



RARE AND PROTECTED PLANTS IN ZASAVICA RIVER (VOJVODINA, SERBIA)

VUKOV, D., ANACKOV, G., IGIC, R.

Department of Biology and Ecology, Faculty of Natural Science and Mathematics, University of Novi Sad, SERBIA AND MONTENEGRO

Abstract:

In 1997 Zasavica has been proclaimed as a special Reservation of Nature (I category), by the decision of the Government of the Republic of Serbia. One of the main characteristic of this reservation is its exceptional richness of plant and animal life. According to recent investigations, over 50 species of aquatic macrophytes have been recorded. These taxa are remnants of tertiary flora of Northern and Central Europe, and in Pannonian Plane region they have relict character. As a natural rarity protected by the Low, aquatic macrophytes had important role in valorization and protection of Zasavica. During the field investigation, species like Hippuris vulgaris, Hottonia palustris and Ranunculus lingua, rarest and therefore classified in volume I of the Red Book of Serbian Flora, have been recorded. Also, Nymphaea alba, Nuphar luteum, Stratiotes aloides and Utricularia australis have been found (they are on the Red List of Serbian flora). During the period from 1998 to 2001 quantity of these species has been changed, and two of them, Hippuris vulgaris and Hottonia palustris are extinct from investigated area. According to the Social Behavior Types, these two species are specialists, organisms that may be considered as the most sensitive indicators of the changes of the habitat. Their disappearance is undoubtedly an early sign of disturbance. It is important to choose the adequate measures of protection in Special Reservation of Nature Zasavica, also to prevail reintroduction of extinct species.

Keywords: *aquatic ecosystem, growth forms, quantitative analysis.*

1. INTRODUCTION

The Natural Reservation Zasavica extending over a 671 ha, covers southern part of Vojvodina and northern Macva (Yugoslavia), to the east of Drina. Due to legislative measures in 1997 it became Special Reservation. A very important role within Reservation plays river Zasavica with its high diversity and richness of plant and animal world. Two streams Prekopac and Jovaca joins together making 33.1 km long river that flows southwest-northeast, and runs into Sava near Macvanska Mitrovica. Numerous depression springs supply it with water during the whole year.

2. MATERIALS AND METHODS

The field work was performed in 1998-2001 period. Plant material was collected and preserved in the Herbarium of the Institute of Biology and Ecology, Novi Sad. Plant determination was done after Flora Europaea [17, 18], Hungarian flora [14] and Hínár határozó [4]. Social behavior types and relative ecological indicator values of recorded plant species are given according to BORHIDI [2]. Categorization of the endangerment degree is given by IUCN [15].

Aquatic macrophyte vegetation was surveyed in stretches of variable length. In each survey stretch the Plant Mass Estimate [8] was assessed on a five - level - scale (1=rare; 2=occasional; 3=frequent; 4=abundant; 5=very abundant). Species list contains: species name, author, species name abbreviation. Obtained data has been processed by standard methodology [6, 9, 12], adopted by Expert Group Macrophytes of the International Association for Danube Research (IAD).

The PME data form the base for mathematical model with: Relative Plant Mass (RPM) for each species, Mean Mass Index (MMI) of an individual species with respect to the survey stretches where it occurs (MMO) and with regard to full length of the river reach investigated (MMT) and Distribution Ratio (d) of each species. These data sets and respective graphics are used for describing quantitative relationships of aquatic macrophyte vegetation.

3. RESULTS AND DISCUSSION

Aquatic macrophytes survey, conducted in 1998, resulted with 57 registered plant species, while in 2001, number of recorded species was 55 (tab. 1).

The Relative Plant Mass (RPM, fig. 1, fig. 2) describes in detail the dominance pattern of the plant species. In Zasavica River, dominant plant species is *Stratiotes aloides*, followed by *Typha angustifolia* and *Phragmites australis*.

The Mean Mass Indices (MMT, MMO, fig. 3, fig. 4) and the Distribution Ratio (d, fig. 5, fig. 6) show the distribution pattern of each species found in river. Aside of species *Hippuris vulgaris* and *Hottonia palustris*, which have been not recorded in Zasavica in 2001, there have been no noticeable changes in distribution pattern of rare and protected species in Zasavica river. Only *Stratiotes aloides* showed the tendencies of retreat, possibly by human impact (clearing the way for boats, by cutting the water plants).

Rare and protected species have specific significance in this protected area (tab. 1). *Acorus calamus* is a remnant of old culture on European continent. Its rhizome has been used in pharmaceutical and cosmetic industry. Due to the irrational exploitation it is almost extinct, it is on The Red List of Serbian Flora, and it is protected as a natural rarity. In Zasavica it is present with relatively large population, but limited on a rather small area (fig. 3, fig. 4).

In time period between 1998 and 2001, two very valuable plant species *Hippuris vulgaris* and *Hottonia palustris* has been disappeared from the investigated area. Both of them are in The Red Book of Serbian Flora [3, 19]. According to BORHIDI [2] they belong to the social behavior type named "Specialists". One of the main characteristics of these plants is their extreme sensitivity to environmental conditions, specially their changes. Disappearance of such species is an early sign of habitat disturbance, while their reappearance is a signal of the habitat revitalization.

In Zasavica, these species have been found only on locality Banovo Polje with very small populations.

Tab. 1: Total species list of Zasavica River

	Species	1998	2001	Abbreviation
1.	<i>Acorus calamus</i> L.			Aco cal
2.	<i>Alisma plantago-aquatica</i> L.			Ali pla
3.	<i>Butomus umbellatus</i> L.			But umb
4.	<i>Callitriche palustris</i> L.			Cal pal
5.	<i>Carex pseudocyperus</i> L.			Car pse
6.	<i>Carex vulpina</i> L.			Car vul
7.	<i>Ceratophyllum demersum</i> L.			Cer dem
8.	<i>Ceratophyllum submersum</i> L.			Cer sub
9.	<i>Glyceria maxima</i> (Hartman) Holmberg			Gly max
10.	<i>Hippuris vulgaris</i> L.			Hip vul
11.	<i>Hottonia palustris</i> L.			Hot pal
12.	<i>Hydrocharis morsus-ranae</i> L.			Hyd mor
13.	<i>Iris pseudacorus</i> L.			Iri pse
14.	<i>Juncus compressus</i> Jacq.			Jun com
15.	<i>Lemna gibba</i> L.			Lem gib
16.	<i>Lemna minor</i> L.			Lem min
17.	<i>Lemna trisulca</i> L.			Lem tri
18.	<i>Lycopus europaeus</i> L.			Lyc eur
19.	<i>Lysimachia nummularia</i> L.			Lys num
20.	<i>Lythrum salicaria</i>			Lyt sal
21.	<i>Mentha aquatica</i> L.			Men aqu
22.	<i>Myriophyllum spicatum</i> L.			Myr spi
23.	<i>Myriophyllum verticillatum</i> L.			Myr ver
24.	<i>Najas marina</i> L.			Naj mar
25.	<i>Najas minor</i> All.			Naj min
26.	<i>Nuphar lutea</i> (L.) Sibth. & Sm.			Nup lut
27.	<i>Nymphaea alba</i> L.			Nym alb
28.	<i>Nymphoides peltata</i> (S.G. Gmelin) O. Kuntze			Nym pel
29.	<i>Oenanthe aquatica</i> (L.) Poiret in Lam.			Oen aqu
30.	<i>Phragmites australis</i> (Cav.) Trin. ex Steudel			Phr aus
31.	<i>Polygonum amphibium</i> L.			Pol amp
32.	<i>Potamogeton acutifolius</i> Link in Roemer et Schultes			Pot acu
33.	<i>Potamogeton crispus</i> L.			Pot cri
34.	<i>Potamogeton lucens</i> L.			Pot luc
35.	<i>Potamogeton pectinatus</i> L.			Pot pec
36.	<i>Potamogeton pusillus</i> L.			Pot pus
37.	<i>Potamogeton trichoides</i> Cham. & Schlecht.			Pot tri
38.	<i>Ranunculus circinatus</i> Sibth.			Ran cir
39.	<i>Ranunculus lingua</i> L.			Ran lin
40.	<i>Riccia fluitans</i> L.			Ric flu
41.	<i>Rumex hydrolapathum</i> L.			Rum hyd
42.	<i>Sagittaria sagittifolia</i> L.			Sag sag
43.	<i>Salvinia natans</i> (L.) All.			Sal nat
44.	<i>Scirpus lacustris</i> L.			Sch lac
45.	<i>Sium latifolium</i> L.			Siu lat
46.	<i>Solanum dulcamara</i> L.			Sol dul
47.	<i>Sparganium emersum</i> Rehm			Spa eme
48.	<i>Sparganium erectum</i> L.			Spa ere
49.	<i>Spirodella polyrhiza</i> (L.) Schleiden			Spi pol
50.	<i>Stratiotes aloides</i> L.			Str alo
51.	<i>Typha angustifolia</i> L.			Typ ang
52.	<i>Typha latifolia</i> L.			Typ lat
53.	<i>Urtica kioviensis</i> Rogow.			Urt kio
54.	<i>Utricularia australis</i> R. Br.			Utr kio
55.	<i>Utricularia vulgaris</i> L.			Utr vul
56.	<i>Wolffia arrhiza</i> (L.) Horkel ex Wimer			Wol arr
57.	<i>Zannichelia palustris</i> L.			Zan pal

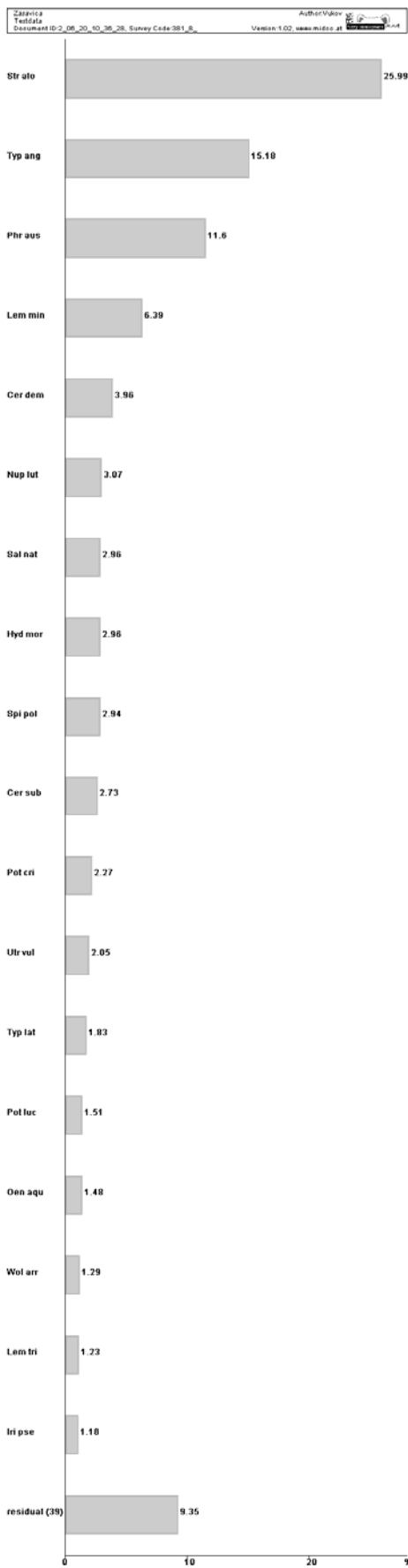


Fig. 1: RPM (%) values in 1998

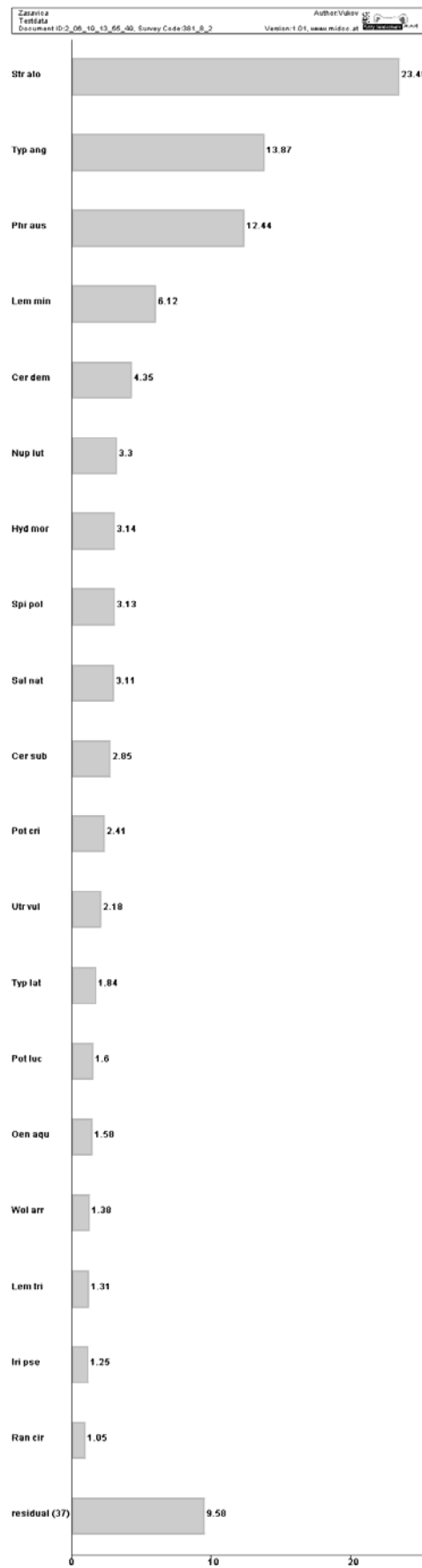


Fig. 2: RPM (%) values in 2001

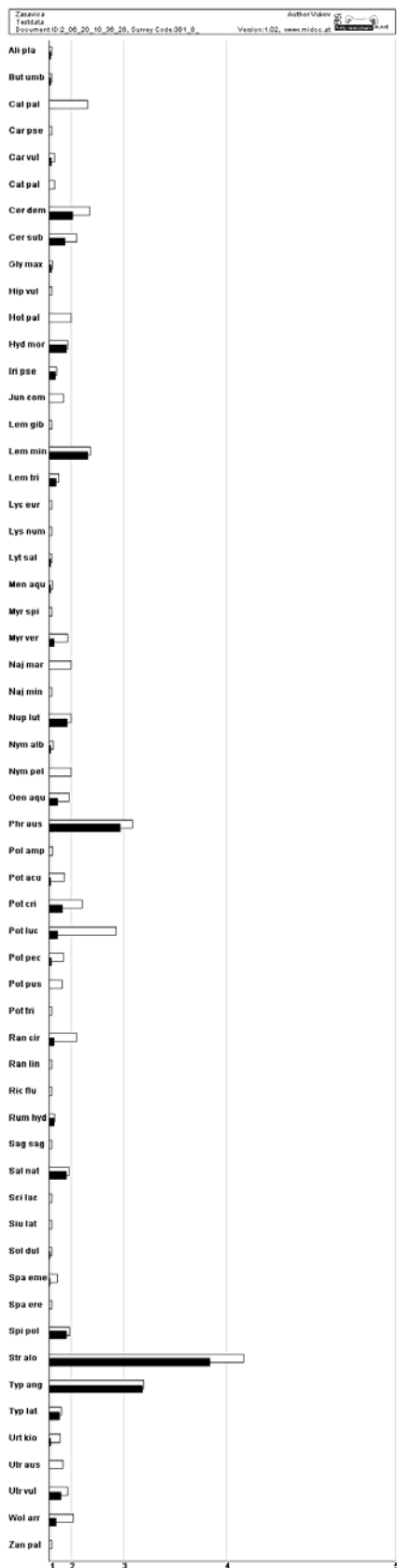


Fig. 3: MMT(black) and MMO (white) values in 1998

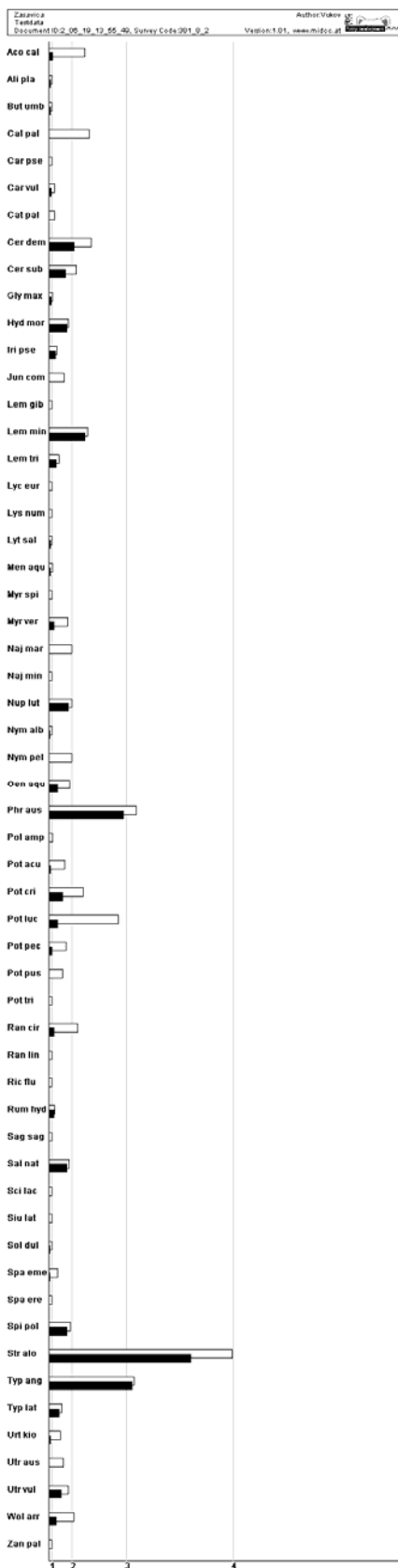


Fig. 4: MMT (black) and MMO (white) values in 2001



Fig. 5: d values in 1998



Fig. 6: d values in 2001

Anchored floating plants *Nuphar luteum* and *Nymphaea alba* could be considered as remnants of tertiary period of Northern and Central Europe, and in

Pannonian plane they have relict character. In Zasavica *Nuphar luteum* is more frequent and its populations are large. *Nymphoides peltata* could be considered as a rare species in investigated area.

Growing only on four localities in Serbia, European species *Ranunculus lingua* is in category of critically endangered species in the Red Book of Serbian Flora [16]. In Zasavica its distribution is limited only on two, rather small populations on locality Sumareva Cuprija.

Distribution of *Stratiotes aloides* is in Serbia limited only on the lowland area of Pannonian Plane. According to old records, it had been growing in rivers Mostonga and Jegricka [1], in Petrovaradinski Rit [10], and the newest data for Koviljski Rit is taken from the literature [20]. This plant is frequent in Obedska Bara [7, 5] it has been discovered in side arm of the upper part of the Danube River near Bezdán (VUKOV, oral information). In Zasavica it is dominant plant species, with very large populations, often covering large areas, and it is present almost in whole reach of the river.

Urtica kioviensis is relict species of the postglacial period. It has been recorded near Celarevo village on the Danube bank, in Koviljski Rit, Kovinski Rit, and in Obedska Bara near Kupinovo [11]. In Zasavica it was found near village Zasavica, on locality Vrbovac, Sumareva Cuprija, and in part of the river called Stari Tok.

Utricularia australis is very rare in flora of Vojvodina. It has been recorded in Obedska Bara [13]. In Zasavica it grows only on locality Valjevac.

4. ACKNOWLEDGEMENTS

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