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A new pioneer community with the dominant *Aurinia petraea* on the rockfall screes in the southern Julian Alps (western Slovenia)

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Summary: Applying the standard Central European phytosociological method we studied the pioneer stands with the dominant *Aurinia petraea* in the submontane and lower montane belt of the southern Julian Alps and their foothills. These stands overgrow the newly developed calcareous screes on rockslide areas that resulted from the earthquakes between 1998 and 2004. They are classified into the new association *Arabido turritae-Aurinietum petraeae* ass. nova (alliance *Stipion calamagrostis*), which is treated as a stage in the primary succession sere: scree community – fringe communities of the alliance *Geranion sanguinei* – the coppice forest of hop hornbeam and other deciduous trees. It has been established that pioneer species on rockfall screes are above all those that can tolerate stress and other disturbances, and that can rapidly, with various adaptations (high seed production, short life span) move into new habitats. Similar communities with *Aurinia petraea* were determined also on Holocene screes above Modrej, which are also one of the proposed areas for the Natura 2000 network.

Keywords: primary succession, scree communities, *Aurinia petraea*, *Stipion calamagrostis*, *Arabido turritae-Aurinietum petraeae* ass. nova, phytosociology, ecological strategy types, Natura 2000

Aurinia petraea (syn. *Alyssum petraeum*) is a Southeast European montane species distributed in the Southeastern Alps (some parts of the Carnic and Julian Alps with their foothills), in the Dinaric and Balkan mountains, in Croatia, Bosnia and Herzegovina, Serbia, Macedonia and Bulgaria, in Greece (Epirus) and Romania (the south Carpathians) – see Nyárády (1955: 324–326), Thellung (1958: 280), Diklić (1972: 290–292), Černic (1977), Pignatti (1982: 425), Trinajstić (1983: 282), Aeschimann et al. (2004: 548). Akeroyd (1993: 370) mentions its distribution from northern Italy to Romania and northern Greece. On the Balkans, Hayek (1927, reprint 1975: 429) found *Alyssum petraeum* (= *Aurinia petraea*) in the Quarnero, Dalmatia, Bosnia and Herzegovina and Montenegro, and the variety *Alyssum petraeum* var. *edentulum* in Bosnia and Herzegovina (questionable), Serbia, Bulgaria and Macedonia. Diklić (1972: 292) mentions both varieties for Serbia – var. *petraeum* (eastern Serbia, the Djerdap gorge) and var. *edentulum*. Surina (in litt.) informed us about a probable thriving of *Alyssum petraeum* var. *edentulum* also in the Quarnero. A slightly similar taxon, *Alyssum medium* Host (= *Aurinia media* (Host) Trinajstić) – Hayek (ibid.), Černic (1977: 72), Trinajstić (1983: 284–285), D. Trpin (in litt.), E. Mayer (in litt.) – occurs in the northern part of the Dinaric mountains (e. g. in the Croatian coastal belt from Istria to the Pelješac peninsula, some of the islands).

The distribution of *Aurinia petraea* in the Southeastern Alps (Friuli and western Slovenia) was thoroughly studied by Černic (1977), whereas Mayer (1954: 26), Praprotnik (1988), Dakskobler (1994: 20, 1996 a, b, 2004) and Trpin & Praprotnik (1994) reported on certain localities. A distribution map of the species in Friuli was published by Poldini (1991: 179, 2002: 72), and Jogan et al. (2001: 58) published a map of its distribution in Slovenia. Supplemented

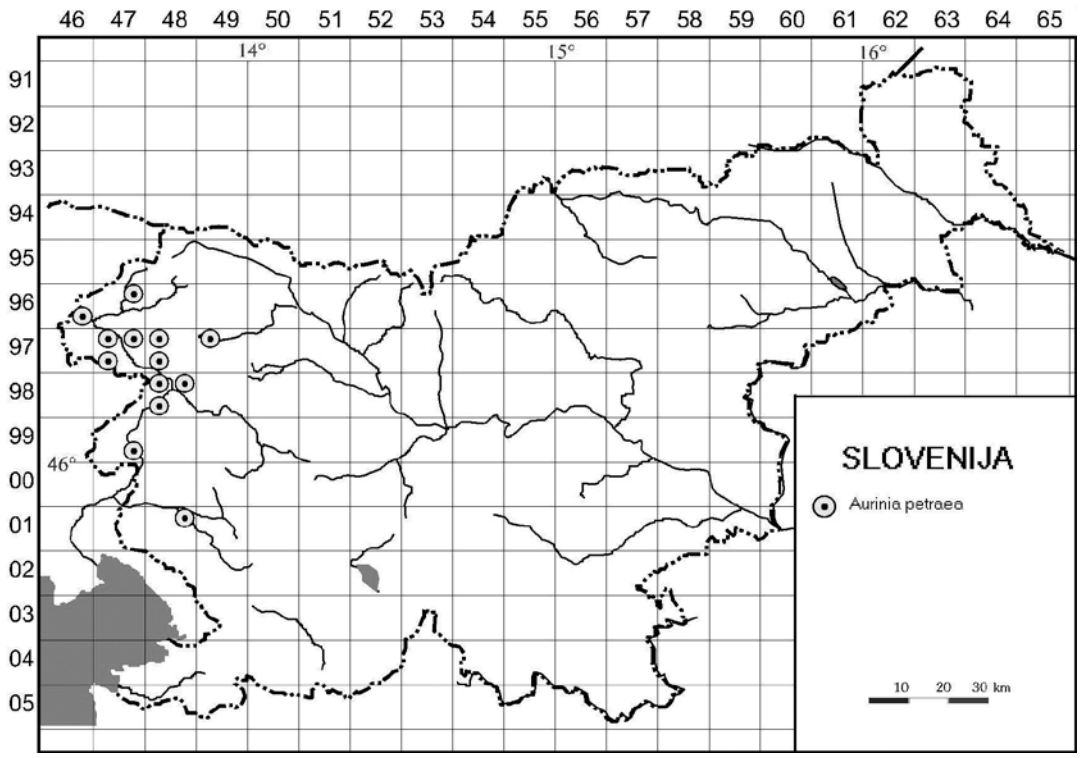

Figure 1: Distribution of *Aurinia petraea* in Slovenia.

with our more current information it is published in figure 1, with consideration of a probably secondary locality near Branik mentioned by Černic (1977: 75) and Wraber (1999: 384). We did not consider Fleischmann's data from 1788 for the Kamnik Alps (the vicinity of Tržič, the Kokra valley), which could not confirmed (Wraber 1999: 384; Trpin & Praprotnik 1994: 25).

Aurinia petraea is a species of rock crevices, screes, walls (Hayek 1927: 429, Diklić 1972: 292, Trinajstić 1983: 282; Pignatti 1982: 425; Wraber 1999: 384), stony pastures (Poldini 1991: 179), and pioneer communities on thermophilous, basiphilous sandy sites, i. e. the communities of the alliance *Alysso-Sedion albi* (see Aeschimann et al. 2004: 548).

According to the Database of phytocoenoses of Serbia (Lakušić et al. 2005, data arranged and provided by Dmitar Lakušić) *Alyssum petraeum* var. *edentulum* was recorded in the following syntaxa: *Syringetum timokense* Knapp 1944 (order *Quercetalia pubescentis*) – Knapp (1944), *Corylo colurnae-Pinetum nigrae* B. Jovanović 1951 (class *Erico-Pinetea*) – Mišić (1981), *Saturejo montanae-Achnatheretum calamagrostis* R. Jovanović & S. Jovanović 1986 (order *Drypetalia spinosae*, alliance *Peltarion alliaceae*) – Jovanović & Jovanović-Dunjić (1986) and *Centaureo derventanae-Seslerietum tenuifoliae* R. Jovanović & S. Jovanović 1986 (class *Asplenietea trichomanis*, order *Amphoricarpetalia*, alliance *Edraianthion jugoslavici*) – Jovanović & Jovanović-Dunjić (1986).

In Romania, the association *Alysso petraei-Sedetum hispanici* Schneider-Binder et al. 1971 was described and classified into this alliance and into the class *Sedo-Scleranthetea* (= *Koelerio-Corynephoretea*) (Schneider-Binder et al. 1971). It was recorded in the Danube gorge on tiny rubble, ledges and convexities in rockwalls.

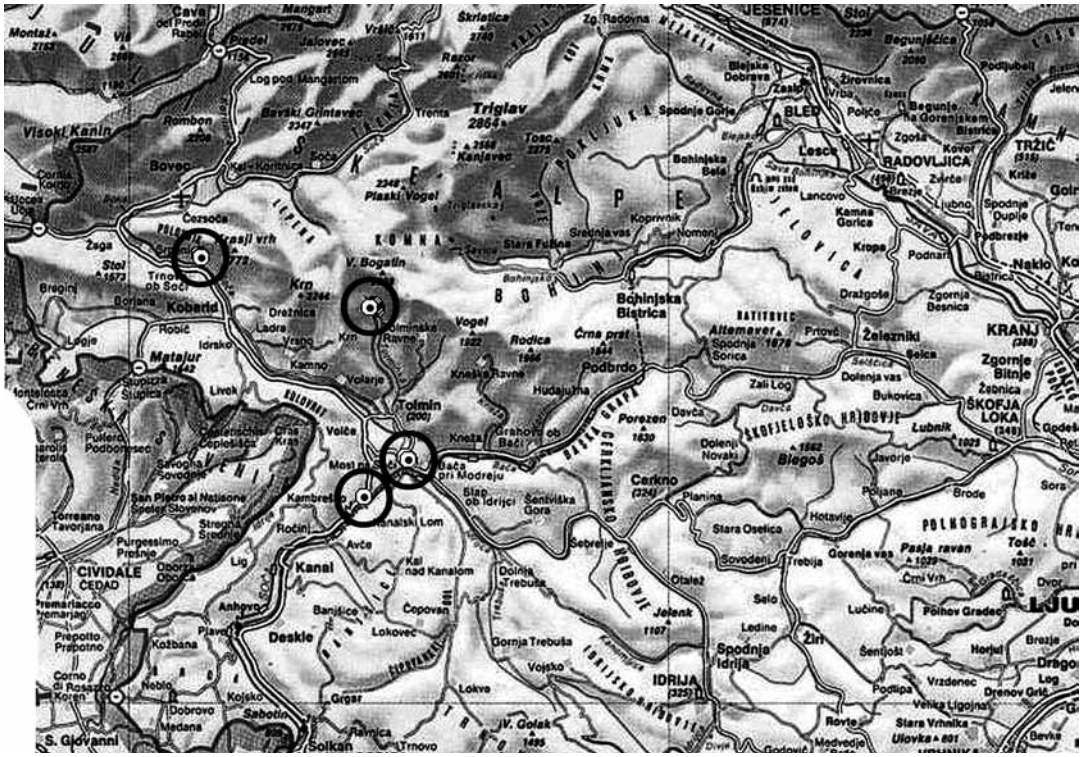

Figure 2: Stands with *Aurinia petraea* in the southern Julian Alps and their foothills (Source: Map of Slovenia 1:750 000, GURS).

In rock crevices, screes and on gravelly or sandy soil it was most frequently recorded in the Upper Soča Valley. In the last few years, its pioneer stands have been regularly spotted, mostly in Morizna (sunny slopes of the Polovnik ridge between Trnovo and Srpenica) and under Osojnica in the Tolminka valley, which are regions where major rockfalls occurred during two strong earthquakes on 12.4.1998 and 12.7.2004 (see, for example Ribičič & Vidrih 1998, and Vidrih 1998, 2004, 2005). Here, this species spread from rock crevices to partly still unstabilized, fresh gravel mixed with particles of organic matter and soil which covers the surfaces that were previously (before the rockfall) overgrown with a mixed forest of deciduous trees. Hop hornbeam stands (*Fraxino orni-Ostryetum* s. lat., incl. *Cytisantho-Ostryetum* and *Seslerio albicantis-Ostryetum*) prevailed on steep slopes where rocks had broken off (relevés 2–6 in tab. 3), and mixed stands of beech and hop hornbeam (*Ostryo-Fagetum*, *Lamio orvalae-Fagetum*) prevailed on old rock slides under the walls (relevés 7–10 in tab. 3). A mixed forest of hornbeam and hop hornbeam (*Asperulo-Carpinetum*) developed in some places at the bottom of gravelly slopes near Modrej (relevés 11–13 in tab. 3).

Materials and methods

Applying the standard Central European phytosociological method (Braun-Blanquet 1964) we made 21 relevés of pioneer stands with the dominant *Aurinia petraea* in the submontane belt of the southern Julian Alps and their foothills (fig. 2), and 13 relevés of hop hornbeam and beech stands in the immediate vicinity. Most relevés were made on rockfall (rockslide) areas below Morizna opposite Trnovo and below Osojnica in the Tolminka valley. Nine relevés (five at the

edge of the scree, four in the surrounding forest stands) were made on edges of screes below Senica (above Modrej near Most na Soči) and one relevé was made in the rockwalls on the right bank of the Soča between Podsela and Doblar (Loški poldan). The geological bedrock under Morizna, Osojnica and Senica is a Holocene hillside (limestone) scree, talus under Senica (with a considerable admixture of chert), and in Loški poldan Cretaceous limestone (Buser 1986, 1987). The submontane and lower montane belt of the southern Julian Alps with their foothills has a humid moderate continental climate with mean annual precipitation of over 2000 mm and a mean annual temperature of 8–9°C (Mekinda-Majaron 1995, Zupančič 1995, Ogrin 1996).

The collected relevés were entered into the FloVegSi database (Seliškar et al. 2003) and analysed with methods of hierarchical classification. We tested the following methods: '(Unweighted) average linkage method UPGMA', 'Incremental sum of squares, MISSQ' (Wishart's similarity ratio was applied in both), and 'Ordinal Clustering, OrdClAn', where we used Goodman-Kruskal's γ coefficient. In ordination we tested the principal coordinates analysis (PCoA) and Wishart's similarity ratio, as well as a non-metric ordination method: Non-metric Multidimensional Scaling (NMDS) and Goodman-Kruskal's γ coefficient. Combined cover-abundance values were transformed into the ordinal scale following van der Maarel (1979). We used the program package SYN-TAX 2000 (Podani 2001). Results of numerical methods were combined with the classic arrangement based on diagnostic species.

Phytosociological groups (= groups of diagnostic species) were formed according to our own criteria, but with consideration of numerous authors. Raunkiaer's life forms were adopted from Poldini (1991), who is the basis, together with 'Flora alpina' (Aeschimann et al. 2004), also in classification of the species into chorological groups. The recorded plants were classified also into ecological strategy types as defined by Grime (1974, 1979, quoted after Grime 2001, see also Batič 2001). This classification was done on the basis of our own findings and partly with the help of the German BIOLFLOR database (Klotz et al. 2002; Klotz & Kühn 2002).

The nomenclature source for the names of vascular plants is the Mala flora Slovenije (Martinčič et al. 1999), and Frahm & Frey (1992) and Martinčič (2003) for the names of mosses. Syntaxonomic units mentioned in the article and their authors are listed in the Appendix.

Results and discussion

Stands with *Aurinia petraea* on screes in the southern Julian Alps were arranged into a phytosociological table (tab. 1). Our main criterion, when arranging the relevés, were the results of hierarchical classification (figs. 3 and 4). The relevés are roughly united into two groups. The larger group (relevés 1–15) includes the stands on rockfall gravel in Morizna and below Osojnica, and the smaller group (relevés 16–21) the relevés on edges of screes above Modrej and the relevé from Loški poldan. We analysed the composition according to phytosociological groups (groups of diagnostic species); on the one hand together for all the relevés and on the other hand separately for these two groups of relevés (tab. 2).

The studied stands are dominated by the species of thermophilous forest edges (class *Trifolio-Geranietea*, alliance *Geranion sanguinei*), species of dry grasslands (class *Festuco-Brometea*) and scree species s. l. (class *Thlaspietea rotundifolii*). Such floristic composition and a relatively high number of species per relevé is unusual for scree communities (on average 26, standard deviation is 10 and coefficient of variation is 34%; following values in the first group are: average number

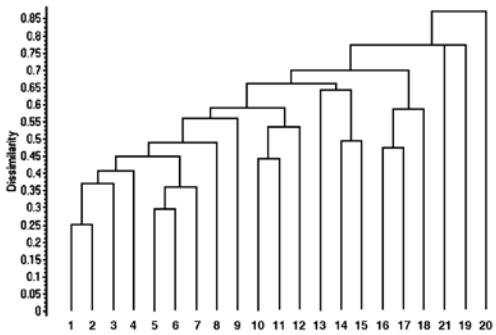

Figure 3: Dendrogram of the stands with *Aurinia petraea* in the Soča Valley (UPGMA, similarity ratio).

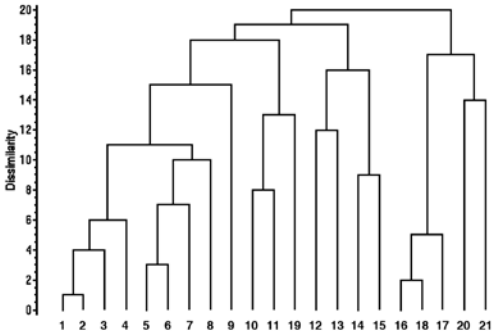

Figure 4: Dendrogram of the stands with *Aurinia petraea* in the Soča Valley (Ordinal Clustering, Goodman-Kruskal's γ).

of species per relevé is 30, standard deviation 6.6 and coefficient of variation 22%). Common species of forest edges and dry grasslands undoubtedly indicate the progress of overgrowth of these screes towards the vegetation growing here before the earthquake and the last rockfalls (the relevés of the first group) or is still growing in the immediate vicinity (indirectly presented in relevés 2–10 in tab. 3). The vegetation clearly shows that the screes in Morizna and below Osojnica are less than ten years old. There are also small particles of organic matter and soil in the gravel (due to the rockfall in the forest belt). Presence of organic matter is indicated for example by two nitrophilous species, *Lapsana communis* and *Urtica dioica*. The community with the dominant *Aurinia petraea* is therefore a succession stage and in several decades a hop hornbeam coppice forest is likely to develop here again. The first pioneers among the scrub and tree species on rockfalls below Osojnica are hop hornbeam, willows (*Salix caprea, S. appendiculata, S. eleagnos*), flowering ash (*Fraxinus ornus*), hazel (*Corylus avellana*), and traveller's joy (*Clematis vitalba*). The earthquake and rockfalls were an obvious disturbance in the mixed broad-leaved forest's habitat, which caused the destruction of individuals and destroyed a great deal of biomass. The way this vegetation adapted to such a change in less than ten years can be described partly with the analysis of Raunkiaer's life forms and the so called 'Grime's ecological strategy types'. These analyses were done for the pioneer stands with *Aurinia petraea* as well as for the surrounding stands of hop hornbeam and other deciduous trees that were spared by the rockfalls. Their results are presented in tables 4 and 5.

Table 1: *Arabido turritae-Aurinietum petraeae* ass. nova in the Julian Alps.

Number of relevé		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21		
Working number		212410	212408	212407	212409	212415	212413	212414	212412	212411	212406	212405	212401	212403	212404	212402	209530	209529	209528	209531	209533	212418		
Altitude in m		670	610	520	625	820	730	790	720	740	500	520	620	570	530	620	260	270	240	210	300	340		
Aspect		SE	S	0	SSW	SE	SE	SE	SE	SW	SW	SW	SW	SSW	S	SW	SW	SW	SW	SW	SW	S		
Slope in degrees		15	25	0	15	25	20	25	10	35	25	35	40	45	80	35	35	35	35	30	80	70		
Parent material		Gr	Gr	Gr	Gr	Gr	Gr	Gr	Gr	Gr	Gr	Gr	Gr	Gr	A	A	Gr	Gr	Gr	Gr	AR	A		
Soil		Li	Li	Li	Li	Li	Li	Li	Li	Li	Li	Li	Li	Li	Li	Li	Li	Li	Li	Li	Li	Li		
Stoniness in %		100	100	80	100	100	100	100	100	40	100	100	100	100	100	20	100	100	100	50	100	90		
Cover in %																								
Shrub layer	E2																		10			10		
Herb layer	E1	50	50	60	50	50	60	50	50	80	80	70	80	60	40	80	30	70	30	60	30	60		
Moss layer	E0																				20	5		
Relevé area	m^2	10	15	10	10	10	10	20	10	20	10	10	10	10	10	10	10	10	10	10	10	25		
Number of species		33	30	32	28	27	28	46	33	35	21	22	18	28	30	33	9	19	9	15	24	33		
Date of taking relevé		5/22/2006	5/22/2006	5/22/2006	5/22/2006	5/22/2006	5/22/2006	5/22/2006	5/22/2006	5/22/2006	5/12/2006	5/12/2006	5/12/2006	5/12/2006	5/12/2006	5/12/2006	4/18/2005	4/18/2005	4/18/2005	4/18/2005	4/18/2005	5/7/1992		
Locality		Osojnica	Osojnica	Osojnica	Osojnica	Osojnica	Osojnica	Osojnica	Osojnica	Osojnica	Morizna	Morizna	Morizna	Morizna	Morizna	Morizna	Robe above Modrej	Robe above Modrej	Robe above Modrej	Robe above Modrej	Robe above Modrej	Loški poldan		
Quadrant		9748/1	9748/1	9748/1	9748/1	9748/1	9748/1	9748/1	9748/1	9748/1	9747/1	9747/1	9747/1	9747/1	9747/1	9747/1	9848/2	9848/2	9848/2	9848/2	9848/2	9848/3		
Character and differential species of the association																							**Pr.**	**Fr.**	**Cl.**
TR	*Aurinia petraea*	E1	4	3	3	3	4	4	4	3	4	4	4	5	3	3	4	3	4	2	3	1	3	21	100	V
QP	*Arabis turrita*	E1	1	1	1	+	+	+	+	+	.	.	.	+	+	+	+	2	+	+	.	2	+	17	81	V
GU	*Geranium robertianum*	E1	1	+	2	+	.	+	+	r	.	1	+	+	.	.	.	1	1	+	.	.	.	13	62	IV
FB	*Ajuga genevensis*	E1	.	.	+	.	1	+	+	.	+	.	.	.	+	+	1	.	+	.	.	.	+	10	48	III

	Number of relevé (tab. 1)		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	**Pr.**	**Fr.**	**Cl.**
	Differential species of lower units																									
FB	*Stachys recta*	E1	+	+	+	.	+	1	+	+	+	+	+	.	+	.	+	.	.	.	.	.	.	12	57	III
EA	*Eupatorium cannabinum*	E1	+	+	+	.	1	1	1	+	1	1	+	.	.	+	.	.	.	.	.	.	.	11	52	III
F	*Campanula trachelium*	E1	r	.	+	+	+	+	+	+	+	+	+	.	+	.	.	.	.	.	.	.	.	11	52	III
ES	*Acinos alpinus*	E1	+	.	+	.	.	+	+	1	.	+	+	.	+	+	+	.	.	.	.	.	.	10	48	III
FB	*Scabiosa triandra*	E1	.	.	.	.	.	.	.	.	.	+	+	r	+	.	+	.	.	.	+	.	.	6	29	II
FB	*Medicago lupulina*	E1	.	.	.	.	.	.	.	.	.	1	+	+	.	+	+	.	.	.	.	.	.	5	24	II
SM	*Galium aparine*	E1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	+	.	.	.	3	14	I
FB	*Satureja montana* subsp. *variegata*	E1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	.	+	2	10	I
	Character species of the alliance *Stipion calamagrostis*																									
TR	*Scrophularia juratensis*	E1	1	2	1	1	2	2	2	.	.	.	.	.	.	.	.	.	1	2	.	.	.	9	43	III
TR	*Calamintha brauneana*	E1	.	.	.	.	.	.	+	.	.	.	+	.	.	.	+	.	.	.	.	+	.	4	19	I
TR	*Achnatherum calamagrostis*	E1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	1	5	I
TG	*Vincetoxicum hirundinaria*	E1	.	.	.	.	.	.	.	.	.	.	.	.	+	+	+	.	.	.	.	.	+	4	19	I
	Differential species of the alliance *Stipion calamagrostis*																									
TG	*Origanum vulgare*	E1	1	+	+	+	+	+	1	1	+	.	1	1	1	.	+	+	.	.	+	.	.	15	71	IV
FB	*Galium lucidum*	E1	r	+	.	+	r	+	r	+	.	+	1	.	.	+	+	.	.	.	.	.	.	11	52	III
KC	*Sedum album*	E1	+	.	+	.	.	.	r	.	.	.	.	.	.	.	.	1	1	.	.	+	.	6	29	II
TR	***Thlaspietea rotundifolii* s. lat.**																									
	Cerastium subtriflorum	E1	+	1	1	1	.	.	+	+	r	.	.	+	.	.	.	.	.	.	.	.	.	8	38	II
	Hesperis candida	E1	+	+	+	.	+	.	.	+	.	.	+	.	.	.	.	.	.	.	.	.	.	6	29	II
	Petasites paradoxus	E1	+	+	+	r	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5	24	II
	Arabis alpina	E1	r	+	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4	19	I
	Iris pallida subsp. *cengialti*	E1	.	.	.	.	.	.	.	.	.	.	+	.	.	+	+	.	.	.	.	.	.	3	14	I
	Medicago pironae	E1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	+	2	10	I
	Hieracium glaucum	E1	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	5	I
	Seseli gouanii	E1	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	1	5	I
	Viola pyrenaica	E1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	1	5	I
	Cardaminopsis arenosa	E1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	1	5	I
	Silene vulgaris subsp. *glareosa*	E1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	1	5	I

	Number of relevé (tab. 1)		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	**Pr.**	**Fr.**	**Cl.**
TG	***Trifolio-Geranietea***																									
	Verbascum lychnitis	E1	1	+	+	+	.	+	1	1	r	1	1	1	1	.	1	.	.	.	.	.	+	14	67	IV
	Hypericum perforatum	E1	.	.	+	r	r	+	+	+	+	+	.	.	.	+	.	.	.	.	+	+	.	11	52	III
	Silene nutans	E1	r	.	.	.	+	+	+	+	+	.	.	+	+	+	+	.	.	.	.	.	+	11	52	III
	Achillea distans	E1	+	+	+	+	+	1	1	+	+	.	.	.	.	+	.	.	.	.	.	.	.	10	48	III
	Libanotis sibirica subsp. *montana*	E1	.	.	+	.	r	+	+	1	+	.	.	.	.	+	.	.	.	.	.	.	.	7	33	II
	Valeriana collina	E1	.	.	.	+	.	.	.	+	.	.	+	.	+	+	.	.	.	.	.	.	.	5	24	II
	Thalictrum minus	E1	.	.	.	.	.	.	r	.	.	.	.	.	.	.	+	.	.	.	.	.	.	2	10	I
	Digitalis grandiflora	E1	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	+	.	2	10	I
	Clinopodium vulgare	E1	.	.	.	.	.	.	.	.	.	+	.	.	.	+	.	.	.	.	.	.	.	2	10	I
	Verbascum alpinum	E1	.	.	.	.	.	.	.	.	+	.	.	+	.	.	.	.	.	.	.	.	.	2	10	I
	Inula conyza	E1	.	.	.	.	.	.	.	.	.	.	.	.	.	+	r	.	.	.	.	.	.	2	10	I
	Laserpitium latifolium	E1	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	5	I
	Viola hirta	E1	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	1	5	I
	Polygonatum odoratum	E1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	1	5	I
	Anthericum ramosum	E1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	1	5	I
	Lilium carniolicum	E1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	1	5	I
FB	***Festuco-Brometea***																									
	Buphthalmum salicifolium	E1	+	.	+	+	+	+	+	+	+	+	.	.	+	.	.	.	.	.	+	.	.	11	52	III
	Bromus erectus s. lat.	E1	+	+	.	.	r	.	.	.	1	+	+	.	.	1	1	.	.	.	2	.	+	10	48	III
	Euphorbia cyparissias	E1	.	+	.	.	.	.	+	.	.	.	.	.	.	.	+	.	.	.	+	.	.	4	19	I
	Carex humilis	E1	.	.	.	.	.	.	.	.	.	.	.	+	+	.	+	.	.	.	.	.	.	3	14	I
	Centaurea triumfettii	E1	.	.	.	.	.	.	.	.	+	.	.	.	.	1	+	.	.	.	.	.	.	3	14	I
	Peucedanum oreoselinum	E1	.	.	.	.	.	.	.	.	.	.	.	.	+	+	+	.	.	.	.	.	.	3	14	I
	Teucrium chamaedrys	E1	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	+	3	14	I
	Allium carinatum	E1	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	5	I
	Anthyllis vulneraria	E1	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	1	5	I
	Arabis hirsuta	E1	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	5	I
	Crepis slovenica	E1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	1	5	I
	Dianthus monspessulanus	E1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	1	5	I
	Genista tinctoria	E1	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	1	5	I
	Helianthemum ovatum	E1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	1	5	I
	Sanguisorba minor	E1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	1	5	I
ES	***Elyno-Seslerietea***																									
	Cerastium strictum	E1	.	.	.	.	.	.	+	1	+	.	.	.	.	1	+	.	.	.	.	.	.	5	24	II

	Number of relevé (tab. 1)		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	**Pr.**	**Fr.**	**Cl.**
	Festuca calva	E1	.	.	.	+	.	r	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.	4	19	I
	Sesleria caerulea subsp. *calcaria*	E1	.	.	.	.	.	.	.	.	.	.	.	.	.	1	+	.	.	.	.	.	1	3	14	I
	Carduus crassifolius	E1	.	.	+	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	2	10	I
	Betonica alopecuros	E1	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	5	I
	Centaurea haynaldi subsp. *julica*	E1	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	5	I
AT	***Asplenietea trichomanis***																									
	Kernera saxatilis	E1	1	+	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4	19	I
	Athamanta turbith	E1	.	.	.	.	.	r	.	.	r	.	.	.	.	.	.	.	.	.	.	.	+	1	4	19	I
	Ceterach javorkeanum	E1	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.	.	+	.	.	+	+	4	19	I
	Silene hayekiana	E1	+	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	3	14	I
	Moehringia muscosa	E1	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	2	10	I
	Asplenium ruta-muraria	E1	.	.	.	.	r	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	2	10	I
	Sedum hispanicum	E1	.	.	.	.	.	.	+	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	2	10	I
	Campanula carnica	E1	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	+	2	10	I
	Asplenium trichomanes	E1	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	2	.	2	10	I
	Sedum maximum	E1	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	1	2	10	I
	Saxifraga petraea	E1	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	5	I
	Campanula spicata	E1	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	1	5	I
	Campanula pyramidalis	E1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	1	5	I
	Sempervivum tectorum	E1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	1	5	I
	Micromeria thymifolia	E1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	1	5	I
KC	***Koelerio-Corynephoretea***																									
	Lactuca perennis	E1	.	.	.	.	.	.	.	.	.	.	.	.	.	+	1	.	.	.	.	.	1	3	14	I
	Sedum acre	E1	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	1	5	I
	Sedum sexangulare	E1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	1	5	I
	Echium vulgare	E1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	1	5	I
GU	***Galio-Urticetea***																									
	Lapsana communis	E1	.	.	+	+	.	.	.	+	+	.	+	.	.	.	+	.	+	.	.	.	.	7	33	II
	Urtica dioica	E1	.	.	+	.	+	.	+	+	1	+	.	+	.	.	.	.	.	.	.	.	.	7	33	II
	Torilis japonica	E1	r	+	.	.	+	.	+	r	.	+	.	.	.	.	.	.	.	.	.	.	.	6	29	II
	Tussilago farfara	E1	.	+	.	r	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	14	I
	Lamium maculatum	E1	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	+	.	.	+	3	14	I
	Calystegia sepium	E1	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	2	10	I
EA	***Epilobietea angustifolii* s. lat.**																									
	Galeopsis speciosa	E1	+	.	+	+	.	+	+	+	.	+	.	1	.	.	+	.	.	.	.	.	.	9	43	III

	Number of relevé (tab. 1)		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	**Pr.**	**Fr.**	**Cl.**
	Silene dioica	E1	+	+	+	.	.	.	.	+	+	.	.	1	+	.	+	.	.	.	.	.	.	8	38	II
	Carex muricata	E1	.	.	.	.	.	.	r	.	+	.	.	.	.	.	.	.	.	.	.	.	+	3	14	I
	Solanum dulcamara	E1	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	5	I
	Salix caprea	E1	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	5	I
	Fragaria vesca	E1	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	1	5	I
MA	***Molinio-Arrhenatheretea***																									
	Dactylis glomerata	E1	1	+	1	1	+	1	1	.	2	.	.	.	.	.	.	.	.	.	.	.	.	8	38	II
	Veronica chamaedrys	E1	.	.	.	.	+	r	+	+	1	.	.	.	.	.	.	.	+	.	.	.	.	6	29	II
	Centaurea jacea	E1	.	+	.	.	.	.	.	+	+	.	.	.	+	.	.	.	.	.	.	.	.	4	19	I
	Taraxacum officinale	E1	.	.	.	.	.	.	r	r	.	.	.	+	1	.	.	.	.	.	.	.	.	4	19	I
	Angelica sylvestris	E1	+	+	.	.	.	.	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.	4	19	I
	Lathyrus pratensis	E1	.	.	.	.	.	.	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.	2	10	I
	Lotus corniculatus	E1	.	.	.	.	.	.	.	.	+	.	+	.	.	.	.	.	.	.	.	.	.	2	10	I
	Galium mollugo	E1	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	5	I
SM	***Stellarietea mediae***																									
	Cardamine hirsuta	E1	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	1	+	.	.	.	.	3	14	I
	Myosoton aquaticum	E1	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	5	I
	Senecio vulgaris	E1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	1	5	I
	Sonchus oleraceus	E1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	1	5	I
	Veronica hederifolia	E1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	1	5	I
QP	***Quercetalia pubescentis***																									
	Ostrya carpinifolia	E1	+	+	.	1	+	.	.	+	.	+	.	.	.	.	.	.	.	.	.	.	.	6	29	II
	Fraxinus ornus	E1	.	.	.	r	.	.	.	.	.	.	.	.	+	.	+	.	.	.	.	+	.	4	19	I
	Peucedanum schottii	E1	.	.	.	.	r	.	r	.	.	.	.	.	.	.	+	.	.	.	.	.	.	3	14	I
	Melittis melissophyllum	E1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	2	10	I
	Hypericum montanum	E1	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	1	5	I
	Campanula persicifolia	E1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	1	5	I
F	***Fagetalia sylvaticae***																									
	Senecio fuchsii	E1	+	r	.	r	+	.	+	r	+	.	.	.	.	.	.	.	.	.	.	.	.	7	33	II
	Mycelis muralis	E1	+	+	+	.	+	.	+	.	.	.	.	.	.	.	.	+	.	.	.	.	.	6	29	II
	Myosotis sylvatica	E1	+	+	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	4	19	I
	Brachypodium sylvaticum	E1	.	+	.	.	.	.	.	+	.	.	.	.	+	.	.	.	.	.	.	.	.	3	14	I
	Cyclamen purpurascens	E1	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	+	.	.	.	.	.	2	10	I
	Lamium orvala	E1	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	r	.	2	10	I
	Galeobdolon flavidum	E1	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	1	5	I

	Number of relevé (tab. 1)		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	**Pr.**	**Fr.**	**Cl.**
	Cardamine impatiens	E1	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	1	5	I
	Helleborus niger	E1	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	1	5	I
	Salvia glutinosa	E1	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	1	5	I
	Euphorbia amygdaloides	E1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	1	5	I
QF	***Querco-Fagetea***																									
	Clematis vitalba	E1	+	+	+	+	.	.	+	+	.	.	+	.	.	.	.	.	.	r	.	+	.	9	43	III
	Carex digitata	E1	.	.	.	.	.	r	.	.	.	.	+	.	.	.	.	.	.	.	+	.	.	3	14	I
	Festuca heterophylla	E1	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	10	I
	Hedera helix	E1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	+	.	2	10	I
	Vinca minor	E1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	+	.	2	10	I
	Hieracium racemosum	E1	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	5	I
	Dactylis polygama	E1	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	1	5	I
	Rubus caesius	E1	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	1	5	I
RP	***Rhamno-Prunetea***																									
	Prunus mahaleb	E2a	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	+	2	10	I
	Ligustrum vulgare	E1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	1	5	I
	Rhamnus catharticus	E2a	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	1	5	I
	Rhamnus saxatilis	E2a	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	1	5	I
	Rosa canina	E2a	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	1	5	I
EP	***Erico-Pinetea***																									
	Calamagrostis varia	E1	.	.	.	.	.	.	r	.	.	.	.	.	.	1	.	.	.	.	.	+	.	3	14	I
	Genista radiata	E1	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	5	I
	Carex alba	E1	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	1	5	I
	Aquilegia nigricans	E1	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	1	5	I
	Aster amellus	E1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	1	5	I
ML	**Mosses and lichens**																									
	Schistidium apocarpum	E0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	1	2	10	I
	Anomodon viticulosus	E0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	1	5	I
	Camptothecium lutescens	E0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	1	5	I
	Homalothecium sericeum	E0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	1	5	I
	Isothecium alopecuroides	E0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	1	5	I
	Dermatocarpon miniatum	E0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	1	5	I
	Porella platyphylla	E0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	1	5	I

Table 2: Groups of diagnostic species in the stands with *Aurinia petraea* in the Soča Valley.

Phytosociological groups	I	II	Total
Thlaspietea rotundifolii	**12**	**13**	**12**
Trifolio-Geranietea	**18**	9.2	**17**
Festuco-Brometea	**17**	**13**	**16**
Asplenietea trichomanis	4.3	12	5.8
Koelerio-Corynephoretea	1.4	5.5	2.2
Elyno-Seslerietea	5.6	0.9	4.7
Epilobietea angustifolii s. lat.	7.4	0.9	6.1
Galio-Urticetea	7.9	5.5	7.4
Molinio-Arrhenatheretea	6.8	0.9	5.6
Stellarietea mediae	0.5	7.3	1.8
Quercetalia pubescentis	5.6	8.3	6.1
Fagetalia sylvaticae	8.1	3.7	7.2
Querco-Fagetea	3.2	6.4	3.8
Rhamno-Prunetea	0	5.5	1.1
Erico-Pinetea	1.4	0.9	1.3
Mosses and lichens	0	7.3	1.4
Total	100	100	100

The results of these comparisons show that – compared to the surrounding forest stands – the pioneer stands on screes comprise a lot more perennial (hemicryptophytes) and annual plants (therophytes), about the same amount of chamaephytes (dwarf shrubs) and fewer geophytes and phanerophytes (trees and shrubs). In pioneer stands on screes there are more biennial plants and stalked hemicryptophytes (H scap) among hemicryptophytes in proportion to the surrounding forest stands.

Compared to the surrounding forest stands there are a bit more species that can be characterised as intermediate type (csr) – most often they are relatively low, short-lived rosette perennials (H ros) – there are also more ruderal species that tolerate disturbances and stress tolerant species among ecological strategy types in the pioneer stands. In comparison with the pioneer stands, on the other hand, there are a lot more competitors in the surrounding forest stands (i. e. the species that can most effectively use sources available in a given situation – light, water, nutrients), but there are fewer of the other two main ecological strategy types (s, r) and (in most cases) also transitional forms. Pioneers on fresh gravel are therefore species that, at least most of them, tolerate stress and disturbances and that have the ability to adapt rapidly to new sites (habitats) after the rockfalls (e. g. high seed production, short life span). One of such taxa is undoubtedly also the biennial species *Aurinia petraea*. In its first year it develops the vegetative organs and the rosette; provided that the rosette is strong it blossoms and fructifies abundantly the next year (E. Mayer, pers. com.). According to our findings, this species is both, ruderal (adapted to disturbances) – which is the reason why it often grows on secondary sites – and stress tolerant (as it can grow in rock crevices). To a certain degree it is also a competitor, as it can effectively use the sources available in the given conditions.

Table 3: *Ostrya carpinifolia* and other decidous trees communities on rockfall areas in Morizna and under Osojnica and on the screes above Modrej.

Number of relevé		1	2	3	4	5	6	7	8	9	10	11	12	13		
Working number		212494	212383	212385	212387	212384	212386	212417	212497	212498	212499	212493	212495	212496		
Altitude in m		240	490	620	610	590	660	850	550	610	620	220	290	300		
Aspect		SW	SSE	SW	SW	SW	SE	SE	SE	SE	S	W	SW	SW		
Slope in degrees		30	45	45	45	30	35	30	30	35	35	10	35	35		
Parent material		Gr	A	A	A	Gr	A	A	Gr	Gr	A	Gr	Gr	Gr		
Soil		Li	R	R	R	R	R	R	R	R	R	R	R	R		
Stoniness in %		40	60	30	50	20	30	40	50	50	30	20	40	50		
Cover in %																
Upper tree layer	E3b	60	70	80	60	90	70	90	80	80	80	90	70	70		
Lower tree layer	E3a						20	10	10	10	10	10	20	30		
Shrub layer	E2	50	40	30	50	40	30	20	30	30	30	30	60	30		
Herb layer	E1	40	60	70	70	70	70	70	50	70	70	80	70	70		
Moss layer	E0	10	10	10	5	10	10	10	20	15	10	5	10	10		
Maximum diameter	cm	8	8	10	8	17	16	25	20	18	20	22	20	18		
Maximum height	m	20	20	25	20	30	25	60	45	40	40	35	30	30		
Relevé area	m^2	100	200	400	200	400	200	400	400	400	200	200	200	400		
Number of species		63	77	89	54	87	68	74	91	88	75	63	52	55		
Date of taking relevé		4/18/2005	5/12/2006	5/12/2006	5/12/2006	5/12/2006	5/12/2006	5/22/2006	5/28/1998	5/28/1998	5/28/1998	4/18/2005	4/18/2005	4/18/2005		
Locality		Modrej	Morizna	Morizna	Morizna	Morizna	Morizna	Osojnica	Osojnica	Osojnica	Osojnica	Modrej	Modrej	Modrej		
Quadrant		9848/2	9747/1	9747/1	9747/1	9747/1	9747/1	9748/1	9748/1	9748/1	9748/1	9848/2	9848/2	9848/2		
															Pr.	Fr.
Carpinion orientalis																
Ostrya carpinifolia	E3b	3	3	4	3	4	3	1	3	2	2	1	1	1	13	100
Ostrya carpinifolia	E3a	.	.	.	.	.	.	+	.	1	.	.	.	.	2	15
Ostrya carpinifolia	E2b	1	.	.	+	.	.	.	.	.	.	.	+	.	3	23
Ostrya carpinifolia	E2a	.	+	.	.	.	.	.	.	.	.	.	.	.	1	8
Mercurialis ovata	E1	1	.	.	.	.	.	.	.	.	.	+	+	.	3	23
Coronilla emerus subsp. *emeroides*	E2a	.	1	1	1	.	.	.	.	.	.	.	.	.	3	23
Frangula rupestris	E2a	.	.	.	1	.	.	.	.	.	.	.	.	.	1	8
Frangula rupestris	E1	.	.	.	+	.	.	.	.	.	.	.	.	.	1	8
Sesleria autumnalis	E1	.	.	.	.	.	.	.	+	.	.	.	.	.	1	8
Quercetalia pubescentis																
Arabis turrita	E1	2	1	1	.	1	1	+	1	1	.	+	1	.	10	77
Cornus mas	E2b	.	2	1	+	2	1	.	.	.	.	+	+	1	8	62
Cornus mas	E2a	+	+	.	.	.	+	.	.	.	.	+	.	.	4	31
Fraxinus ornus	E3b	2	3	2	2	2	2	.	+	.	.	.	.	.	7	54
Fraxinus ornus	E3a	.	.	1	.	1	1	.	1	1	1	.	1	2	8	62
Fraxinus ornus	E2b	1	1	1	1	1	.	.	+	+	.	.	.	.	7	54
Fraxinus ornus	E2a	.	2	2	1	3	1	.	1	.	.	.	.	.	6	46
Fraxinus ornus	E1	.	.	1	.	.	+	+	.	.	.	.	.	.	3	23

Number of relevé (tab. 3)		1	2	3	4	5	6	7	8	9	10	11	12	13	Pr.	Fr.
Euonymus verrucosa	E2a	1	.	+	+	+	1	.	.	.	+	.	.	.	6	46
Sorbus aria	E3b	.	.	1	.	.	1	r	r	+	+	.	.	.	6	46
Sorbus aria	E3a	.	.	+	.	+	.	.	+	+	+	.	.	.	5	38
Sorbus aria	E2b	.	.	.	+	+	+	+	.	+	+	.	.	.	6	46
Sorbus aria	E2a	.	+	.	.	+	.	.	.	.	+	.	.	.	3	23
Sorbus aria	E1	.	.	+	.	+	.	.	.	.	.	.	.	.	2	15
Tamus communis	E1	.	+	.	+	+	+	.	.	.	.	.	+	+	6	46
Campanula persicifolia	E1	.	+	+	.	1	.	.	.	.	.	.	.	+	4	31
Betonica officinalis	E1	.	.	.	.	.	.	.	+	+	1	.	.	.	3	23
Clematis recta	E1	.	+	.	+	.	.	.	.	.	+	.	.	.	3	23
Convallaria majalis	E1	.	.	+	.	.	+	.	.	.	+	.	.	.	3	23
Hypericum montanum	E1	.	.	+	.	.	.	.	.	+	+	.	.	.	3	23
Ruscus aculeatus	E2a	.	.	.	.	.	.	.	.	.	.	+	4	3	3	23
Peucedanum schottii	E1	.	+	.	.	+	.	.	.	.	.	.	.	.	2	15
Quercus cerris	E3b	.	.	.	.	.	.	.	.	.	.	1	r	.	2	15
Orchis signifera	E1	.	.	.	.	.	.	.	.	.	+	.	.	.	1	8
Quercus pubescens	E1	.	.	+	.	.	.	.	.	.	.	.	.	.	1	8
Tanacetum corymbosum	E1	.	+	.	.	.	.	.	.	.	.	.	.	.	1	8
Viola alba	E1	.	.	.	.	.	.	.	.	.	.	.	.	+	1	8
Aremonio-Fagion																
Cyclamen purpurascens	E1	1	1	1	1	1	+	+	+	+	+	1	+	1	13	100
Anemone trifolia	E1	.	+	.	.	1	1	+	1	1	1	2	.	.	8	62
Cardamine enneaphyllos	E1	.	.	+	.	.	.	1	1	.	+	.	2	.	5	38
Lamium orvala	E1	.	.	.	.	.	.	2	+	.	.	+	2	.	4	31
Helleborus niger	E1	.	+	+	.	.	1	.	.	.	.	.	.	.	3	23
Rhamnus fallax	E2b	.	.	.	.	.	.	+	.	r	.	.	.	.	2	15
Rhamnus fallax	E2a	.	.	.	.	.	.	.	.	+	+	.	.	.	2	15
Hacquetia epipactis	E1	.	.	.	.	.	.	.	.	.	.	1	.	.	1	8
Erythronio-Carpinion																
Primula vulgaris	E1	.	1	+	.	1	1	1	+	+	1	1	1	1	11	85
Helleborus odorus	E1	.	.	.	.	+	1	.	.	.	.	2	2	2	5	38
Ornithogalum pyrenaicum	E1	.	.	.	.	.	.	1	.	.	.	.	.	.	1	8
Galanthus nivalis	E1	.	.	.	.	.	.	.	.	.	.	1	.	.	1	8
Fagetalia sylvaticae																
Campanula trachelium	E1	+	+	+	.	1	+	+	+	1	1	+	.	+	11	85
Asarum europaeum subsp. *caucasicum*	E1	.	+	.	.	1	1	1	1	+	1	+	+	1	10	77
Euphorbia amygdaloides	E1	1	1	.	.	.	.	+	+	+	+	+	1	2	9	69
Galium laevigatum	E1	1	+	+	.	1	1	+	1	1	1	.	.	.	9	69
Lathyrus vernus	E1	.	+	1	.	+	+	+	.	.	+	+	+	.	8	62
Salvia glutinosa	E1	+	r	+	.	+	.	1	+	1	1	.	.	.	8	62
Acer platanoides	E3b	.	.	.	.	.	.	+	r	r	.	.	.	.	3	23
Acer platanoides	E3a	.	.	.	.	.	.	.	.	.	.	.	+	.	1	8
Acer platanoides	E2b	.	.	.	.	.	.	.	.	.	.	+	.	+	2	15
Acer platanoides	E2a	.	.	.	.	.	.	.	.	.	.	.	+	.	1	8
Acer platanoides	E1	.	.	.	.	.	.	+	+	+	.	1	+	+	6	46
Fraxinus excelsior	E3b	.	.	.	.	r	.	1	r	.	.	1	2	+	6	46
Fraxinus excelsior	E3a	.	.	.	.	.	.	.	.	.	.	.	1	.	1	8
Fraxinus excelsior	E2b	.	.	.	.	.	.	.	.	.	.	.	1	+	2	15
Fraxinus excelsior	E2a	.	.	.	.	.	.	+	+	.	.	2	1	.	4	31
Fraxinus excelsior	E1	.	.	.	.	.	.	1	.	.	.	1	1	.	3	23
Galeobdolon flavidum	E1	.	.	.	.	+	.	+	1	1	.	+	.	+	6	46
Mercurialis perennis	E1	.	.	.	.	+	1	1	.	2	1	+	.	.	6	46

Number of relevé (tab. 3)		1	2	3	4	5	6	7	8	9	10	11	12	13	Pr.	Fr.
Dryopteris filix-mas	E1	.	.	.	.	+	.	1	1	1	+	.	.	+	6	46
Carpinus betulus	E3b	.	.	.	.	+	.	.	r	.	.	3	3	4	5	38
Carpinus betulus	E3a	.	.	r	.	.	.	.	.	.	.	1	1	1	4	31
Carpinus betulus	E2b	.	.	.	.	.	.	.	.	.	.	.	+	.	1	8
Carpinus betulus	E1	.	.	r	.	+	.	.	.	.	.	+	.	1	4	31
Fagus sylvatica	E3b	.	.	.	.	.	.	4	2	3	3	1	.	.	5	38
Fagus sylvatica	E3a	.	.	r	.	.	.	+	+	1	.	+	.	.	5	38
Fagus sylvatica	E2b	.	.	.	.	.	.	.	+	+	+	.	.	.	3	23
Fagus sylvatica	E1	.	.	.	.	.	.	+	.	.	.	+	.	.	2	15
Mycelis muralis	E1	.	.	.	.	+	.	+	+	1	.	.	+	.	5	38
Brachypodium sylvaticum	E1	.	.	.	.	+	+	.	+	.	.	+	.	.	4	31
Cardamine impatiens	E1	.	.	.	.	.	.	.	r	.	.	+	+	+	4	31
Daphne mezereum	E2a	.	.	.	.	.	.	+	+	+	+	.	.	.	4	31
Melica nutans	E1	+	.	.	.	.	.	.	.	+	+	+	.	.	4	31
Phyllitis scolopendrium	E1	.	.	.	.	.	.	1	1	+	.	.	.	+	4	31
Sambucus nigra	E2b	.	.	.	.	.	.	+	+	.	.	.	1	+	4	31
Sambucus nigra	E2a	.	.	.	.	.	.	.	.	+	.	.	.	.	1	8
Sambucus nigra	E1	.	.	.	.	.	.	.	.	.	.	.	+	.	1	8
Acer pseudoplatanus	E3b	.	.	.	.	.	.	1	.	.	.	.	.	.	1	8
Acer pseudoplatanus	E1	.	.	r	.	.	+	1	.	.	.	.	.	.	3	23
Cardamine bulbifera	E1	.	.	.	.	.	.	+	.	.	.	.	2	2	3	23
Actaea spicata	E1	.	.	.	.	.	.	.	+	+	+	.	.	.	3	23
Epipactis helleborine	E1	.	.	.	.	.	.	.	+	+	+	.	.	.	3	23
Laburnum alpinum	E3b	.	.	.	.	.	.	.	.	r	r	.	.	.	2	15
Laburnum alpinum	E3a	.	.	.	.	.	.	.	.	.	+	.	.	.	1	8
Laburnum alpinum	E2b	.	.	.	.	.	.	.	+	+	+	.	.	.	3	23
Laburnum alpinum	E2a	.	.	.	.	.	.	.	.	+	+	.	.	.	2	15
Tilia cordata	E3b	.	.	.	.	.	.	.	.	.	.	1	+	+	3	23
Tilia cordata	E3a	.	.	r	.	.	.	.	.	.	.	.	.	.	1	8
Tilia cordata	E2a	.	.	+	.	.	.	.	.	.	.	+	.	.	2	15
Tilia cordata	E1	.	.	.	.	.	.	.	.	.	.	.	+	.	1	8
Tilia platyphyllos	E3b	.	.	.	.	.	+	r	.	.	.	.	1	.	3	23
Tilia platyphyllos	E3a	.	.	r	.	.	.	+	.	.	.	.	+	.	3	23
Tilia platyphyllos	E2b	.	.	+	.	.	.	.	.	.	.	+	.	.	2	15
Tilia platyphyllos	E2a	.	.	.	.	.	.	.	.	.	.	+	.	.	1	8
Tilia platyphyllos	E1	.	.	.	.	.	+	+	.	.	.	.	.	.	2	15
Polystichum aculeatum	E1	.	.	.	.	.	.	.	1	.	.	.	+	+	3	23
Neottia nidus-avis	E1	.	.	.	.	+	+	.	.	.	.	.	.	.	2	15
Festuca altissima	E1	.	.	.	.	.	.	+	+	.	.	.	.	.	2	15
Milium effusum	E1	.	.	.	.	.	.	r	1	.	.	.	.	.	2	15
Myosotis sylvatica	E1	.	.	.	.	.	.	+	1	.	.	.	.	.	2	15
Corydalis cava	E1	.	.	.	.	.	.	+	.	.	.	+	.	.	2	15
Epilobium montanum	E1	.	.	.	.	.	.	.	+	+	.	.	.	.	2	15
Scrophularia nodosa	E1	.	.	.	.	.	.	.	1	+	.	.	.	.	2	15
Ulmus glabra	E3b	.	.	.	.	.	.	.	r	r	.	.	.	.	2	15
Ulmus glabra	E3a	.	.	.	.	.	.	.	.	r	.	.	.	.	1	8
Ulmus glabra	E2a	.	.	.	.	.	.	.	+	+	.	.	.	.	2	15
Urtica dioica	E1	.	.	.	.	.	.	.	+	+	.	.	.	.	2	15
Viola reichenbachiana	E1	.	.	.	.	.	.	.	+	.	+	.	.	.	2	15
Euphorbia dulcis	E1	.	.	.	.	.	.	.	.	.	.	1	+	.	2	15
Prunus avium	E3b	.	.	.	.	.	.	.	.	.	.	+	.	+	2	15
Prunus avium	E3a	.	.	.	.	.	.	.	.	.	.	.	.	+	1	8
Prunus avium	E1	.	.	.	.	.	.	.	.	.	.	+	.	+	2	15

Number of relevé (tab. 3)		1	2	3	4	5	6	7	8	9	10	11	12	13	Pr.	Fr.
Symphytum tuberosum	E1	.	.	.	.	.	.	.	.	.	.	+	.	+	2	15
Lonicera alpigena	E2a	.	.	.	.	.	.	+	.	.	.	.	.	.	1	8
Lunaria rediviva	E1	.	.	.	.	.	.	+	.	.	.	.	.	.	1	8
Poa nemoralis	E1	.	.	.	.	.	.	+	.	.	.	.	.	.	1	8
Polygonatum multiflorum	E1	.	.	.	.	.	.	.	+	.	.	.	.	.	1	8
Galium odoratum	E1	.	.	.	.	.	.	.	.	.	.	+	.	.	1	8
Arum maculatum agg.	E1	.	.	.	.	.	.	.	.	.	.	.	.	+	1	8
Quercetalia roboris																
Hieracium racemosum	E1	.	+	.	.	.	+	.	.	.	+	.	.	.	3	23
Pteridium aquilinum	E1	.	r	.	.	.	.	.	r	.	+	.	.	.	3	23
Quercus petraea	E1	.	.	+	.	.	+	.	.	.	.	.	.	.	2	15
Festuca heterophylla	E1	.	.	.	.	+	.	1	.	+	.	.	.	.	3	23
Rubus hirtus	E2a	.	.	.	.	.	.	.	+	r	.	.	.	.	2	15
Quercus petraea	E3b	.	.	.	.	.	.	.	.	.	.	+	.	.	1	8
Querco-Fagetea																
Vinca minor	E1	+	1	1	.	1	1	.	1	+	1	2	2	1	11	85
Carex digitata	E1	.	1	1	+	1	1	.	1	+	+	+	.	.	9	69
Melittis melissophyllum	E1	.	1	1	1	1	1	r	+	+	1	.	.	.	9	69
Corylus avellana	E2b	.	.	.	.	+	1	1	1	1	1	+	+	.	8	62
Corylus avellana	E2a	+	.	.	.	.	.	.	+	.	+	+	.	.	4	31
Hepatica nobilis	E1	.	+	1	.	1	+	.	+	+	+	1	.	.	8	62
Listera ovata	E1	+	.	.	.	.	+	.	+	+	+	+	.	+	7	54
Lonicera xylosteum	E2	1	.	.	.	1	.	.	+	.	+	+	+	+	7	54
Veratrum nigrum	E1	.	.	.	.	+	+	1	+	+	+	.	.	.	6	46
Clematis vitalba	E3a	.	.	.	.	.	.	.	+	.	.	.	.	.	1	8
Clematis vitalba	E2b	.	.	.	.	+	+	.	.	.	.	.	1	.	3	23
Clematis vitalba	E2a	+	.	.	.	.	.	+	.	.	.	+	1	+	5	38
Acer campestre	E3b	.	.	.	.	.	.	.	.	.	.	+	1	2	3	23
Acer campestre	E3a	.	.	.	.	.	.	.	.	.	.	+	1	1	3	23
Acer campestre	E2b	.	.	.	.	.	.	.	.	.	.	+	1	1	3	23
Acer campestre	E2a	.	.	.	.	.	.	.	.	.	.	1	.	+	2	15
Acer campestre	E1	+	.	+	.	.	.	.	.	.	.	+	.	+	4	31
Dactylis polygama	E1	.	.	.	.	.	+	1	1	1	.	.	.	.	4	31
Viola riviniana	E1	.	+	+	.	+	+	.	.	.	.	.	.	.	4	31
Hedera helix	E3b	.	.	.	.	.	.	.	.	.	.	.	.	.	1	8
Hedera helix	E3a	1	.	.	.	.	.	.	.	.	.	2	.	2	3	23
Hedera helix	E2a	+	.	.	.	.	.	.	.	.	.	.	.	.	1	8
Hedera helix	E1	1	.	.	.	.	+	.	.	.	.	1	1	.	4	31
Moehringia trinervia	E1	.	.	.	.	.	.	.	+	+	.	.	+	1	4	31
Stellaria holostea	E1	+	.	.	.	.	.	.	.	.	.	3	2	2	4	31
Cephalanthera longifolia	E1	.	.	.	.	+	.	.	.	+	+	.	.	.	3	23
Rubus caesius	E2a	+	.	.	.	+	.	.	.	.	.	.	.	.	2	15
Viola mirabilis	E1	.	.	+	.	.	.	.	.	.	.	.	+	.	2	15
Rosa arvensis	E2a	r	.	.	.	.	.	.	.	.	.	.	.	.	1	8
Cruciata glabra	E1	.	.	.	.	+	.	.	.	.	.	.	.	.	1	8
Rhamno-Prunetea																
Euonymus europaea	E2b	.	.	.	.	.	.	.	.	.	.	.	+	.	1	8
Euonymus europaea	E2a	.	.	.	.	.	+	.	+	.	.	+	+	+	5	38
Crataegus monogyna	E3a	.	.	.	.	.	.	.	.	.	.	.	+	.	1	8
Crataegus monogyna	E2b	+	+	.	.	.	.	.	.	.	.	.	+	+	4	31
Crataegus monogyna	E2a	+	+	+	.	.	.	.	.	.	.	+	.	.	4	31
Crataegus monogyna	E1	.	.	.	.	.	.	.	.	.	.	+	.	.	1	8
Rhamnus catharticus	E3b	+	.	.	.	.	.	.	.	.	.	.	.	.	1	8

Number of relevé (tab. 3)		1	2	3	4	5	6	7	8	9	10	11	12	13	Pr.	Fr.
Rhamnus catharticus	E2b	1	.	.	.	.	.	.	.	.	.	.	.	.	1	8
Rhamnus catharticus	E2a	1	.	+	.	.	+	.	+	.	.	.	.	.	4	31
Ligustrum vulgare	E2b	1	.	.	.	.	.	.	.	.	.	.	.	.	1	8
Ligustrum vulgare	E2a	.	+	.	.	.	.	.	.	.	.	.	+	+	3	13
Cornus sanguinea	E2b	+	.	.	.	.	.	.	.	.	.	.	.	.	1	8
Cornus sanguinea	E2a	+	.	.	.	+	.	.	.	.	.	.	.	.	2	15
Rubus fruticosus agg.	E2a	+	.	.	.	.	.	.	.	.	.	.	2	.	2	15
Viburnum lantana	E2b	+	.	.	.	.	.	.	.	.	.	.	.	.	1	8
Viburnum lantana	E2a	1	.	.	.	.	.	.	.	.	.	.	.	.	1	8
Rosa canina	E2b	+	.	.	.	.	.	.	.	.	.	.	.	.	1	8
Rosa glauca	E2a	.	.	.	+	.	.	.	.	.	.	.	.	.	1	8
Berberis vulgaris	E2a	.	.	.	.	.	.	.	+	.	.	.	.	.	1	8
Erico-Pinetea																
Calamagrostis varia	E1	.	+	+	.	+	+	.	.	+	+	.	.	.	6	46
Carex alba	E1	.	.	.	.	3	3	.	+	1	2	+	.	.	6	46
Aster amellus	E1	+	+	+	1	.	.	.	.	.	.	.	.	.	4	31
Cirsium erisithales	E1	.	.	.	.	.	.	+	.	+	+	.	.	.	3	23
Chamaecytisus hirsutus	E1	.	.	+	+	.	.	.	.	.	.	.	.	.	2	15
Genista radiata	E2a	.	.	r	3	.	.	.	.	.	.	.	.	.	2	15
Polygala chamaebuxus	E1	.	.	+	1	.	.	.	.	.	.	.	.	.	2	15
Berberis vulgaris	E2b	1	.	.	.	.	.	.	.	.	.	.	.	.	1	8
Amelanchier ovalis	E2b	.	.	.	+	.	.	.	.	.	.	.	.	.	1	8
Amelanchier ovalis	E2a	.	.	.	+	.	.	.	.	.	.	.	.	.	1	8
Carex ornithopoda	E1	.	.	.	+	.	.	.	.	.	.	.	.	.	1	8
Leontodon incanus	E1	.	.	.	1	.	.	.	.	.	.	.	.	.	1	8
Vaccinio-Piceetea																
Solidago virgaurea	E1	+	r	+	.	+	.	.	.	+	+	+	.	.	7	54
Hieracium murorum	E1	.	+	+	.	.	.	.	.	+	+	.	.	.	4	31
Luzula luzuloides	E1	.	.	.	.	.	.	+	+	1	+	.	.	.	4	31
Veronica urticifolia	E1	.	.	.	.	.	.	+	+	+	+	.	.	.	4	31
Aposeris foetida	E1	.	.	.	.	.	.	1	.	+	.	.	.	.	2	15
Gentiana asclepiadea	E1	.	.	.	.	.	.	.	.	+	.	.	.	.	1	8
Abies alba	E1	.	.	.	.	.	.	.	.	.	.	+	.	.	1	8
Picea abies	E3b	.	.	.	.	.	.	.	.	.	.	r	.	.	1	8
Mulgedio-Aconitetea																
Aconitum angustifolium	E1	.	.	.	.	+	.	1	+	+	1	.	.	.	5	38
Tephroseris pseudocrispa	E1	.	.	.	.	.	.	+	1	1	+	.	.	.	4	31
Silene dioica	E1	.	.	.	.	.	.	+	+	+	.	.	.	.	3	23
Hesperis candida	E1	.	.	.	.	.	+	+	.	.	.	.	.	.	2	15
Aconitum degenii subsp. *paniculatum*	E1	.	.	.	.	.	.	1	+	.	.	.	.	.	2	15
Senecio fuchsii	E1	.	.	.	.	.	.	1	+	.	.	.	.	.	2	15
Aconitum lycoctonum	E1	.	.	.	.	.	.	.	+	.	.	+	.	.	2	15
Phyteuma ovatum	E1	.	.	.	.	.	.	+	.	.	.	.	.	.	1	8
Athyrium filix-femina	E1	.	.	.	.	.	.	.	.	+	.	.	.	.	1	8
Trifolio-Geranietea																
Vincetoxicum hirundinaria	E1	+	1	+	1	.	+	+	+	+	1	.	.	+	10	77
Digitalis grandiflora	E1	+	+	+	.	+	+	+	+	+	+	.	.	.	9	69
Valeriana collina	E1	1	+	+	.	+	+	+	+	+	+	.	.	.	9	69
Campanula rapunculoides	E1	.	+	+	+	1	1	.	.	.	.	+	1	2	8	62
Clinopodium vulgare	E1	.	+	+	.	1	+	.	r	+	+	.	.	.	7	54
Libanotis sibirica subsp. *montana*	E1	.	+	+	+	+	+	.	.	+	+	.	.	.	7	54
Silene nutans	E1	.	1	+	+	+	+	.	.	+	+	.	.	.	7	54

Number of relevé (tab. 3)		1	2	3	4	5	6	7	8	9	10	11	12	13	Pr.	Fr.
Anthericum ramosum	E1	.	+	1	1	+	+	.	.	.	+	.	.	.	6	46
Lilium carniolicum	E1	.	r	+	.	+	.	r	.	.	.	.	+	.	5	38
Viola hirta	E1	.	+	+	1	+	+	.	.	.	.	.	.	.	5	38
Polygonatum odoratum	E1	.	.	+	1	+	+	.	.	.	.	.	.	.	4	31
Thesium bavarum	E1	.	+	+	+	.	.	.	.	.	.	.	.	.	3	23
Verbascum alpinum	E1	.	.	.	.	.	.	.	+	+	+	.	.	.	3	23
Origanum vulgare	E1	+	1	.	.	.	.	.	.	.	.	.	.	.	2	15
Hypericum perforatum	E1	+	.	.	.	.	.	.	.	.	+	.	.	.	2	15
Verbascum lychnitis	E1	+	.	.	.	.	.	.	+	.	.	.	.	.	2	15
Thalictrum minus	E1	.	.	.	+	+	.	.	.	.	.	.	.	.	2	15
Achillea distans	E1	.	.	.	.	.	.	.	.	+	+	.	.	.	2	15
Inula conyza	E1	.	.	.	.	+	.	.	.	.	.	.	.	.	1	8
Trifolium rubens	E1	.	.	.	.	+	.	.	.	.	.	.	.	.	1	8
Valeriana nemorensis	E1	.	.	.	.	+	.	.	.	.	.	.	.	.	1	8
Laserpitium latifolium	E1	.	.	.	.	.	+	.	.	.	.	.	.	.	1	8
Epilobietea angustifolii																
Fragaria vesca	E1	+	1	+	.	1	1	.	+	+	+	.	.	.	8	62
Carex muricata	E1	.	.	.	.	.	.	.	+	+	.	.	.	+	3	23
Rubus idaeus	E2a	.	.	.	.	.	.	+	.	.	.	.	.	.	1	8
Solanum dulcamara	E1	.	.	.	.	.	.	.	r	.	.	.	.	.	1	8
Physalis alkekengi	E1	.	.	.	.	.	.	.	.	.	.	.	+	.	1	8
Festuco-Brometea		.	.	.	.	.	.	.	.	.	.	.	.	.		
Buphthalmum salicifolium	E1	+	.	+	+	.	.	.	.	+	+	.	.	.	5	38
Carex humilis	E1	.	3	1	1	1	+	.	.	.	.	.	.	.	5	38
Ajuga genevensis	E1	1	1	+	.	+	.	.	.	.	.	.	.	.	4	31
Allium carinatum	E1	.	+	.	.	+	+	.	.	.	1	.	.	.	4	31
Dianthus monspessulanus	E1	.	1	1	.	+	.	.	.	.	+	.	.	.	4	31
Euphorbia cyparissias	E1	.	.	+	1	+	.	.	.	.	+	.	.	.	4	31
Galium purpureum	E1	.	+	+	1	+	.	.	.	.	.	.	.	.	4	31
Genista tinctoria	E1	.	+	1	.	+	.	.	.	.	+	.	.	.	4	31
Peucedanum oreoselinum	E1	.	+	+	+	.	.	.	.	.	+	.	.	.	4	31
Teucrium chamaedrys	E1	.	1	+	1	+	.	.	.	.	.	.	.	.	4	31
Stachys recta	E1	+	.	1	+	.	.	.	.	.	.	.	.	.	3	23
Arabis hirsuta	E1	.	+	+	.	.	.	.	.	.	.	.	.	.	2	15
Bromus erectus	E1	.	1	.	.	+	.	.	.	.	.	.	.	.	2	15
Satureja montana subsp. *variegata*	E1	.	+	.	1	.	.	.	.	.	.	.	.	.	2	15
Scabiosa triandra	E1	.	+	.	+	.	.	.	.	.	.	.	.	.	2	15
Centaurea triumfettii	E1	.	.	+	+	.	.	.	.	.	.	.	.	.	2	15
Galium lucidum	E1	.	.	.	+	+	.	.	.	.	.	.	.	.	2	15
Brachypodium rupestre	E1	.	+	.	.	.	.	.	.	.	.	.	.	.	1	8
Helianthemum ovatum	E1	.	.	.	+	.	.	.	.	.	.	.	.	.	1	8
Molinio-Arrhenatheretea																
Veronica chamaedrys	E1	1	+	.	.	+	.	.	+	+	.	.	.	1	6	46
Achillea milefolium	E1	.	.	+	.	+	+	.	.	.	.	.	.	.	3	23
Angelica sylvestris	E1	.	.	.	.	.	.	.	r	+	.	.	.	.	2	15
Centaurea jacea agg.	E1	.	.	+	.	.	.	.	.	.	.	.	.	.	1	8
Phyteuma zahlbruckneri	E1	.	.	.	.	.	+	.	.	.	.	.	.	.	1	8
Galium mollugo	E1	.	.	.	.	.	.	.	.	+	.	.	.	.	1	8
Taraxacum officinale	E1	.	.	.	.	.	.	.	.	.	.	r	.	.	1	8
Ajuga reptans	E1	.	.	.	.	.	.	.	.	.	.	.	.	+	1	8
Galio-Urticetea																
Geranium robertianum	E1	+	.	.	.	.	.	+	1	1	+	.	.	+	6	46

Number of relevé (tab. 3)		1	2	3	4	5	6	7	8	9	10	11	12	13	Pr.	Fr.
Geum urbanum	E1	.	.	.	.	.	+	.	+	.	.	+	1	+	5	38
Torilis japonica	E1	.	.	.	.	.	r	.	r	.	.	.	+	.	3	23
Glechoma hederacea	E1	.	.	.	.	.	.	.	.	.	.	1	1	+	3	23
Lamium maculatum	E1	.	.	.	.	.	.	.	.	.	.	.	2	1	2	15
Lapsana communis	E1	.	.	.	.	.	.	.	.	.	.	.	.	+	1	8
Elyno-Seslerietea																
Festuca calva	E1	.	r	+	.	r	.	.	.	+	.	.	.	.	4	31
Carduus crassifolius	E1	.	+	+	+	.	.	.	.	.	.	.	.	.	3	23
Phyteuma orbiculare	E1	.	.	+	.	.	.	.	.	+	+	.	.	.	3	23
Sesleria caerulea subsp. *calcaria*	E1	.	1	3	4	.	.	.	.	.	.	.	.	.	3	23
Acinos alpinus	E1	.	+	+	.	.	.	.	.	.	.	.	.	.	2	15
Betonica alopecuros	E1	.	.	+	.	.	.	.	.	.	+	.	.	.	2	15
Asperula aristata	E1	.	.	.	+	.	.	.	.	.	.	.	.	.	1	8
Thlaspietea rotundifolii																
Hieracium porrifolium	E1	.	+	+	+	.	.	.	.	.	.	.	.	.	3	23
Viola pyrenaica	E1	.	+	.	+	.	+	.	.	.	.	.	.	.	3	23
Cerastium subtriflorum	E1	.	.	.	.	.	.	1	+	+	.	.	.	.	3	23
Hieracium bifidum	E1	+	.	.	+	.	.	.	.	.	.	.	.	.	2	15
Aurinia petraea	E1	1	.	.	.	.	.	.	.	.	.	.	.	.	1	8
Calamintha brauneana	E1	+	.	.	.	.	.	.	.	.	.	.	.	.	1	8
Medicago pironae	E1	+	.	.	.	.	.	.	.	.	.	.	.	.	1	8
Silene vulgaris subsp. *glareosa*	E1	+	.	.	.	.	.	.	.	.	.	.	.	.	1	8
Hieracium glaucum	E1	.	.	+	.	.	.	.	.	.	.	.	.	.	1	8
Gymnocarpium robertianum	E1	.	.	.	.	.	.	.	.	+	.	.	.	.	1	8
Arabis alpina	E1	.	.	.	.	.	.	.	.	.	.	.	.	r	1	8
Asplenietea trichomanis																
Asplenium trichomanes	E1	1	1	+	.	+	1	+	+	+	+	+	+	+	12	92
Moehringia muscosa	E1	1	1	+	1	1	1	+	1	.	.	.	.	.	8	62
Asplenium ruta-muraria	E1	.	1	1	+	+	1	+	.	+	.	.	.	.	7	54
Polypodium vulgare	E1	+	.	+	.	+	+	.	.	+	.	.	.	.	5	38
Campanula carnica	E1	.	+	+	+	.	.	.	.	+	.	.	.	.	4	31
Sedum maximum	E1	+	+	.	.	+	.	.	.	.	.	.	.	.	3	23
Asplenium adiantum-nigrum	E1	+	.	.	.	.	.	.	.	.	.	.	+	+	3	23
Ceterach javorkeanum	E1	+	.	.	+	.	.	.	.	.	.	.	.	+	3	23
Saxifraga petraea	E1	.	.	.	.	.	.	+	+	+	.	.	.	.	3	23
Sedum album	E1	+	.	+	.	.	.	.	.	.	.	.	.	.	2	15
Campanula spicata	E1	.	.	+	+	.	.	.	.	.	.	.	.	.	2	15
Cystopteris fragilis	E1	.	.	.	.	.	.	1	.	+	.	.	.	.	2	15
Athamanta turbith	E1	.	.	.	.	.	.	r	.	.	.	.	.	.	1	8
Other species																
Robinia pseudacacia	E3b	+	.	.	.	.	.	.	.	.	.	r	+	.	3	23
Juglans regia	E3b	.	.	.	.	.	.	.	.	.	.	r	+	r	3	23
Juniperus communis	E2b	+	.	.	.	.	.	.	.	.	.	.	.	.	1	8
Festuca sp.	E1	.	+	.	.	.	.	.	.	.	.	.	.	.	1	8
Juglans regia	E1	.	.	.	.	.	.	.	.	.	.	+	.	.	1	8
Galium aparine	E1	.	.	.	.	.	.	.	.	.	.	.	.	+	1	8
Mosses and lichens																
Schistidium apocarpum	E0	+	1	+	+	1	.	+	+	+	+	+	.	.	10	77
Anomodon viticulosus	E0	+	+	+	.	1	+	.	+	+	1	.	.	.	8	62
Isothecium alopecuroides	E0	.	.	.	.	+	1	1	1	1	.	1	+	+	8	62
Homalothecium sericeum	E0	1	1	+	+	1	.	.	.	.	+	.	.	.	6	46
Anomodon attenuatus	E0	.	.	.	.	+	1	.	1	+	+	+	.	.	6	46
Homalothecium lutescens	E0	+	.	.	.	1	.	1	1	1	1	.	.	.	6	46

Number of relevé (tab. 3)		1	2	3	4	5	6	7	8	9	10	11	12	13	Pr.	Fr.
Ctenidium molluscum	E0	.	.	+	.	+	+	.	.	.	.	+	.	.	4	31
Tortella tortuosa	E0	+	1	.	.	.	.	.	.	.	.	.	.	.	2	15
Neckera crispa	E0	.	.	1	.	.	+	.	.	.	.	.	.	.	2	15
Peltigera canina	E0	.	.	.	.	+	.	+	.	.	.	.	.	.	2	15
Brachythecium rutabulum	E0	.	.	.	.	.	.	.	1	.	.	+	.	.	2	15
Rhytidium rugosum	E0	.	.	+	.	.	.	.	.	.	.	.	.	.	1	8
Hypnum cupressiforme	E0	.	.	.	.	1	.	.	.	.	.	.	.	.	1	8
Cladonia pyxidata	E0	.	.	.	.	+	.	.	.	.	.	.	.	.	1	8
Marchantia polymorpha	E0	.	.	.	.	.	.	+	.	.	.	.	.	.	1	8
Polytrichum formosum	E0	.	.	.	.	.	.	+	.	.	.	.	.	.	1	8
Dermatocarpon miniatum	E0	.	.	.	.	.	.	+	.	.	.	.	.	.	1	8
Plagiomnium cuspidatum	E0	.	.	.	.	.	.	.	+	.	.	.	.	.	1	8
Mnium sp.	E0	.	.	.	.	.	.	.	.	+	.	.	.	.	1	8

Because we could not find a similar community with the dominant *Aurinia petraea* in literature, we treat the studied stands on rockfall screes as a new association *Arabido turritae-Aurinietum petraeae* ass. nova hoc loco. Its only character species is *Aurinia petraea*, and its differential species are *Arabis turrita*, *Geranium robertianum* and *Ajuga genevensis*. Like *Aurinia petraea*, the first two are biennials, and all three are classified into a similar, transitional (csr) strategy type. They usually grow on stony sites, *Arabis turrita* and *Ajuga genevensis* on dry, and *Geranium robertianum* also on slightly wet sites. The first is a diagnostic species of the order *Quercetalia pubescentis*, and the second of the class *Festuco-Brometea*, while the third occurs in many forest and also ruderal communities. The nomenclature type (*holotypus*) of the new association is relevé No. 6 in table 1. Relevés on fresh, slightly nitrophilous rockfall scree in Morizna and below Osojnica are treated as the variant with *Eupatorium cannabinum* (other differential species are *Acinos alpinus*, *Stachys recta* and *Campanula trachelium*). The relevés on edges of screes above Modrej and the relevé in Loški poldan are temporarily classified into two variants: into the variant with *Galium aparine* and into the variant with the taxon *Satureja montana* subsp. *variegata*. The synsystematic status of these stands, which are floristically considerably different from the others, remains unclear. Considering the dominant presence of *Aurinia petraea* and *Arabis turrita* they are temporarily classified into the association *Arabido-Aurinietum petraeae*.

The established floristic and sociological composition makes the classification into higher syntaxonomical units rather difficult. We described a pioneer's community, a successional stage, and further development is possibly presented in relevé No. 1 in table 3. This is a relevé of an open coppice hop hornbeam forest on stable scree, in which *Aurinia petraea* still grows. The stands described can be treated as a fringe community – on edges of screes, on places in direct contact with the surrounding pioneer's forest stands – classified into the alliance *Geranium sanguinei* because of the predominating proportion of the species from the class *Trifolio-Geranietea*. However, considering that the character and dominant species of the association, *Aurinia petraea,* occupies above all rock crevices, screes and other very stony (sandy) sites (and is only rarely a species of thermophilous forest edges), we find it more appropriate to classify it into the alliance *Stipion calamagrostis,* class *Thlaspietea rotundifolii* (i. e. into the group of montane xerothermophilous communities on calcareous screes), despite its uncharacteristic and species-rich composition. We should also point out a certain similarity with the Central European association *Vincetoxicetum*

Table 4: Plant life form spectrum in the stands with *Aurinia petraea* in the Soča Valley.
Ia: Stands with *Aurinia petraea*, weighted (weight is frequency),
Ib: Stands with *Aurinia petraea* (unweighted),
II: Surrounding forest stands (unweighted)

Plant life forms		Ia	Ib	II
Weight		Fr.	Nr.	Nr.
Phanerophytes	**P**	**5.43**	**7.84**	**20**
	NP	0.72	2.61	5.1
	P caesp	1.99	3.27	7.8
	P scap	0.72	0.65	5.9
	P lian	1.99	1.31	0.8
	P ep	0	0	
Chamaephytes	**Ch**	**7.05**	**13.1**	**11**
	B Ch	1.27	3.92	4.7
	Ch lich	0.18	0.65	1.2
	Ch frut	0.36	0.65	0.4
	Ch rept	0.36	0.65	0.4
	Ch suffr	3.26	4.58	3.5
	Ch pulv	0	0	0
	Ch succ	1.63	2.61	0.4
Hemicryptophytes	**H**	**75.1**	**62.7**	**52**
	H bienn	13	6.54	3.1
	H caesp	9.22	10.5	9.4
	H rept	0.18	0.65	1.2
	H ros	5.97	6.54	7.8
	H scap	46.3	37.9	29
	H th	0	0	1.6
	H scand	0.36	0.65	
Geophytes	**G**	**3.62**	**7.19**	**15**
	G bulb	0.72	1.96	2.7
	G rhiz	2.89	5.23	13
	G rad	0	0	
Therophytes	**T**	**8.86**	**9.15**	**2.3**
	T scap	8.86	9.15	2.3
	T par	0	0	
Total		100	100	100

hirundinariae Kaiser 1926, which is successionally connected with fringe communities from the alliance *Geranion sanguinei* and a Scotch pine community (Englisch et al. 1993: 333).

In terms of chorological affinity, the stands of the association *Arabido turritae-Aurinietum petraeae* are dominated by European, Eurasian and paleotemperate species but diagnostically significant is also the proportion of Mediterranean-montane, Southeast European (in the wider sense: Southeast-Alpine, Alpine-Illyrian, Illyrian-sub-Mediterranean) and sub-Mediterranean species (table 6).

Table 5: Ecological strategy types in the stands with *Aurinia petraea* in the Soča Valley.
Ia: Stands with *Aurinia petraea*, weight is frequency,
Ib: Stands with *Aurinia petraea*, unweighted,
II: Surrounding stands of hop hornbeam and other decidous trees, unweighted,
III: Spectrum of strategy types in the German flora (Klotz & Kühn 2002: 201).

c – competitors; s – stress tolerant species; r – ruderals

	Ia	Ib	II	III
	%Fr	%Pr	% Pr	% Gr
c	20	20	34	29
cr	15	8.2	3.3	10
cs	23	26	27	18
csr	39	38	33	26
r	0.4	1.4	0	8
s	1.7	4.1	2.1	5
sr	1.5	2.1	0.4	4
To.	100	100	100	100

Table 6: Chorological groups in the stands with *Aurinia petraea* in the Soča Valley (weighted – weight is frequency – Fr; and unweighted – Nr.)

Chorological groups	Fr.	Nr.
Arctic-alpine species	0.7	0.7
East- and Southeast-Alpine species	3.3	4.1
Southeast-Alpine-Illyrian species	2.4	4.1
Sub-Mediterranean-Illyrian species	1.8	4.1
Southeast-European species	5.7	3.4
sub-Mediterranean species	**11**	5.5
Mediterranean-Pontic species	1.8	1.4
Pontic species	3.9	4.8
Mediterranean-Atlantic species	0.9	2.7
Mediterranean-montane species	**14**	**12**
European species	**14**	**19**
Eurasian species	**14**	**16**
Eurosiberian species	2.6	4.1
Paleotemperate species	**18**	**12**
Boreal species	1.7	2.7
Cosmopolitan	4.6	2.7
Total	100	100

Conclusions

Aurinia petraea is a Southeast European species of rock crevices, screes and sandy sites, whose phytosociological affinity is still poorly investigated (Černic 1977, Aeschimann et al. 2004, Lakušić et al. 2005). Following two powerful earthquakes in 1998 and 2004 in the Soča Valley, numerous rockfalls occurred in the southern Julian Alps and their foothills and swept away or buried several hectares of forest (Vidrih 1998, 2005). It only takes a few years before pioneer

vegetation starts growing on newly developed rockfall screes and in places, e. g. in Morizna opposite Trnovo and below Osojnica in the Tolminka valley, one of the most dominant pioneers is exactly *Aurinia petraea*. According to our findings, this species quickly responds to disturbances in its habitat and is also stress tolerant. In addition, because it makes good use of the sources available in given circumstances, it can also be classified among competitors, according to Grime's terminology (1974, 1979, quoted after Grime 2001, see also Batič 2001 and Klotz & Kühn 2002). Its pioneer stands on screes, which developed after earthquakes (and which contain also particles of soil and organic matter), are relatively species-rich (on average 30 species per relevé) and uncharacteristic for scree communities. They already contain a good number of species characteristic for communities of thermophilous forest edges (alliance *Geranion sanguinei*) and dry grasslands (class *Festuco-Brometea*), but relatively few characteristic scree species. As we have not found similar communities previously described in literature, we classify these stands into a new association, *Arabido turritae-Aurinietum petraeae* ass. nova (*holotypus* is relevé No. 6 in table 1). The new association is classified into the alliance *Stipion calamagrostis*, class *Thlaspietea rotundifolii*. Classification into the higher syntaxonomical units is founded on the phytosociological (coenological) affinity (fidelity) of the dominant species of the community (*Aurinia petraea*). Regarding the entire floristic composition, classification into the alliance *Geranion sanguinei*, class *Trifolio-Geranietea*, would also be possible.

Considering the surrounding forest stands of hop hornbeam and other deciduous trees, in some places beech (which also partly grow on rock slides that developed after the previous earthquakes), – table 3, we came to the conclusion that this is a primary succession sere: scree community (*Arabido-Aurinietum petraeae*) – thermophilous edge communities from the alliance *Geranion sanguinei* – open coppice stands of hop hornbeam and other deciduous trees – hop hornbeam and beech forest (*Ostryo-Fagetum*). Similar successional processes are seen on already stable (Holocene) screes above Modrej (below Senica, near Most na Soči), where the stands with the dominant *Aurinia petraea* occur mostly at the contact of more or less sterile limestone screes (with a considerable admixture of chert) and pioneer forests of hornbeam and hop hornbeam (*Asperulo-Carpinetum*). A transitional successional stage, an open hop hornbeam stand with *Aurinia petraea* in the herb layer, was recorded in one relevé (relevé 1 in table 3).

The screes above Modrej are one of the proposed Natura 2000 areas, i. e. a Potential Site of Community Interest (pSCI), which are defined on the criteria of the Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora. With our research (relevés 16–20 in table 1 and relevé 1 in table 3) we present at least a partial picture of their vegetation.

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Abbreviations

Parent material
A – limestone
AR – limestone with chert
Gr – talus

Soil types
R – rendzina (Rendzic Leptosol)
Li – Lithosols

Appendix (List of mentioned syntaxa)

Asplenietea trichomanis Br.-Bl. in Meier & Br.-Bl. 1934
- *Amphoricarpetalia* Lakušić 1968
  - *Edraianthion jugoslavici* Lakušić 1968

Thlaspietea rotundifolii Br.-Bl. in Br.-Bl. & Jenny 1926
- *Stipetalia calamagrostis* Oberdorfer & Seibert in Oberdorfer 1977 (= *Galio-Parietarietalia officinalis* Boşcaiu & al. 1966)
  - *Stipion calamagrostis* Jenny-Lips ex Quantin 1932
    - *Vincetoxicetum hirundinariae* Kaiser 1926
- *Drypetalia spinosae* Quezel 1967
  - *Peltarion alliaceae* H-ić 1956 apud Domac 1957

Koelerio-Corynephoretea Klika in Klika & Novák 1941 (= *Sedo-Scleranthetea* Br.-Bl. 1955)
- *Alysso-Sedetalia* Moravec 1967
  - *Alysso-Sedion albi* Oberdorfer & Th. Müller in Th. Müller 1961
    - *Alysso petraei-Sedetum hispanici* Schneider-Binder & al. 1971

Molinio-Arrhenatheretea R. Tx. 1937 em. R. Tx. 1970

Festuco-Brometea Br.-Bl. & Tx. 1943
- *Mesobromion erecti* (Br.-Bl. & Moor 1938) Oberdorfer 1957 (= *Bromion erecti* Br.-Bl. (1925) 1936)

Elyno-Seslerietea Br.- Bl. 1948

Trifolio-Geranietea Th. Müller 1962
- *Origanetalia vulgaris* Th. Müller 1962
  - *Geranion sanguinei* Tüxen in Th. Müller 1962

Epilobietea angustifolii R. Tx. & Preising in R. Tx. 1950

Galio-Urticetea Passarge ex Kopecký 1969

Stellarietea mediae R. Tx., Lohmeyer & Preising in R. Tx. 1950

Mulgedio-Aconitetea Hadač & Klika in Klika 1948

Erico-Pinetea I. Horvat 1959
- *Erico-Fraxinion orni* Horvat 1959
  - *Ostryo carpinifoliae-Fraxinetum orni* Aichinger 1933 (= *Fraxino orni-Ostryetum carpinifoliae* Aichinger 1933 corr. Franz 2002)
  - *Cytisantho-Ostryetum* M. Wraber 1961

Vaccinio-Piceetea Br.-Bl. 1939 emend. Zupančič (1976) 2000

Rhamno-Prunetea Rivas Goday & Borja Carbonell 1961

Querco-Fagetea Br.-Bl. & Vlieg. 1937
- *Fagetalia sylvaticae* Pawł. in Pawł. & al. 1928
  - *Aremonio-Fagion* (Ht. 1938) Borhidi in Török, Podani & Borhidi 1989
    - *Lamio orvalae-Fagetum* (Ht. 1938) Borhidi 1963
    - *Ostryo-Fagetum* M. Wraber ex Trinajstić 1972
    - *Asperulo-Carpinetum* M. Wraber 1969
- *Quercetalia pubescentis* Klika 1933
  - *Ostryo-Carpinion orientalis* Horvat 1954 em. 1958
    - *Seslerio albicantis-Ostryetum* Lausi & al. 1982 corr. Poldini & Vidali 1995
- *Quercetalia roboris-petraeae* R. Tx. 1931