

The phytosociological position of *Senecio fontanicola* Grulich & Hodálová, a rare and endangered species endemic to the Eastern Alps, in the successional sere on the montane wetland Zelenci (NW Slovenia)

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Summary: In the Zelenci nature reserve (Julian Alps, NW Slovenia) we found a new locality of the rare Eastern Alpine endemic species *Senecio fontanicola*. This species grows in stands with dominant *Carex paniculata* and *Salix myrsinifolia* on the spring area of an extensive montane wetland, about 0.3 ha large. Closed stands of dark-leaved willow on the southwestern fringe of this wetland were described as a new association *Carici paniculatae-Salicetum myrsinifoliae* which designates a relatively long-term successional stage in the sere between spring communities of tall sedges and riparian stands of grey alder, European ash and spruce.

Keywords: *Senecio fontanicola*, *Caricetum paniculatae*, *Carici paniculatae-Salicetum myrsinifoliae*, *Aceri-Alnetum incanae*, synsystematics, syndynamics, Zelenci, Natura 2000, Slovenia

Senecio fontanicola is an Eastern Alpine species known so far only in Carinthia in southern Austria and in the regions of Friuli, very rarely also in Veneto in northeastern Italy (AESCHIMANN et al. 2004b: 542; POLDINI 2002: 452; POLDINI & ORIOLO 2002: 110–111; FISCHER et al. 2008: 934; Sburlino, in litt.). The species, which belongs to the *Senecio doria* group (agg.), was described as new based on the specimens from southern Carinthia (the foothills of Dobratsch / Dobrač) by GRULICH & HODÁLOVÁ (1994: 261–262). Until then, this ragwort from Carinthia was classified as *S. doria* (for distribution see HARTL et al. 1992: 325). *S. fontanicola*, however, is morphologically, ecologically and phenologically different from other Central European taxa of the *S. doria* group. The most distinguishing characters are: absence of hairs, stem length (much shorter than stems of other taxa of this group), shape and size of leaves which are oblanceolate and distinctly narrower than in related taxa and the length of the involucre bracts which are 6–8 mm long (only 5–6 mm in *S. doria* s.str.). The flowering period is June and July (August and September for *S. doria* s.str.). It grows in marshy spring areas and fens in communities of the alliance *Caricion davallianae* Br.-Bl. 1949 and suballiance *Schoenenion nigricantis* Giugni 1991 (GRULICH & HODÁLOVÁ 1994; AESCHIMANN et al. 2004b; FISCHER et al. 2008). According to Sburlino (in litt.), it is very rare in Friuli and Veneto – the only locality is Palude di Onara, a marshy area about 20 km north of Padova. It has been phytosociologically classified into the association *Erucastro-Schoenetum nigricantis* Poldini 1973 emend. Sburlino & Ghirelli 1994 (POLDINI & ORIOLO 2002; SBURLINO & GHIRELLI 1994). Stands in which it thrives in Carinthia belong to the association *Schoenetum ferruginei* Du Rietz 1925 = *Primulo-Schoenetum ferruginei* Oberd. (1957) 1962 (Franz, in litt.). *S. fontanicola* was found in the early summer 2011 during mapping of habitat types conducted in the framework of the Conservation and Management of Freshwater Wetlands in Slovenia (WETMAN project) in the Zelenci nature reserve between Podkoren and Rateče in northwestern Slovenia (VREŠ et al. 2011). The sites were phytosociologically studied in connection to the surrounding willow shrub communities.

Materials and methods

Flora and vegetation in Zelenci were studied according to BRAUN-BLANQUET (1964) and EHRENDORFER & HAMANN (1965). The floristic records and phytosociological relevés were entered into the FloVegSi database (SELIŠKAR et al. 2003). Numerical comparisons were performed with the SYN-TAX 2000 program package (PODANI 2001). Combined cover-abundance values were transformed into numerical values (1–9) according to MAAREL (1979). The relevés were compared by means of (unweighted) average linkage method (UPGMA), incremental sum of squares method (MISSQ) and principal coordinates analysis (PCoA). Wishart's similarity ratio was used in all of the methods. Nomenclature of vascular plants follows 'Mala flora Slovenije' (MARTINČIČ et al. 2007) and GRULICH & HODÁLOVÁ (1994) for the taxon *S. fontanicola*, and of mosses MARTINČIČ (2003). Mosses were determined by Prof. Dr Andrej Martinčič. Nomenclature of syntaxa is according to THEURILLAT (2004). Determination of parent material follows JURKOVŠEK (1987a, b) and of soil types URBANČIČ et al. (2005). Climatic data (precipitation volume, temperature) were obtained from PRISTOV et al. (1998) and the Ministry of the Environment and Spatial Planning, Slovenian Environment Agency. Herbarium specimens of *S. fontanicola* are stored in the Herbarium of the Jovan Hadži Institute of Biology, Scientific Research Centre of the Slovenian Academy of Sciences and Arts [LJS].



Figure 1. *Senecio fontanicola*: a – habitus; b – inflorescence. (Photographs: B. Vreš; A. Seliškar)

Results and discussion

Ecological description of the study area

Zelenci is a nature reserve situated between Podkoren and Rateče at the altitude of about 835 m. It comprises the source lake of the Sava Dolinka River and its surrounding marshes with a total area of about 47 ha. The strictly protected core area of the reserve measures about 28 ha. The reserve is both an important biological and hydrological area and a beauty spot (GREGORI 1994, 2001). The eastern part of the marsh is called Drni. Its centre has developed into a transitional bog, partly a fen with peat moss *Sphagnum contortum*. Flora and vegetation of Drni were studied by MARTINČIČ (1988), who determined the following associations in its fringe area: *Phragmitetum vulgaris* von Soó 1927, *Caricetum rostratae* Osvald emend. Dierssen 1982 (also see MARTINČIČ & SELIŠKAR 2004), *Caricetum elatae* W. Koch 1926 and *Caricetum vesicariae* Chouard 1924. The western part of the marsh is called Zelenci and there are sources of the Sava Dolinka River. This area is dominated by tall sedge communities (*Caricetum paniculatae*, *Caricetum rostratae*), partly overgrown by willow shrubs (*Salix cinerea*, *S. purpurea* and *S. myrsinifolia*). On the easternmost border of the nature reserve occur riparian stands of grey alder, European ash and spruce (*Aceri-Alnetum incanae* Berger 1922). *S. fontanicola* (Fig. 1a,b) was found on the edge of the marsh Zelenci at the headwaters in the south of the source lake of the Sava Dolinka River (Fig. 2). The parent material is fan (proluvium), unsorted and unrounded rock material, fine-grained and waterlogged (JURKOVŠEK 1987a, 1987b: 38). It was deposited by torrents from the Vitranc range. The valley itself is filled with unconsolidated glacial material (till). *S. fontanicola* grows



Figure 2. Localities of *Senecio fontanicola* in Zelenci. (Scale 1:5000; map source: Surveying and Mapping Authority of the Republic of Slovenia)



Figure 3. Habitat of *Senecio fontanicola* in the large sedge community overgrown by willows. (Photograph: I. Dakskobler)

on an undeveloped hydromorphic soil changing to fen and peat soils. The climate is cold (mean annual temperature is 5.7°C) and moderately humid (mean annual precipitation volume is around 1600 mm) with about 130 days of snow cover.

Description of the locality and site of *Senecio fontanicola*

Slovenia: Julian Alps, Upper Sava Valley, Rateče, Zelenci, 835 m a.s.l., headwaters along the fringe of a willow shrub stand with dominant *Salix myrsinifolia*. 9548/1 (UTM 33TVM04). Leg. & det. B. Vreš & I. Dakskobler, 20.6.2011, herbarium LJS 11626, phytosociological research of the site B. Vreš, I. Dakskobler & A. Seliškar, 4.7.2011.

Senecio fontanicola was found on the southwestern fringe of Zelenci, in the southwest of the springs of the Sava Dolinka on an area of about 0.3 ha (Fig. 2). The site is explicitly marshy with ground water near the surface (Fig. 3). This is a new locality of this species and the only known in Slovenia (Figs 4–5). Four relevés were made here (Appendix 1, relevés 1–4). On the first relevé the studied species occur only individually; the dominant species is the sedge *Carex paniculata* which is accompanied by *Phragmites australis*, *Crepis paludosa*, *Cirsium oleraceum*, *Caltha palustris* and *Equisetum palustre*. This stand is classified into the association *Caricetum paniculatae* Wangerin ex von Rochow 1951, which is characteristic of spring wetlands. *S. fontanicola* is abundant in the other three relevés. Besides, the sedge *Carex paniculata* and 0.5–1 m tall shrubs of the willow *Salix myrsinifolia* cover a larger area. High frequency species also are: *Molinia caerulea* subsp. *caerulea*, *Carex davalliana*, *Cirsium oleraceum*, spruce (*Picea abies*) in the shrub layer and *Calliergonella cuspidata* among the moss species. In Zelenci, *S. fontanicola* therefore occurs along smaller springs at the bottom of fans from the Vitranc range, at fringes of the wetland in a mosaic marsh community with elements of at least three associations (*Caricetum paniculatae*, *Caricetum davallianae* and *Salicetum myrsinifoliae* s. lat.).

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Figure 4. Distribution of *Senecio fontanicola* in Slovenia.

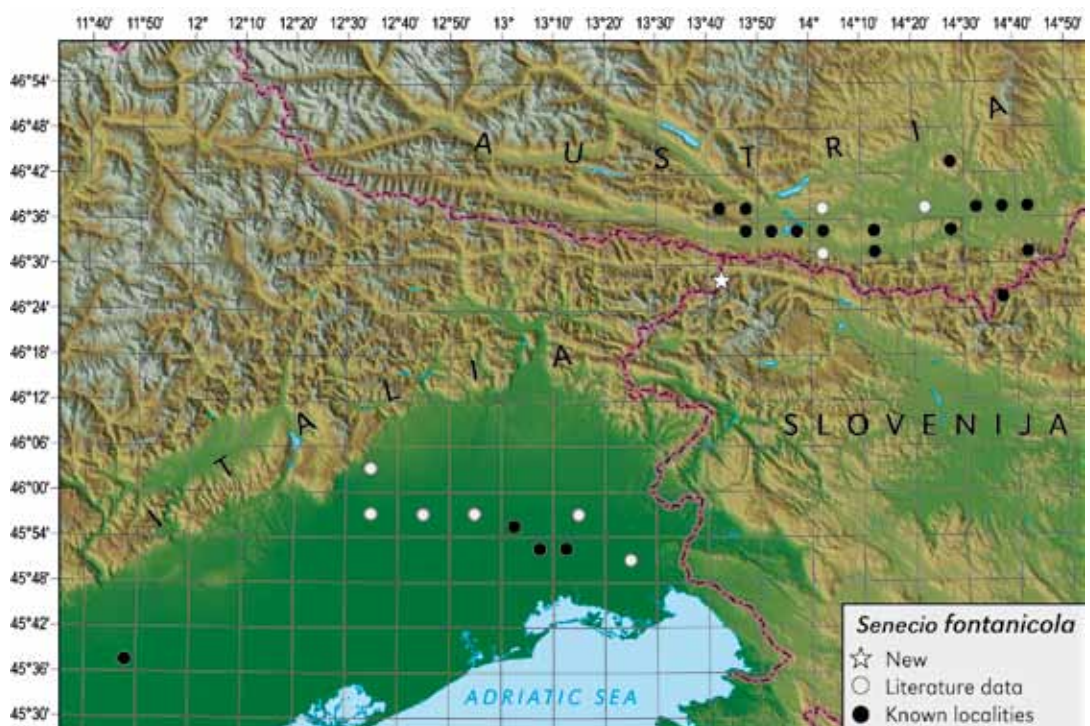


Figure 5. Distribution of *Senecio fontanicola* in the Eastern Alps. (Map source: JARVIS et al. 2008)

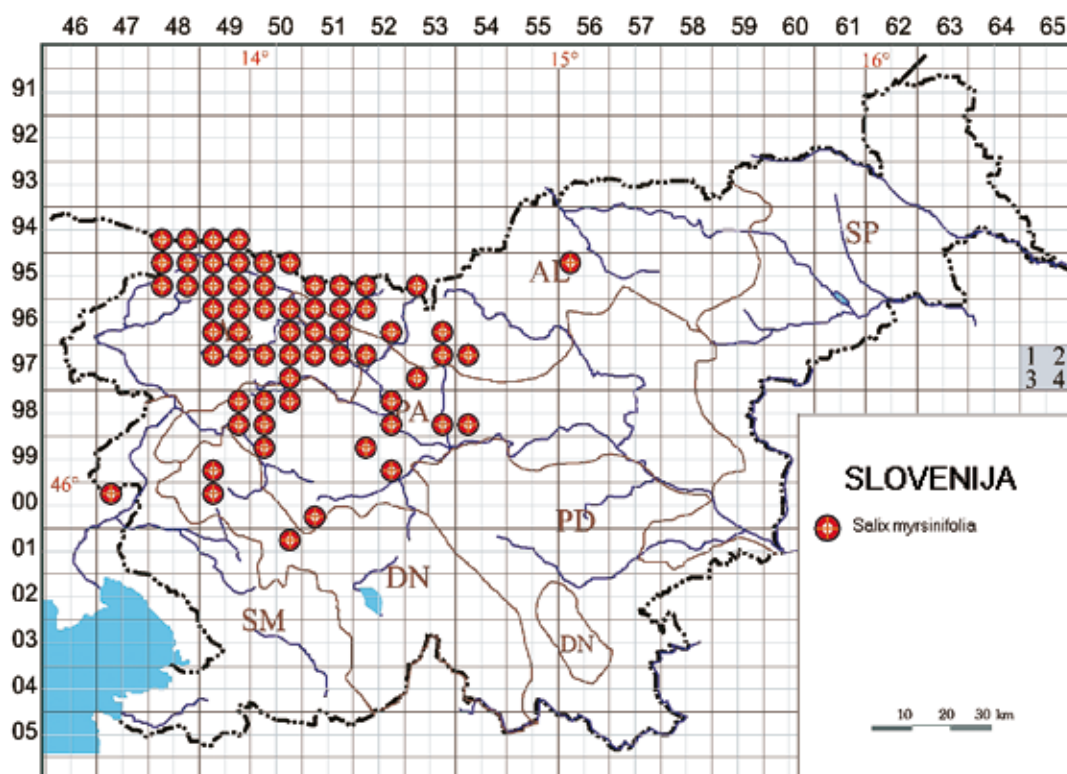


Figure 6. Distribution of *Salix myrsinifolia* in Slovenia.

A new association with dominant *Salix myrsinifolia* in the Southeastern Alps

On the edges of the site of *S. fontanicola* the stands of *Salix myrsinifolia* become more closed, forming a spatially clear and sufficiently extensive transitional belt (Appendix 1, relevés 5–9) between tall sedge communities on marshy soils and riparian stands of grey alder, European ash and spruce (*Aceri-Alnetum incanae* Berger 1922: Table 1 relevé 10). *Salix myrsinifolia* is a Euro-Siberian species distributed in the entire Alpine arc and characteristic for riparian willow stands of the class *Salicetea purpureae* Moor 1958 (AESCHIMANN et al. 2004a: 466). It is relatively rare in Slovenia and is most common in the northwestern part of the country (Fig. 6). In Austria it is classified as the character species of the alliance *Salicion eleagno-daphnoidis* (Moor 1958) Grass 1993; it is differential for mantle communities of moist forests, mainly grey alder stands or *Salici-Viburnetum opuli* Moor 1958. It also occurs in the communities of the alliance *Salicion pentandrae* Kerner 2007 prov., an alliance of willow shrubs on periodically flooded stream deposits in the altimontane and subalpine belt (WILLNER & GRABHERR 2007a, b). Poldini (in litt.) does not know pure stands of this species in Friuli Venezia Giulia; it grows in the montane form of the grey alder forest (*Aceri-Alnetum incanae*) and serves as a good differential species. MOOR (1958) described the *Salix myrsinifolia* mantle of grey alder stands (*Calamagrostio-Alnetum incanae* Moor 1958) as the association *Salicetum alpicolae* Moor 1958 (his relevés comprised the subspecies *Salix nigrescens* subsp. *alpicola* = *Salix myrsinifolia* subsp. *alpicola*). He classified this association into the alliance *Berberidion vulgaris* Br.-Bl. 1950, differentiated from a similar association *Salici-Viburnetum opuli* by the dominant *Salix myrsinifolia* and *Picea abies*, *Salix eleagnos*, *Frangula alnus* and *Calamagrostis varia*. The numerical comparison of our relevés 5–9

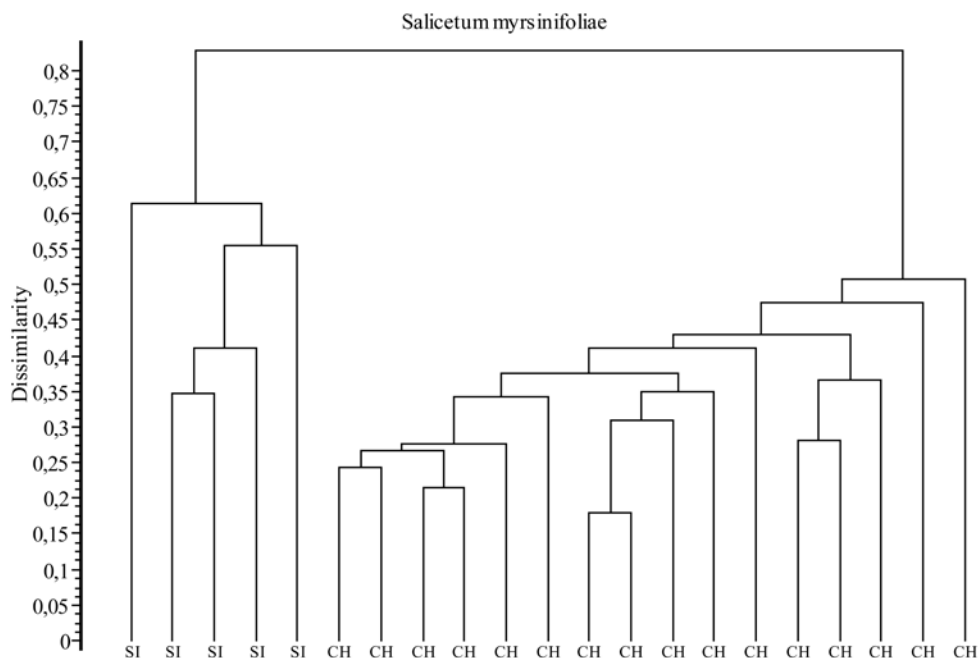
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Figure 7. Dendrogram of two communities with dominant *Salix myrsinifolia* from Slovenia and Switzerland (Moor 1958) – UPGMA, similarity ratio. CH – *Salicetum alpicolae* Moor 1958, SI – *Carici paniculatae-Salicetum myrsinifoliae* ass. nov. hoc loco.

(Appendix 1) with MOOR's Table 22 (1958; see column 11 in our Appendix 1) shows a low degree of floristic similarity; 32% according to SØRENSEN (1948). This can also be confirmed by the comparison of individual relevés (see Figs 7–8). Due to such low similarity, our stands with dominant *Salix myrsinifolia* cannot be classified into Moor's association *Salicetum alpicolae* and even not into the alliance *Berberidion*. Based on the determined successional sere in the decreasing soil moisture gradient from marsh communities with sedge through fringe shrubby willow stands towards riparian stands of grey alder, European ash and spruce, the stands of *Salix myrsinifolia* in Zelenci are classified into a new association *Carici paniculatae-Salicetum myrsinifoliae* Dakskobler in Vreš, Seliškar & Dakskobler ass. nov. hoc loco. Diagnostic species of the new association are *Salix myrsinifolia* as the dominant species, *Carex paniculata*, *Cardamine amara* and *Valeriana dioica*. Differential for the new association are therefore distinctly hygrophilous species of the class *Phragmito-Magnocaricetea* Klika in Klika & Novák 1941, order *Molinietalia caeruleae* W. Koch 1926, and even of the class *Montio-Cardaminetea* Br.-Bl. & R. Tx. ex Klika & Hadač 1944 (*Cardamine amara*). The listed species define the stands of the newly described association as a relatively long-term succession stage in the overgrowing of the spring mire and not merely as a grey alder mantle. The association *Carici paniculatae-Salicetum myrsinifoliae* is classified into the class *Salicetea purpureae* and into the alliance *Salicion eleagno-daphnoidis*. The nomenclatural type of the new association (*holotypus*) is relevé No. 7 in Appendix 1.

Conclusions

The new locality of *S. fontanicola* in the Zelenci nature reserve (Julian Alps, NW Slovenia) is remarkable because this Eastern Alpine endemic species is known so far only in southern Austria and northeastern Italy. This rare and endangered species thrives in a fringe spring area of an

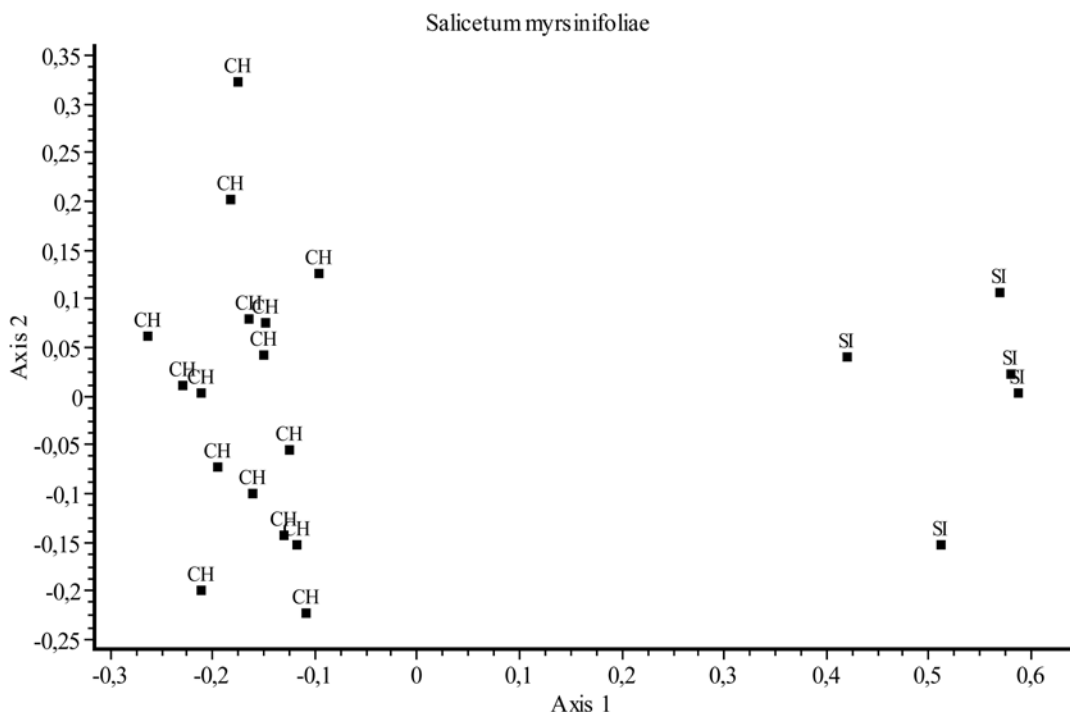


Figure 8. Two-dimensional scatter-diagram of two communities with dominant *Salix myrsinifolia* from Slovenia and Switzerland (Moor 1958) – PCoA, similarity ratio. CH – *Salicetum alpicolae* Moor 1958, SI – *Carici paniculatae-Salicetum myrsinifoliae* ass. nov. hoc loco.

extensive wetland in the stand of the association *Caricetum paniculatae*, which shows initial stages of an overgrowth by *Salix myrsinifolia*. On a relatively small surface (about 0.3 ha) we counted approximately 50 specimens of *S. fontanicola*. Due to a relatively small population on a narrowly limited area which is an extremely vulnerable habitat, we propose that the species should be included in the Red Data List of Vascular Plants in Slovenia as vulnerable (V). Fringe shrub communities of dark-leaved willow, typical of the Alps but rare, contain a number of hygrophilous species of the class *Phragmiti-Magnocaricetea* and the order *Molinietalia caeruleae*. They are a relatively long-term successional stage developing into a riparian grey alder, European ash and spruce stand (*Aceri-Alnetum incanae*) on the less moist fringes of the wetland. Considering that the studied stands are distinctly floristically different from the mantle community *Salicetum myrsinifoliae* Moor 1958 = *Salicetum alpicolae* Moor 1958 (alliance *Berberidion*) described in Switzerland, they are classified into the new association *Carici paniculatae-Salicetum myrsinifoliae* ass. nov. hoc loco (alliance *Salicion eleagno-daphnoidis*). Although the main purpose of the nature reserve Zelenci is to preserve the wetland and the fen Drni as much as possible (the overgrowth with dark-leaved willow on its southwestern fringes is a disturbing phenomenon), we believe that the community *Carici paniculatae-Salicetum myrsinifoliae* in Zelenci should nevertheless be preserved as an interesting successional stage and a habitat that is rare in Slovenia. For now, we classify it into habitat type 44.92: “Low woods and scrubs colonizing fens, marshy floodplains and fringes of lakes and ponds of the boreal zone of the Palaearctic dominated by large or medium sized shrubby willows” (JOGAN et al. 2004). We advise against thinning down these successional stages, at least in the described area of Zelenci.

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Appendix 1. Stands with *Senecio fontanicola* and *Salix myrsinifolia* in Zelenci (9548/1), the Julian Alps (NW Slovenia).

Number of relevé		1	2	3	4	5	6	7	8	9	10					11	
		241076	240967	239678	239680	239679	239834	239836	239838	239837	239835					Moor 1958	
Database number of relevé																	
Altitude in m		835	835	835	835	835	840	840	840	850	840						
Aspect		0	0	0	0	0	0	0	0	0	0						
Slope in degrees		0	0	0	0	0	0	0	0	0	0						
Parent material		Pr	Pr	Pr	Pr	Pr	Al	Al	Al	Al	Al						
Soil		Hy	Hy	Hy	Hy	Hy	Fl	Fl	Fl	Fl	Fl						
Cover of tree layer in %		E3	.	.	.	.	.	.	.	3	70						
Cover of shrub layer in %		E2	5	10	45	40	80	100	100	100	40						
Cover of herb layer in %		E1	98	98	95	90	30	90	60	80	70						
Cover of moss layer in %		E0	1	1	10	10	30	10	30	20	5						
Relevé area		m²	30	18	50	30	50	100	100	200	100	400					
Number of species			19	18	24	28	23	31	23	31	36	48					77
Date of taking relevé		7/4/2011	7/4/2011	7/4/2011	7/4/2011	7/4/2011	7/4/2011	7/4/2011	7/4/2011	7/4/2011	7/4/2011						
SP	<i>Salicetea purpureae</i>											Pr.	Fr.	Pr. (5-9)	Fr. (5-9)	Moor 1958	
	<i>Salix myrsinifolia</i>	E2	1	1	3	3	5	5	5	5	+	10	100	5	100	100	
	<i>Salix purpurea</i>	E2b	.	.	.	.	.	+	+	r	+	4	44	4	80	94	
	<i>Salix eleagnos</i>	E3	.	.	.	.	.	.	.	.	.	1	10	.	.	.	
	<i>Salix eleagnos</i>	E2b	.	.	.	.	.	.	.	r	.	2	20	1	20	81	
	<i>Salix fragilis</i>	E3	.	.	.	.	.	.	.	.	.	1	10	.	.	.	
	<i>Salix daphnoides</i>	E2	.	.	.	.	.	.	.	.	.	.	.	.	.	13	
	<i>Populus nigra</i>	E2	.	.	.	.	.	.	.	.	.	.	.	.	.	6	
PM	<i>Phragmiti-Magnocaricetea</i>																
	<i>Carex paniculata</i>	E1	5	3	4	3	2	+	+	+	+	9	90	5	100	.	
	<i>Phragmites australis</i>	E1	2	.	.	+	+	.	+	.	.	5	50	2	40	.	
	<i>Poa palustris</i>	E1	.	.	.	.	.	+	+	+	.	3	30	3	60	.	
	<i>Carex elata</i>	E1	.	.	.	.	.	+	+	.	.	2	20	2	40	.	
	<i>Galium palustre</i>	E1	.	.	.	.	.	.	+	.	.	1	10	1	20	.	
	<i>Typhoides arundinacea</i>	E1	.	.	.	.	.	.	.	+	.	1	10	1	20	.	
SCF	<i>Scheuchzerio-Caricetea fuscae</i>																
	<i>Senecio fontanicola</i>	E1	+	3	3	3	.	.	.	.	.	4	40	0	0	.	
	<i>Carex flava</i> s.str.	E1	+	.	+	.	.	+	.	.	.	3	30	1	20	.	
	<i>Carex davalliana</i>	E1	.	2	+	1	.	.	.	.	.	3	30	0	0	.	
	<i>Carex lepidocarpa</i>	E1	.	.	1	+	.	.	.	.	.	2	20	0	0	.	
	<i>Carex panicea</i>	E1	.	1	.	.	.	.	.	.	.	1	10	0	0	.	
	<i>Juncus alpino-articulatus</i>	E1	.	+	.	.	.	.	.	.	.	1	10	0	0	.	
	<i>Parnassia palustris</i>	E1	.	+	.	.	.	.	.	.	.	1	10	0	0	.	
MC	<i>Molinietalia caeruleae</i>																
	<i>Crepis paludosa</i>	E1	2	+	+	1	+	2	2	1	3	10	100	5	100	.	
	<i>Caltha palustris</i>	E1	1	+	1	1	2	3	2	2	+	9	90	5	100	.	
	<i>Cirsium oleraceum</i>	E1	2	2	3	3	1	.	2	2	2	9	90	4	80	25	
	<i>Equisetum palustre</i>	E1	1	+	1	+	+	1	.	1	.	8	80	3	60	.	
	<i>Angelica sylvestris</i>	E1	+	.	+	+	+	1	+	+	1	8	80	5	100	.	
	<i>Valeriana dioica</i>	E1	+	.	+	+	+	1	3	.	+	7	70	4	80	.	
	<i>Molinia caerulea</i> subsp. <i>caerulea</i>	E1	.	3	1	1	.	.	.	.	.	3	30	0	0	6	
	<i>Sanguisorba officinalis</i>	E1	.	+	.	+	.	.	.	.	+	3	30	1	20	.	
	<i>Thalictrum lucidum</i>	E1	+	.	.	+	.	.	.	.	.	2	20	0	0	.	
MA	<i>Molinio-Arrhenatheretea</i>																
	<i>Deschampsia cespitosa</i>	E1	+	+	.	+	.	1	+	+	1	8	80	4	80	13	
	<i>Festuca arundinacea</i>	E1	+	.	.	1	.	.	.	.	.	2	20	0	0	.	
	<i>Galium mollugo</i>	E1	.	.	.	.	.	+	.	.	+	2	20	2	40	13	
	<i>Centaurea jacea</i> s.lat.	E1	.	+	.	.	.	.	.	.	.	1	10	0	0	.	
	<i>Festuca rubra</i>	E1	.	.	+	.	.	.	.	.	.	1	10	0	0	.	
	<i>Phleum pratense</i>	E1	.	.	.	.	.	+	.	.	.	1	10	1	20	.	
	<i>Poa trivialis</i>	E1	.	.	.	.	.	.	.	+	.	1	10	1	20	.	
	<i>Prunella vulgaris</i>	E1	.	.	.	.	.	.	.	+	.	1	10	1	20	.	
	<i>Ranunculus acris</i>	E1	.	.	.	.	.	.	.	+	.	1	10	1	20	.	

The phytosociological position of *Senecio fontanicola* in NW Slovenia

Number of relevé		1	2	3	4	5	6	7	8	9	10	Pr.	Fr.	Pr. (5-9)	Fr. (5-9)	11
	<i>Pimpinella major</i>	E1	.	.	.	.	.	.	.	+	.	1	10	1	20	.
	<i>Astrantia major</i>	E1	.	.	.	.	.	.	.	+	.	1	10	1	20	.
	<i>Centaurea carniolica</i>	E1	.	.	.	.	.	.	.	.	+	1	10	.	.	.
	<i>Veronica chamaedrys</i>	E1	.	.	.	.	.	.	.	.	+	1	10	.	.	.
	<i>Dactylis glomerata</i>	E1	.	.	.	.	.	.	.	.	.	.	.	.	.	6
FC	Filipendulo-Convulvetea															
	<i>Mentha longifolia</i>	E1	.	.	.	.	+	.	+	.	.	2	20	2	40	.
	<i>Filipendula ulmaria</i>	E1	.	.	.	.	.	.	+	.	.	1	10	1	20	.
GU	Galio-Urticetea		.	.	.	.	.	.	.	.	.	.	.	.	.	.
	<i>Petasites hybridus</i>	E1	.	.	.	.	2	+	.	+	1	4	40	3	60	.
AV	<i>Aegopodium podagraria</i>	E1	.	.	.	.	.	.	.	+	+	2	20	1	20	13
MuA	Mulgedio-Aconitetea															
	<i>Veratrum album</i> subsp. <i>album</i>	E1	+	.	.	.	.	+	.	+	.	4	40	2	40	.
	<i>Geum rivale</i>	E1	.	.	.	.	.	+	.	.	.	1	10	1	20	.
	<i>Senecio ovatus</i>	E1	.	.	.	.	.	.	.	.	+	1	10	.	.	.
	<i>Thalictrum aquilegifolium</i>	E1	.	.	.	.	.	.	.	.	+	1	10	.	.	.
	<i>Salix appendiculata</i>	E2	.	.	.	.	.	.	.	.	.	.	.	.	.	6
ES	Elhno-Seslerietea															
	<i>Polygonum viviparum</i>	E1	+	+	+	+	.	.	.	.	.	4	40	0	0	.
AI	Alnion incanae															
	<i>Equisetum arvense</i>	E1	.	+	.	.	.	+	+	+	+	6	60	4	80	.
MCa	<i>Cardamine amara</i>	E1	.	.	.	.	+	+	1	2	.	4	40	4	80	.
	<i>Agropyron caninum</i>	E1	+	.	.	.	.	.	+	+	+	4	40	2	40	6
	<i>Alnus incana</i>	E3	.	.	.	.	.	+	.	r	3	3	30	2	40	50
	<i>Alnus incana</i>	E2	.	.	.	.	.	+	+	.	+	4	40	3	60	100
	<i>Alnus incana</i>	E1	.	.	.	.	.	+	.	.	.	1	10	1	20	.
	<i>Chaerophyllum hirsutum</i>	E1	.	.	.	.	3	1	3	.	1	4	40	3	60	.
	<i>Prunus padus</i>	E2	.	.	.	.	.	+	.	+	2	4	40	3	60	.
	<i>Solanum dulcamara</i>	E1	.	.	.	.	.	.	+	+	+	3	30	3	60	.
	<i>Viburnum opulus</i>	E2a	.	.	.	.	.	.	.	.	1	2	20	1	20	88
	<i>Chrysosplenium alternifolium</i>	E1	.	.	.	.	.	.	.	+	.	1	10	1	20	.
	<i>Listera ovata</i>	E1	.	.	.	.	.	.	.	.	+	1	10	1	20	.
	<i>Prunus padus</i>	E3	.	.	.	.	.	.	.	.	+	1	10	.	.	.
	<i>Rubus caesius</i>	E1	.	.	.	.	.	.	.	.	1	1	10	.	.	100
	<i>Frangula alnus</i>	E2	.	.	.	.	.	.	.	.	.	.	.	.	.	75
	<i>Humulus lupulus</i>	E1	.	.	.	.	.	.	.	.	.	.	.	.	.	19
	<i>Lysimachia nemorum</i>	E1	.	.	.	.	.	.	.	.	.	.	.	.	.	6
TA	Tilio-Acerion															
	<i>Geranium robertianum</i>	E1	.	.	.	.	.	.	.	+	.	2	20	1	20	6
	<i>Cardamine flexuosa</i>	E1	.	.	.	.	.	.	.	+	.	1	10	1	20	.
	<i>Acer pseudoplatanus</i>	E2	.	.	.	.	.	.	.	.	+	1	10	.	.	.
	<i>Acer pseudoplatanus</i>	E1	.	.	.	.	.	.	.	.	+	1	10	1	20	56
	<i>Ulmus scabra</i>	E2	.	.	.	.	.	.	.	.	.	.	.	.	.	13
	Aremonio-Fagion															
	<i>Anemone trifolia</i>	E1	.	.	.	.	.	.	.	.	+	1	10	1	20	.
	<i>Knautia drymeia</i>	E1	.	.	.	.	.	.	.	.	.	1	1	10	.	.
	<i>Helleborus niger</i>	E1	.	.	.	.	.	.	.	.	+	1	10	.	.	.
	<i>Lamium orvala</i>	E1	.	.	.	.	.	.	.	.	+	1	10	.	.	.
FS	Fagetalia sylvaticae															
	<i>Brachypodium sylvaticum</i>	E1	.	.	.	.	.	+	.	+	1	3	40	3	60	75
	<i>Paris quadrifolia</i>	E1	.	.	.	.	.	+	+	.	+	3	30	3	60	6
	<i>Carex sylvatica</i>	E1	.	.	.	.	.	+	.	.	+	2	20	1	20	.
	<i>Mycelis muralis</i>	E1	.	.	.	.	.	+	.	.	+	2	20	1	20	.
	<i>Fraxinus excelsior</i>	E1	.	.	.	.	.	.	.	.	2	1	10	.	.	.
	<i>Fraxinus excelsior</i>	E2	.	.	.	.	.	.	.	.	1	2	20	1	20	88
	<i>Melica nutans</i>	E1	.	.	.	.	.	.	.	.	+	2	20	1	20	38
	<i>Symphytum tuberosum</i>	E1	.	.	.	.	.	.	.	.	+	1	10	1	20	.
	<i>Viola reichenbachiana</i>	E1	.	.	.	.	.	.	.	.	+	1	10	.	.	13
	<i>Campanula trachelium</i>	E1	.	.	.	.	.	.	.	.	+	1	10	.	.	6
	<i>Daphne mezereum</i>	E1	.	.	.	.	.	.	.	.	+	1	10	.	.	6
	<i>Sambucus nigra</i>	E1	.	.	.	.	.	.	.	.	+	1	10	.	.	6
	<i>Fagus sylvatica</i>	E1	.	.	.	.	.	.	.	.	+	1	10	.	.	.
	<i>Petasites albus</i>	E1	.	.	.	.	.	.	.	.	+	1	10	.	.	.
	<i>Salvia glutinosa</i>	E1	.	.	.	.	.	.	.	.	+	1	10	.	.	.
	<i>Dryopteris filix-mas</i>	E1	.	.	.	.	.	.	.	.	+	1	10	.	.	.
	<i>Prunus avium</i>	E1	.	.	.	.	.	.	.	.	.	.	.	.	.	25
	<i>Galeobdolon flavidum</i>	E1	.	.	.	.	.	.	.	.	.	.	.	.	.	6

B. VREŠ, A. SELIŠKAR & I. DAKSKOBLER

Number of relevé		1	2	3	4	5	6	7	8	9	10	Pr.	Fr.	Pr. (5-9)	Fr. (5-9)	11	
QP	Quercetalia pubescentis																
	<i>Carex flacca</i>	E1	.	.	.	.	.	.	.	+	.	1	11	1	20	38	
	<i>Tammyus comunis</i>	E1	.	.	.	.	.	.	.	.	.	.	.	.	.	6	
	<i>Sorbus aria</i>	E2	.	.	.	.	.	.	.	.	.	.	.	.	.	19	
QF	Quercio-Fagetea																
	<i>Lonicera xylosteum</i>	E2a	.	.	.	.	+	+	+	+	1	5	50	4	80	88	
	<i>Corylus avellana</i>	E2	.	.	.	.	.	.	.	.	+	1	10	.	.	43	
	<i>Clematis vitalba</i>	E2	.	.	.	.	.	.	.	.	.	.	.	.	.	56	
	<i>Crataegus laevigata</i>	E2	.	.	.	.	.	.	.	.	.	.	.	.	.	19	
	<i>Populus tremula</i>	E2	.	.	.	.	.	.	.	.	.	.	.	.	.	13	
	<i>Quercus robur</i>	E2	.	.	.	.	.	.	.	.	.	.	.	.	.	6	
	<i>Hepatica nobilis</i>	E1	.	.	.	.	.	.	.	.	.	.	.	.	.	6	
VP	Vaccinio-Picetea																
	<i>Picea abies</i>	E3a	.	.	.	.	.	.	.	r	+	2	20	1	20	13	
	<i>Picea abies</i>	E2	1	.	1	1	1	+	+	.	+	2	90	4	80	94	
	<i>Melampyrum sylvaticum</i>	E1	.	.	.	.	.	+	.	.	+	2	20	2	40	.	
	<i>Aposeris foetida</i>	E1	.	.	.	.	.	.	.	.	+	2	20	1	20	.	
	<i>Veronica urticifolia</i>	E1	.	.	.	.	.	.	+	.	.	1	10	1	20	.	
	<i>Abies alba</i>	E1	.	.	.	.	.	.	.	.	.	.	.	.	.	6	
EP	Erico-Pinetea																
	<i>Calamagrostis varia</i>	E1	.	.	.	+	.	.	.	.	.	1	11	0	0	.	
	<i>Molinia caerulea</i> subsp. <i>arundinacea</i>	E1	.	.	.	.	.	.	.	.	+	1	11	1	20	.	
	<i>Rubus saxatilis</i>	E1	.	.	.	.	.	.	.	.	+	1	10	.	.	.	
	<i>Calamagrostis varia</i>	E1	.	.	.	.	.	.	.	.	.	.	.	.	.	44	
	<i>Carex alba</i>	E1	.	.	.	.	.	.	.	.	.	.	.	.	.	25	
RP	Rhamno-Prunetea																
	<i>Ligustrum vulgare</i>	E2	.	.	.	.	.	.	.	.	.	.	.	.	.	100	
	<i>Viburnum lantana</i>	E2	.	.	.	.	.	.	.	.	.	.	.	.	.	100	
	<i>Cornus sanguinea</i>	E2	.	.	.	.	.	.	.	.	.	.	.	.	.	94	
	<i>Crataegus monogyna</i>	E2	.	.	.	.	.	.	.	.	.	.	.	.	.	69	
	<i>Rhamnus catharticus</i>	E2	.	.	.	.	.	.	.	.	.	.	.	.	.	63	
	<i>Euonymus europaea</i>	E2	.	.	.	.	.	.	.	.	.	.	.	.	.	25	
	<i>Berberis vulgaris</i>	E2	.	.	.	.	.	.	.	.	.	.	.	.	.	19	
	<i>Rosa canina</i>	E2	.	.	.	.	.	.	.	.	.	.	.	.	.	13	
	<i>Prunus spinosa</i>	E2	.	.	.	.	.	.	.	.	.	.	.	.	.	13	
	<i>Rubus</i> sp.	E2	.	.	.	.	.	.	.	.	.	.	.	.	.	6	
O	Other species																
	<i>Potentilla erecta</i>	E1	.	.	.	+	.	.	.	.	.	1	10	0	0	.	
	<i>Fragaria vesca</i>	E1	.	.	.	.	.	.	.	.	+	1	10	.	.	.	
	<i>Stachys sylvatica</i>	E1	.	.	.	.	.	.	.	.	+	1	10	.	.	.	
	<i>Juniperus communis</i>	E2	.	.	.	.	.	.	.	.	.	.	.	.	.	25	
	<i>Sorbus aucuparia</i>	E2	.	.	.	.	.	.	.	.	.	.	.	.	.	13	
	<i>Tussilago farfara</i>	E1	.	.	.	.	.	.	.	.	.	.	.	.	.	6	
M	Mosses																
	<i>Mnium</i> sp.	E0	+	1	1	+	2	.	.	.	+	.	6	67	2	40	.
	<i>Plagiomnium undulatum</i>	E0	.	.	.	.	.	2	3	2	.	1	4	40	3	60	6
	<i>Calliergonella cuspidata</i>	E0	.	.	1	1	+	.	.	.	.	.	3	30	1	20	.
	<i>Plagiomnium elatum</i>	E0	.	.	+	+	+	.	.	.	.	.	3	30	1	20	.
	<i>Palustriella commutata</i>	E0	.	.	+	+	.	.	.	.	.	.	2	20	0	0	.
	<i>Cratoneuron filicinum</i>	E0	.	.	+	+	.	.	.	.	.	.	2	20	0	0	.
	<i>Drepanocladus cossonii</i>	E0	.	.	+	+	.	.	.	.	.	.	2	20	0	0	.
	<i>Calliergon cordifolium</i>	E0	.	.	.	1	1	.	.	.	.	.	2	20	1	20	.
	<i>Philonotis calcarea</i>	E0	.	.	1	.	.	.	.	.	.	.	1	10	0	0	.
	<i>Bryum</i> sp.	E0	.	.	+	.	.	.	.	.	.	.	1	10	0	0	.
	<i>Chiloscyphus pallescens</i>	E0	.	.	.	.	+	.	.	.	.	.	1	10	1	20	.
	<i>Climacium dendroides</i>	E0	.	.	.	.	+	.	.	.	.	.	1	10	1	20	.
	<i>Crenidium molluscum</i>	E0	.	.	.	.	+	.	.	.	.	.	1	10	1	20	.
	<i>Eurhynchium angustirete</i>	E0	.	.	.	.	+	.	.	.	.	.	1	10	1	20	.
	<i>Plagiomnium cuspidatum</i>	E0	.	.	.	.	+	.	.	.	.	.	1	10	1	20	.
	<i>Plagiomnium rostratum</i>	E0	.	.	.	.	+	.	.	.	.	.	1	10	1	20	.
	<i>Platyhypnidium riparioides</i>	E0	.	.	.	.	+	.	.	.	.	.	1	10	1	20	.
	<i>Sanionia uncinata</i>	E0	.	.	.	.	+	.	.	.	.	.	1	10	1	20	.

Pr - Proluvium

Al - Alluvium

Hy - Hydromorphic soil

Fl - Fluvisols

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