	calciphilous, helsciaphilous
2.	<i>A. scolopendrium</i>	s	grassland, screes, forest on rocky substrate	perennial, geophyte, polyploid (2n=72)	calciphilous, mezo-hygrophilous, sciaphilous
3.	<i>A. trichomanes</i>	f	On cliffs in grassland and forest	perennial, hemicytophyte	eurifita., helsciaphilous
4.	<i>A. viride</i>	f	cliffs	perennial, hemicytophyte, polyploid (2n=72)	calciphilous, mezophilous, helsciaphilous
5.	<i>Ceterach officinarum</i>	s	cliffs	perennial, hemicytophyte, polyploid (2n=144)	calciphilous, xerophilous – xeromezophilous, heliophilous – helsciaphilous, termophilous
Family Blechnaceae					
6.	<i>Blechnum spicant</i>	s	grassland, shrubland	perennial, hemicytophyte, polyploid (2n=68)	mezo- mezo-hygrophilous, sciaphilous, helsciaphilous
Family Ophioglossaceae					
7.	<i>Botrychium lunaria</i>	f	grassland	perennial, geophyte	xeromezophilous-mezophilous, weak acidotrophic-neutrophilous, oligotrophic
Family Dryopteridaceae					
8.	<i>Dryopteris affinis</i>	s	forest, shrubland, weeds	perennial, hemicytophyte	mezophilous, sciaphilous, mesotrophic
9.	<i>D. dilatata</i>	s			
10.	<i>D. filix-mas</i>	f		perennial, hemicytophyte, polyploid (2n=164)	
11.	<i>Polystichum aculeatum</i>	f			
12.	<i>P. lonchitis</i>	f	Forest clearcut, shrubland, weeds, cliffs	perennial, hemicytophyte, polyploid (2n=82)	mezophilous, mesotrophic
13.	<i>P. setiferum</i>	f	forest, weeds, shrubland	perennial, hemicytophyte, polyploid (2n=164)	mezo-mezohygrophite, sciaphilous, mesotrophic
Family Lycopodiaceae					
14.	<i>Huperzia selago</i>	s	Grassy places, more or less humid, forest, shrubland, bogs	perennial, chamaephyte, polyploid (2n = 90, 264, 272)	oligotrofa, microtermophilous, calciphilous, mezo-hygrophilous, sciaphilous–helsciaphilous

15.	<i>Lycopodium annotinum</i>	s	forest, shrubland, humid places	perennial, chamaephyte, polyploid (2n=68)	oligotrophic, mezohygrophilous, helosciaphilous-sciaphilous
16.	<i>L. clavatum</i>	s	Edge of the forest, shrubland, grassland		oligotrophic, euryphilous, helosciaphilous-sciaphilous
Family Thelypteridaceae					
17.	<i>Phegopteris connectilis</i>	f	forest, shrubland	perennial, geophyte, polyploid (2n=90)	mezophilous- mezohygrophilous, sciaphilous
Family Polypodiaceae					
18.	<i>Polypodium vulgare</i>	f	forest, shady cliffs	perennial, geophyte, polyploid (2n=148)	saxicolous, euryphilous, helosciaphilous
Family Dennstaedtiaceae					
19.	<i>Pteridium aquilinum</i>	f	Edges and clearings of the forest, grassland	perennial, geophyte, polyploid (2n=104)	mezoxer-mezophitous, helophilous-sciaphilous, oligotrophic
Family Selaginellaceae					
20.	<i>Selaginella helvetica</i>	f	grassland, on rocky substrate	perennial, chamaephyte, diploid (2n=18)	calciphilous
21.	<i>S. selaginoides</i>	f	Grassland, shrubland		
Family Woodsiaceae					
22.	<i>Athyrium filix-femina</i>	f	forest, weeds	perennial, hemicytophyte, polyploid (2n=80)	mezohygrophilous, mezotrophic
23.	<i>Cystopteris fragilis</i>	f	cliffs	perennial, hemicytophyte, polyploid (2n=168)	
24.	<i>Gymnocarpium dryopteris</i>	f	weeds, forest	perennial, geophyte, polyploid (2n=160)	sciaphilous, mezotrophic
25.	<i>G. robertianum</i>	s	Forest clearings on skeletal or stony soil		mezophilous- mezohygrophilous, helosciaphilous, calciphilous

Legend: f - frequent, s - sporadic.

Table 3. Key and indicator fern species from Buila-Vânturarița National Park. / Tabel 3. Specii de ferigi cheie și indicatoare din Parcul Național Buila-Vânturarița.

No.	Species	Key species	Indicator species
1.	<i>Asplenium ruta-muraria</i>		Calcareous
2.	<i>A. scolopendrium</i>		Calcareous
3.	<i>A. viride</i>		Calcareous
4.	<i>Blechnum spicant</i>	Tertiary relict	
5.	<i>Ceterach officinarum</i>		Calcareous
6.	<i>Gymnocarpium robertianum</i>		Calcareous
7.	<i>Huperzia selago</i>	Habitat Directive	Calcareous
8.	<i>Lycopodium annotinum</i>	Habitat Directive	
9.	<i>L. clavatum</i>	Habitat Directive	
10.	<i>Selaginella helvetica</i>		Calcareous
11.	<i>S. selaginoides</i>		Calcareous

The studied species growing in forests, forests clearings, shrublands and even those growing in grasslands are clonal and clumped distributed in small sites but on large area; therefore we can declare that the populations are formed by small subpopulations (dems) with aboveground shoots sometimes in small number but the underground shoots are largely and dense distributed in the soil or beneath the bryophytes or the thick litter layer (i.e. *Polypodium vulgare*). Their regeneration potential from the underground biomass is high in spite of impact of tourists or animal trampling, both impacts not a significant in the Park.

The fact that these species are clonal prevents us to take the number of aerial shoots as unit measures. Even they were counted on square meter unit, the extrapolation were made to the clonal individuals (genets) because we were not able to separate one genet from other. But the high density of the above ground shoots on square meter combined with the large distribution of the species (high number of micro-areals) pointed that the species are well represented in studied area. We can highlight that the total number of aerial shoots on the Park territory is high these species being frequent in the area.

Another clonal species growing on cliffs, screens, in the forest, at the cliffs foot in the litter layer, in semi-shaded grassy places is *Asplenium scolopendrium*, well represented by numerous old individuals. Our observations showed that the old age of the individuals is given by the high number of the leaves in rosetts. The more leaves are presented in the rosetts the oldest are individuals. The number of genets is high, the population is largely distributed. They are also present individuals with small number of leaves (2-3 young leaves) this demonstrating that the input of new individuals in the population still occur. The anthropic impact (tourists, grazing) is present in the area but because the area is less accesible favorise the existence, development and distribution of the species.

Polystichum aculeatum and *P. lonchitis* are rare but still well represented at the Park level; as well as *P. setiferum*. In spite of the reduced number of the individuals and small populations, these species are not affected by anthropic impact, being distributed in sites (i.e. high and big cliffs) difficult to be reached by tourists and animals.

The number of *Asplenium trichomanes* individuals is high, the population is largely distributed in cliffs cracks,

alone or together with *Cystopteris fragilis*, *Asplenium ruta-muraria*, etc. On the south-eastern slope the density of *A. trichomanes* individuals is higher than on the north-western slope, they growing not only in cliffs cracks but also at the base of cliffs from grasslands, on paths, etc. In this area, sheeps pass towards grazing places. It might that the high development of *A. trichomanes* individuals to be due to nutrient input from the decomposition of sheep manure. There are also individuals with big rossets (large number of leaves), showing their old age. The small individuals demonstrate that the population expands. The distance among individuals is not high, thus the gene flow is frequent, the genetic diversity not being threatened.

On both slopes of the Massif grows *Asplenium ruta-muraria*, more frequent than *A. trichomanes* with which might share the same sites. On the south-western slope we noticed dry individuals in cliff's crack but the phenomenon was due to high insolation and dryness. These natural processes usually affect plant species growing on cliffs (ONETE *et al.*, 2010).

Species density is different according to their ecological requirements and integrator habitat. The anthropic factors that might affect the ferns' populations in Buila-Vânturarița National Park are tourism and grazing. Up to now, 2012, there has not been identified a significant negative impact on fern populations. The negative impact on grasslands for grazing usage is given by *Pteridium aquilinum* individuals highly developed in some grasslands.

Even if most of the ferns from Buila-Vânturarița National Park do not have their own conservation status, they are distributed in habitats with high conservation values (DONIȚĂ *et al.*, 2005; GAFTA & MOUNTFORD, 2008):

Romanian habitat: R6108 South-carpathian communities of calcareous scree with reduced mobility and increased humidity with *Rumex scutatus*, *Saxifraga moschata*, *S. aizoides* and *Doronicum columnae*.

Corresponding to:

NATURA 2000: 8120 Calcareous and calchist scree of the montane to alpine levels (*Thlaspietea rotundifolii*)

EMERALD: 61 Scree

CORINE: 61 Scree

PAL. HAB 1999: 61.242 East Carpathian calcareous scree; 61.2424 East Carpathian dock scree

EUNIS: H2.44 Carpathian calcareous scree

Romanian habitat: R6209 South-East Carpathian communities on calcareous cliffs with *Asplenium trichomanes* ssp. *quadrialeans* and *Poa nemoralis*.

Corresponding to:

NATURA 2000:

EMERALD: 6 Inland rocks, scree and sand

CORINE: 62 Inland cliffs and exposed rocks

PAL. HAB 1999: 62 Inland cliffs and exposed rocks

EUNIS: H3 Inland cliffs and exposed rocks habitats

Romanian habitat: R3401 South-East Carpathian Grasslands with *Asperula capitata* and *Sesleria rigida*.

Corresponding with:

NATURA 2000: 6170 Alpine and subalpine calcareous grasslands

EMERALD:

CORINE: 36.4 Alpine and subalpine calciphilous grasslands

PAL. HAB 1999: 36.43921 East Carpathian Sesleria-evergreen sedge grasslands

EUNIS: E4.4392 East Carpathian calciphile stepped grasslands.

CONCLUSIONS

According to Habitat Directive 92/43/CEE the conservation status will be taken as "favourable" when: population dynamics data on the species concerned indicate that it is maintaining itself on a long-term basis as a viable component of its natural habitats, and the natural range of the species is neither being reduced nor is likely to be reduced for the foreseeable future, and there is, and will probably continue to be, a sufficiently large habitat to maintain its populations on a long-term basis.

In this stage do not exist data regarding the dynamic of the fern populations and the status of the populations' range. The present data represent only the population distribution and frequency in 2011, therefore our opinion stipulates that the present data represent the reference population data for future studies that might establish, on the scientific base, the conservation status of the ferns.

We can argue that there still are sufficiently large habitats to maintain ferns' populations on a long-term basis if the present impact is kept at least at the present intensity. They are needed long term studies for stipulating the conservation status of the ferns from Buila-Vânturarița National Park.

The diversity, frequency, development and distribution of the ferns' species from Buila-Vânturarița National Park is well represented, this demonstrating the favourable conservation status of all integrating habitats.

ACKNOWLEDGEMENT

The study has been supported from RO1567-IBB01/2011 and POS-Environment contract "Mapping/ assessing the pteridophytes species from Park territory".

REFERENCES

- BUIA M. & PĂUN M. 1956. *Materiale pentru flora Muntelui Buila*. Studii și Cercetări. Edit. Cluj Napoca: 85-105.
- CIOCĂRLAN V. 2009. *Flora Ilustrată a României. Pteridophyta et Spermatophyta*. Edit. Ceres. București. 1141 pp.
- DONIȚĂ N., POPESCU A., PAUCĂ-COMĂNESCU MIHAELA, MIHĂILESCU SIMONA, BIRIȘ I. A. 2005. *Habitatele din România*. Edit. Tehnică și Silvică. București. 442 pp.
- GAFTA D. & MOUNTFORD J. O. (coord.). 2008. *Manual de interpretare a habitatelor Natura 2000 din România*. Edit. Risoprint. Cluj Napoca. 104 pp.
- ONETE MARILENA, ION R., ION M., PAUCĂ-COMĂNESCU M. 2010. *Brebu cliffs - basic research and possibility of practical approaches*. Book of Abstract. The Anniversary Conference of the Institute of Biology. 50 years of Academic Research in Biology. Edit. Ars Docendi. București: 95-96.
- PĂUN M. & POPESCU G. 1971. *Cercetări asupra vegetației de pădure din munții Buila*. Analele Universității din Craiova. Biologie-Științe Agricole. Craiova. **13**(3): 21-30.
- PĂUN M. & POPESCU G. 1978. *Date despre vegetația ierboasă a catenei calcaroase Buila-Vânturarița din Munții Căpățâni jud. Vâlcea*. Analele Universității Craiova. Edit. Universitaria. Craiova. **19**(9): 67-73.
- ***. Habitat Directive 92/43/CEE, in EU Nature Legislation, <http://ec.europa.eu/environment/nature/legislation/> (accessed: February 22, 2012).

Onete Marilena

Institute of Biology of the Romanian Academy,
Splaiul Independenței 296,
Sector 6, 060031, Bucharest, Romania
E-mail: m_onete@yahoo.com

Received: March 29, 2012

Accepted: July 26, 2012