

## **Phytogeographical and phytocoenological analysis of the threatened plant taxa in the flora of the Vlasina plateau (SE Serbia)**

*Vladimir Randelović<sup>1\*</sup>, Bojan Zlatković<sup>1</sup>, Danijela Dimitrijević<sup>1</sup>, Tijana Vlahović<sup>2</sup>*

<sup>1</sup> *University of Niš, Faculty of Sciences and Mathematics, Department of Biology and Ecology, Višegradska 33, 18000 Niš, Serbia*

<sup>2</sup> *National Library of Serbia, Belgrade, Serbia*

\* *E-mail: vladar@pmf.ni.ac.rs*

### **Abstract:**

**Randelović, V., Zlatković, B., Dimitrijević, D., Vlahović, T.: Phytogeographical and phytocoenological analysis of the threatened plant taxa in the flora of the Vlasina plateau (SE Serbia). *Biologica Nyssana*, 1 (1-2), December 2010: 1-7.**

In analysing the flora of the Vlasina plateau, it was determined that this area contains 956 species, 23 subspecies, 32 varieties and 28 forms of vascular plants. The data shows the exceptional floristic riches of this territory. Among these species, there are 91 species (9.52%) which may be categorized as under threat in the flora of Serbia. Critically endangered taxa (Cr) are especially interesting because their sanctuary in Serbia is only in the Vlasina plateau. This group includes the following species: *Betula pubescens*, *Elatine triandra*, *Utricularia minor*, *Cirsium helenioides* and *Carex limosa*. All these species have the Boreal type of distribution and live in wetlands.

**Key words:** flora, Serbia, threatened plant taxa, Vlasina plateau

### **Introduction**

The Vlasina plateau is situated in southeastern Serbia between Vardenik, Černik, Plana and Bukova Glava mountains (**Fig. 1**). Geologically, the greater part of Vlasina plateau is uniform area and it is made of metamorphic rocks, the most frequent of them being schists, rarely gneisses, andesites and dacites (Petković et al., 1977, Dragišić, 1997). Vlasina plateau is in the zone of brown forest land (dystric cambisol), but characteristic soil is peat, which is differentiated in four types: Phragmitetum-type, Caricetum-type, Equisetetum-type and mossy peat (Randelović 1994). The climate of this plateau is a typical continental one (Đukanović, 1967, Randelović & Zlatković, 2010).

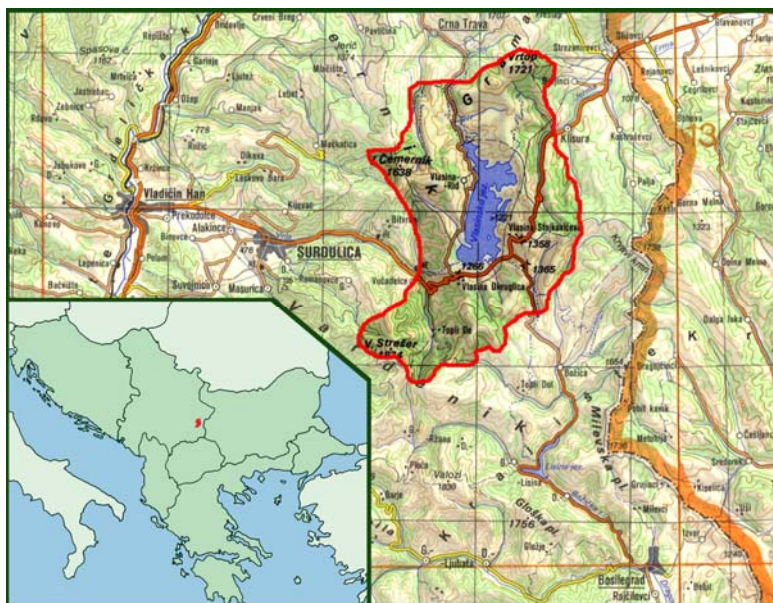
Floristically and phytocoenologically, Vlasina plateau is relatively well documented in the

monograph "Flora and Vegetation of the Vlasina plateau" (Randelović & Zlatković, 2010). Also, in this monograph threatened plant taxa are processed. However, phytogeographical and phytocoenological analysis of Vlasina plateau is not made.

### **Material and methods**

List of flora of the Vlasina plateau from Randelović & Zlatković (2010) was used for the analysis. The nomenclature follows Med-Checklist (Greuter et al., 1984-1989) and Flora Europaea (Tutin et al., eds. 1964-1980).

All taxa that occur in the area of the Vlasina are assessed according to IUCN version 3.1 (IUCN, 2001) methods for determining vulnerability at the local level and in Serbia. IUCN Red List criteria were used to classify species according to one of the



**Fig 1.** Geographical position of investigated area

five categories of threat: Extinct in Serbia (EW), Critically Endangered (CR), Endangered (EN), Vulnerable (VU) and Near Threatened (NT). If there was insufficient information to make an assessment, the category Data Deficient (DD) was assigned, especially in cases of taxonomic uncertainty.

Area-types, area-groups and life forms are taken from Randelović & Zlatković (2010). Phytocoenological relevance of taxa is determined by Randelović & Zlatković (2010), Horvat et al. (1974) and Apostolova & Slavova (1997).

## Results and discussion

Flora of Vlasina plateau contains 956 species, 23 subspecies, 32 varieties and 28 forms of vascular plants. The data shows the exceptional floristic riches of this territory. Among these species, there are 90 species (9.41%) which may be categorized as under threat in the flora of Serbia (**Tab. 1**) (Randelović & Zlatković, 2010).

The high degree of presence of endangered species that make flora of the Vlasina plateau and the fact that every eleventh species in some way is endangered and that sooner or later it is in danger of disappearing from the territory of Serbia, shows the biodiversity importance of this area. Among other things, it was one of the reasons for classifying the Vlasina plateau in botanical significant areas of Europe (IPA) (Randelović in Stevanović, ed. in Radford, Ode, eds. 2009).

The Red data list of flora of Serbia (Stevanović, ed. 1997) states 53 taxa from the

Vlasina plateau. The first volume of the Red data book of flora of Serbia (Stevanović, ed. 1999), which contains extinct and critically endangered taxa, lists 11 taxa from the Vlasina plateau.

As extinct species from the flora of Serbia, the following species are processed: *Polemonium coeruleum* (Randelović, 1999a), *Dracocephalum ruyschiana* (Diklić, 1999), *Caldesia parnassifolia* (Vukojičić, Janković, 1999) and *Juncus capitatus* (Randelović, 1999). However, later investigations showed that species *Juncus capitatus* (Tomović et al, 2009) and *Dracocephalum ruyschiana* (Lazarević et al., 2009) are not extinct, because they were found on the other localities in Serbia.

The species *Ranunculus lingua* (Stojšić, Panjković, 1999), *Betula pubescens* (Jovanović, 1999), *Elatine triandra* (Blaženčić, Blaženčić, 1999), *Utricularia minor* (Blaženčić, Blaženčić, 1999a), *Cirsium helenioides* (Randelović, 1999c), *Carex limosa* (Randelović, 1999b) and *Sparganium natans* (Blaženčić, Blaženčić, 1999b) are classified as critically endangered.

## Phytogeographical analysis

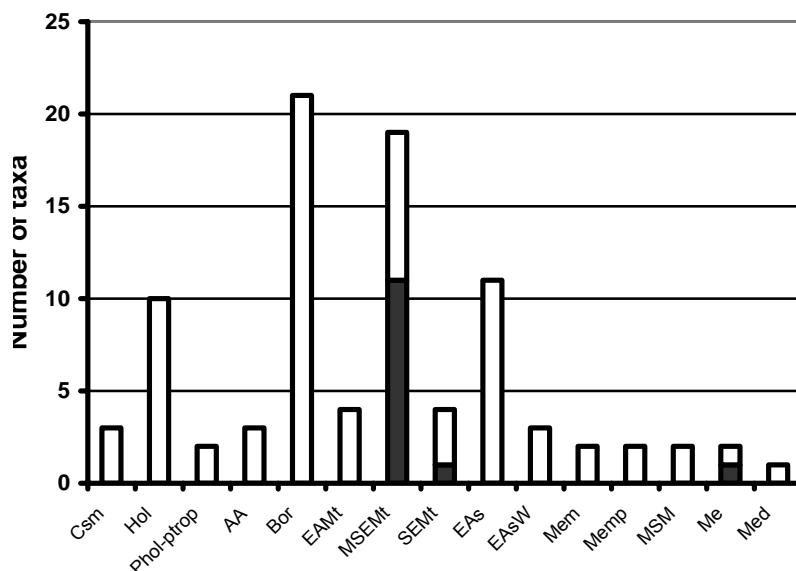
According to phytogeographical analysis (**Fig. 2**), highest proportions of threatened taxa have Boreal (21 taxa) or Euroasian Mountain (27) type of distribution. Within Euroasian Mountain area-type, Middle-South-European Mountain area-group (19) stands out with the number of taxa, which includes most of the Balkan endemic species (11).

## Phytocoenological analysis

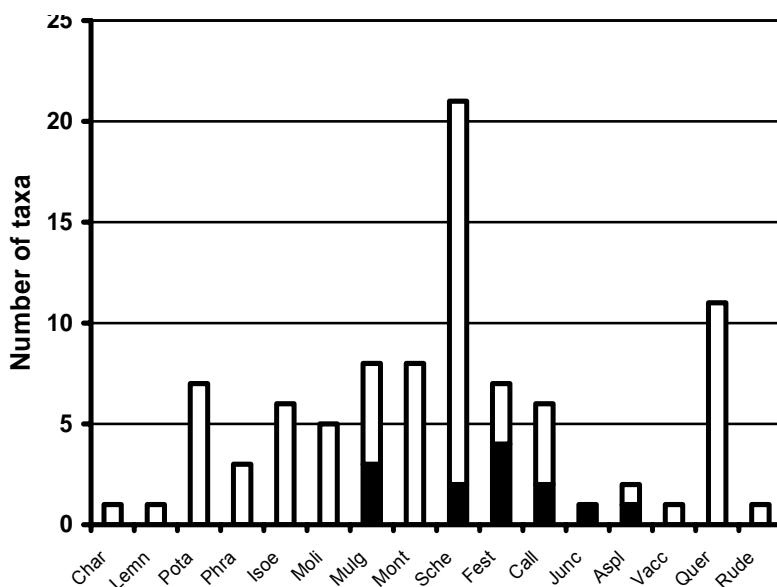
The highest proportion of threatened taxa is characteristic of peat vegetation (21), and another 39 for other types of wet vegetation. High presence of threatened taxa (11) is found in the forest vegetation. (**Fig. 3**).

## Analysis of life forms

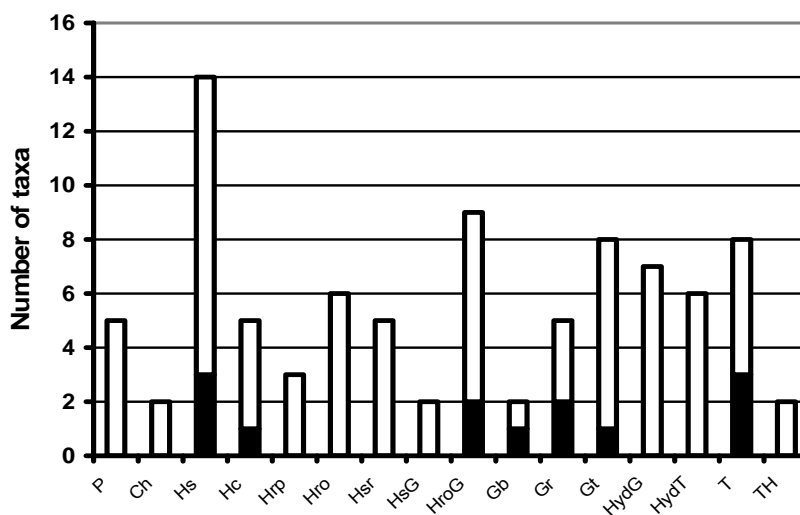
According to analysis of life forms (**Fig. 4**) the dominance of hemicryptophytes (33 taxa) is established.



**Fig. 2.** Phytogeographical analysis of the threatened plant taxa (Balkan endemic taxa (B) are marked in black). Area types and area groups: **Csm** – Cosmopolitan, **Hol** – Holarctic, **Phol-ptrop** – Palaeoholarctic-palaeotropic, **AA** - Arcto-Alpian, **Bor** - Boreal, **EAMt** - Euroasian Mountain, **MSEMt** - Middle-South-European Mountain, **SEMt** - South-European mountain, **EAs** - Euroasian, **EAsW** - European - West Asian, **Mem** - Middle European-Mediterranean, **Memp** - Middle European-Mediterranean-Pontic, **MSM** - Merridional-Submerridional, **Me** - Middle-European, **Medp** - Mediterranean Pontian, **Med** - Mediterranean



**Fig. 3.** Phytocoenological analysis of the threatened plant taxa (Balkan endemic taxa are marked in black). Vegetation class: **Char** - Charetea, **Lemn** - Lemnetaea, **Pota** - Potametea, **Phra** - Phragmitetea, **Isoe** - Isoeto-Nanojuncetea, **Moli** - Molinio-Arrhenatheretea, **Mont** - Montio-Cardaminetea, **Mulg** - Mulgedio-Aconitetea, **Sche** - Scheuchzerio-Caricetea fuscae, **Fest** - Festuco-Brometea, **Call** - Calluno-Ulicetea, **Junc** - Juncetea trifidi, **Aspl** – Asplenietea trichomanis, **Vacc** - Vaccinio-Piceetea, **Quer** - Querco-Fagetea, **Rude** - Ruderalis



**Fig. 4.** Life forms of the threatened plant taxa (Balkan endemic taxa are marked in black): **P** - Phanerophyta, **Ch** - Chamaephyta, **Hs** - Hemicryptophyta scaposa, **Hc** - Hemicryptophyta caespitosa, **Hrp** - Hemicryptophyta reptosa, **Hro** - Hemicryptophyta rosulata, **Hsr** - Hemicryptophyta semirosulata, **HsG** - Hemicryptophyta scaposa/Geophyta, **HroG** - Hemicryptophyta rosulata/Geophyta, **Gb** - Geophyta tuberosa, **Gb** - Geophyta bulbosa, **Gr** - Geophyta rhizomatosa, **HydG** - Hydrogeophyta, **HydT** - Hydrotherophyta, **T** - Therophyta (Including: **Tc** - Therophyta caespitosa, **Ts** - Therophyta scaposa, **Tsb** - Therophyta scaposa biennis), **TH** - Therophyta/Hemicryptophyta scaposa

**Table 1.** Contribution of threatened taxa in the flora of Vlasina plateau with categories of endangered (CE) in the flora of Serbia, area-type (AT), area-group (AG), life form (LF) and phytocoenological relevance of taxa (P) (abbreviations are shown in the legends of appropriate figures)

Name of taxon	CE	AT	AG	LF	P
<i>Caldesia parnassifolia</i>	EW	Csm	Csm	HydG	Pota
<i>Polemonium coeruleum</i>	EW	Bor	BorEA	Hs	Mulg
<i>Trisetum sibiricum</i>	EW	Bor	BorH	Hc	Sche
<i>Betula pubescens</i>	CR	Bor	BorEA	P	Sche
<i>Cirsium helenioides</i>	CR	Bor	BorEA	Hs	Mulg
<i>Eleocharis mamillata</i>	CR	Bor	BorEA	HydG	Isoe
<i>Sparganium natans</i>	CR	Bor	BorH	HydG	Pota
<i>Utricularia minor</i>	CR	Bor	BorH	HydT	Pota
<i>Carex limosa</i>	CR	Bor	BorH	Gr	Sche
<i>Elatine triandra</i>	CR	Bor	BorH	Tsb	Isoe
<i>Hypericum humifusum</i>	CR	Csm	Csm	Hrp	Isoe
<i>Ranunculus lingua</i>	CR	EAMt	EAMt	HydG	Phra
<i>Ranunculus auricomus</i> var. <i>biformis</i>	CR	EAs	Eas	Hrp	Sche
<i>Dracocephalum ruyschiana</i>	CR	EAs	Eas	Hs	Fest
<i>Gentiana pneumonanthe</i>	CR	EAs	Memp	Hs	Moli
<i>Sisyrinchium montanum</i>	CR	Hol	Hol	Gt	Moli
<i>Juncus capitatus</i>	CR	Hol	Phol-ptrop	Tc	Isoe
<i>Campanula hemschinica</i>	CR	Me	MeB	Tsb	Fest
<i>Sagina saginoides</i>	EN	AA	AA	Hc	Mont
<i>Pirola chlorantha</i>	EN	Bor	BorH	Hsr	Quer
<i>Lycopodium clavatum</i>	EN	Bor	BorH	Ch	Mont
<i>Cardamine raphanifolia</i> ssp. <i>acris</i>	EN	EAMt	MSEMt	Hro	Mont
<i>Alchemilla cinerea</i>	EN	EAMt	MSEMt	HroG	Fest
<i>Alchemilla connivens</i>	EN	EAMt	MSEMt	HroG	Sche

Table 1. Continued

<i>Alchemilla crinita</i>	EN	EAMt	MSEMt	HroG	Fest
<i>Alchemilla heterophylla</i>	EN	EAMt	MSEMtB	HroG	Fest
<i>Alchemilla viridiflora</i>	EN	EAMt	MSEMtB	HroG	Mulg
<i>Geum rivale x rhodopaeum</i>	EN	EAMt	MSEMtB	Gr	Mulg
<i>Pedicularis hoermaniana</i>	EN	EAMt	MSEMtB	Hs	Fest
<i>Gentiana acaulis</i>	EN	EAMt	SEMt	Hro	Call
<i>Pirola rotundifolia</i>	EN	EAs	EAs	Hsr	Quer
<i>Dactylorhiza sambucina</i>	EN	EAs	Mem	Gt	Quer
<i>Scleranthus neglectus</i>	EN	EAs	Mem	Tc	Aspl
<i>Eriophorum gracile</i>	EN	Hol	Hol	Gr	Sche
<i>Stellaria alsine</i>	EN	Hol	Hol	Hc	Mont
<i>Potentilla palustris</i>	EN	Hol	Hol	HsG	Sche
<i>Potamogeton obtusifolius</i>	EN	Hol	Hol	HydT	Pota
<i>Ranunculus fontanus</i>	EN	Med	Med	THs	Mont
<i>Ranunculus ophioglossifolius</i>	EN	MSM	MSM	THs	Isoe
<i>Pseudorchis albida</i>	VU	AA	AA	Gt	Sche
<i>Sagittaria sagittifolia</i>	VU	Bor	BorEA	HydT	Pota
<i>Arctostaphylos uva-ursi</i>	VU	Bor	BorH	Ch	Vacc
<i>Corallorhiza trifida</i>	VU	Bor	BorH	Gr	Quer
<i>Drosera rotundifolia</i>	VU	Bor	BorH	Hro	Sche
<i>Orthilia secunda</i>	VU	Bor	BorH	Hsr	Quer
<i>Zanichellia palustris</i>	VU	Csm	Csm	HydT	Pota
<i>Salix rosmarinifolia</i>	VU	EAMt	EAMt	P	Sche
<i>Dactylorhiza cordigera</i>	VU	EAMt	MSEMtB	Gt	Sche
<i>Pseudorchis friwaldii</i>	VU	EAMt	MSEMt	Gt	Sche
<i>Geum rhodopaeum</i>	VU	EAMt	MSEMtB	Gr	Mulg
<i>Alchemilla glabra</i>	VU	EAMt	MSEMt	HroG	Mulg
<i>Alchemilla reniformis</i>	VU	EAMt	MSEMt	HroG	Moli
<i>Silene asterias</i>	VU	EAMt	SEMtB	Hs	Sche
<i>Salix pentandra</i>	VU	EAs	EAs	P	Sche
<i>Cephalanthera longifolia</i>	VU	EAs	EAs	Gt	Quer
<i>Epipactis palustris</i>	VU	EAs	EAs	Gt	Sche
<i>Dianthus superbus</i>	VU	EAs	EAs	Hs	Sche
<i>Stellaria palustris</i>	VU	EAs	EAs	Hs	Sche
<i>Dactylorhiza incarnata</i>	VU	EAs	EAsW	Gt	Sche
<i>Trollius europaeus</i>	VU	EAs	EAs	Hs	Moli
<i>Callitriche verna</i>	VU	Hol	Hol	HydT	Lemn
<i>Menyanthes trifoliata</i>	VU	Hol	Hol	Hrp	Sche
<i>Ranunculus aquatilis</i>	VU	Hol	Hol	HydG	Pota
<i>Najas minor</i>	VU	Hol	Phol-ptrop	HydT	Char
<i>Saxifraga stellaris</i> ssp. <i>alpigena</i>	NT	AA	AA	Hro	Mont
<i>Schoenus ferrugineus</i>	NT	Bor	BorE	Hc	Phra
<i>Pirola media</i>	NT	Bor	BorEA	Hsr	Quer
<i>Pinguicula vulgaris</i>	NT	Bor	BorEN	Hro	Sche
<i>Pirola minor</i>	NT	Bor	BorH	Hsr	Quer
<i>Pedicularis palustris</i>	NT	Bor	BorH	Tsb	Sche
<i>Alchemilla acutiloba</i>	NT	EAMt	EAMt	HroG	Call
<i>Alchemilla gracilis</i>	NT	EAMt	EAMt	HroG	Mulg
<i>Allium melanantherum</i>	NT	EAMt	MSEMtB	Gb	Call
<i>Silene lerchenfeldiana</i>	NT	EAMt	MSEMtB	Hc	Aspl
<i>Peucedanum oligophyllum</i> ssp. <i>aequiradium</i>	NT	EAMt	MSEMtB	Hs	Junc
<i>Trifolium trichopterum</i>	NT	EAMt	MSEMtB	Ts	Fest

Table 1. Continued

<i>Verbascum adamovicii</i>	NT	EAMt	MSEMtB	Tsb	Call
<i>Achillea lingulata</i>	NT	EAMt	SEMt	Hro	Call
<i>Butomus umbelatus</i>	NT	EAs	EAs	HydG	Phra
<i>Euphorbia villosa</i>	NT	EAs	EAs	Hs	Rude
<i>Ribes alpinum</i>	NT	EAs	EAsW	P	Quer
<i>Cardamine amara</i>	NT	EAs	EAsW	Hs	Mont
<i>Ranunculus flammula</i>	NT	Hol	Hol	HydG	Isoe
<i>Gratiola officinalis</i>	NT	Hol	Hol	Hs	Moli
<i>Lilium jankae</i>	DD	EAMt	MSEMt	Gb	Call
<i>Ranunculus serbicus</i>	DD	EAMt	SEMt	HsG	Mulg
<i>Silene viridiflora</i>	DD	EAs	Memp	Hs	Quer
<i>Anagalis minimus</i>	DD	Me	Me	Ts	Mont
<i>Malus praecox</i>	DD	MSM	MSM	P	Quer

## Conclusion

Phytogeographical analysis showed that representatives of the boreal flora are the most endangered, which indicates that the Vlasina Plateau is one of the most important refuges of postglacial floristic elements characteristic for far north of Europe and Asia. In support of this statement is the fact that the largest number of threatened taxa (60) occurs in wet habitats, especially in the peat vegetation (21). Of 18 extinct and extremely vulnerable taxa, 16 are characteristic of wetlands.

The highly fragile are forest ecosystems which are the habitat for 11 endangered taxa.

Based on the performed analysis we can conclude that it is necessary to protect all wetlands on the Vlasina plateau, especially peat vegetation. Also, it is necessary to prevent the irrational exploitation of forest cover, which is partly achieved by the declaration of the entire area of outstanding natural landscape features.

**Acknowledgements.** This study was supported by the Project of Ministry of Science and Technological Development of Republic of Serbia (Project No. 143015 – *Diversity of flora and vegetation in the Central Balkan Peninsula – ecology, chorology and conservation*).

## References

Апостолова, И., Славова, Л., 1997: *Конспект на растителните съобщества в България* (Compendium of bulgarian plant community). БАН, Инст. по ботан., София. 340 стр. (in bulgarian)

Blaženčić, J., Blaženčić, Ž., 1999: *Elatine triandra* Schkuhr. In: V. Stevanović, ed.: Crvena knjiga flore Srbije 1, Ministarstvo za životnu sredinu R Srbije, Biološki fakultet Univ. u Beogradu i Zavod za zaštitu prirode R Srbije, 286-287.

Blaženčić, J., Blaženčić, Ž., 1999a: *Utricularia minor* L. In: V. Stevanović, ed.: Crvena knjiga flore Srbije 1, Ministarstvo za životnu sredinu R Srbije, Biološki fakultet Univ. u Beogradu i Zavod za zaštitu prirode R Srbije, 233-234.

Blaženčić, J., Blaženčić, Ž., 1999b: *Sparganium natans* L. In: V. Stevanović, ed.: Crvena knjiga flore Srbije 1, Ministarstvo za životnu sredinu R Srbije, Biološki fakultet Univ. u Beogradu i Zavod za zaštitu prirode R Srbije, 380-382.

Diklić, N., 1999: *Dracocephalum ruyschiana* L. In: V. Stevanović, ed.: Crvena knjiga flore Srbije 1, Ministarstvo za životnu sredinu R Srbije, Biološki fakultet Univ. u Beogradu i Zavod za zaštitu prirode R Srbije, 70-71.

Dragišić, V., 1997: Geološko-hidrogeološke karakteristike sliva Vlasinskog jezera. In: J. Blaženčić, ed.: Vlasinsko jezero – hidrobiološka studija. Biološki fakultet Univ. u Beogradu, 25-35.

Đukanović, D., 1967: *Klima sreza Leskovac*. Beograd.

Greuter, W., Burdet, H. M. & Long, G., 1984-89: *Med-Checklist. A critical inventory of vascular plants of the circum-mediterranean countries*, 1, 3 and 4. Optima, Genève & Berlin.

Horvat, I., Glavač, V., Ellenberg, H., 1974: *Vegetation Südosteuropas*. Geobotanica selecta, Band 4. Gustav Fischer Verlag. Stuttgart. 768 p. (in german)

IUCN, 2001. *IUCN Red List Categories and Criteria: version 3.1*. Prepared by the IUCN Species Survival Commission. IUCN, Gland, Switzerland and Cambridge, U. K.

Jovanović, B., 1999: *Betula pubescens* Ehrh. ssp. *carpatica* (Willd.) Ascherson & Graebner. In: V. Stevanović, ed.: Crvena knjiga flore Srbije 1, Ministarstvo za životnu sredinu R Srbije, Biološki fakultet Univ. u Beogradu i Zavod za zaštitu prirode R Srbije, 239-242.

- Lazarević, P., Lazarević, M., Krivošej, Z., Stevanović, V., 2009: On the distribution of *Dracocephalum ruyschiana* (Lamiaceae) in the Balkan Peninsula. *Phytologia balcanica*, 15 (2): 175-179.
- Petković, K., ed., 1977: Geologija Srbije III-2: Metamorfizam. Zavod za regionalnu geologiju i paleontologiju rudarsko geološkog fakulteta. Univ. u Beogradu.
- Radford, E. A., Odé, B., eds., 2009: Conserving Important Plant Areas: investing in the Green Gold of South East Europe. Plantlife International, Salisbury.
- Randelović, V., 1994: Geobotanička studija Vlasinske tresave. Magistarska teza. Biološki fakultet. Beograd.
- Randelović, V., 1999: *Juncus capitatus* Weigel. In: V. Stevanović, ed.: Crvena knjiga flore Srbije 1, Ministarstvo za životnu sredinu R Srbije, Biološki fakultet Univ. u Beogradu i Zavod za zaštitu prirode R Srbije, 74-75.
- Randelović, V., 1999a: *Polemonium coeruleum* L.. In: V. Stevanović, ed.: Crvena knjiga flore Srbije 1, Ministarstvo za životnu sredinu R Srbije, Biološki fakultet Univ. u Beogradu i Zavod za zaštitu prirode R Srbije, 85-86.
- Randelović, V., 1999b: *Carex limosa* L.. In: V. Stevanović, ed.: Crvena knjiga flore Srbije 1, Ministarstvo za životnu sredinu R Srbije, Biološki fakultet Univ. u Beogradu i Zavod za zaštitu prirode R Srbije, 247-249.
- Randelović, V., 1999c: *Cirsium helenoides* (L.) Hill. In: V. Stevanović, ed.: Crvena knjiga flore Srbije 1, Ministarstvo za životnu sredinu R Srbije, Biološki fakultet Univ. u Beogradu i Zavod za zaštitu prirode R Srbije, 331-333.
- Randelović, V., Zlatković, B., 2010: *Flora i vegetacija Vlasinske visoravni* (Flora and vegetation of Vlasina plateau). Prirodno-matematički fakultet Univerziteta u Nišu. 448 str. (in serbian)
- Stevanović, V., ed., 1997: Crvena lista flore Srbije i Crne Gore (The red data list of flora of Serbia and Montenegro). Manuscript. Biological faculty, University of Belgrade.
- Stevanović, V., ed., 1999: *Crvena knjiga flore Srbije, 1: Iščezli i krajnje ugroženi taksoni* (The red data book of flora of Serbia, 1: Extinct and critically endangered taxa). Ministarstvo za životnu sredinu, Biološki fakultet Univ. u Beogradu i Zavod za zaštitu prirode R Srbije. (in serbian and english)
- Stojšić, V., Panjković, B., 1999: *Ranunculus lingua* L. In: V. Stevanović, ed.: Crvena knjiga flore Srbije 1, Ministarstvo za životnu sredinu R Srbije, Biološki fakultet Univ. u Beogradu i Zavod za zaštitu prirode R Srbije, 305-307.
- Tomović, G., Zlatković, B., Niketić, M., Perić, R., Lazarević, P., Duraki, Š., Stanković, M., Lakušić, L., Anačkov, G., Knežević, J., Szabados, K., Krivošej, Z., Prodanović, D., Vukojičić, S., Stojanović, V., Lazarević, M., Stevanović, V., 2009: Threat status revision of some taxa from "The Red Data Book of Flora of Serbia 1". *Botanica Serbica*, 33 (1): 33-43.
- Tutin, T.G., V.H. Heywood, N.A. Burges, D.M. Moore, D.H. Valentine, S.M. Walters & D.A. Webb, eds., 1964-1980: *Flora Europaea*, I-V. Cambridge University Press. London.
- Vukojičić, S., Janković, M., 1999: *Caldesia parnassifolia* (L.) Parl. In: V. Stevanović, ed.: Crvena knjiga flore Srbije 1, Ministarstvo za životnu sredinu R Srbije, Biološki fakultet Univ. u Beogradu i Zavod za zaštitu prirode R Srbije, 62-63.