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Regeneration of high montane plant communities in the "Nationalpark Kalkalpen" (Northern Alps) after fire events

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Abstract

Forest fires are comparably rare and accidental in higher altitudes of the Alps. The restoration of the plant cover is obviously slow and the direction of the succession is still unclear.

We investigated the influence on the vegetation by fire events with emphasis on vegetation regeneration, plant species diversity and nature conservation targets. We surveyed two neighboring fire areas of different age (8 and 61 years after fire event) on a south exposed slope of the Hagler Mountain in the National Park (NP) "Kalkalpen" (Eastern Alps, Austria). For the vegetation survey we performed relevés of 25 m² along 3 altitudinal transect lines (1500m, 1550m, 1600m a.s.l.) across each fire site and in adjoining reference areas which were not affected by the fire. They are dominated by *Pinus mugo*. The syntaxonomical and ecological characterization of the plant communities was performed using habitat preferences and indicator values of the species.

We found out that fire events in high montane ecosystems of the Alps have a substantial long-term effect on the vegetation. Krummholz (*Pinus mugo*) will not regenerate within 60 years, it is replaced by natural, alpine grassland with significant disturbance indicators for several decades. Low indicator values for temperature on the older fire site shows, that species from higher altitudes may seize such areas as new habitats. The physiognomic turn from shrub to grassland vegetation and the decrease of beta diversity lead to the necessity of revision of nature conservation targets after fire events. Facing increasing fire events in the Alps as an effect of global warming, this becomes more important.

Keywords

Fire, vegetation regeneration, high montane ecosystems, Nationalpark Kalkalpen

Introduction

In some regions of the world, e. g. SE Australia, S Africa, fire is inherent to ecosystem dynamics. Plants of these ecosystems are adapted to periodic fires, some of them even rely on these recurring events (Walter & Breckle 1999). Here fire is necessary to maintain the ecological balance.

In high montane ecosystems of the Alps, bushfires are considerably rare and accidental. They occur mainly on south exposed slopes with high sun radiation, where the vegetation is highly flammable.

There are no adequate data about fire frequencies in the Alps. Sass et al. (2012), however, predict a fire frequency of 250–525 years for northern Tyrol. Human impact is the main reason for fire events in the montane and subalpine belt and illustrates an increasing anthropogenic pressure on the Alps in the last 100 years.

This unsteadiness of fire events is also reflected by the vegetation of high montane ecosystems of the Alps. These biota show no special adaptations on periodic fire events. Fire has to be considered as an extreme event, which causes long-lasting changes in vegetation cover and ecosystem characteristics.

Direct consequences are the destruction of the plant cover and – depending on the intensity of the fire – of the organic soil layer, followed by geomorphological processes like altered conditions for erosion, mudslides, rock fall and avalanches (Sass et al. 2006).

On the other hand, fire leads to short-term mobilization of nutrients, which supports plant growth. Hence, the conditions of competition are altered completely by these factors.

We tried to find out how vegetation in high montane ecosystems reacts on fire events. Is there any evidence for regeneration of the pre-fire vegetation? Are there any unexpected trends in the development of the succeeding plant cover?

These questions are of growing relevance facing the recent climatic trends. Rising summer temperature could enhance the heat load of the earth surface, which, in turn, could lead to higher likelihood of forest fires. Furthermore, climatic changes could also drive changes in vegetation structure (see Nicolussi & Patzelt 2006). Consequentely, fire sites in future may gain even greater significance as special habitats in the vegetation mosaic.

Methods

We surveyed two neighboring fire areas of different age (the younger fire site, 8 years after fire event; and the older fire site, 61 years after fire event) on a south exposed slope of the Hagler Mountain, in the NP "Kalkalpen" (Eastern Alps, Austria). We conducted vegetation surveys in 3 transects at an altitude of 1400, 1450 and 1500 m a.s.l., respectively. We performed a set of vegetation relevés each with an area of 25 m^2 across both fire sites and in adjoining areas which were not affected by the fire (reference areas, dominated by *Pinus mugo*). 103 relevés were used for analysis. Numerical classification and syntaxonomical evaluation of the vegetation were performed using the program Juice (TICHÝ 2002) and TWINSPAN (HILL 1979). For ecological characterization we used Ellenberg's indicator values (ELLENBERG et al. 1991).

Results

We found a total number of 211 species on our research area. 48 species (22.8 %) were found on all three sites, 24 species (11.4 %) were shared between the older (A) and the younger (N) fire site, 17 species (8.1 %) between the younger fire site and the reference sites (R), and 11 species (5.2 %) between the older fire site and the reference sites. 27 species (12.8 %) were exclusively found on the older fire site, 53 (25.1 %) on the younger fire site and 24 (11.4 %) on the reference sites (table 1). This means a species turnover rate from the reference sites to the younger fire site of 65 %, and from the younger to the older fire site of 60 %. This is visible in the average Bray-Curtis dissimilarity too (BRAY & CURTIS 1957). The dissimilarity between the reference site and the younger fire site amounts 89 %, between the younger and the older fire site 90 % and between the reference site and the older fire site 83 %.

Table 1: Shared, exclusive and total species number (presence/absence transformation) of the vegetation data set, n=103. R=reference areas, N=younger fire site, A=older fire site.

	R	N	A	%
shared species	48	48	48	22,75
	17	17		8,06
	11		11	5,21
		24	24	11,37
exclusive species	24			11,37
		53		25,12
			27	12,8
total nr of species		211		100

A TWINSPAN numerical classification results in a clear clustering of the vegetation along the fire-time gradient. All relevés of the particular fire sites form distinct relevé groups. Manual improvement led to a similar result. The vegetation table is presented in table 2 (see appendix, p. 337-339).

The younger fire site was characterized by low values of plant cover with inhomogeneous patches of well growing herbs. We found species from montane forest clearings as well as from subalpine talus vegetation. A lot of species were of colline to lower montane distribution (e.g. *Mycelis muralis*, *Calamagrostis epigeios*, *Thymus pulegioides*) and characteristic for anthropogenic habitats (*Urtica dioica*, *Epilobium montanum, Taraxacum officinale agg*.). A quite good regeneration of *Larix decidua* was observed, but most individuals were not older than 1-3 years. Due to the inhomogeneity of the stands it is not possible to assign the vegetation to any association described in GRABHERR & MUCINA (1993).

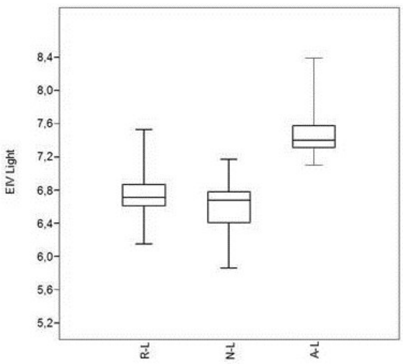

Figure 1: Boxplot of Ellenberg's indicator values for light calculated as unweighted mean values of the single relevés. R = reference site, n=13; N = younger fire site, n=50; A = older fire site, n=40.

The older fire site displayed the structure of relatively homogeneous grassland, characterized by species of semi-dry calcareous grassland and some talus and debris habitats. *Helicotrichon parlatorei* is widely dominant. Interestingly, some other species from normally higher altitudes occurred, such as *Veronica fruticans, Minuartia* *austriaca, Trisetum alpestre, Achillea clavennae* or *Polygala alpestris*. The community could be considered as a disturbed variant of the Seslerio-Caricetum sempervirentis, subtype of *Helicotrichon parlatorei* (DULLINGER et al. 2001). DULLINGER et al. (2001) mentioned further a species assemblage named "Lawinarrasen" with *Helicotrichon parlatorei*. The tussocks of this species are well adapted to recolonize unstable slopes of calcareous mountains.

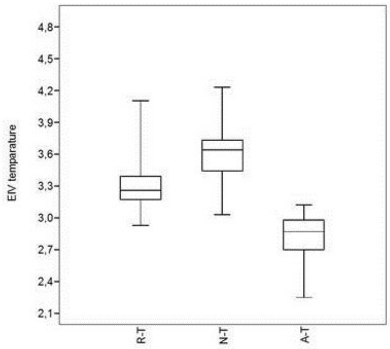

Figure 2: Boxplot of Ellenberg's indicator values for temperature calculated as unweighted mean values of the single relevés. R = reference site, n=13; N = younger fire site, n=50; A = older fire site, n=40.

The vegetation of the reference areas is classified as subalpine Krummholz over limestone bedrocks (Rhododendo hirsuti-Pinetum prostratae ZÖTTL 1951, Rhodothamno-Laricetum WILLNER & ZUKRIGL 1999, see WILLNER & GRABHERR 2007).

Significant changes between the three sites are visible using the mean Ellenberg Indicator values (EIV), calculated as a mean of the unweighted values of all relevés.

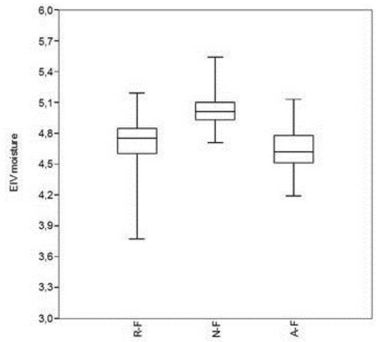

Figure 3: Boxplot of Ellenberg's indicator values for moisture calculated as unweighted mean values of the single relevés. R = reference site, n=13; N = younger fire site; n=50, A = older fire site, n=40.

The mean EIV light remain similar on the younger fire site but increased at the older fire site (figure 1). On the opposite the mean EIV temperature increased on the younger fire site to a lower temperature value on the older fire site (figure 2). The older fire site shows a significantly lower mean T-value even than that of the reference site.

The mean EIV moisture is increased at the younger fire site and similar to the reference site at the older fire site (figure 3).

The mean R-value indicates the lowest fluctuations. Compared to the reference sites it shows no differences on the younger and increases slightly on the older fire site, (figure 4).

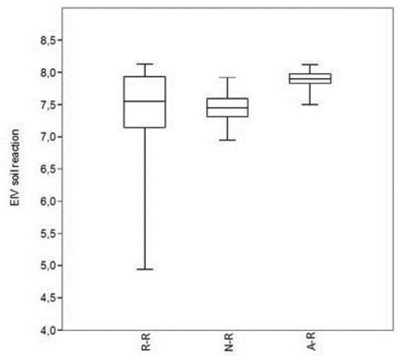

Figure 4: Boxplot of Ellenberg's indicator values for soil reaction calculated as unweighted mean values of the single relevés. R = reference site, n=13; N = younger fire site; n=50, A = older fire site, n=40.

The mean N-value was strongly affected by the fire. The younger fire site showed a significantly higher N-value than the older fire site and the reference sites (figure 5).The older fire site showed a week but significantly lower N-value than the reference sites.

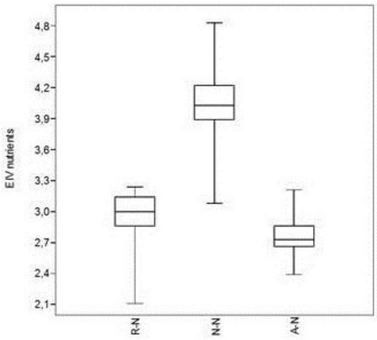

Figure 5: Boxplot of Ellenberg's indicator values for nutrients calculated as unweighted mean values of the single relevés. R = reference site, n=13; N = younger fire site; n=50, A = older fire site, n=40.

Some differences can be explained by the vegetation structure. Figure 6 shows the mean vegetation cover per site. It can be seen that, even 60 years after fire event, the percentage of total cover of the reference sites is not reached.

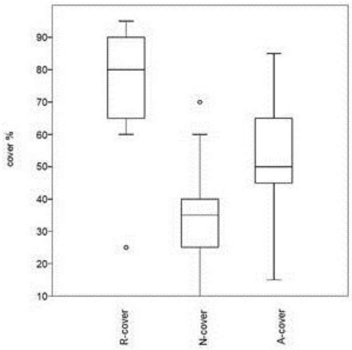

Figure 6: Boxplot of total vegetation cover calculated from the average cover values of the single relevés. Two outlayers are excluded. R = reference site, n=13; N = younger fire site, n=50; A = older fire site, n=40.

Calculating the cover values separately for the different plant growth forms (woody species, perennial and annual herbs and bryophytes), shows a way to explain this in a different way (figure 7). Especially woody species do not regenerate even after 60 years. A higher bryophyte cover is characteristic for the reference site. Annuals do not occur in the reference site, but they do not play such an important role at all as it is known for early succession stages in lower altitudes. In the contrary, their proportion increases in the older fire site. Here the general cover increased again compared with the younger fire site, but caused mainly by perennials.

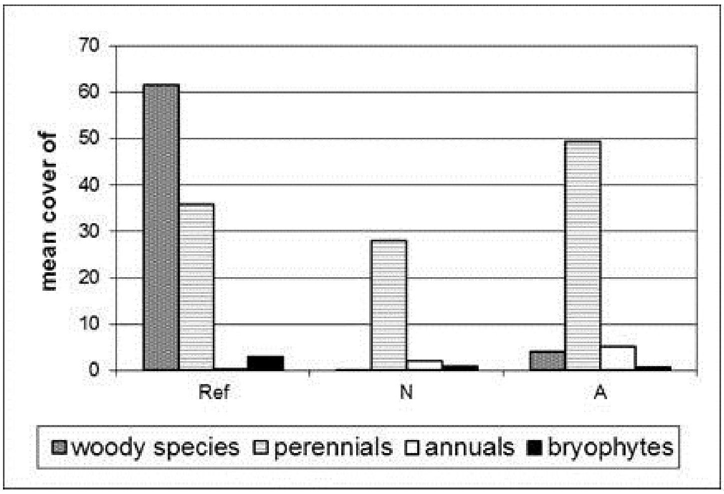

Figure 7: Bar chart of mean cover values divided into different plant growth forms. R = reference site; N = younger fire site; A = older fire site.

Discussion

The high EIV nutrient on the younger fire site is plausible in the light of the nutrient mobilization after fire events. Leaching and erosion leads subsequently to a loss of humus and nutrients, which explains the low nutrient values of the older fire site. The relatively large fluctuation on the younger fire site is a result of the inhomogeneity of the site conditions and hence the vegetation of this part.

Some widely distributed weeds are involved in post-fire regeneration even in the high montane belt, which increased the mean EIV temperature short time after the fire event, as we can see at the young fire site. The significantly low temperature value on the older fire site can be explained by the immigration of alpine species in that area. This is an important indication that post-fire areas could act as a secondary habitat for endangered alpine species.

The high mean moisture value on the younger fire site can be explained by the reduced competition for water due to the lack of the tree and shrub layer. After 60 years the area has leveled off in their natural moisture potential similar to the reference sites.

The L-value has hardly changed 8 years after the fire event. This is surprising because the loss of shrub layer leads to completely new light conditions. Only on the old fire site, a significant increase of the mean light value can be observed. This is to be explained by the migration of species from the subalpine to alpine belt into the area. They generally show higher light indicator values.

Also the R-value has changed only little after the fire. Striking, however, is the high statistical spread of the soil reaction value at the reference sites. This variation is explained by the presence of acid soil indicator species, which occur on the mor humus layer developed from pine needle litter under the old *Pinus mugo* shrubs. The fire event destroyed the humus layer more or less completely leaving the bare upcoming bedrock (limestone), which primarily determines the soil pH for the next decades. The low nutrient and high soil reaction value of the older fire site is due to the loss of the remains of the original humus layer by post fire erosion and leaching.

Our results show, no evidence for regeneration of the original vegetation type of this high montane ecosystem 60 years after a fire event.

Based on the changed site conditions, the evolving vegetation is a stable subalpine dry grassland.

The younger fire site displayed a ruderal character which is typical for disturbed areas. The mobilization of nutrients by the fire attracts short-living “weeds”. Beside that species from the reference sites as well as from the older fire site play a prominent role in the species composition. Presumably, this is a short term state that will change slowly over the next years. The younger fire site shared more species with the reference sites, than the older one. This indicates, that the 60 years lasting succession still did not lead to a regeneration of the pre-fire vegetation.

The high alpha diversity on the older fire site indicates its importance for nature conservation targets. We found some species from alpine habitats on this site. If global warming leads to changes in the competitive situation of alpine vegetation (GRABHERR at al. 2010, GOTTFRIED et al. 2012), fire sites could serve as refuge for endangered species. So these habitats could play an important role in the vegetation mosaic of National Parks.

Conclusion

Fire events in high montane ecosystems of the Alps have a substantial long-term effect on the vegetation. Krummholz will not regenerate even after 60 years. It is replaced by natural, alpine grassland vegetation with significant disturbance indicators. Species from higher altitudes may seize such areas as a new habitat. The physiognomic turn from shrub to grassland vegetation leads to the necessity of revision of nature conservation targets after fire events, especially for management planning in National Parks. Facing an increase of fire events following global warming in the Alps, this is vitally important.

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Table 2: Vegetation table from the south slope of the Hagler Mountain, National Park "Kalkalpen" (Eastern Alps, Austria). Clusters obtained as a result of TWINSPAN classfication. Cluster A = older fire site (n=40); cluster N = younger fire site (n=50); cluster R = reference site (n=13).
All relevés from June to August 2011, relevé area 25 m². The second column provides the following layer information: t1, t2 = first and second tree layer; sl = shrub layer; hl = herb layer; j = juvenile woody species; ml = moss layer.

Kategorie		A (relevés 1–40)	N (relevés 1–50)	R (relevés 1–13)
Slope (degree)		[illegible]	[illegible]	[illegible]
Cover total (%)		[illegible]	[illegible]	[illegible]
Altitude		[illegible]	[illegible]	[illegible]
Relevé Number		[illegible]	[illegible]	[illegible]
Helictotrichon parlatorei	hl	33332323223322223221242r13rr.1.1112rrr.2	............................r.....................	..........r..
Veronica fruticans	hl	11r111r.112111111211r121111111rr11111.1r	.......................rr.r.r..r..................	....
Carex ornithopoda	hl	11.11rr...111...111.r1r1..1rrrrr111.1r.1	....	..r..........
Euphrasia salisburgensis	hl	r..rrr111rrrr1.1..1r1rr1r1111111111111r1	....	....
Adenostyles glabra	hl	11.rr1rr1rrr111111r1rrr.r11r11r.1rr11r1r	....................rr...................r........	...........r.
Trisetum alpestre	hl	111111111111111111111.22r1111111121r11.r	...............r..................................	....
Achillea clavennae	hl	rr1r1.1r11.11rr.1rr.rr.1.r.rrr11rrrr.r..	........r......r........r.r.......................	........r....
Gentianella aspera	hl	1r.rr.1r11..r1rrr.1rr.12..rrr1r11rrr.rrr	............................r.....................	....
Botrychium lunaria	hl	rrr.rr.....r.rrr.r.r..rr..r...rr........	....	....
Linum catharticum	hl	...r.........r.r..11..11...rr1..rr....r.	....	....
Minuartia austriaca	hl	.rrr.rr.r1rrrr2211r2rr1111r.rrrrr..rrrrr	..1.................1.............................	r11.......2r.
Thymus praecox	hl	..1rr11r11r.1..21.12...1.....r1.r....r.r	....	....
Hippocrepis comosa	hl	rr111rr1rrr1r.r1r.rr.rr1..r.rrrr..r11...	.....r.r......r1.rr.r..r..rr..rrrr.r...r.r..rrr...	....
Carlina acaulis	hl	rrrrrrrrrrrrrr...r....r.rrrrrr....1rr.rr	.r.........r....r...........r.....................	..........r..
Cardaminopsis arenosa	hl	.rr..r..r1rrr.rrrrrrr.rrr1r..rr.rrr.rr.r	r.rrr....r..r.........r...r.11rr.11.1.r..rr...r.r.	..........r..
Polygala alpestris	hl	.......rrrrrrr...........1...r..........	....	....
Larix decidua	hl	......r............rr.r..........1...r.r	....	....
Larix decidua	sl	...............................r2.222.2r	....	....
Carex sempervirens	hl	122222r11..1.2..122..rrr...........r.r..	....	....
Scabiosa lucida	hl	................1.r...rr....1r..r1r..1..	....	.......r.....
Carduus defloratus defloratus	hl	rrrrrrrrrrr1rrrrr.11r.1r.r1111rrrr111r11	..r.r..rrr.....r.....rr..rr....r.r.r.rr..rrr.r....	1r1rrrrr.....
Campanula cochleariifolia	hl	.r.r11.rr1rr1r11r11.r.r1r1111rr1r11r11.1	1......rrr.1r..1.rrrr.1..1.rr...r.r.rr..rr.r.1....	2......1r.11.
Rumex scutatus	hl	....11..........11......1...............	....	....
Sesleria albicans	hl	r11.1r121r.1r1...1......................	....	........r....
Kernera saxatilis	hl	....r.r................r..........r.....	....	....
Acinos alpinus	hl	11r.11rr1rrr11r.11.....1...r...rr.r1..1.	rrr.....rr.....r.r................................	1r1....1.....
Teucrium montanum	hl	...................r..r........r..r.....	....	....
Epilobium montanum	hl	..............r.........................	rr.21211111r11r1111111r11111111.121222221132112122	....
Urtica dioica	hl	................rr......1...............	r..221211212r1212rr1r21121r11211112212211111112212	....
Taraxacum officinale agg.	hl	...........r............................	rrr.1rrrrrrr..rrrr.rrr.rrrrrrrrrrrrr11rrrrrrrr1rrr	r.r..........
Mycelis muralis	hl	....	..rrr1rrrrrr.rr.rrrrrr.rrrrrrrr.rr11r1r.1r211r11r1	.........rrr.
Salix caprea	hl	.................................r.r.r..	r....r.........rrrrr.rrrrrr.rrrrr.r1rrrrrrr.r1rrrr	....
Arenaria serpyllifolia s.str.	hl	.................r......................	1.....1.11.11...1.2.r.rr..rr1..1rr.rr..r1..r...rr.	....
Moehringia muscosa	hl	..........r.r.r.1rr.r....r...r..........	111r1rrr11r1111.111r111.1rrrr1r1r11rr.rr.r1rr11r1r	rrrr.r...r.1.
Tussilago farfara	hl	....	.......r........r......r.........1rrr1rrr1r.rr.rrr	....
Larix decidua	j	.................r.....r............r...	rrrrrr1rr1.r.rrrrrrrr.rrr.rr..r.rr1rrrrrrrrrr.rrr.	..r..........
Marchantia polymorpha	ml	....	...r..r........rr1.....r..r.1....r..rr....1..rrr.r	....
Cirsium palustre	hl	....	.....rr..rr.........r...r.r.r..r...r..rr1r..rr....	....
Gymnocarpium robertianum	hl	rr.r..........21.rr2rr...2r.r11..r..r.1.	r.r2r...r.r11111r1rrrrrr1r1r11.1.11r1r1rr.rr.rrr1r	121..1...r...
Epilobium angustifolium	hl	....	.....111.........................r1..1r1rr1.r1...r	....
Dryopteris filix-mas	hl	....................r.................r.	.....r.rr..1r.rr....r..r..rr..r.....rr..r.r.rr.r.r	..........r..
Calamagrostis epigejos	hl	....	.......1r......rr.rr.r1....rr.........1...r..r....	....
Athyrium filix-femina	hl	....	...rr1.rr......rr.r.....r.........................	....
Ceratodon purpureus	ml	....	............................1.......1..r1..r.r....	....
Poa annua	hl	....	2..............r.rr...............1...............	....
Poa nemoralis	hl	....	..........r..1..r.r...........21...r....1.........	..........r..
Thymus pulegioides	hl	............r...........................	12r1112.r.1..1.1r.............r.......1........r..	2.2rr........
Euphorbia amygdaloides	hl	....	rr.rr.r.1..1..........................r...........	1r.1.1.......
Fissidens dubius	ml	....	....	1.r.r.r.rrr..
Sorbus aucuparia	j	....	......r...	..r1r1r..r..r
Polygala chamaebuxus	hl	....	....	r.1..1.r.....
Vaccinium myrtillus	hl	....................r...................	.r1r..r.....1r....................................	1.11111r.2..r
Pinus mugo s.str.	sl	......................................1.	..r...	533555555
Dicranum scoparium	ml	....	r...	..1.1.r.r11r.
Hylocomium splendens	ml	....	....	....r....r...

Continuation of Table 2 with accompanying species

Kategorie		A A A … A N N N … N R R R … R
Slope (degree)		[illegible]
Cover total (%)		[illegible]
Altitude		[illegible]
Relevé Number		[illegible]
Galium anisophyllon	hl	r r r 1 r r 1 r r 1 1 r r 1 r 1 1 r r 1 r r r 1 r r r r r 1 r r 1 r 1 r r 1 1 1 1 2 1 1 2 r 1 r 1 . 1 . 1 1 1 2 r 1 r . 1 . r . 1 1 . r r . r r . 1 1 1 r r r . r . 1 1 . 1 1 r r . 1 1 1 1 r r r r 1 . 1 r .
Erica carnea	hl	3 1 2 r r r 2 2 2 2 . . 1 2 . r . r 2 1 2 . 1 . . . 2 2 3 2 2 2 2 2 2 3 3 3 3 3 3 r 1 1 . . r r . r . . r r r . r r r r r r r . . r r r r r r r r r . r r r r r r r r r r r r . r r . 2 r 2 2 2 1 1 2 4 1 2 1 2
Calamagrostis varia	hl	2 . . 1 1 2 1 2 1 1 1 . 1 1 r r 2 . r 2 2 1 2 1 . 1 1 2 2 1 . 1 2 r 1 2 2 1 1 2 . . 1 . . 2 1 2 r 1 1 . . r r . r . . . 1 . . r r 1 r r . . r 1 r 1 r 2 1 1 2 . . 2 . 2 1 r . 1 1 r 2 . r 2 2 2 1 2 1 2 . r .
Campanula rotundifolia	hl	r r r . . . . r r 1 r . r r . . . . r . . . r . . . . 1 1 1 1 . 1 r . . 1 . 1 1 . . . r . r 1 r . . r 1 r 1 r . 1 1 1 1 1 r r r r 1 . 1 r r . r 1 . . r 1 . 1 1 r 1 1 r r . . . r
Asplenium viride	hl	. r . r r r . . . . r . r r r r r 1 . r 1 r . . . r r . r . r r . . . . r r . . r r r r r . . . . r r r r r r . r . . . . . . r r . r . r . r . r r . r . r r . . . . r r r r . . r . 1 r r . . r . . . . r . .
Helleborus niger	hl	. r . r . r . . . . r r 1 . . 1 . . . . . . r r 2 r r . r r r r . . . 1 r r r r . r r r . r r r r r r . r . . . . r . . . . r . r r . . 2 1 2 1 . 1 r r . . r . .
Asplenium ruta-muraria	hl	. r . r r . . . r . r r 1 . r . . . 1 . r r . . r . r r . . . r r r r r r r . . . r r r r 1 . . . . r . 1 r . 1 r . r . . r r r . . . . r . . . . . . r . r . . . . r . . r . . r . . . . r . . . .
Asplenium trichomanes	hl	. . . r . . r . r . . . . . r r . r r . . . r . . . . r r r r r . . . . r r . r r . . r 1 1 r . . . . r r . r . . . . . r . . r . . r . . . . r . . . . r . . . .
Vaccinium vitis-idaea	hl	. . . . 1 r r 1 r r r 1 r . . r r 1 1 . r . . r . . 1 . . 1 r . . . . r r 2 1 2 3 . . 1 r . 5
Lotus corniculatus var. alpicola	hl	. r r . . r r r . . r . . . . . r . r r . . . . . . r 1 1 1 . . r . . r . . . 1 r . r . . r r . . . . r . . r . . . . r . . . . . . r . . . . r r . . . . . . r . . . r . . . .
Campanula scheuchzeri	hl	. . . r r . r . . . . r r r r . . . r r r . . . . r . r r r r 1 . . . . . r . . r . . r . . . 1 . . . . r 2 r . . . . r . . . . r r r .
Sedum atratum	hl	. . . . r r . r . r 1 r r 1 . . . r r 1 . 1 . . r r . r . r . . . . r . . . . r . r r . . r r . . 1 . . . 1 . . . . r . . . . . 1 . . . .
Ranunculus montanus	hl	. . . . . r . r . . . . r . . r r . . . . r . . . . r r . . r r r . r r r . . . . r . . . r . . . . 1 r 1 . r 1 r r . r . . .
Fragaria vesca	hl	. . . . . . r . . . . r . . . r . . . . r 1 1 1 . 1 r . . r . r 2 r . . . . . . 1 r r r r . . . 1 . . 2 . . . . 1 r . 1 . . r r . . . .
Betonica alopecuros	hl	. . . . r r r . . . . r . . . . 1 r . . 1 r . . . . r . r r . r . . . r . 1 . . . . r . . r . . . . r r 1 . r r . r . r . . .
Polygala amara	hl	. r r r . r . . . . r r . . r r 1 r . . . . 1 . . r r . . . . r . . r . . . . r . . . . r r . r . . r . . . . .
Galeobdolon flavidum	hl	. . . . 1 r r . . 1 . . . . . r . . . . 1 . 1 r r . r r r 1 r . . . 1 . . . . 1 . . . . r . . . . 1 1 .
Daphne mezereum	hl	. . . . r . . . . . . r . . . . r . . . . r . r . . . . r . r r r . . . . r . . . . r . . 1 r . . r r r .
Tortella tortuosa	ml	. . . . r . . . . 1 . r . . 1 1 . . . . r . . 1 r . . r . r r . r r . . . . r . . . . r . . . . r r . . . r
Cystopteris fragilis	hl	. . . . r . . . r . . r . . r . . . r . . . . r . . . . . . r r . r . . . . . . r . . . . r r r r r . . . r . . . .
Polystichum lonchitis	hl	. . . . r . r . . . . r . r . r . . r . . . . r . . . . r . . . . . . r . r r . . . . r . . . . . r . . . . . r . . . .
Valeriana montana	hl	. . . . r . . 1 . . r . r . . 1 1 . . . . r 1 . . . . r . . r . . . . . r . 1 1
Linaria alpina	hl	. r . . . . r . . . . 1 r r . . . . 1 r . . . . 1 . . . . r . . r . . . . 1 . . . .
Picea abies	j	r . r . . . . . . r . r . . . . r . . . . r . . . . r . . r . . . . r . . . . r . . . . 1 . . r . . . . 1 . . .
Phyteuma orbiculare	hl	r . r 1 1 1 . . . . 1 . . . . r . . . . 1 . . . . r . . . . r . . 2 . . . . 1 . . . . . .
Hieracium murorum	hl	r . . . . r . . . . r . r . . . . . r r . . r . . r . . . . 1 . . 1 . r . . . . . r . . .
Rubus saxatilis	hl	. . . . r r r . . . . r . . . . r . . . . r . . . . . r r . . . . r . r . . r . . 1
Ranunculus nemorosus	hl	. . . . r . r r . . . r . r . . . . r r . . . . r . 1 r . . . r . . . .
Heracleum austriacum	hl	r . . r . . . . . . r r . . . . 1 . . . . r . . . . r . . . . r r . . . . . r . . . .
Cerastium holosteoides	hl	. . . . r . . . . r r . . . . r r r . 1 . . . . r . . . . 1 . . . .
Larix decidua	t1	. . . . r . 2 . . . 2 2 . . . . 4 2 2 . 3 . . . . . .
Senecio rupestris	hl	. . . . r . . . . r . . . . r . . . . r . . r . . . . . . r r . r . . . .
Carex brachystachys	hl	. . . 1 r . . . . 1 . r . . . . r . . . . r . . . .
Ajuga reptans	hl	. . . . r . r r r r . . . . 1 . . . r . . . .
Picea abies	hl	. . . . . . r r r . . . . 1 . . . . 1 . r . 1 . . . .
Mercurialis perennis	hl	. . . . r . . . . r . . . . r . . . . 1 . . . . 1 r .
Globularia cordifolia	hl	. . 1 . r . . . . r r r 1 . . . . 1 . . . .
Picea abies	sl	. . . . 1 1 2 . 1 . . . . r . . 2 1 . . . .
Aconitum napellus s. str.	hl	. . . . r . . . . r 1 . r r . . . . r . . . .
Polystichum aculeatum	hl	. . . . r . . . . r r r . . . . r . . . r . . . .
Polytrichum formosum	ml	. . . . r . . . . r . . r . . . . . . r . . . . r . . . .
Cerastium arvense strictum	hl	. . . r . 1 . . . . 1 1 . . . . r . . . .
Hypericum maculatum s. str.	hl	. . . . r . . . 1 . . . . r . . . . r . . r . . . . . .
Silene pusilla ssp. pusilla	hl	. . . . r r . r . . . . r . . . . 1 . . . .
Cirsium vulgare	hl	. . . . r r . . . . . . r . . . r . . . . r . . . .
Salix appendiculata	hl	. . . . r . . . . r . . . r . . . . r . r . . . .
Luzula pilosa	hl	. . . . r . . . . r . . . . r . . . . r . . . . r . . . .
Pulsatilla alpina ssp. Alpina	hl	. . . . r r . r . r . . . . r . . . . . .
Dentaria enneaphyllos	hl	. . . . r . . . . r r 1 . . . .
Carex digitata	hl	. . . . r . . . 1 . . r . . . . r . . . . r . . . .
Gymnocarpium dryopteris	hl	. . . . 2 r r . r . . . .
Calamagrostis villosa	hl	. . . . r . . . . r . . . .
Salix caprea	j	. . . . r r . . r . . r . . . .
Luzula sylvatica ssp. sylvatica	hl	. . . . r . . . r . . . . 1 . . . .
Campanula glomerata	hl	. . . . r 2 . . 1 . . . . 1 . . . .
Eupatorium cannabinum	hl	. . . . r . . . . . . r . r . . . . . r . . . .
Potentilla brauneana	hl	. . . . r r . r . . . . r . . . .
Bryum capillare	ml	. . . . r . . . . r . . . . r r . . . . .
Polytrichum juniperinum	ml	. . . . r . . . . 1 . . . . 1 . . . . r . . . .
Pinus mugo s.str.	j	. . . . . r . . . . r . . . . r . . . .
Ditrichum flexicaule	ml	. . . . 1 . . . . r r . . . . r . . . .
Viola biflora	hl	. . . . r . . . . r . . . .

Kategorie		A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	R	R	R	R	R	R	R	R	R	R	R	R	R	R
Slope (degree)		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Cover total (%)		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Altitude		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Relevé Number		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Rhododendron hirsutum	hl	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.
Asplenium fissum	hl	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Hieracium villosum	hl	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Digitalis grandiflora	hl	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Picea abies	t1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.
Knautia arvensis agg.	hl	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.	.	r	.	.	.	.	.	.	.	.	.
Valeriana tripteris	hl	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	r
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Ranunculus hybridus	hl	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.
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Plagiothecium laetum secundum	ml	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Saxifraga rotundifolia	hl	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
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Calypogeia azurea	ml	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
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Veronica chamaedrys	hl	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Myosotis arvensis	hl	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
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Pinus sylvestris	j	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Encalypta streptocarpa	ml	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Cerastium carinthiacum carinth	hl	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Arabis alpina	hl	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
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Senecio ovatus	hl	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
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Blechnum spicant	hl	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Geranium sylvaticum	hl	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.
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Other species:

Acer pseudoplatanus [6] 95: r; *Alchemilla coriacea* [6] 41: r; *Alchemilla monticola* [6] 42: r; *Alchemilla vulgaris agg.* [6] 82: r; *Antennaria dioica* [6] 35: +; *Arabis ciliata* [6] 93: 1; *Athamanta cretensis* [6] 7: r; *Atropa bella-donna* [6] 49: r; *Barbilophozia attenuata* [9] 103: +; *Barbula convoluta* [9] 78: +; *Blechnum spicant* [6] 54: r; *Carex montana* [6] 14: +; *Cerastium glutinosum* [6] 71: +; *Clematis alpina* [6] 48: r; *Cystopteris alpina* [6] 66: r; *Dicranum montanum* [9] 93: +; *Epilobium palustre* [6] 58: 1; *Euphorbia cyparissias* [6] 50: r; *Festuca rupicola* [6] 41: 2; *Fraxinus excelsior* [7] 65: r; *Homogyne alpina* [6] 97: r; *Huperzia selago* [6] 94: r; *Hypnum* [illegible] [9] 93: +; *Juncus monanthos* [6] 19: +; *Juniperus communis ssp. communis* [6] 40: r; *Juniperus communis ssp. communis* [4] 95: 1; *Knautia arvensis* [6] 41: r; *Knautia maxima* [6] 56: 1; *Lathyrus pratensis* [6] 47: r; *Leontodon helveticus* [6] 76: r; *Leontodon hispidus ssp. hispidus* [6] 97: +; *Leucanthemum atratum* [6] 94: 1; *Lonicera alpigena* [6] 100: +; *Luzula luzulina* [6] 42: +; *Medicago lupulina* [6] 89: r; *Melica nutans* [6] 47: +; *Orobanche sp.* [9] 32: r; *Phyteuma spicatum* [6] 48: +; *Pinus sylvestris* [1] 37: 3; *Plagiochila porelloides* [9] 93: +; *Plagiothecium undulatum* [9] 103: +; *Poa angustifolia* [6] 97: +; *Pulsatilla alpina ssp. alpina s.lat* [6] 98: r; *Rhododendron hirsutum* [6] 97: 3; *Rhytidiadelphus loreus* [9] 103: +; *Rhytidiadelphus triquetrus* [9] 103: +; *Salix purpurea* [6] 87: r; *Salix sp.* [7] 83: r; *Sambucus ebulus* [6] 76: 2; *Scabiosa sp.* [6] 97: +; *Schistidium apocarpum* [9] 42: +; *Sedum album* [6] 71: r; *Senecio abrotanifolius* [6] 93: +; *Silene alpestris* [6] 59: +; *Silene nutans ssp. nutans* [6] 32: 1; *Solanum nigrum* [6] 74: r; *Sorbus aria* [6] 100: 2; *Sorbus aucuparia* [8] 91: +; *Sorbus chamaemespilus* [7] 103: 1; *Teucrium chamaedrys* [6] 21: 1; *Thesium alpinum* [6] 24: r; *Ulmus glabra* [7] 88: r; *Verbascum sp.* [6] 81: r; *Veronica serpyllifolia ssp. humifusa* [6] 93: r;