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FLORA ALONG THE LOWER COURSE OF THE UNA RIVER (CENTRAL CROATIA)

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Floristic research of the area along the lower course of the Una River was conducted during spring of 2009. The floristic list obtained contains 252 vascular plant taxa, out of which three are considered to be under threat of extinction (endangered *Dactylorhiza incarnata* (L.) Soó and vulnerable *Carex rostrata* Stokes ex With. and *Alopecurus rendlei* Eig), while three are data deficient (*Stellaria palustris* Retz., *Orchis laxiflora* Lam. ssp. *elegans* (Heuff.) Soó and *Bromus commutatus* Schrad.). In the investigated area 14 invasive alien species were recorded, which mainly spread because traditional agricultural practices had been abandoned.

Key words: vascular flora, invasive alien plant species, Croatia

Boršić, I., Posavec Vukelić, V. & Alegro, A. L.: Flora donjeg toka rijeke Une (središnja Hrvatska). Nat. Croat., Vol. 21, No. 1., 1–20, 2012, Zagreb.

Floristička istraživanja područja uz donji tok rijeke Une provedena su u proljeće 2009. godine. Dobivena floristička lista sadrži 252 svojti vaskularne flore, od kojih se tri nalaze u opasnosti od izumiranja (ugrožena *Dactylorhiza incarnata* (L.) Soó i osjetljive *Carex rostrata* Stokes ex With. and *Alopecurus rendlei* Eig), a tri su nedovoljno poznate (*Stellaria palustris* Retz., *Orchis laxiflora* Lam. ssp. *elegans* (Heuff.) Soó and *Bromus commutatus* Schrad.). Na istraživanom području zabilježili smo i 14 stranih invazivnih vrsta koje se pretežno šire zbog napuštanja tradicionalne poljoprivrede.

Ključne riječi: vaskularna flora, strane invazivne biljke, Hrvatska

INTRODUCTION

The Una River springs between Lendek and Čaire Mountains in the southeastern part of Lika, a region in Croatia. In its upper part it is a typical karstic river, with an inconsistent profile of flow, while in the lower course it has the characteristics of a wide lowland river (BOGNAR, 2005). It is a right tributary of the Sava River, the confluence being located by Jasenovac (central Croatia). Along its 212 km long flow it partly passes through Bosnia and Herzegovina and partly forms the border between Croatia and Bosnia and Herzegovina. In total, the Una River basin extends over an area of 9368 km^2, 636 km^2 of which are in Croatia (ANONYMOUS, 2009a).

The Una River has conformed to the primary geological structure and the activity of tectonic movements. Its valley has complex characteristics defined by the interchange of gorges, basins and valley extensions (BOGNAR, 2005). In the lower course, sediments of the valley of the Una River are of Holocene alluvial origin. The most

abundant are sediments of flood sequences, while slope aprons and riverbed facies can also be found (MAGAŠ, 1980; ČASLAV & MAGAŠ, 1980). In the first ca 146 km the Una River flows through the Dinarides, where carbonate rock complexes, limestone and dolomites prevail, and different morphogenetic types of calcareous sinter are well developed. They can also sporadically be found downstream (MATONIČKIN & PAVLETIĆ, 1963; BOGNAR, 2005)

The lower course of the Una River is a part of The Ecological Network of the Republic of Croatia (»Valley of the Una River«, site code HR2000463; ANONYMOUS, 2007) and will form a part of the NATURA2000 proposal. Conservation objectives of this site are the fish species *Cottus gobio*, *Hucho hucho* and *Rutilus pigus* as well as »Surface inland waters and marsh habitats«. The same area has been proposed for protection in the category of Regional Park (IUCN category V). It is a flat, relatively narrow (from ca 50 to 2500 m) but more than 70 km long part, with an area of 39.38 km^2. It extends between the Croatian border, mostly following the Una River on the southeast and the road that leads from Jasenovac to Hrvatska Dubica on the northwest.

According to the climate classification by Köppen (BERTOVIĆ, 1975) the studied area belongs to the temperate C climate, C_{fwbx} for the northern part and C_{fsbx} for the southern. According to the data of the weather station in Kostajnica for the eleven-year period (1998–2008), the average annual air temperature was 10.9 °C and the average annual amount of precipitation was 1036.4 mm. The average monthly air temperature was highest in July and August (20.7 °C and 20.2 °C, respectively), while in January it was the lowest (0.5 °C). The highest amount of precipitation occurred in September and the lowest in February (Croatian Meteorological and Hydrological Service, unpublished data).

LAKUŠIĆ *et al*. (1991) differentiate seven vertical belts on the Una River vertical profile: supra-Mediterranean, submontane, montane, supramontane, subalpine, alpine and subnival. In the lower course of the Una River, the submontane belt with several subbelts dominates. Typical vegetation of this area, developed under the general climate, are mesophyllous sessile oak and hornbeam forests (*Epimedio-Carpinetum betuli* (Ht. 1938) Borhidi 1963) (HORVAT, 1949), while by the mouth of the Una River and its lower course alluvial forests with black alder (*Alnion glutinosae* Malcuit 1929) as well as alluvial willow and poplar forests (*Salicion albae* Soó 1930 and *Populion albae* Br.-Bl. 1931) prevail. According to the Habitat Map of Croatia (provided by the State Institute for Nature Protection (http://www.dzzp.hr) and described by ANTONIĆ *et al.*, 2005) on this area 20 main habitat types or mosaic areas of two or more different habitat types have been mapped, designated according to the National Habitat Classification (ANONYMOUS, 2009c). It is mostly a typical mosaic rural area with an interchange of cultivated fields, grasslands, hedges, scrubs, forest fragments and ruderal habitats.

The area along the lower course of the Una River has not been floristically well researched. The only floristic research that at least partly includes this area has been conducted by ŠEGULJA *et al.* (1998). They were researching the wider area of Zrinska gora, which includes the area besides Una River. For the whole of the research area they noted 682 vascular plant taxa.

Considering the obvious lack of exact floristic data of this area, we think it is useful to publish the results of our research.

MATERIALS AND METHODS

Fieldwork was carried out during spring (April-June) of 2009 at different locations in the area of the ecological site »Valley of the Una River« (ANONYMOUS, 2007). Vascular flora was investigated at point localities whose positions were determined using a Garmin GPSMAP 60CSx GPS Receiver. Taxa not recorded at these exact localities and frequent taxa have been assigned to the MTB 1/64 field in which they were recorded. Point localities and MTB 1/64 fields investigated are listed in Tab. 1 and depicted in Fig. 1. For MTB 1/64 fields, the geographic coordinates of their centroids have been used.

Localities of recorded taxa have been listed behind the name of each taxon according to the coordinate codes listed in the Tab 1.

Tab. 1. Investigated point localities and MTB 1/64 fields

Coordinate code	x coordinate	y coordinate	MTB 1/64 field	Coordinate accuracy
C1	5649548	5014180	0767/144	MTB 1/64 field
T1	5649547	5014352	0767/144	point locality
T2	5648711	5014475	0767/143	point locality
C2	5647946	5012752	0767/321	MTB 1/64 field
T3	5647113	5012411	0767/312	point locality
C3	5646343	5011325	0767/314	MTB 1/64 field
T4	5646297	5011547	0767/314	point locality
T5	5646271	5011544	0767/314	point locality
T6	5646148	5011091	0767/314	point locality
T7	5645158	5010424	0767/331	point locality
C4	5644803	5007121	0867/111	MTB 1/64 field
C5	5644771	5008510	0767/333	MTB 1/64 field
C6	5644739	5009899	0767/331	MTB 1/64 field
T8	5643929	5006831	0866/222	point locality
T9	5643693	5006253	0866/224	point locality
C7	5643198	5005695	0866/224	MTB 1/64 field
C8	5641530	5007047	0866/221	MTB 1/64 field
T10	5641341	5006599	0866/221	point locality
T11	5641331	5006626	0866/221	point locality
T12	5636845	5008360	0766/344	point locality
C9	5636590	5008329	0766/344	MTB 1/64 field
T13	5633826	5008129	0766/334	point locality
T14	5631730	5008545	0766/333	point locality
C10	5631682	5008225	0766/333	MTB 1/64 field

T15	5630994	5008770	0766/333	point locality
T16	5628431	5009452	0765/441	point locality
C11	5628382	5009547	0765/441	MTB 1/64 field
T17	5626319	5010853	0765/414	point locality
C12	5625083	5010870	0765/413	MTB 1/64 field
T18	5624729	5010849	0765/413	point locality
C13	5620203	5009386	0765/332	MTB 1/64 field
T19	5619074	5009695	0765/331	point locality
C14	5618567	5009355	0765/331	MTB 1/64 field
T20	5617721	5008621	0764/444	point locality
C15	5617008	5005158	0864/224	MTB 1/64 field
C16	5616983	5006547	0864/222	MTB 1/64 field
C17	5616957	5007936	0764/444	MTB 1/64 field
T21	5616916	5006668	0864/222	point locality
T22	5616217	5005424	0864/224	point locality
C18	5615447	5000962	0864/421	MTB 1/64 field
T23	5614929	5001319	0864/421	point locality
T24	5614330	5000161	0864/414	point locality
C19	5613834	4999543	0864/414	MTB 1/64 field
C20	5613809	5000932	0864/412	MTB 1/64 field
C21	5612220	4998125	0864/431	MTB 1/64 field
T25	5611852	4998624	0864/431	point locality
C22	5610630	4995319	0964/122	MTB 1/64 field
T26	5609937	4995754	0964/122	point locality
C23	5609038	4992513	0964/141	MTB 1/64 field
C24	5608991	4995290	0964/121	MTB 1/64 field
T27	5607533	4986973	0964/332	point locality
C25	5607492	4986929	0964/332	MTB 1/64 field
C26	5607469	4988318	0964/314	MTB 1/64 field
T28	5607343	4986922	0964/332	point locality
T29	5607181	4988174	0964/314	point locality
T30	5607096	4985626	0964/334	point locality
T31	5606225	4985081	0964/333	point locality
T32	5606144	4985036	0964/333	point locality
T33	5604932	4985198	0963/444	point locality
T34	5604686	4985217	0963/444	point locality
T35	5604092	4985166	0963/444	point locality
T36	5603443	4984963	0963/444	point locality

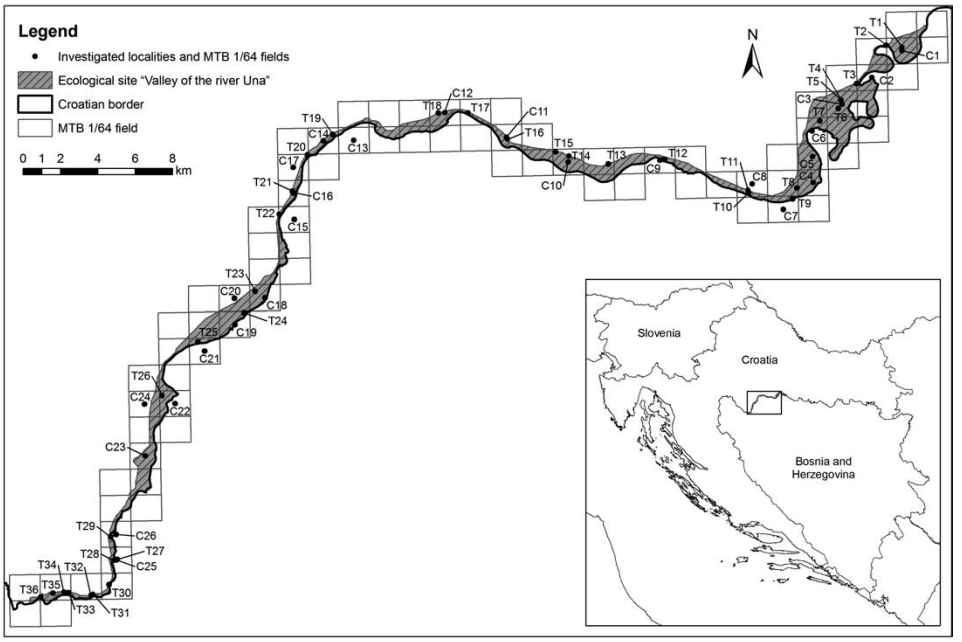

Fig. 1. Investigated localities where new taxa were recorded (for an explanation of the site numbers see text).

Taxa were determined using standard determination keys and iconographies (JÁVORKA & CSAPODY, 1975; TUTIN *et al.*, 1968–1980; TUTIN *et al.*, 1993; DOMAC, 1994; ROTHMALER, 1995). The nomenclature has been adjusted according to the Croatian Flora Checklist (NIKOLIĆ (ed.), 2010). Plant families and genera with their appertaining species and subspecies are listed in alphabetical order within higher systematic units. As well as newly recorded taxa, the floristic list also contains taxa that had previously been noted by ŠEGULJA *et al.* (1998) for the research area. These taxa are marked with * in front of the name of each taxon.

Species considered to be invasive alien plant species according to BORŠIĆ *et al.* (2008) are denoted with the abbreviation **IAS.** Subspontaneously occurring cultivated species are marked with the abbreviation **NAT**. Taxa listed in the Red Book of Vascular Flora of Croatia (NIKOLIĆ & TOPIĆ (eds.), 2005) are marked with their corresponding threat category: **CR** – critically endangered, **EN** – endangered, **VU** – vulnerable. Also, **DD** – data deficient taxa have been denoted.

Taxa protected by the Nature Protection Act (ANONYMOUS, 2005; ANONYMOUS, 2008; ANONYMOUS, 2011) and listed in the Ordinance on Designating Wild Taxa Protected and Strictly Protected (ANONYMOUS, 2009b) are denoted as **P** – protected and **SP** – strictly protected.

RESULTS

Taxa of vascular plants along the lower course of the Una River (including taxa cited in ŠEGULJA *et al.*, 1998) are as follows:

PTERIDOPHYTA

Equisetaceae

**Equisetum arvense* L.	C3, T6, C6, T8, T16, T17, C12, C16, C19, C20, T26
**Equisetum palustre* L.	
Equisetum telmateia Ehrh.	C2, C11, C15, C18

Hypolepidaceae

Pteridium aquilinum (L.) Kuhn	C14, C15, T30

Ophioglossaceae

**Ophioglossum vulgatum* L.	(P)

SPERMATOPHYTA
GYMNOSPERMAE

Cupressaceae

Juniperus communis L.	T28

ANGIOSPERMAE
MAGNOLIATAE

Aceraceae

Acer campestre L.	C20
Acer negundo L.	(IAS) T2, T3, C3, T5, T6, C6, C8, C13, C14, T20, T22, T24, C20

Amaranthaceae

**Amaranthus albus* L.	

Apiaceae

Aegopodium podagraria L.	(P) C6, T9, T12, T14, C11, T17, C13, C17, T22, T24
**Aethusa cynapium* L.	(P)
**Anethum graveolens* L.	
**Angelica archangelica* L.	(IAS)
Angelica sylvestris L.	C6, T14, T17, C19
Anthriscus sylvestris (L.) Hoffm.	T24
**Chaerophyllum aureum* L.	
**Daucus carota* L.	
Heracleum sphondylium L.	C6, T12, T13, C11, T17, C13, T19, C15, C16, C19, C20, C21
**Oenanthe fistulosa* L.	T17, C12
**Oenanthe silaifolia* M. Bieb.	
**Pastinaca sativa* L.	C3, C6, T8, T13, T15, C15, C16, C18, C20, T26, C24, T32
**Pimpinella major* (L.) Huds.	(P)
**Pimpinella saxifraga* L.	(P)
**Smyrnium perfoliatum* L.	

Araliaceae

**Hedera helix* L.	T20, T30

Aristolochiaceae

Aristolochia clematitis L.	C3, T5, C5, C6, C11, T17, C12, C15, C20, C24

Asclepiadaceae

Asclepias syriaca L.	(IAS) C1, T1, C3, C6

Asteraceae

**Achillea millefolium* L.	T2, T3, C3, C6, T8, T9, C8, T12, C10, T15, C11, T17, C12, T18, T20, C15, C16, C18, C19, C22, T26, C23, C24, T27, C26
**Ambrosia artemisiifolia* L.	(IAS) C3, T5, T6, C5, C8, T13, C10, T15, T17, T19, C15, C16, T22, C18, T25, C24
**Anthemis arvensis* L.	C14
**Arctium lappa* L.	C13, T19, T22
**Arctium minus* Bernh.	
**Artemisia vulgaris* L.	C3, C5, T8, T13, C10, T15, C11, C12, C13, T19, C18, C19, C20, C24, C26
**Bellis perennis* L.	C1, T9, C8, C9, C13, T19
**Bidens tripartita* L.	
**Carduus acanthoides* L.	
**Centaurea jacea* L.	C6, T8, C18, T26, C23
**Centaurea jacea* L. subsp. *angustifolia* Gremli	
Chamomilla suaveolens (Pursh) Rydb.	(IAS) C8, C21
**Cirsium arvense* (L.) Scop.	T25, C24
**Conyza canadensis* (L.) Cronquist	(IAS)
Erigeron annuus (L.) Pers.	(IAS) C3, C5, C6, T8, C8, C9, T13, T15, T16, C11, T17, C12, T18, T19, C14, T20, C15, C16, T21, T22, C19, C20, T25, C22, C23, C24, T27, T29, T30, T32
**Eupatorium cannabinum* L.	T16
Helianthus tuberosus L.	(IAS) T29
**Inula britannica* L.	
**Leucanthemum vulgare* Lam. (incl. *Leucanthemum praecox* (Horvatić) Horvatić)	C3, C6, T8, C18, C19, T26
Matricaria perforata Mérat	C8
Petasites hybridus (L.) P. Gaertn., B. Mey. et Schreb.	T24
**Pulicaria dysenterica* (L.) Bernh.	
**Senecio aquaticus* Hill	
Senecio erraticus Bertol.	C3, C18
**Senecio jacobaea* L.	(P)
**Senecio vulgaris* L.	C9
**Tanacetum vulgare* L.	(P) C3

Balsaminaceae

**Impatiens parviflora* DC.	

Berberidaceae

**Berberis vulgaris* L.	(P)

Betulaceae

**Alnus glutinosa* (L.) Gaertner	T12, T14, T20, C19

Boraginaceae

Cerinthe minor L. C24
**Lithospermum arvense* L. (as *Buglossoides arvensis* (L.) I. M. Johnst.)
Myosotis arvensis (L.) Hill C4, C5, C6, T10, C9, C16, C18, T25, T26
Symphytum officinale L. T2, C3, T6, C6, T11, T17, C12, C13, C17, T24, C20, C23
Symphytum tuberosum L. (P) T20

Brassicaceae

**Alliaria petiolata* (M. Bieb.) Cavara et Grande (P) T3, C6, T9, C8, T12, C17
**Arabidopsis thaliana* (L.) Heynh.
**Armoracia rusticana* P. Gaertn., B. Mey. et Scherb.
**Brassica nigra* (L.) Koch (P)
**Brassica oleracea* L. C5, T8, C17, T25
Calepina irregularis (Asso) Thell. C1, C9, T17
**Capsella bursa-pastoris* (L.) Medik. C1, C8, T12, T13, T17, C16, T25
**Cardamine hirsuta* L. T2, C6, T9, T12, T20
Cardamine pratensis L. T3, T7, T9, C9, T20
**Cardaria draba* (L.) Desv.
**Diplotaxis muralis* (L.) DC.
Hesperis matronalis L. C21
**Lepidium campestre* (L.) R. Br.
**Lepidium virginicum* L. (IAS) T10
**Rorippa amphibia* (L.) Besser T10
**Rorippa sylvestris* (L.) Besser T5, T6, C8, T11, T22, C18, T25, T26
Sinapis arvensis L. C4, T26
**Sisymbrium officinale* (L.) Scop. C8
**Thlaspi alliaceum* L. C1, C9

Campanulaceae

**Campanula patula* L.
**Campanula rapunculoides* L.
**Campanula rapunculus* L. C24
**Legousia speculum-veneris* (L.) Chaix

Cannabaceae

**Humulus lupulus* L. C1, T3, T6, T7, C5, C6, T11, T14, C11, C13, C16, C17, T22, C18, C20, C23, T30

Caprifoliaceae

Sambucus ebulus L. C5, C8, T16, C11, C14, C18, C21, C24
Sambucus nigra L. C1, T1, C3, C5, C6, T9, C8, T12, T13, C11, T17, T19, C15, C16, C17, T22, C20, C21, C26, T30
Viburnum opulus L. C6, C11, C12, C25

Caryophyllaceae

**Agrostemma githago* L. (P)
**Arenaria leptoclados* (Reichenb.) Guss.

**Arenaria serpyllifolia* L.
**Cerastium fontanum* Baumg. subsp. *vulgare* (Hartman) Greuter et Burdet (as *Cerastium holosteoides* Frein emend. Hyl.) C10
Cerastium glomeratum Thuill. C1, C9
Cerastium sylvaticum Waldst. et Kit. C1
**Gypsophila muralis* L. (P)
**Lychnis flos-cuculi* L. C3, C6, T8, C12
**Moenchia mantica* (L.) Bartl.
**Myosoton aquaticum* (L.) Moench T22, T24, C19
**Saponaria officinalis* L. (P)
**Silene latifolia* Poir. subsp. *alba* (Mill.) Greuter et Bourdet (as *Silene alba* (Mill.) E.H.L. Krause subsp. *alba*)
Silene vulgaris (Moench) Garcke C6, T17
**Stellaria graminea* L. C10, T26
**Stellaria media* (L.) Vill. C1, T9, T12, C17
Stellaria palustris Retz. (DD, SP) C10, T21

Celastraceae
Euonymus europaeus L. (P) T7, C6, T12, C12, C18, T26, C25

Ceratophyllaceae
Ceratophyllum demersum L. T10

Chenopodiaceae
**Chenopodium album* L. T6, C11, T25

Cichoriaceae
**Cichorium intybus* L. C3, C6, T32
**Crepis biennis* L. C13, C16, T22, C18, C20, C24
Lactuca serriola L. C5, T8, C8, T15, C16, T22, C21, T25
**Lapsana communis* L.
**Leontodon autumnalis* L.
**Leontodon hispidus* L.
**Picris hieracioides* L.
**Sonchus arvensis* L.
**Sonchus asper* (L.) Hill T25
Sonchus asper (L.) Hill subsp. *glaucescens* (Jord.) Ball T10
**Sonchus oleraceus* L.
**Taraxacum officinale* Weber T2, T3, C3, T7, C5, T9, T12, T13, T17, C12, C13, T19, T20, C16, C20, C26, T30, T32
**Tragopogon pratensis* L.
**Tragopogon pratensis* L. subsp. *orientalis* (L.) Čelak. (as *Tragopogon orientalis* L.)

Clusiaceae
**Hypericum perforatum* L. (P)
**Hypericum tetrapterum* Fr.

Convolvulaceae
**Calystegia sepium* (L.) R. Br. C5, C10, T15, T16, C11, C12, C13, T19, C16, T21, T22, C18, T24, C20, C24

**Calystegia silvatica* (Kit.) Griseb.	
**Convolvulus arvensis* L.	C3, T6, C4, C6, T8, T11, T13, C11, T17, C12, C15, C20, T25, C23, C24, C26, T30
Cornaceae	
**Cornus sanguinea* L.	C1, T1, C3, T7, C5, C6, T8, T9, T12, C10, C12, T22, C18, C19, C20, T26, C23, C24, T27, T30, T32
Corylaceae	
Carpinus betulus L.	T9, T20
Corylus avellana L.	T13, C10
Cucurbitaceae	
Echinocystis lobata (Michx.) Torr. et Gray	(IAS) C1, T3, T5, T6, C5, T10, T11, T12, C13, T19, T22, T24, T29, T30, T31, T33
Cuscutaceae	
**Cuscuta epithymum* (L.) L.	
**Cuscuta europaea* L.	
Dipsacaceae	
**Dipsacus fullonum* L.	C1
**Knautia arvensis* (L.) Coult.	
Euphorbiaceae	
**Euphorbia cyparissias* L.	C16
Euphorbia esula L.	C4, C6, C18, C22
**Euphorbia exigua* L.	
**Euphorbia helioscopia* L.	C1, C9, C17, T27
Euphorbia platyphyllos L.	C12
Euphorbia serrulata Thuill.	T19, T25
Euphorbia virgata Waldst. et Kit.	C20
Fabaceae	
**Amorpha fruticosa* L. C11, C14, C16	(IAS) T1, T2, T3, C3, T4, T5, T6, C5, C6, T16,
Coronilla varia L.	C21
**Lathyrus aphaca* L.	T8, C21
Lathyrus hirsutus L.	C10, T15, T25, C24
Lathyrus nissolia L.	C10
**Lathyrus pratensis* L.	T8, C10, T16, C15, T21, C18, C20, T26, C24
Lathyrus tuberosus L.	C18
Lotus corniculatus L.	C6, C8, C18, C23
**Lotus glaber* Mill. (as *Lotus tenuis* W. & K. ex Willd.)	
**Lotus uliginosus* Schkuhr	
Medicago arabica (L.) Huds.	T10, C10, C15
**Medicago falcata* L.	
**Medicago lupulina* L.	C3, C6, T8, C8, C9, T15, T18, T19, C15, C16, C18, T25, C22, T26, C24
**Medicago sativa* L.	C11, C16, C24
**Melilotus officinalis* (L.) Lam.	C24

Robinia pseudoacacia L.	(IAS) C5, C8, T19, C14, C15, C16, C21, T33, T34, T35, T36
Trifolium campestre Schreber	C6, T8, C15, C16, T21, C19, C24
Trifolium hybridum L.	C3
**Trifolium patens* Schreb.	
**Trifolium pratense* L.	T2, T3, C3, C6, T8, C8, T13, C10, C11, C12, T18, C13, C15, C16, C18, C19, C20, C22, T26, C23, C24, C26, T32
**Trifolium repens* L.	T2, T3, C3, C6, T8, C8, C9, T13, T15, T16, C11, T17, C12, T18, C13, T19, C16, C18, C20, C24
**Vicia cracca* L.	C3, T8, T16, C11, T17, T21, C18, C21
**Vicia dumetorum* L.	
**Vicia hirsuta* (L.) Gray	C20
Vicia pannonica Crantz subsp. *pannonica*	C20
Vicia sativa L.	C10, C19, C20, T26
**Vicia tetrasperma* (L.) Schreber	T21, C18
Fagaceae	
Quercus robur L.	C5
Gentianaceae	
**Centaurium pulchellum* (Sw.) Druce	
Geraniaceae	
**Geranium columbinum* L.	C15
Geranium dissectum L.	T6, C6, C18
Geranium phaeum L.	C15, C19
Haloragaceae	
**Myriophyllum spicatum* L.	
Juglandaceae	
Juglans regia L.	(NAT) T8, T12, T13, C10, C13, C14, C16
Lamiaceae	
**Ajuga reptans* L.	C1, C6, C9, T14
**Ballota nigra* L.	(P)
Betonica officinalis L.	(P) T8, T16, T21
**Glechoma hederacea* L.	T2, C3, T7, C5, C6, T9, C8, T12, T13, T14, C12, C13, T20, C21, T26, C23
Lamium album L.	C1, C5, C8, C10, T17, C13, T22, T24
**Lamium maculatum* L.	T9, T12, C13, T20, T22, C19, T30
**Lamium purpureum* L.	T2, T3, C6, T9, C9, C17, T25
Lycopus europaeus L.	(P) T6, C5, C8, T16, T17, C16, T22, T24
**Mentha longifolia* (L.) Huds.	(P) T6
**Mentha pulegium* L.	(P) C6
**Origanum vulgare* L.	
**Prunella vulgaris* L.	C3, C6
**Salvia pratensis* L.	C6
Scutellaria hastifolia L.	C10, T16, C12
Stachys sylvatica L.	C15

Loranthaceae
**Loranthus europaeus* Jacq.
Viscum album L. C7, T20

Lythraceae
**Lythrum salicaria* L. (P)

Malvaceae
Malva sylvestris L. C8, T15, C11, C21

Moraceae
Morus alba L. (NAT) T6, C18
Morus nigra L. (NAT) T10

Nymphaeaceae
Nuphar lutea (L.) Sm. in Sibth. et Sm. (P) T22

Oleaceae
**Ligustrum vulgare* L. C5, C6, C16, C21, C25

Onagraceae
**Epilobium hirsutum* L.

Oxalidaceae
**Oxalis fontana* Bunge T25

Papaveraceae
Chelidonium majus L. C5, T9, C8, C9
**Papaver rhoeas* L. (P) C3, C5, T8, C14, C20, C21, T25, C24

Phytolaccaceae
Phytolacca americana L. (IAS) T30, T31

Plantaginaceae
**Plantago lanceolata* L. T2, C3, C6, T8, C8, C9, T15, T17, C12, T18, C15, C16, C21, C23, T32
**Plantago major* L. T2, T3, C3, T6, C5, C6, T8, C8, T17, T18, C13, T19, T22, C18, C20, C21, C24, C26, T30, T32
Plantago media L. C18

Polygonaceae
**Fallopia convolvulus* (L.) Á.Löve
**Fallopia dumetorum* (L.) Holub
Polygonum aviculare L. C5, C8, T10, C11, C14, C21, T25
**Polygonum hydropiper* L. (P)
**Polygonum minus* Hudson
**Polygonum mite* Schrank
Reynoutria japonica Houtt. (IAS) T1, T11, C15
**Rumex acetosa* L. T2, C3, C4, C6, C10, C10, C18, C20, T26, C23, C24
**Rumex conglomeratus* Murray C15
Rumex crispus L. C1, T3, C3, T6, C5, C6, C8, T11, C9, T13, C10, T17, C12, C13, C15, C16, C18, T25, T26, C23

Primulaceae
**Anagallis arvensis* L. T25

**Anagallis coerulea* Schreb. (as *Anagallis femina* Mill.)
**Lysimachia nummularia* L. T2, T12, C10, T18, T19, C16, T22, C21, C22, C24
Lysimachia vulgaris L. C5, T16, T17, C13, T21

Ranunculaceae

**Clematis vitalba* L. C5, C6, C8, T16, C11, T19, C16, T22, C20, C21, T27, T30
**Ranunculus acris* L. (P) T2, C6, T8, T11, T12, T15, T17, C12, T22, C18, T26, C23, C24, C26
Ranunculus arvensis L. (P) C18
Ranunculus bulbosus L. (P) C9
Ranunculus ficaria L. (P) T2, T3, T7, T9, T12, T20
Ranunculus lanuginosus L. (P) C20
Ranunculus neapolitanus Ten. (P) T10, T25
Ranunculus repens L. (P) C3, T5, T6, C5, T8, T11, C10, C13, T19, T22, T24, C20
**Ranunculus sardous* Crantz (P)
**Ranunculus strigulosus* Schur (P)
Ranunculus trichophyllus Chaix in Vill. (P) T17

Resedaceae

**Reseda lutea* L. (P)

Rosaceae

Agrimonia eupatoria L. (P) C10, C19
**Crataegus laevigata* (Poir.) DC. (P)
Filipendula ulmaria (L.) Maxim. (P) C11
Filipendula vulgaris Moench T8, C18
Fragaria vesca L. C10, C18
**Potentilla cinerea* Chaix ex Vill. (as *Potentilla arenaria* Borkh.)
**Potentilla erecta* (L.) Raeuschel (P)
Potentilla reptans L. C6, C8, T13, T14, T17, C12, C15, C16, C18, C21, T26, C23, C24
**Prunus spinosa* L.
**Rosa canina* L. (P) C6
Rubus idaeus L. (NAT) C18
Sanguisorba minor Scop. (P) T32

Rubiaceae

**Cruciata laevipes* Opiz C1, T3, T9, T12, T15, C12, C16, C17, C18, C19, C20, T26, C24
**Galium aparine* L. C1, T3, T7, C5, T8, T9, C8, T12, T13, T15, C13, C16, C17, T22, T24, C21
**Galium mollugo* L. T2, C3, C6, T8, C12, T18, C18, C20, T26, C24
**Galium verum* L. (P) C6, T8, C11

Salicaceae

Populus alba L. T5, T6, T17
Populus nigra L. T6, C6

**Salix alba* L.	C3, T5, T6, C6, C8, T10, T11, T17, C12, C13, T19, C15, T22, C19
**Salix caprea* L.	C3, C12
**Salix fragilis* L.	C6, T19, C15, T22, C21
**Salix purpurea* L.	C3, T6, C10, T32
Salix triandra L.	T6, C8, T10

Saxifragaceae

**Saxifraga tridactylites* L.	

Scrophulariaceae

Chaenorhinum minus (L.) Lange	C24
**Gratiola officinalis* L.	(P) T8, C18
**Kickxia spuria* (L.) Dumort.	
**Linaria vulgaris* Mill.	(P)
**Misopates orontium* (L.) Raf.	
Odontites vernus (Bellardi) Dumort.	T25
**Rhinanthus angustifolius* C.C.Gmel. (as *Rhinanthus serotinus* (Schönh.) Oborny)	
Rhinanthus freynii (A.Kern. ex Sterneck) Fiori	(SP) C10
**Rhinanthus minor* L.	
Scrophularia nodosa L.	C14
**Verbascum blattaria* L.	(P)
Veronica anagallis-aquatica L.	T11
**Veronica arvensis* L.	T10
**Veronica chamaedrys* L.	T12, C19
Veronica montana L.	T22
**Veronica persica* Poir.	(IAS) T2, T3, T9, C8, T13, T20, T25
**Veronica polita* Fr.	
**Veronica serpyllifolia* L.	C6, C10

Simaroubaceae

Ailanthus altissima (Mill.) Swingle	(IAS) C13

Solanaceae

Solanum dulcamara L.	(P) C11, C13, C15, C16

Staphyleaceae

Staphylea pinnata L.	C5

Tiliaceae

Tilia cordata Mill.	T17
**Tilia platyphyllos* Scop.	

Ulmaceae

Ulmus glabra Huds.	T6, C8, T17, C18

Urticaceae

**Urtica dioica* L.	T2, C3, T5, T6, T7, C5, C6, T9, T10, T11, T12, T13, T15, C11, T17, C12, C13, T19, C16, C17, T22, T24, C25, T29, T30

Valerianaceae

Valeriana officinalis L.	(P) C1, C6

**Valerianella carinata* Loisel. C9
**Valerianella locusta* (L.) Laterrade (P)

Verbenaceae
Verbena officinalis L. C22

Violaceae
**Viola canina* L.
**Viola hirta* L.
**Viola tricolor* L. (P)

LILIATAE

Alismataceae
Alisma plantago-aquatica L. C5, T10, T17, C15

Amaryllidaceae
**Leucojum aestivum* L. (P) T5

Butomaceae
Butomus umbellatus L. (P) T17

Cyperaceae
Carex acuta L. C3, T17
Carex acutiformis Ehrh. (P) C12
Carex buekii Wimm. (P) C18
**Carex distans* L.
Carex divulsa Stokes C18
**Carex hirta* L. C4, T10, C10, T15, T17, C14, C15, C18, C19, T26
Carex otrubae Podp. T6, C10, T15, C18, C20, C21
**Carex pallescens* L. C10
Carex pendula Huds. T22
Carex remota L. T22
Carex rostrata Stokes ex With. (VU, SP) C6, C12
Carex spicata Huds. C6, C12, C15, C18, C19, C24
**Carex tomentosa* L.
Carex vulpina L. C10, C12, C23
Eleocharis palustris (L.) Roem. et Schult. C5, T17
Scirpus lacustris L. T10, C13
Scirpus sylvaticus L. C16, T22

Dioscoreaceae
**Tamus communis* L. (P)

Iridaceae
Iris pseudacorus L. (SP) C5, T8, C8, T17, C12

Juncaceae
**Juncus articulatus* L.
Juncus compressus Jacq. C12
**Juncus conglomeratus* L. C10, C11
**Juncus effusus* L. C11, T22
Juncus inflexus L. C10, C21

**Juncus tenuis* Willd. (IAS)
**Luzula campestris* (L.) DC. T8

Liliaceae
**Allium oleraceum* L.
Allium scorodoprasum L. T15, C21
**Allium vineale* L.
Asparagus officinalis L. (P) C3, C4
Colchicum autumnale L. (P) C18, C20
Hemerocallis fulva L. (NAT) T15, C21
Ornithogalum pyramidale L. (P) C18

Orchidaceae
Anacamptis pyramidalis (L.) Rich. (SP) T18
Dactylorhiza incarnata (L.) Soó (EN, SP) T23
Orchis laxiflora Lam.
ssp. *elegans* (Heuff.) Soó (DD, SP) T14, T16

Poaceae
**Agrostis canina* L. (P)
**Agrostis stolonifera* L.
Alopecurus pratensis L. C1, C3, C6, T8, T17, C12, T21, C23
Alopecurus rendlei Eig (VU, SP) C18
**Anthoxanthum odoratum* L. T8, C18, T26
**Apera spica-venti* (L.) P.Beauv.
**Arrhenatherum elatius* (L.) P. Beauv. ex J. Presl et C. Presl C3, C6, T13, C10, C12, C13, C14, C16, C18, C20, T26, C23
Avena sativa L. T25
**Briza media* L. T8, C10, C11
Bromus commutatus Schrad. (DD, SP) C5, T10, C16, C18, C20, C24
Bromus hordeaceus L. C8, T10, C10, C20, T26
**Bromus racemosus* L. C6, C20
Bromus sterilis L. C5, T10, T15, C14, C16, T22
**Cynodon dactylon* (L.) Pers.
**Cynosurus cristatus* L.
**Dactylis glomerata* L. C3, C5, T8, C8, C9, T13, T15, C11, C12, T18, C13, C16, T22, C18, C19, C20, C21, T26, C23, C24
**Deschampsia cespitosa* (L.) P.Beauv.
**Digitaria sanguinalis* (L.) Scop.
**Echinochloa crus-galli* (L.) P.Beauv.
**Elymus repens* (L.) Gould (as *Agropyron repens* (L.) PB.) C3, C4, T8, T10, T13, C10, T15, C12, C13, C14, T21
**Festuca pratensis* Huds. C3, T8, C10, C18, C20, T26
**Festuca rubra* L.
**Holcus lanatus* L. T8, T15, C12, C16, T21, T22, C18, C20, T26, C24
Hordeum murinum L. T10
Lolium multiflorum Lam. C3, C5
**Lolium perenne* L. C3, T10, T17, C15, C22, T26
**Panicum capillare* L. (IAS)

Phalaris arundinacea L.	C3, T6, C6, C8, T22, T24
Phleum phleoides (L.) H.Karst.	T25
**Phleum pratense* L.	
Phragmites australis (Cav.) Trin. ex Steud.	T21
**Poa annua* L.	C1, T3, T8, T9, C16
**Poa compressa* L.	
**Poa pratensis* L.	C9, C19, C20
**Poa trivialis* L.	C3, T6, C4, C5, C6, T10, T22, T22, C19, T25, T26
**Setaria viridis* (L.) P. Beauv.	
**Trisetum flavescens* (L.) P. Beauv.	
Potamogetonaceae	
**Potamogeton crispus* L.	
Potamogeton nodosus Poir.	C15, T17
**Potamogeton perfoliatus* L.	

DISCUSSION

Up to this contribution, the only floristic data concerning the investigated area were those of ŠEGULJA *et al.* (1998). In their work they registered 682 vascular plant taxa. As they were investigating the wider area of Zrinska gora, they also included the area along the Una River in their research. However, the localities in their work were listed only generally, without precisely describing the locality or giving exact coordinates, so taxa limited only to the investigated area could not be exactly determined. Out of their list we have extracted 225 taxa which had the localities that we considered to be in our investigated area, such as: »valley of the Una River«, »by the Una River«, »Kostajnica«, »Unčani«, »Dvor« etc.

During our research we registered 252 vascular plant taxa. This list can not be considered final as fieldwork has not been carried through the whole vegetational season but only in one part (April-June). Because of the scarcity of the data regarding the investigated area, we nevertheless find it useful to publish our results. Thorough investigation of vascular flora should be continued in other parts of the vegetational season.

Although vascular plants are not a conservation objective of the Ecological Network site »Valley of the Una River«, one of the conservation objectives is »Surface inland waters and marsh habitats«, a category which comprises some habitat types that are considered to be rare and threatened in Croatia (ANONYMOUS, 2009c). In this sense, by the Una River, marshland communities of the alliances *Phragmition australis* W. Koch 1926 and *Magnocaricion elatae* W. Koch 1926 occur, but only sporadically and on small surfaces. Loss of aquatic and moist habitats (especially because of drainage and regulation; cf. NIKOLIĆ & TOPIĆ (eds.), 2005) means that many water and marsh plant taxa are now facing the threat of extinction and are therefore listed on the national red list and protected by the law. Special attention to this type of vegetation is therefore needed. As water plant species have their vegetational peak during July and August, they have not been thoroughly investigated during our research.

From the nature protection/conservation point of view, taxa under threat of extinction as well as rare and threatened habitats are especially evaluated in considering an area for protection. In the list we have placed special emphasis on taxa that are considered to be under threat of extinction i.e. that are listed in the Red Book of Vascular Flora in Croatia (NIKOLIĆ & TOPIĆ (eds.), 2005). There are only three such taxa recorded in the investigated area: one endangered (*Dactylorhiza incarnata*) and two vulnerable (*Carex rostrata* and *Alopecurus rendlei*). Since the species *Alopecurus rendlei* was listed as vulnerable it has been found on numerous new localities so its status requires re-evaluation (TOPIĆ, pers. comm.). Data deficient taxa have also been listed, as taxa in this category could also be under threat of extinction (IUCN STANDARDS AND PETITIONS SUBCOMMITTEE, 2010). There are three data deficient taxa recorded: *Stellaria palustris*, *Orchis laxiflora* ssp. *elegans* and *Bromus commutatus*.

ALEGRO *et al*. (2006) have shown that moderate anthropogenic influence in the continental part of Croatia enriches floristic diversity by enhancing habitat diversity. Especially significant in this sense are grasslands, which, as seminatural habitats, contain the greatest number of species. On the researched area, among all grasslands, mesophyllous grasslands (National Habitat Classification code: C.2.3.; Order *Arrhenatheretalia*) predominate (Habitat Map of Croatia; http://www.dzzp.hr). Some of these grasslands except an early-spring phase with most of their area under water also have a dry summer phase when all the water withdraws and the area dries up. Therefore species characteristic of drier grassland could also be found on them.

Invasive alien species represent an accentuated threat on the investigated area. During our research we have recorded 14 invasive alien plant species. The most widespread and prominent among them are *Acer negundo*, *Ambrosia artemisiifolia*, *Amorpha fruticosa*, *Echinocystis lobata*, *Erigeron annuus* and *Robinia pseudoacacia*. This area has suffered extreme depopulation from the 1990s (MIŠETIĆ, 2002), which caused extensive agricultural activities to be abandoned. On abandoned cultivated fields *Ambrosia artemisiifolia*, the most allergenic plant in Europe, flourishes. In the lowest part of the Una River course, where traditional cattle breeding also ceased and especially in areas suspected of being mined, *Amorpha fruticosa* has spread and forms dense stands today. On the other hand, despite the fact that the area has been depopulated in recent time, the anthropogenic influence is still high. As settlements are more or less evenly distributed along the whole area, there is no part of the area that is devoid of human influence, which also facilitates a spread of IAS.

CONCLUSION

The area along the lower course of the Una River has not been sufficiently floristically studied, with only one wider investigation that has at least partly included this area. Our results represent a contribution to the knowledge of vascular flora of this area but the list presented can not be considered final. Therefore, floristic investigations on this area should continue.

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SAŽETAK

Flora donjeg toka rijeke Une (središnja Hrvatska)

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Flora donjeg toka rijeke Une nije dovoljno dobro istražena. Jedini floristički podaci koji se odnose na ovo područje su oni ŠEGULJE i sur. (1998) koji su istraživali šire područje Zrinske gore, uključujući i područje uz Unu u svoje istraživanje. U našem istraživanju, koje je provedeno samo u prvom dijelu vegetacijske sezone, zabilježili smo 252 biljne svojte. Tri svojte nalaze se u opasnosti od izumiranja: ugrožena orhideja *Dactylorhiza incarnata* (L.) Soó i dvije osjetljive vrste, *Carex rostrata* Stokes ex With. i *Alopecurus rendlei* Eig. Isto tako, tri svojte su nedovoljno poznate: *Stellaria palustris* Retz., *Orchis laxiflora* Lam. ssp. *elegans* (Heuff.) Soó i *Bromus commutatus* Schrad. Istaknut problem na istraživanom području predstavljaju strane invazivne vrste, kojih smo zabilježili 14. One se pretežno šire zbog napuštanja tradicionalne poljoprivrede. Dobiveni floristički popis ne može se smatrati konačnim pa je floristička istraživanja u budućnosti potrebno nastaviti.