

# A guide to frequent and typical plant communities of the European Alps

Guide to the  
virtual excursion  
in lesson B1  
(Alpine plant biodiversity)

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## Preface

This guide provides an overview over the most frequent, widely distributed, and characteristic plant communities of the European Alps; each of them occurring under different growth conditions. It serves as the basic document for the virtual excursion offered in lesson B1 (Alpine plant biodiversity) of the ALPECOLE course. Naturally, the guide can also be helpful for a real excursion in the field!

By following the road map, that begins on page 3, you can determine the plant community you are looking at. Communities you have to know for the final test are indicated with bold frames in the road maps. On the portrait sheets you will find a short description of each plant community. Here, the names of communities you should know are underlined. The portrait sheets are structured as follows:

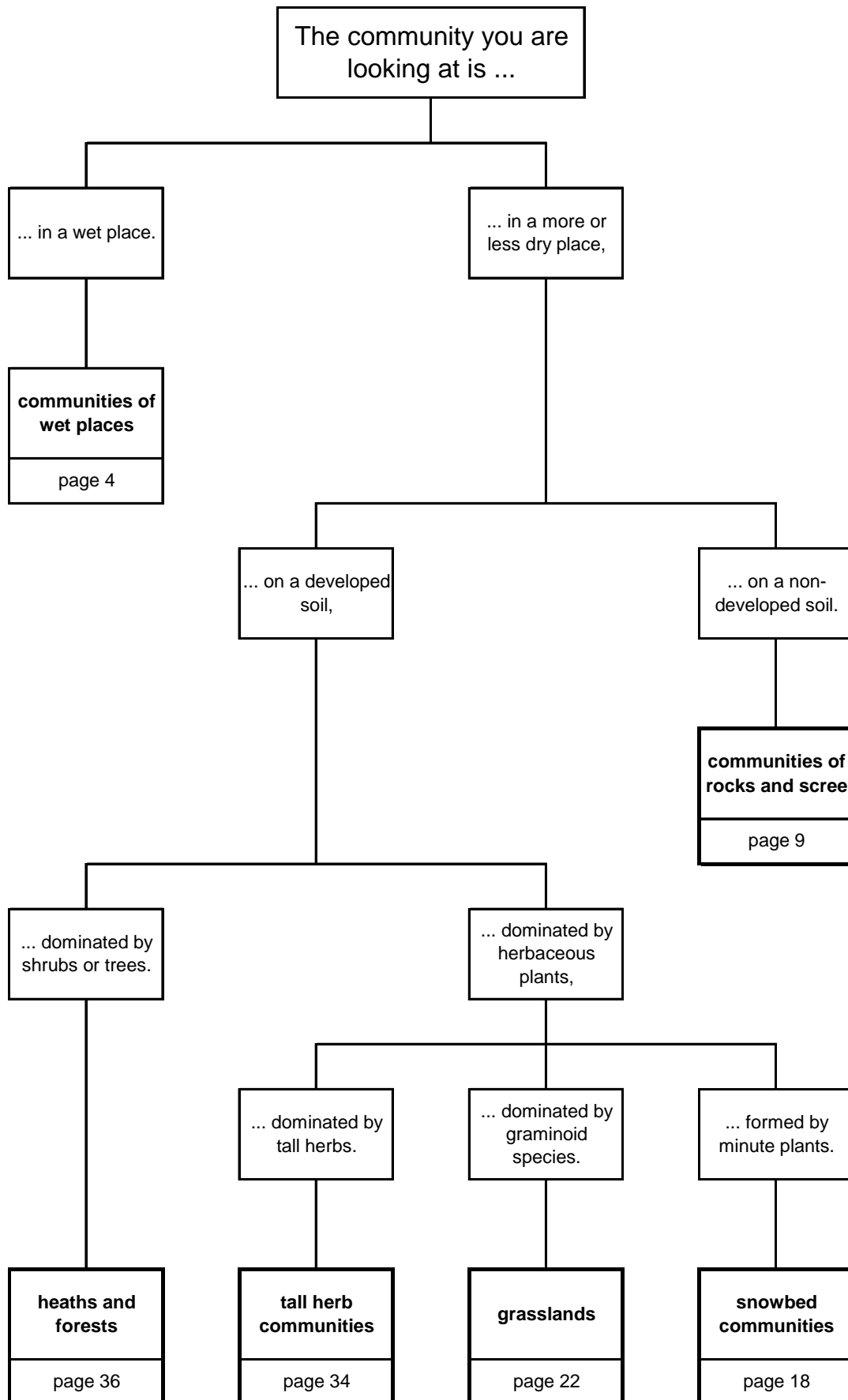
- After the English name of the community the corresponding **phytosociological units** are indicated, i.e. the association (Ass.) and/or the alliance (All.). The names of the units follow Ellenberg (1996) and Grabherr & Mucina (1993).
- The paragraph “**site characteristics**” provides information on the altitudinal occurrence of the community, its topographical situation, the types of substrata, specific climate conditions, the duration of snow-cover, as well as on the nature of the soil. Where appropriate, specifications on the agricultural management form are given.
- In the section “**stand characteristics**” the horizontal and vertical structure of the community is described. Details on important plant species are also reported and for most communities an assessment of the species richness is indicated. In some cases, spatial (zonation) or temporal relations (succession) to other communities are specified.
- The list of **typical species** includes vascular plant\* species that occur frequently and more or less exclusively in the specific community. Here, the scientific names, the family as well as the common English names are given.
- The last section, named “**distribution**”, specifies the spatial occurrence of the specific community within the European Alps. Furthermore, it provides information on the occurrence of the community or of similar communities in other (mountainous) parts of the world.

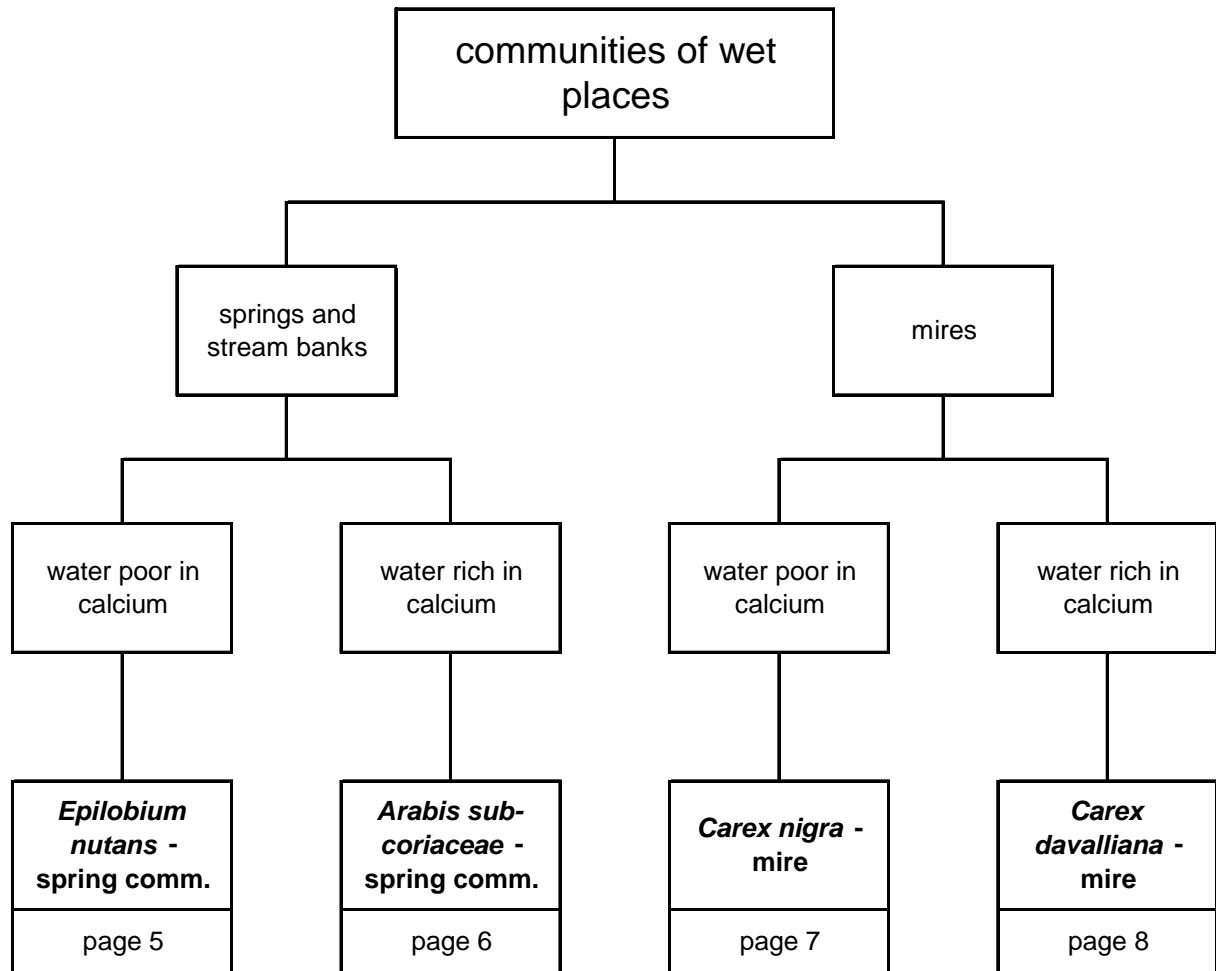
The **reference** list contains general works on the vegetation of the European Alps as well as works on the vegetation of other mountain chains. In the **glossary**, botanical terms used in the guide are explained. These terms are highlighted with an asterisk (\*) in the text. The guide is completed by an **index** of the species cited herein.

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### Road map to Alpine plant communities





## *Epilobium nutans* – spring community

**Phytosociological unit:** All.: *Cardamino - Montion*.

### Site characteristics:

Subalpine and lower alpine zones between 1400 and 2500 m. Along soft, calcium-poor watercourses (springs and streams). Stable water temperature throughout the year, generally free of ice in winter. In regions with siliceous bedrock. Continuously moist soil; acid to neutral (pH 4 – 7) and nutrient-poor.

### Stand characteristics:

Dense canopy of mosses such as *Bryum schleicheri*, *Philonotis seriata*, or *Scapania undulata*. The moss cushions are often colonized by vascular plants\* such as *Epilobium nutans* or *Saxifraga stellaris*; however, the cover of vascular plants\* always remains scanty.

### Typical species:

<i>Cardamine amara</i>	BRASSICACEAE	large bittercress
<i>Epilobium nutans</i>	ONAGRACEAE	nodding willowherb
<i>Saxifraga stellaris</i>	SAXIFRAGACEAE	starry saxifrage

### Distribution:

Distributed in the siliceous parts of the European Alps, especially in the Central Alps.

Corresponding communities outside of the European Alps:

- *Epilobium hornemannii* – communities: Scandinavia, Greenland.
- *Epilobium palustre/Saxifraga stellaris* – communities: Iceland.
- *Cardamine nymanii/Saxifraga foliosa* – communities: Spitsbergen.
- *Epilobium anagallidifolium/Primula parryi* – community: Rocky Mountains (Colorado Front Range).
- *Saxifraga stellaris/Ranunculus marschlinsii* – community: Corsica.
- *Saxifraga aquatica* – community: Pyrenees.
- *Montia rivularis/Sagina sabuletorum* – communities: High Atlas.

## ***Arabis subcoriacea* – spring community**

**Phytosociological unit:** All.: *Cratoneurion commutati*.

### **Site characteristics:**

Subalpine and lower alpine zones between 1400 and 2400 m. Along hard, calcium-rich watercourses: springs, streams, or rocks that are exposed to a constant stream of water. Constant water temperature year-round, generally free of ice in winter.

In regions with calcareous bedrock. Continuously moist soil, formation of tufa\*, neutral to basic (pH 7 – 8) and nutrient-poor.

### **Stand characteristics:**

Community dominated by tufa\*-forming mosses such as *Cratoneuron falcatum* and *Philonotis calcarea*. These are colonized by some vascular plants\* such as *Arabis subcoriacea* or *Epilobium alsinifolium*; their cover always remains feeble. *Saxifraga aizoides*, however, often dominates in these habitats.

### **Typical species:**

<i>Arabis subcoriacea</i>	BRASSICACEAE	Jacquin's rockcress
<i>Epilobium alsinifolium</i>	ONAGRACEAE	chickweed willowherb
<i>Saxifraga aizoides</i>	SAXIFRAGACEAE	yellow saxifrage

### **Distribution:**

Distributed in the calcareous parts of the European Alps.

Corresponding communities outside of the European Alps:

- *Epilobium alsinifolium*/*Saxifraga aizoides* – communities: Scandinavia.
- *Cratoneuron falcatum*/*Arabis bellidifolia* – community: Pyrenees.

## *Carex nigra* – mire

**Phytosociological unit:** All.: *Caricion fuscae*.

### Site characteristics:

Subalpine and lower alpine zones between 1400 and 2500 m. In depressions, on level surfaces or gentle slopes, along watercourses, and around lakes and ponds.

On siliceous substrata. Gley\* type soil, generally with a layer of peat; moist throughout the year; acid to neutral and nutrient-poor.

### Stand characteristics:

Monotonous, species-poor community dominated by sedges (*Carex sp.*) and other graminoids\* of the *Cyperaceae* family. Above treeline, the stands are often exclusively formed of *Eriophorum scheuchzeri*.

### Typical species:

<i>Carex echinata</i>	CYPERACEAE	star sedge
<i>Carex nigra</i>	CYPERACEAE	common sedge
<i>Eriophorum scheuchzeri</i>	CYPERACEAE	Scheuchzer's cotton-grass
<i>Trichophorum caespitosum</i>	CYPERACEAE	deergass
<i>Viola palustris</i>	VIOLACEAE	marsh violet

### Distribution:

Distributed in the siliceous regions of the European Alps.

Corresponding communities outside of the European Alps:

- *Carex nigra* – communities: Scandinavia, Iceland, Greenland, Caucasus, Pyrenees.
- *Eriophorum scheuchzeri* – communities: Scandinavia, Iceland, Spitsbergen, Greenland, Alaska.
- *Carex scopulorum/Pedicularis groenlandica* – communities: Rocky Mountains (Colorado Front Range).
- *Festuca rivularis/Veronica repens* – communities: Sierra Nevada (Spain).
- *Carex intricata/Isolepis setacea* – communities: High Atlas.

## *Carex davalliana* – mire

**Phytosociological unit:** All.: *Caricion davallianae*.

### Site characteristics:

Subalpine and lower alpine zones between 1400 and 2300 m. Along watercourses as well as around lakes and ponds.

On calcareous bedrock. Gley\* type soil, normally covered by a peat layer; moist year-round; neutral to basic and nutrient-poor.

### Stand characteristics:

Species-poor communities dominated by graminoids\*, predominantly by *Carex davalliana*. At lower altitudes, *Eriophorum latifolium* as well as some lovely flowering herbs\*, such as certain orchids, form the aspect of this community.

### Typical species:

<i>Carex davalliana</i>	CYPERACEAE	Davall's sedge
<i>Carex flava</i>	CYPERACEAE	large yellow-sedge
<i>Epipactis palustris</i>	ORCHIDACEAE	marsh helleborine
<i>Eriophorum latifolium</i>	CYPERACEAE	broad-leaved cottongrass
<i>Parnassia palustris</i>	PARNASSIACEAE	grass-of-Parnassus
<i>Pinguicula vulgaris</i>	LENTIBULARIACEAE	common butterwort
<i>Primula farinosa</i>	PRIMULACEAE	bird's-eye primrose
<i>Swertia perennis</i>	GENTIANACEAE	marsh felwort
<i>Tofieldia calyculata</i>	TOFIELDIACEAE	tofield's asphodel

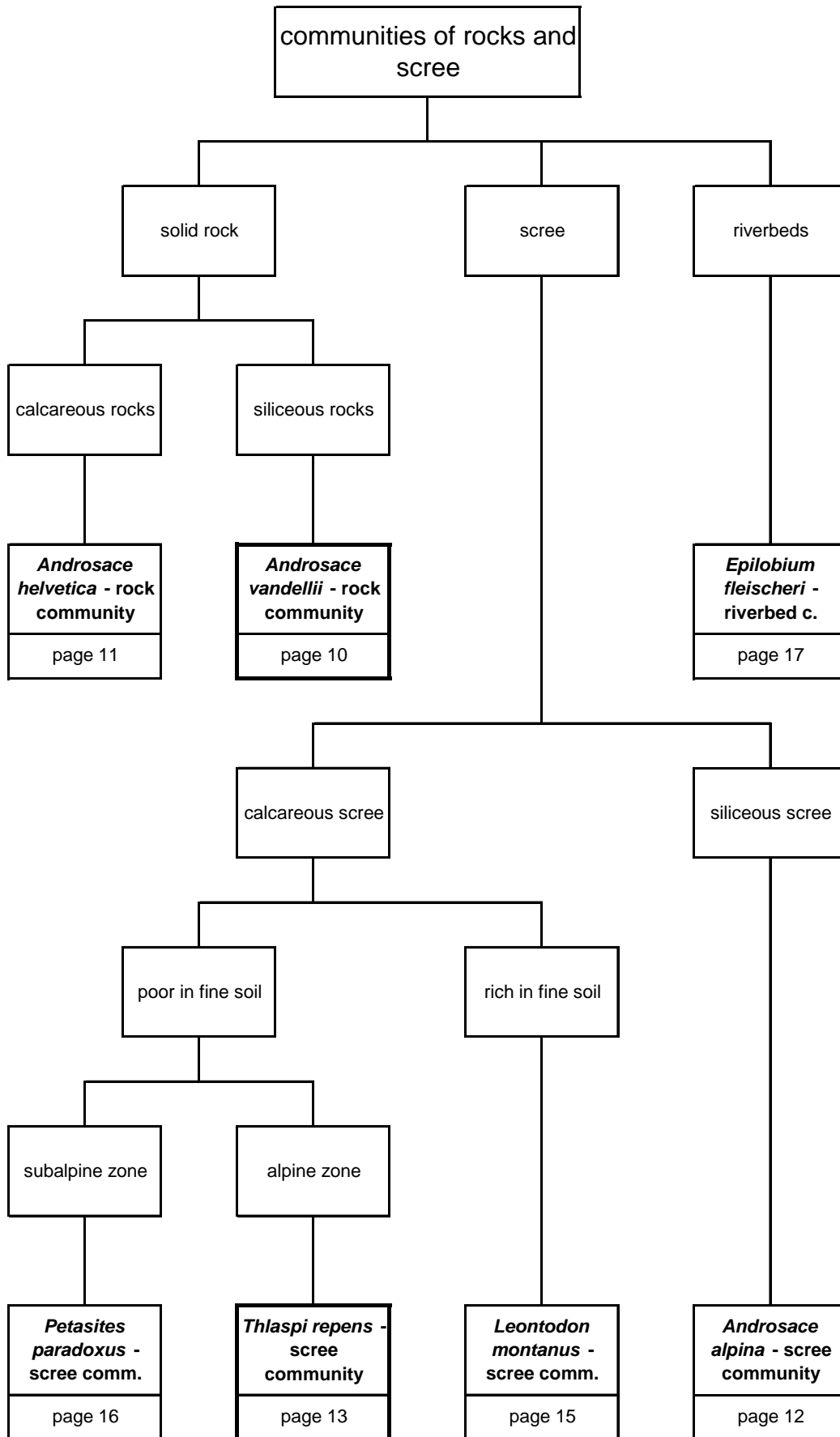
### Distribution:

Distributed in the calcareous regions of the European Alps.

Corresponding communities outside of the European Alps:

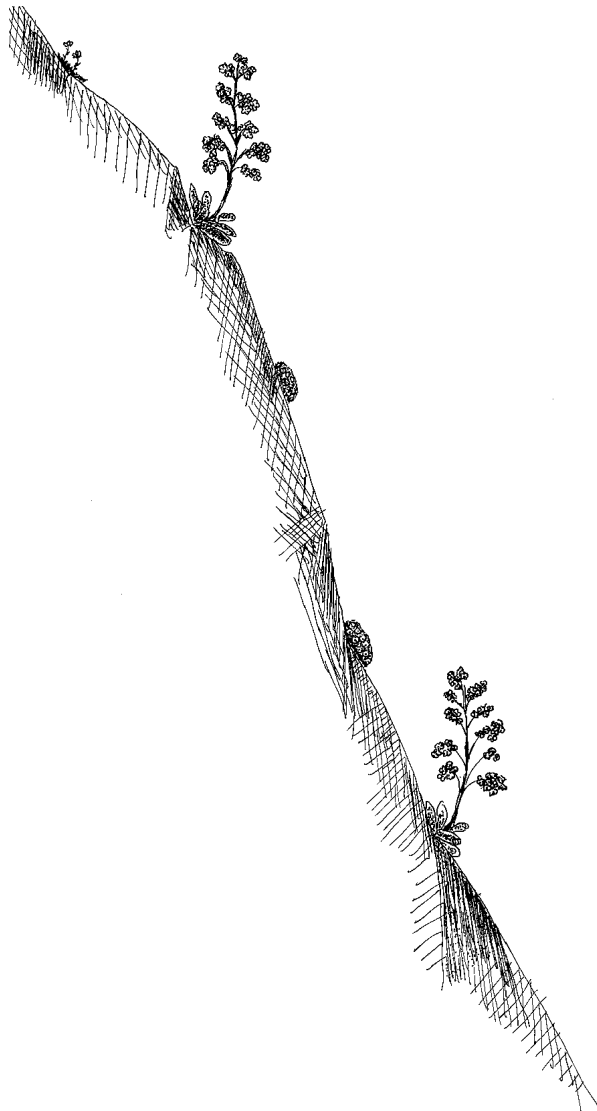
- *Carex davalliana* – community: Pyrenees.
- *Blysmus compressus/Veronica balkanica* – community: Greek Mountains.





## *Androsace vandellii* – rock community

**Phytosociological unit:** Ass.: *Androsacetum vandellii* (All.: *Androsacion vandellii*).



### Site characteristics:

Subalpine, alpine, and nival zones between 1400 and 3000 m. On rocks and cliffs of different inclination; in lower regions, the community colonizes habitats in different exposures; while at higher altitudes, it predominantly occurs on south-faced cliffs. Snow cover depends on inclination and exposure and may be completely lacking in the extreme case (on steep slopes). Significant fluctuations in daily and seasonal temperatures.

Exclusive to siliceous rocks (granite, gneiss). Raw soil; dry, acid, and nutrient-poor.

### Stand characteristics:

The rock surface is colonized by so called "lithophytes\*": algae, lichens, such as *Rhizocarpon geographicum* and *Umbilicaria sp.*, or mosses, e.g. *Andreaea rupestris* and *Grimmia sp.* Vascular plants\* only occur on rock ledges ("chomophytes\*") or in fissures ("chasmo-phytes\*"). They, therefore, form an open community determined by the occurrence of terraces and crevices. Typical life forms in this habitat are cushion plants, for example *Androsace vandellii* or *Eritrichium nanum*, and rosette plants with succulent\* leaves, such as *Saxifraga cotyledon* or *Primula latifolia*. Due to the low density of the community, competition is more or less absent.

Siliceous rocks often harbour rare and endemic\* species; for instance *Androsace brevis*, an endemic\* *Primulaceae* of the Bergamaschi Alps.

### Typical species:

<i>Androsace vandellii</i>	PRIMULACEAE	many-flowered rock-jasmine
<i>Artemisia umbelliformis</i>	ASTERACEAE	Alps wormwood
<i>Erigeron gaudinii</i>	ASTERACEAE	Gaudin's fleabane
<i>Eritrichium nanum</i>	BORAGINACEAE	king of the Alps
<i>Primula hirsuta</i>	PRIMULACEAE	stinking primrose
<i>Primula latifolia</i>	PRIMULACEAE	broad-leaved primrose
<i>Saxifraga cotyledon</i>	SAXIFRAGACEAE	pyramidal saxifrage
<i>Saxifraga exarata</i>	SAXIFRAGACEAE	white musky saxifrage
<i>Woodsia alpina</i>	ATHYRIACEAE	Alpine woodsia

### Distribution:

Widely distributed all over the siliceous parts of the European Alps.

Corresponding communities outside of the European Alps:

- *Saxifraga serpyllifolia*/*Potentilla elegantis* – communities: Alaska.
- *Saxifraga rivularis*/*Claytonia megarhiza* – communities: Rocky Mountains (Colorado Front Range).
- *Phyteuma serratum*/*Festuca sardoa* – community: Corsica.
- *Saxifraga mixta* – community: Pyrenees.
- *Saxifraga nevadensis* – community: Sierra Nevada (Spain).

## *Androsace helvetica* – rock community

**Phytosociological unit:** Ass.: *Androsacetum helveticae* (All.: *Potentillion caulescentis*).

### Site characteristics:

Alpine and nival zones between 2100 and 3000 m. On rocks and cliffs of different inclination; in lower altitudes, the community occurs in different exposures; with increasing altitude, it colonizes south-faced habitats exclusively. Snow cover depends on inclination and exposure and may be totally absent on steep slopes. Significant daily and seasonal differences in temperature.

Exclusive to calcareous rocks. Raw soil, dry to fresh, neutral to basic, and nutrient-poor.

### Stand characteristics:

The rock surface is colonized by “lithophytes\*”: mosses and lichens, such as *Lecanora sp.* or *Verrucaria sp.*; on moist rocks, cyanobacteria (blue-green algae), for instance *Gloeocapsa sp.*, produce coloured coatings. Vascular plants\* rooting on rock ledges (“chomophytes\*”) or in fissures (“chasmo-phytes\*”) form an open community with low competition. Cushion plants, e.g. *Androsace helvetica*, and plants with succulent\* leaves, such as *Primula auricula* or *Saxifraga paniculata*, are typical life forms in these habitats.

Calcareous rocks are a typical habitat for endemic\* species, for example *Physoplexis comosa*, an endemic\* *Campanulaceae* of the southern calcareous Alps.

### Typical species:

<i>Androsace helvetica</i>	PRIMULACEAE	swiss rock-jasmine
<i>Arabis bellidifolia</i>	BRASSICACEAE	daisy-leaved rockcress
<i>Carex mucronata</i>	CYPERACEAE	spine-pointed sedge
<i>Draba ladina</i>	BRASSICACEAE	Ladin hunger flower
<i>Draba tomentosa</i>	BRASSICACEAE	tomentose draba
<i>Festuca alpina</i>	POACEAE	alpine fescue
<i>Hieracium humile</i>	ASTERACEAE	low hawkweed
<i>Kernera saxatilis</i>	BRASSICACEAE	rock kernera
<i>Minuartia rupestris</i>	CARYOPHYLLACEAE	rock stitchwort
<i>Potentilla caulescens</i>	ROSACEAE	stalked cinquefoil
<i>Primula auricula</i>	PRIMULACEAE	auricula
<i>Saxifraga paniculata</i>	SAXIFRAGACEAE	live-long saxifrage

### Distribution:

Widely distributed in the calcareous regions of the European Alps.

Corresponding communities outside of the European Alps:

- *Saxifraga media* – community: Pyrenees.
- *Viola saxifraga/Hypochaeris leontodontides* – communities: High Atlas.
- *Silene auriculata* – communities: Greek Mountains.

## ***Androsace alpina* – scree community**

**Phytosociological unit:** Ass.: *Androsacetum alpinae* (All.: *Androsacion alpinae*).

### **Site characteristics:**

Alpine and nival zones between 2200 and 3300 m. Fine- to medium-grained, stabilised siliceous scree on slopes, ridges and peaks; also on moraines. Snow cover depends on inclination and exposure and may be totally absent.

Exclusive to siliceous bedrock. Raw soil with varying amounts of fine soil; fresh to moist; acid (pH 4 – 6) and relatively nutrient-poor. Saturation of the soil with water causes soil movement.

### **Stand characteristics:**

Open, species-poor (about 10 species per m<sup>2</sup>) community formed by creeping plants, such as *Cerastium uniflorum*, but also by larger, erect herbs\*, for instance *Doronicum clusii*.

For further information on plants colonising scree → see *Thlaspi repens* – scree community.

### **Typical species:**

<i>Achillea moschata</i>	ASTERACEAE	musk milfoil
<i>Androsace alpina</i>	PRIMULACEAE	Alpine rock-jasmine
<i>Cerastium pedunculatum</i>	CARYOPHYLLACEAE	long-peduncled mouse-ear
<i>Cerastium uniflorum</i>	CARYOPHYLLACEAE	one-flowered mouse-ear
<i>Doronicum clusii</i>	ASTERACEAE	Clusius's leopard's-bane
<i>Geum reptans</i>	ROSACEAE	creeping avens
<i>Oxyria digyna</i>	POLYGONACEAE	mountain sorrel
<i>Poa laxa</i>	POACEAE	wavy meadow-grass
<i>Ranunculus glacialis</i>	RANUNCULACEAE	glacier crowfoot
<i>Saxifraga bryoides</i>	SAXIFRAGACEAE	mossy saxifrage

### **Distribution:**

Widely distributed in the siliceous regions of the European Alps.

Corresponding communities outside of the European Alps:

- *Oxyria digyna* – communities: Iceland, Spitsbergen, Greenland, Carpathians, Rhodope Massif, Corsica, Pyrenees.
- *Aquilegia coerulea/Cirsium scopulorum* – community: Rocky Mountains (Colorado Front Range).
- *Senecio leucophyllus* – community: Pyrenees.
- *Linaria glacialis* – community: Sierra Nevada (Spain).

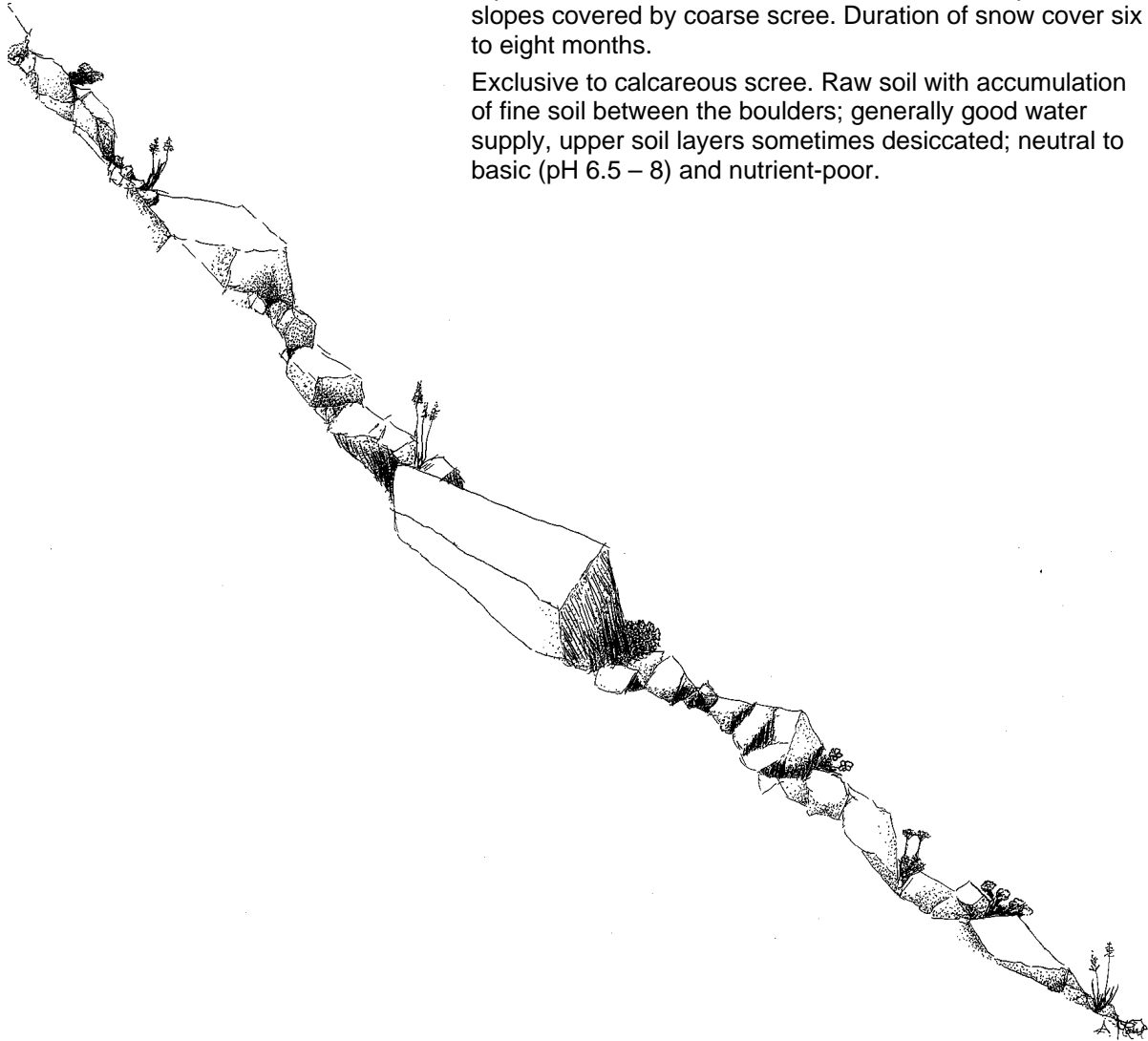
## **Thlaspi repens – scree community**

**Phytosociological unit:** Ass.: *Thlaspietum rotundifolii* (All.: *Thlaspion rotundifolii*).

### **Site characteristics**

Alpine zone between 2000 and 3000 m. On steep, unstable slopes covered by coarse scree. Duration of snow cover six to eight months.

Exclusive to calcareous scree. Raw soil with accumulation of fine soil between the boulders; generally good water supply, upper soil layers sometimes desiccated; neutral to basic (pH 6.5 – 8) and nutrient-poor.



### **Stand characteristics:**

Open, sparse, and species-poor community of vascular plant\* species. Due to the constant movement of soil and boulders, the plants occurring in these habitats must have developed adequate growing strategies. Some species grow in the direction of the scree movement by forming subterranean or aboveground creeping stems, for example *Thlaspi repens* or *Linaria alpina*. Other species stabilise the scree by developing surface patches of clonal\* shoots (e.g. *Dryas octopetala*) or by forming firmly anchored tussocks (graminoids\*) or cushions with taproots. Since plants may be mechanically damaged due to soil movements, they must be capable of regenerating immediately and frequently. As long as the scree slope remains mobile, succession towards a more closed vegetation type (grassland) virtually does not occur. Due to the open structure of the community, competition is rather feeble.

**Typical species:**

<i>Arabis alpina</i>	BRASSICACEAE	Alpine rockcress
<i>Cerastium latifolium</i>	CARYOPHYLLACEAE	broad-leaved mouse-ear
<i>Galium megalospermum</i>	RUBIACEAE	Swiss bedstraw
<i>Linaria alpina</i>	SCROPHULARIACEAE	Alpine toadflax
<i>Moehringia ciliata</i>	CARYOPHYLLACEAE	hairy sandwort
<i>Papaver aurantiacum</i>	PAPAVERACEAE	Rhaetian poppy
<i>Pritzelago alpina</i>	BRASSICACEAE	chamois cress
<i>Saxifraga aphylla</i>	SAXIFRAGACEAE	saxifrage with naked stems
<i>Thlaspi repens</i>	BRASSICACEAE	round-leaved penny-cress

**Distribution:**

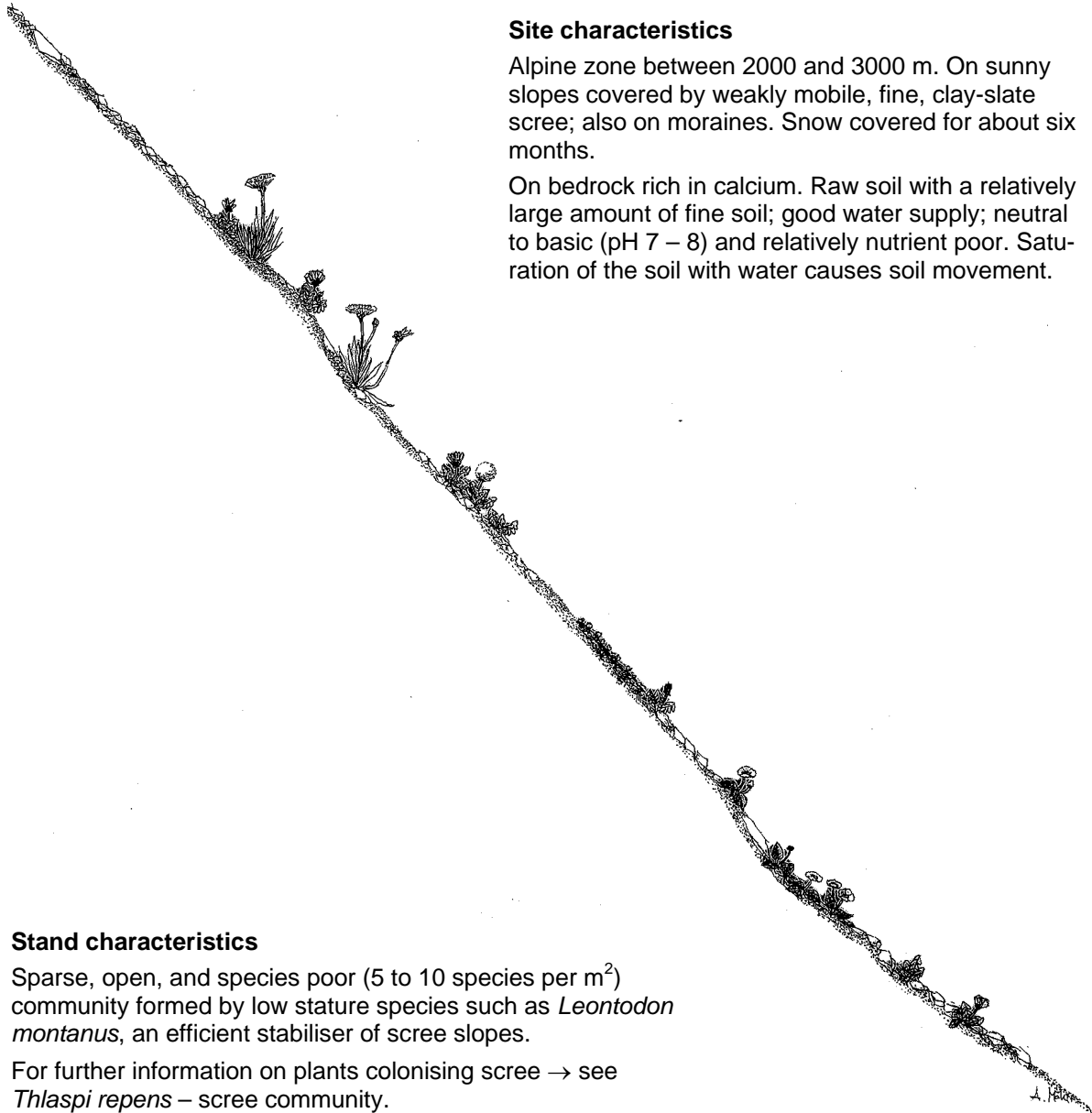
Widely distributed in the calcareous regions of the European Alps.

Corresponding communities outside of the European Alps:

- *Crepis pygmaea* – community: Pyrenees.
- *Silene caesia* – communities: Greek Mountains.

## *Leontodon montanus* – scree community

**Phytosociological unit:** Ass.: *Leontodontetum montani* (All.: *Thlaspion rotundifolii*).



### Site characteristics

Alpine zone between 2000 and 3000 m. On sunny slopes covered by weakly mobile, fine, clay-slate scree; also on moraines. Snow covered for about six months.

On bedrock rich in calcium. Raw soil with a relatively large amount of fine soil; good water supply; neutral to basic (pH 7 – 8) and relatively nutrient poor. Saturation of the soil with water causes soil movement.

### Stand characteristics

Sparse, open, and species poor (5 to 10 species per m<sup>2</sup>) community formed by low stature species such as *Leontodon montanus*, an efficient stabiliser of scree slopes.

For further information on plants colonising scree → see *Thlaspi repens* – scree community.

### Typical species:

<i>Campanula cenisia</i>	CAMPANULACEAE	Mont Cenis bellflower
<i>Crepis pygmaea</i>	ASTERACEAE	pygmy hawksbeard
<i>Leontodon montanus</i>	ASTERACEAE	mountain hawkbit
<i>Ranunculus parnassifolius</i>	RANUNCULACEAE	parnassia-leaved crowfoot
<i>Saxifraga oppositifolia</i>	SAXIFRAGACEAE	purple saxifrage
<i>Sedum atratum</i>	CRASSULACEAE	dark stonecrop
<i>Taraxacum alpinum</i>	ASTERACEAE	Alpine dandelion

### Distribution:

Distributed in the calcareous regions of the European Alps.

## *Petasites paradoxus* – scree community

**Phytosociological unit:** Ass.: *Petasitetum paradoxi* (All.: *Petasion paradoxi*).

### Site characteristics:

Subalpine and lower alpine zones between 1400 and 2500 m. On slopes covered by mobile calcareous scree; also in avalanche paths and streambeds.

On calcareous bedrock. Raw soil with varying amounts of fine soil; fresh to moist; neutral to basic and relatively nutrient-poor.

### Stand characteristics:

Open scree community characterised by erect plants and some herbs\* with large leaves, such as *Petasites paradoxus*, *Adenostyles glabra*, or *Doronicum grandiflorum*. *Petasites paradoxus* is an efficient stabiliser of the scree.

For further information on plants colonising scree → see *Thlaspi repens* – scree community.

### Typical species:

<i>Achillea atrata</i>	ASTERACEAE	black yarrow
<i>Adenostyles glabra</i>	ASTERACEAE	glabrous-leaved adenostyle
<i>Athamanta cretensis</i>	APIACEAE	candy carrot
<i>Doronicum grandiflorum</i>	ASTERACEAE	large-flowered leopard's-bane
<i>Gypsophila repens</i>	CARYOPHYLLACEAE	Alpine gypsophila
<i>Petasites paradoxus</i>	ASTERACEAE	Alpine butterbur
<i>Silene vulgaris subsp. glareosa</i>	CARYOPHYLLACEAE	bladder champion
<i>Trisetum distichophyllum</i>	POACEAE	distichous oat-grass
<i>Valeriana montana</i>	VALERIANACEAE	mountain valerian

### Distribution:

Calcareous regions of the European Alps.



## ***Epilobium fleischeri* – riverbed community**

**Phytosociological unit:** Ass.: *Epilobietum fleischeri* (All.: *Epilobion fleischeri*).

### **Site characteristics:**

Subalpine and alpine zones between 1400 and 2600 m. In the flood zones of mountain streams; also on moist moraines. In streambeds the community is regularly flooded.

On calcareous and siliceous substrata. Stony and/or sandy raw soils; fresh to moist, upper soil layers sometimes desiccated; weakly acid to weakly basic and rather nutrient-poor.

### **Stand characteristics:**

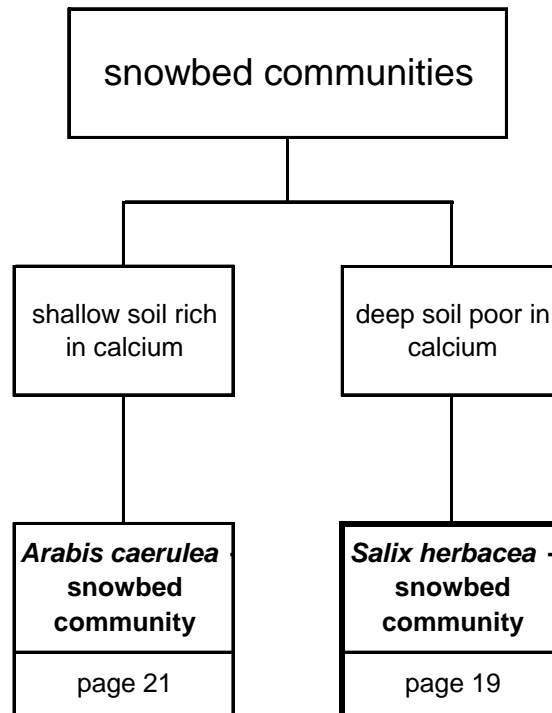
Pioneer community typically dominated by *Epilobium fleischeri*. The composition and density depends on the spell of time since the last inundation. Besides the typical species listed below, species of other vegetation types (scree communities, grasslands) regularly occur in these habitats, at least up to the next flooding, for example *Anthyllis vulneraria* ssp. *alpestris*, *Gypsophila repens*, *Saxifraga aizoides* as well as different willow species (*Salix* sp.)

### **Typical species:**

<i>Calamagrostis pseudophragmites</i>	POACEAE	reed-like reedgrass
<i>Chondrilla chondrilloides</i>	ASTERACEAE	Alpine chondrilla
<i>Epilobium fleischeri</i>	ONAGRACEAE	Alpine willowherb
<i>Erigeron acer</i>	ASTERACEAE	blue fleabane
<i>Erucastrum nasturtiifolium</i>	BRASSICACEAE	watercress-leaved rocket
<i>Hieracium staticifolium</i>	ASTERACEAE	statice-leaved hawkweed
<i>Myricaria germanica</i>	TAMARICACEAE	myricaria

### **Distribution:**

Widely distributed all over the European Alps, but not frequent.



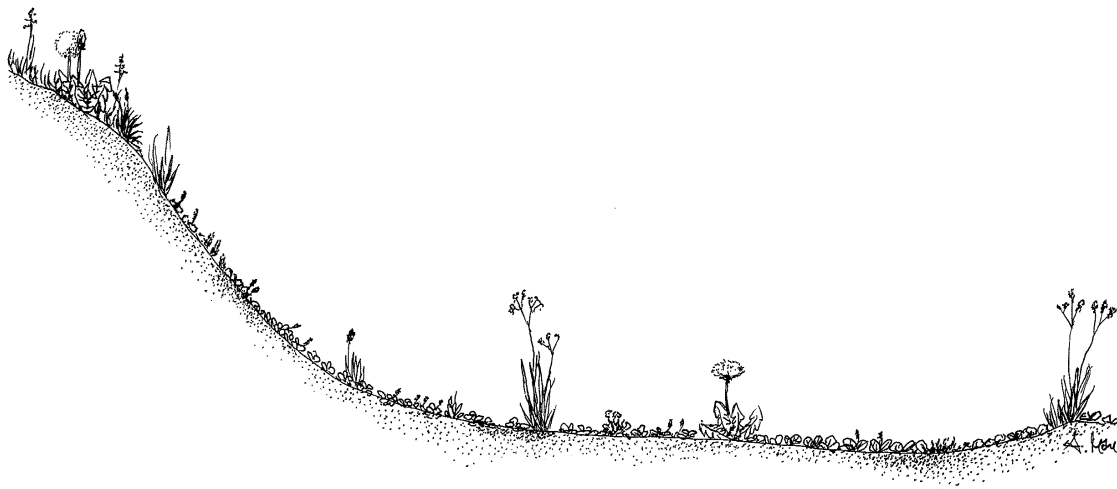
## **Salix herbacea – snowbed community**

**Phytosociological unit:** Ass.: *Salicetum herbaceae* (All.: *Salicion herbaceae*).

### **Site characteristics:**

Alpine zone between 2200 and 2800 m. In places with long-lasting snow pack (eight to ten months), especially depressions and hollows. Even low temperatures during growing season.

On siliceous or more seldom on calcareous bedrock. Developed and relatively deep soil of gley\* type containing a large amount of fine soil; moist throughout the whole growing season, often waterlogged after snow melt or heavy rains (risk of anoxia); weakly acid to acid (pH 4.5 – 6.5) and relatively nutrient-rich.



### **Stand characteristics:**

Dense carpet of tiny plants, often dominated by the prostrate dwarf willow. The branches of this dioecious\* and clonal\* species are subterranean, only the youngest shoots leave the soil forming two to three small leaves and, in years of early snow melt, an inflorescence. The dwarf willow is a summer green, entomogamous\* and anemochorous\* species. Other clonal\* species such as *Alchemilla pentaphyllea* or *Gnaphalium supinum* often form monospecific patches within the dwarf willow carpets.

When growing season is shorter than two months, vascular plants\* disappear and bryophytes\* such as *Polytrichum sexangulare*, *Pohlia drummondii*, or *Anthelia juratzkana* dominate these habitats.

Due to the fact that only a small number of plant species is capable of surviving and reproducing during the short growing season, snowbed communities are species-poor. Over large distances, the species composition of this vegetation type is fairly constant. This may be why, the *Salix herbacea* - snowbed community was probably the world's first recognized and described plant community.

### **Typical species:**

<i>Alchemilla pentaphyllea</i>	ROSACEAE	five-fingered lady's mantle
<i>Arenaria biflora</i>	CARYOPHYLLACEAE	two-flowered sandwort
<i>Cardamine alpina</i>	BRASSICACEAE	Alpine bittercress
<i>Carex foetida</i>	CYPERACEAE	foetid sedge
<i>Cerastium cerastioides</i>	CARYOPHYLLACEAE	starwort mouse-ear
<i>Gnaphalium supinum</i>	ASTERACEAE	dwarf cudweed
<i>Ranunculus pygmaeus</i>	RANUNCULACEAE	dwarf buttercup
<i>Salix herbacea</i>	SALICACEAE	dwarf willow
<i>Sedum alpestre</i>	CRASSULACEAE	Alpine stonecrop
<i>Sibbaldia procumbens</i>	ROSACEAE	sibbaldia
<i>Soldanella pusilla</i>	PRIMULACEAE	dwarf snowbell

**Distribution:**

Widely distributed throughout the European Alps, especially in regions of siliceous bedrock.

Corresponding communities outside of the European Alps:

- *Salix herbacea* – communities: Scandinavia, Iceland; Greenland, Carpathians, Pyrenees.
- *Salix polaris* – communities: Northern Siberia, Spitsbergen.
- *Salix rotundifolia* – communities: Alaska.
- *Sibbaldia procumbens* – community: Scotland.
- *Sibbaldia procumbens/Carex pyrenaica* – communities: Rocky Mountains (Colorado Front Range).
- *Gnaphalium supinum/Sibbaldia procumbens* – communities: Caucasus, Corsica.
- *Raffenaldia platycarpa/Ranunculus montanus* – community: High Atlas.

## *Arabis caerulea* – snowbed community

**Phytosociological unit:** Ass.: *Arabidetum caeruleae* (All.: *Arabidion caeruleae*).

### Site characteristics:

Alpine zone between 2300 and 3000 m. In depressions or at the foot of calcareous scree slopes with long-lasting snow cover (eight to ten months). Temperatures in these places are evenly low during growing season.

Exclusive to calcareous substrata. Weakly developed stony soils; generally moist, becoming drier at the end of the growing season; neutral (pH 6.5 – 7) and relatively nutrient-poor.

### Stand characteristics:

Scarce and discontinuous cover of tiny, mesomorphic\* plants.

### Typical species:

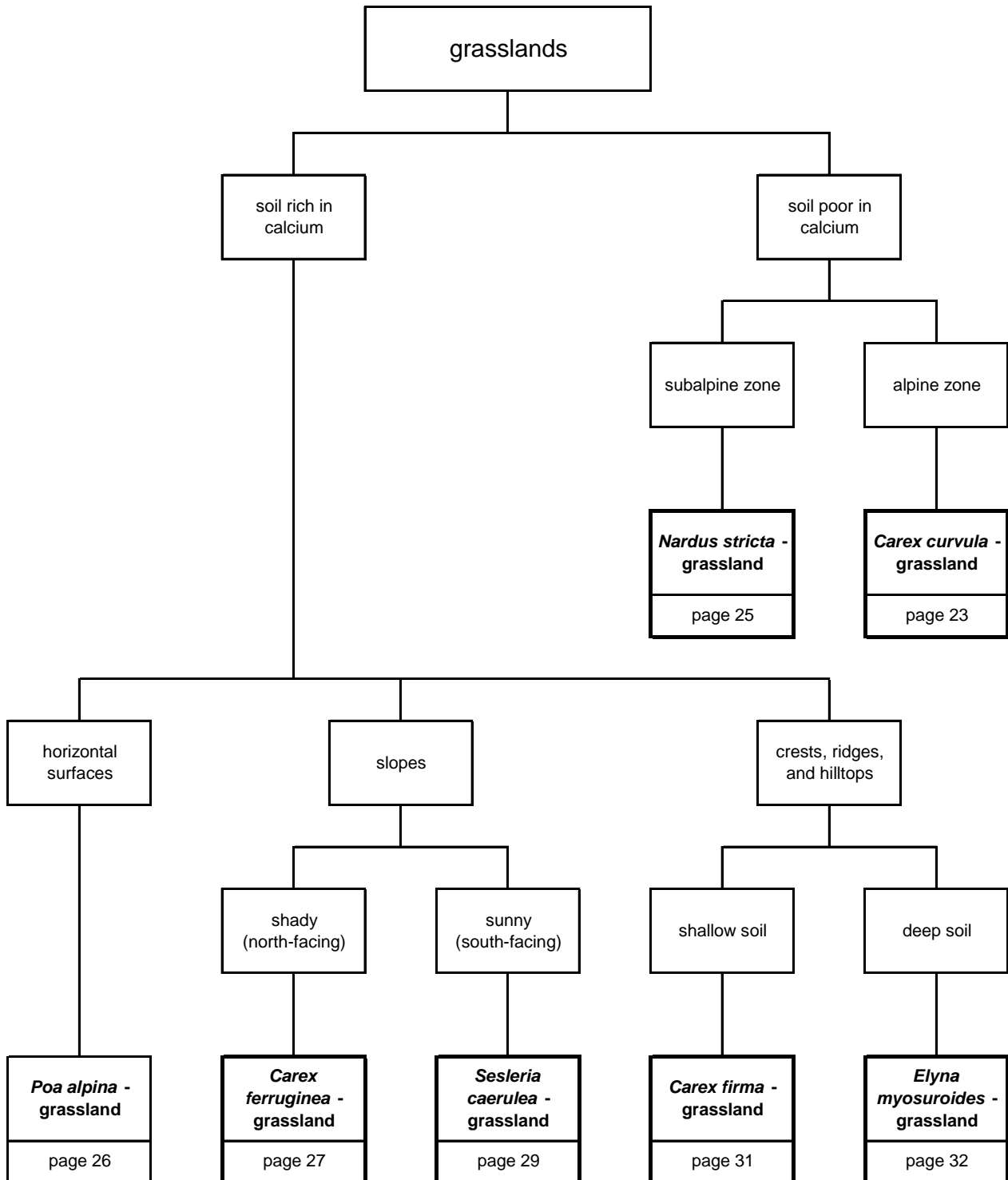
<i>Arabis caerulea</i>	BRASSICACEAE	bluish rockcress
<i>Carex parviflora</i>	CYPERACEAE	small-flowered sedge
<i>Gnaphalium hoppeanum</i>	ASTERACEAE	Hoppe's cudweed
<i>Potentilla brauneana</i>	ROSACEAE	Braun's cinquefoil
<i>Ranunculus alpestris</i>	RANUNCULACEAE	Alpine buttercup
<i>Rumex nivalis</i>	POLYGONACEAE	snow dock
<i>Salix reticulata</i>	SALICACEAE	net-leaved willow
<i>Salix retusa</i>	SALICACEAE	blunt-leaved willow
<i>Saxifraga androsacea</i>	SAXIFRAGACEAE	androsace-like saxifrage

### Distribution:

Calcareous regions of the European Alps.

Corresponding communities outside of the European Alps:

- *Salix polaris*/*Salix reticulata* – community: Scandinavia.
- *Potentilla dubia*/*Gnaphalium hoppeana* – community: Pyrenees.



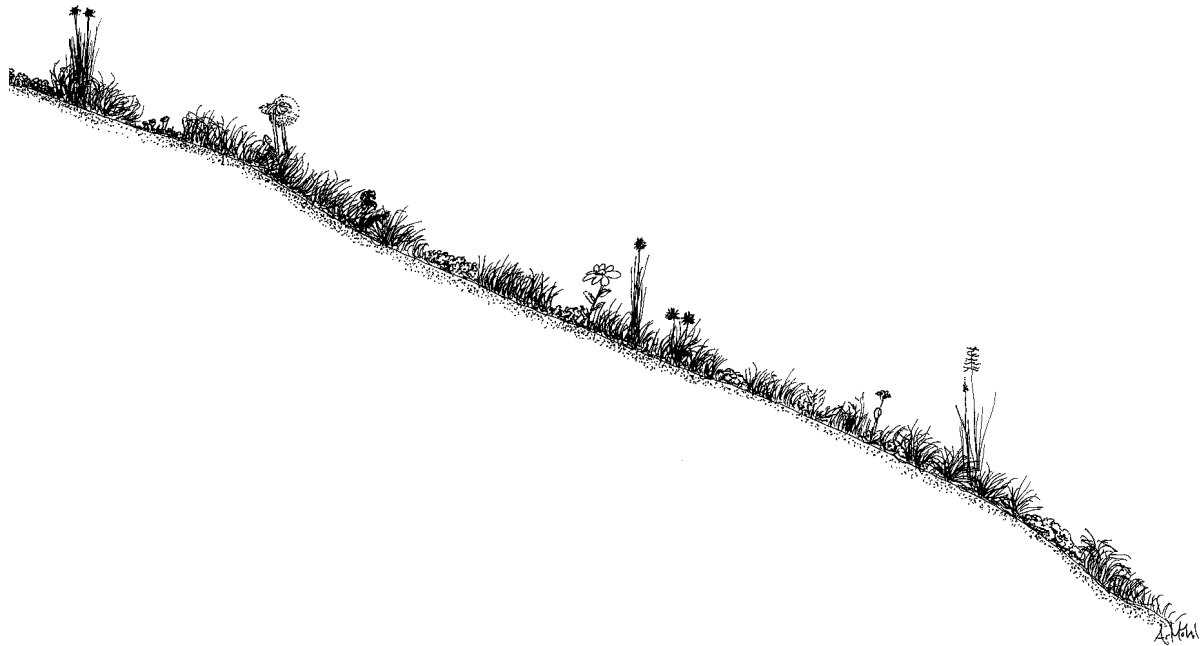
## **Carex curvula – grassland**

**Phytosociological unit:** Ass.: *Caricetum curvulae* (All.: *Caricion curvulae*).

### **Site characteristics:**

Alpine zone between 2300 and 2800 m. On level surfaces and gentle slopes. Snow cover from five to eight months.

Exclusive to siliceous bed rock. Relatively shallow soils of the ranker\* type, but also on more developed soils of the alpine brown earth\* type; fresh to rather dry; acid (pH 3.5 – 5.5) and nutrient-poor.



### **Stand characteristics:**

*Carex curvula* forms a short and more or less closed turf. Its leaf tips are attacked by the ascomycete *Pleospora elynae* causing their early death and curling, that gives the brownish, autumnal appearance of these grasslands. *C. curvula* develops thick tussocks that migrate about 1 mm per year. A tussock lives for 15 to 20 years. The rhizomes\* produce two leaves per year and only about 0.25 % of the shoots will flower. Consequently, sexual reproduction is very rare in this species. *Oreochloa disticha* seems to be the only species capable of directly competing with *C. curvula*. The other species colonize gaps in the *C. curvula* canopy that are caused by disturbances such as wind erosion or cryoturbation\*.

The *Carex curvula* – grasslands are relatively species-poor (10 to 15 species per m<sup>2</sup>).

Transitions to the *Nardus stricta* – grassland in lower altitudes, to the *Salix herbacea* – snowbed community in depressions, and to the *Loiseleuria procumbens* – heath on ridges and hilltops are frequent. In the latter, lichens (*Alectoria ochroleuca*, *Cetraria* sp., *Thamnolia vermicularis*) occur frequently.

**Typical species:**

<i>Carex curvula</i>	CYPERACEAE	Alpine sedge
<i>Helictotrichon versicolor</i>	POACEAE	variegated oat
<i>Hieracium angustifolium</i>	ASTERACEAE	narrow-leaved hawkweed
<i>Juncus trifidus</i>	JUNCACEAE	three-leaved rush
<i>Leontodon helveticus</i>	ASTERACEAE	Swiss hawkbit
<i>Leucanthemopsis alpina</i>	ASTERACEAE	Alpine marguerite
<i>Luzula lutea</i>	JUNCACEAE	yellow wood-rush
<i>Minuartia sedoides</i>	CARYOPHYLLACEAE	cyphel
<i>Oreochloa disticha</i>	POACEAE	two-lined sesleria
<i>Pedicularis kernerii</i>	SCROPHULARIACEAE	Kerner's lousewort
<i>Phyteuma hemisphaericum</i>	CAMPANULACEAE	globe-headed rampion
<i>Senecio incanus</i>	ASTERACEAE	grey Alpine groundsel
<i>Veronica bellidioides</i>	SCROPHULARIACEAE	dwarf blue speedwell

**Distribution:**

Typical community of the European Alps, where it is widely distributed in the siliceous regions.

Corresponding communities outside of the European Alps:

- *Carex curvula* – grasslands: Carpathians, Pyrenees.
- *Carex tristis* – grasslands: Caucasus.



## **Nardus stricta – grassland**

**Phytosociological unit:** Ass.: *Geo – Nardetum strictae* (All.: *Eu-Nardion*).

### **Site characteristics:**

Subalpine and lower alpine zones between 1400 and 2500 m. On horizontal surfaces or gentle slopes. Snow covered for four to six months.

On siliceous or more rarely on calcareous substrata. Relatively deep and developed soils corresponding to a podsolic\* brown earth\*; medium water capacity; leached bases, i.e. acid reaction (pH 4.5 – 6). Generally, this grassland type is heavily grazed by cattle or by sheep but not fertilised. Consequently, nutrient export by grazing is larger than nutrient import by fertilisation leading to the low nutrient content of this grassland type.

In the subalpine zone, *Nardus stricta* – grasslands occur on sites that were naturally colonized by forests; without grazing, reforestation would begin immediately.



### **Stand characteristics:**

*Nardus stricta* is the typical species of these short and dense turfs giving them their brownish colour. This species forms compact tussocks that are firmly rooted. Its leaves are stiff, piercing, rich in silicium; and are, therefore, hardly palatable to livestock. Furthermore, its litter prevents most other species from colonizing its tussocks. Consequently, this species is very competitive leading to its dominance in this grassland type.

In spite of the clear dominance of *Nardus stricta*, a number of other species are capable of coexisting with this species by colonizing the gaps between its tussocks.

Transition to the *Carex curvula* – grasslands in higher altitudes and to the *Poa alpina* – grasslands on more productive soils are frequent.

### **Typical species:**

<i>Arnica montana</i>	ASTERACEAE	European arnica
<i>Campanula barbata</i>	CAMPANULACEAE	bearded bellflower
<i>Gentiana acaulis</i>	GENTIANACEAE	trumpet gentian
<i>Gentiana punctata</i>	GENTIANACEAE	spotted gentian
<i>Geum montanum</i>	ROSACEAE	Alpine avens
<i>Hypochaeris uniflora</i>	ASTERACEAE	giant cat's-ear
<i>Nardus stricta</i>	POACEAE	mat-grass
<i>Phyteuma betonicifolium</i>	CAMPANULACEAE	betony-leaved rampion
<i>Potentilla aurea</i>	ROSACEAE	golden cinquefoil
<i>Pseudorchis albida</i>	ORCHIDACEAE	small-white orchid
<i>Trifolium alpinum</i>	FABACEAE	Alpine clover

### **Distribution:**

Widely distributed in the European Alps, especially in the rainy outer chains.

Corresponding communities outside of the European Alps:

- Throughout Europe, *Nardus stricta* is a characteristic and often dominant species in heavily-grazed areas on base-poor soils independent of the altitude.
- Arctic-alpine *Nardus stricta* – grasslands: Scotland, Scandinavia, Iceland, Carpathians, Caucasus, Pyrenees, Dinaric Alps.
- In Mediterranean mountain chains (Corsica, Sierra Nevada, High Atlas, Greek Mountains), it often occurs in grasslands on moist soils, in the so called "pozzines".

## *Poa alpina* – grassland

**Phytosociological unit:** Ass.: *Crepidi – Festucetum rubrae* (All.: *Poion alpinae*).

### Site characteristics:

Subalpine and lower alpine zones between 1400 and 2400 m. On level surfaces or gentle slopes. Long-lasting snow cover.

Well-developed and deep soils containing large amount of fine earth; moist throughout the whole growing-season; weakly acid to basic and relatively nutrient-rich.

In the subalpine zone, forests and heaths were clear cut to establish these relatively productive pastures. They are regularly grazed by cattle and sporadically fertilised with dung. Without grazing, woody species would quickly colonize these habitats leading to their reforestation.



### Stand characteristics:

Short and dense turf of a lively green colour; herbs\* dominate, graminoids\* are subordinate. Species of the *Asteraceae* and *Fabaceae* families are well represented. Most valuable grassland community for Alpine dairy farming.

These pastures are quite species-rich containing about 15 to 25 species per m<sup>2</sup>.

Transitions to the *Nardus stricta* – grasslands on nutrient-poor soils are frequent.

### Typical species:

<i>Alchemilla vulgaris</i>	ROSACEAE	common lady's mantle
<i>Crepis aurea</i>	ASTERACEAE	golden hawksbeard
<i>Festuca nigrescens</i>	POACEAE	chewings fescue
<i>Leontodon hispidus</i>	ASTERACEAE	rough hawkbit
<i>Ligusticum mutellina</i>	APIACEAE	mountain lovage
<i>Phleum alpinum</i>	POACEAE	Alpine cat's-tail
<i>Poa alpina</i>	POACEAE	Alpine meadow-grass
<i>Soldanella alpina</i>	PRIMULACEAE	Alpine snowbell
<i>Trifolium badium</i>	FABACEAE	brown clover
<i>Trifolium pratense subsp. nivale</i>	FABACEAE	snow clover

### Distribution:

Widely distributed in the humid regions of the European Alps.

## **Carex ferruginea – grassland**

**Phytosociological unit:** Ass.: *Caricetum ferrugineae* (All.: *Caricion ferrugineae*).

**Site characteristics:**

Upper supalpine and lower alpine zones between 1800 and 2500 m. On steep slopes and avalanche paths in northern exposition. Relatively long-lasting snow cover.

On calcareous substrata rich in clay, especially marl or calcareous slates. Relatively developed and deep soil with a large amount of fine earth and a high water capacity; continuously fresh or moist; neutral to basic and relatively nutrient-rich.

*Carex ferruginea* – grasslands are grazed by game or livestock (cattle, sheep); in the past, they were also mowed sporadically.



**Stand characteristics:**

The community is dominated by graminoid\* species, especially by the tussock-forming and stoloniferous\* rusty sedge. The long, thin leaves of this species often characterise the aspect of this community by hanging down the slopes like combed hair. The sward is productive, closed and rich in relatively tall, mesotrophic\* vascular plant\* species.

Due to the relatively favourable growth conditions, these habitats can be colonized by many species; hence, these communities are species-rich (20 to 30 species per m<sup>2</sup>).

**Typical species:**

<i>Anemone narcissiflora</i>	RANUNCULACEAE	narcissus-flower thimbleweed
<i>Astragalus frigidus</i>	FABACEAE	yellow Alpine milk-vetch
<i>Campanula thyrsoides</i>	CAMPANULACEAE	yellow bellflower
<i>Carex ferruginea</i>	CYPERACEAE	rusty sedge
<i>Crepis bocconei</i>	ASTERACEAE	mountain hawksbeard
<i>Festuca pulchella</i>	POACEAE	large blue fescue
<i>Hedysarum hedysaroides</i>	FABACEAE	Alpine sweet-vetch
<i>Pedicularis foliosa</i>	SCROPHULARIACEAE	leafy lousewort
<i>Phleum hirsutum</i>	POACEAE	hirsute timothy
<i>Pulsatilla alpina</i>	RANUNCULACEAE	Alpine pasqueflower
<i>Traunsteinera globosa</i>	ORCHIDACEAE	round-headed orchid
<i>Trollius europaeus</i>	RANUNCULACEAE	European globe flower

**Distribution:**

Calcareous regions of the European Alps, especially in the oceanic northern Prealps.

Corresponding communities outside of the European Alps:

- *Primula intricata* – community: Pyrenees.

## **Sesleria caerulea – grassland**

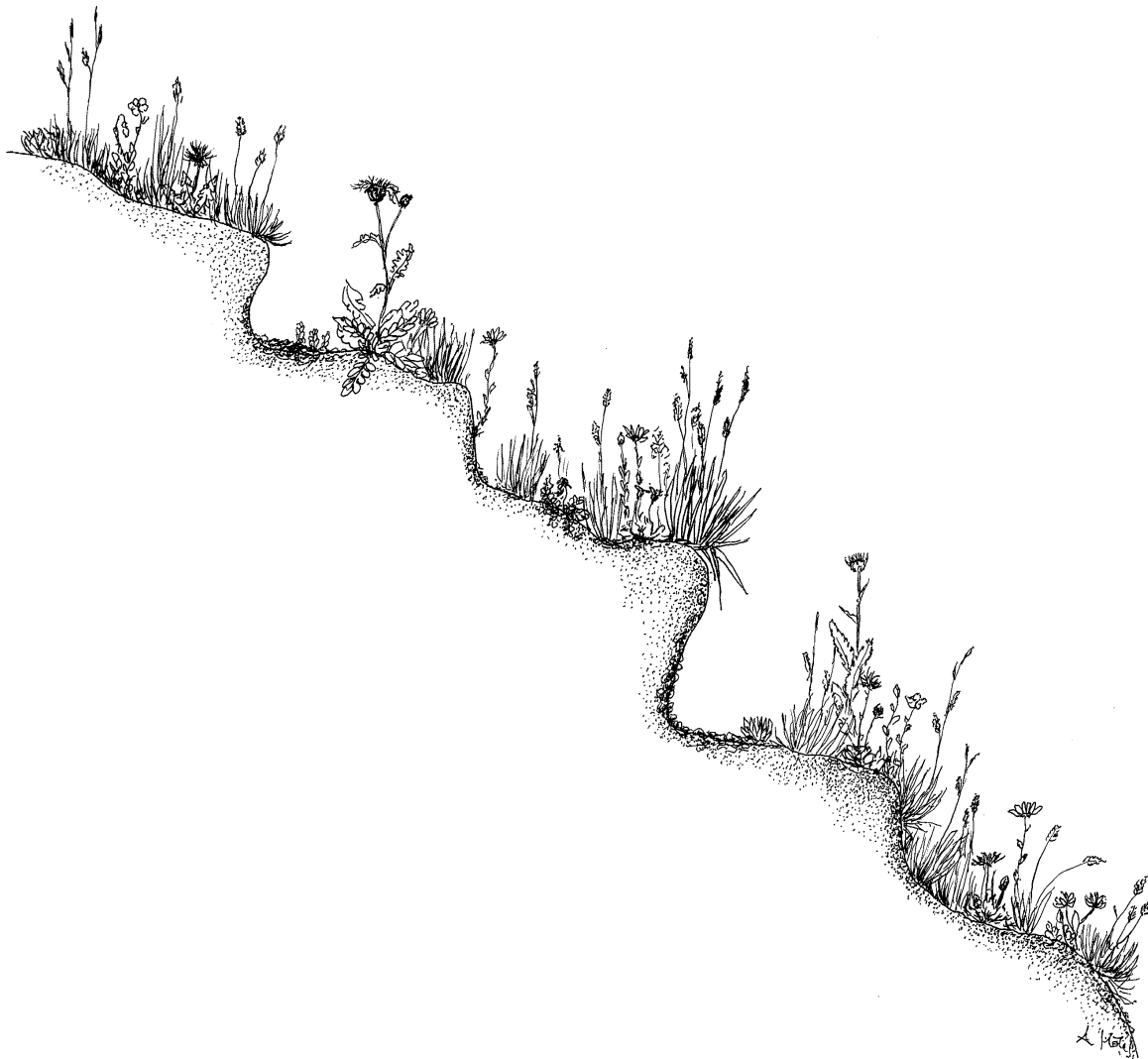
**Phytosociological unit:** Ass.: *Seslerio – Caricetum sempervirentis* (All.: *Seslerion albicantis*).

### **Site characteristics:**

Upper subalpine and lower alpine zones between 1600 and 2600 m. On steep slopes with high irradiation, often in southern exposition; significant fluctuations in daily temperature, especially in spring. Snow covered during five to seven months.

Exclusive to calcareous substrata. Superficial, stony soils of rendzina\* type; rather dry, especially in summer; weakly acid to basic (pH 6 – 7.5) and relatively nutrient-poor. Soil movements such as solifluction\* and cryoturbation\* occur regularly.

*Sesleria caerulea* – grasslands are often grazed by game and livestock (sheep).



### **Stand characteristics:**

Heterogeneous grassland dominated by two graminoids\*, the stoloniferous\* blue sesleria and the tussock-forming evergreen sedge. With their dense root systems, these species stabilise the steep slopes thereby promoting the formation of terraces and horizontal girdles. They also form protected microhabitats, thus facilitating the immigration and colonisation of other plant species. The swards are open with a large portion of non-vegetated areas covered by fine earth, debris, or boulders.

Due to the heterogenous structure, these communities contain many different microhabitats and are, therefore, species-rich (20 to 30 species per m<sup>2</sup>).

**Typical species:**

<i>Anthyllis vulneraria ssp. alpestris</i>	FABACEAE	kidney vetch
<i>Aster alpinus</i>	ASTERACEAE	Alpine aster
<i>Biscutella laevigata</i>	BRASSICACEAE	buckler mustard
<i>Carduus defloratus</i>	ASTERACEAE	Alpine thistle
<i>Carex sempervirens</i>	CYPERACEAE	evergreen sedge
<i>Gentiana clusii</i>	GENTIANACEAE	Clusius's gentian
<i>Hieracium villosum</i>	ASTERACEAE	shaggy hawkweed
<i>Leontopodium alpinum</i>	ASTERACEAE	edelweiss
<i>Oxytropis jacquinii</i>	FABACEAE	mountain milk-vetch
<i>Pedicularis rostratocapitata</i>	SCROPHULARIACEAE	capitate lousewort
<i>Pedicularis verticillata</i>	SCROPHULARIACEAE	verticillate lousewort
<i>Scabiosa lucida</i>	DIPSACACEAE	small scabious
<i>Sesleria caerulea</i>	POACEAE	blue sesleria

**Distribution:**

Widely distributed in the calcareous regions of the European Alps.

Corresponding communities outside of the European Alps:

- *Sesleria caerulea* – grassland: Dinaric Alps.
- *Sesleria tenuifolia* – grassland: Apennini.
- *Sesleria haynaldiana* – grassland: Carpathians.
- *Carex meinschausiana* – grassland: Caucasus.
- *Festuca scoparia* – grassland: Pyrenees.

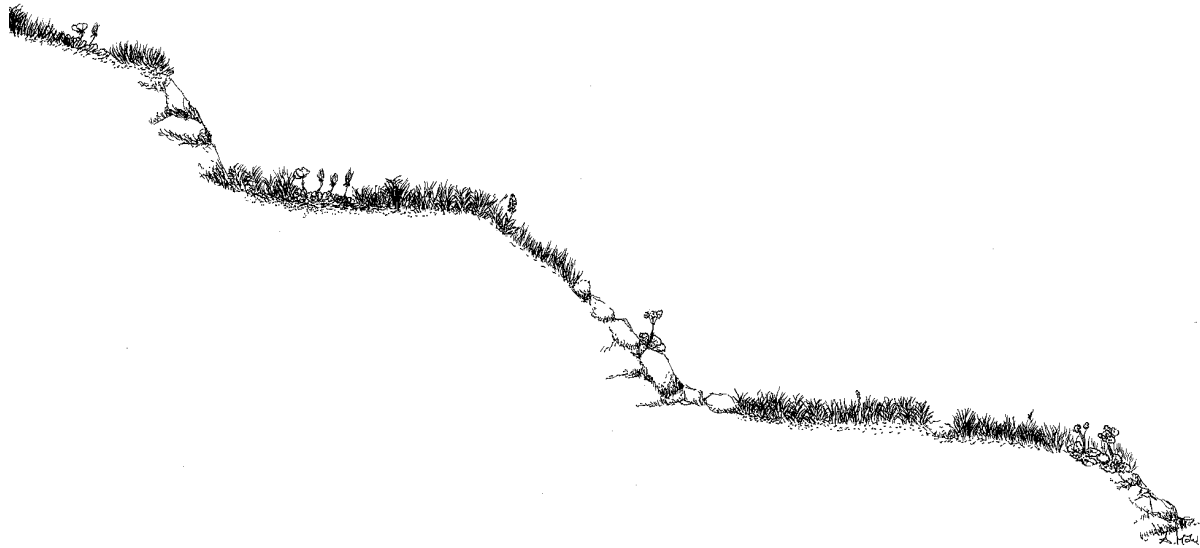
## **Carex firma – grassland**

**Phytosociological unit:** Ass.: *Caricetum firmae* (All.: *Seslerion albicantis*).

### **Site characteristics:**

Alpine zone between 2000 and 2800 m. On wind-exposed crests, ridges, or hilltops. Snow cover often scanty during five to eight months.

Exclusive to calcareous bedrock, especially on solid limestone or dolomite. Superficial, stony soil poor in fine earth (rendzina\* type); rather dry after snow melt; neutral to basic (pH 6.2 – 7.8) and nutrient-poor. Frequent soil movements due to solifluction\*.



### **Stand characteristics:**

The open, fragmented sward of this community is dominated by the hemispherical, superficially rooted cushions of *Carex firma*, that give a wavy aspect to its canopy. *C. firma* is a long-lived species with stiff, coriaceous\* leaves acting as a trap for fine earth, thus promoting soil development. Between the cushions, small plants, such as *Androsace chamaejasme*, *Chamorchis alpina*, or *Helianthemum alpestre* grow. Mountain avens often acts as a pioneer species\* for the *Carex firma* – grassland by covering the rock surface with an espalier of branches. The leaves of this dwarf shrub provide a humus that can be colonized by other plant species.

With about 15 species per m<sup>2</sup>, this community has medium diversity.

### **Typical species:**

<i>Androsace chamaejasme</i>	PRIMULACEAE	sweet-flower rock-jasmine
<i>Carex firma</i>	CYPERACEAE	cushion sedge
<i>Chamorchis alpina</i>	ORCHIDACEAE	Alpine orchid
<i>Crepis kernerii</i>	ASTERACEAE	Kerner's hawksbeard
<i>Dryas octopetala</i>	ROSACEAE	mountain avens
<i>Festuca quadriflora</i>	POACEAE	four-edged fescue
<i>Helianthemum alpestre</i>	CISTACEAE	Alpine rock rose
<i>Saxifraga caesia</i>	SAXIFRAGACEAE	blue-green saxifrage
<i>Silene acaulis</i>	CARYOPHYLLACEAE	moss campion

### **Distribution:**

Calcareous regions of the European Alps.

Corresponding communities outside of the European Alps:

- *Carex firma* – grasslands: Carpathians, Dinaric Alps.
- *Carex scirpoidea*/*Dryas octopetala* – grassland: Alaska.



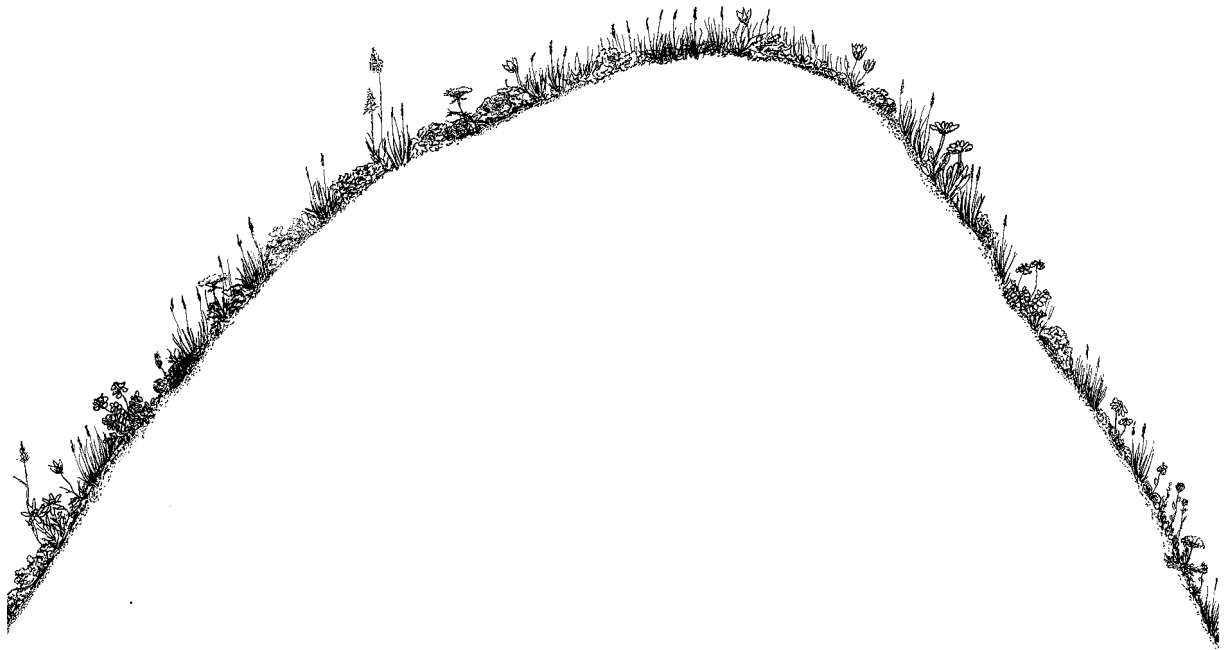
## ***Elyna myosuroides* – grassland**

**Phytosociological unit:** Ass.: *Elynetum myosuroidis* (All.: *Elynion*).

### **Site characteristics:**

Alpine zone between 2100 and 2800 m. On wind-exposed ridges, crests, or hilltops. Snow cover often scanty or even missing in winter.

On calcareous substrata. Developed, deep soil with a large amount of fine soil; fresh to rather dry; neutral to slightly acid (pH 6 – 7) and nutrient-poor.



### **Stand characteristics:**

More or less closed, rather species-poor swards dominated by *Elyna myosuroides*. The dense tussocks of this frost-resistant species act as a trap for fine earth and its litter produces humus. However, *E. myosuroides* is not a pioneer species\*, for colonization it demands humus-rich soils. Within the *Elyna* tussocks, the microclimate is more favourable than outside: lower wind velocity, higher temperature and air humidity. Lichens, such as *Cetraria islandica*, *C. nivalis*, or *Thamnolia vermicularis* occur in gaps of the *E. myosuroides* turf.

### **Typical species:**

<i>Antennaria carpatica</i>	ASTERACEAE	carpathian catsfoot
<i>Cerastium alpinum</i>	CARYOPHYLLACEAE	Alpine mouse-ear
<i>Dianthus glacialis</i>	CARYOPHYLLACEAE	glacial pink
<i>Draba siliquosa</i>	BRASSICACEAE	Carinthian whitlow-grass
<i>Elyna myosuroides</i>	CYPERACEAE	naked rush
<i>Erigeron uniflorus</i>	ASTERACEAE	one-flowered fleabane
<i>Gentiana tenella</i>	GENTIANACEAE	dane's dwarf-gentian
<i>Ligusticum mutellinoides</i>	APIACEAE	Alpine lovage
<i>Oxytropis campestris</i>	FABACEAE	yellow oxytropis
<i>Oxytropis halleri</i>	FABACEAE	purple oxytropis
<i>Potentilla crantzii</i>	ROSACEAE	Alpine cinquefoil



**Distribution:**

Calcareous regions of the European Alps.

Corresponding communities outside of the European Alps:

- *Elyna myosuroides* – grasslands: Scandinavia, Greenland, Alaska, Rocky Mountains (Colorado Front Range), Carpathians, Altai, Japan, Pyrenees.  
Note: *Kobresia myosuroides*, *Kobresia bellardii*, and *Elyna bellardii* are all synonymous of *Elyna myosuroides*.
- In the Himalaya, similar communities are formed by other *Kobresia* species (*Kobresia nepalensis*, *K. pygmaea*).

## **Adenostyles alliariae – tall herb community**

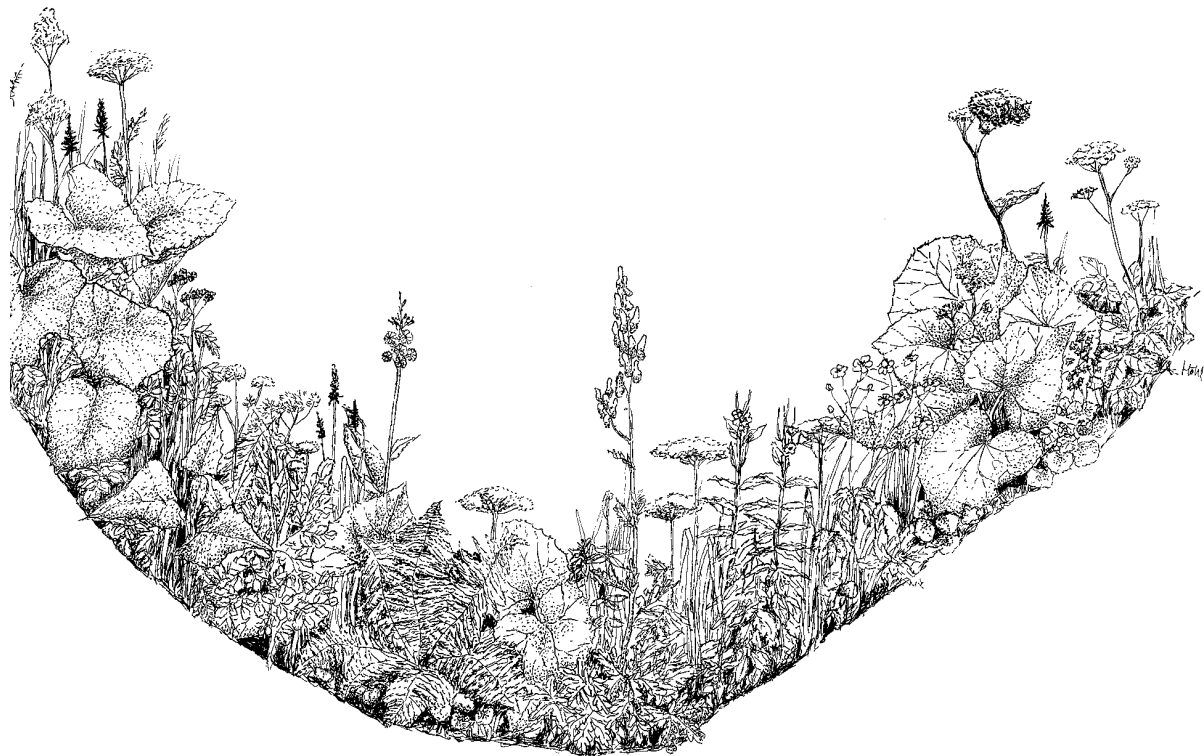
**Phytosociological unit:** Ass.: *Cicerbitetum alpinae* (All.: *Adenostylion alliariae*).

### **Site characteristics:**

Subalpine and lower alpine zones between 1400 and 2300 m. On locations with high air humidity: foot of slopes, hollows, gullies, avalanche paths, and stream banks. Long-lasting snow cover.

On calcareous or siliceous substrata. Deep soils formed by colluvial\* humus accumulation; moist throughout the growing season; acid to basic (pH 3.5 – 8.0); due to the nutrient input by overflow water, the soils are extraordinarily fertile.

Soil movements and avalanches are typical disturbances in these habitats that obstruct the colonization by trees.



### **Stand characteristics:**

Dense and luxuriant community of tall herbs\* with large, mesomorphic\* leaves; predominantly species of the *Apiaceae*, *Asteraceae*, and *Ranunculaceae* families. The tall herbs\* are mainly hemicryptophytes\* reproducing every spring from their subterranean organs.

Tall herb communities are relatively species-rich harbouring 15 to 20 species per m<sup>2</sup>.

### **Typical species:**

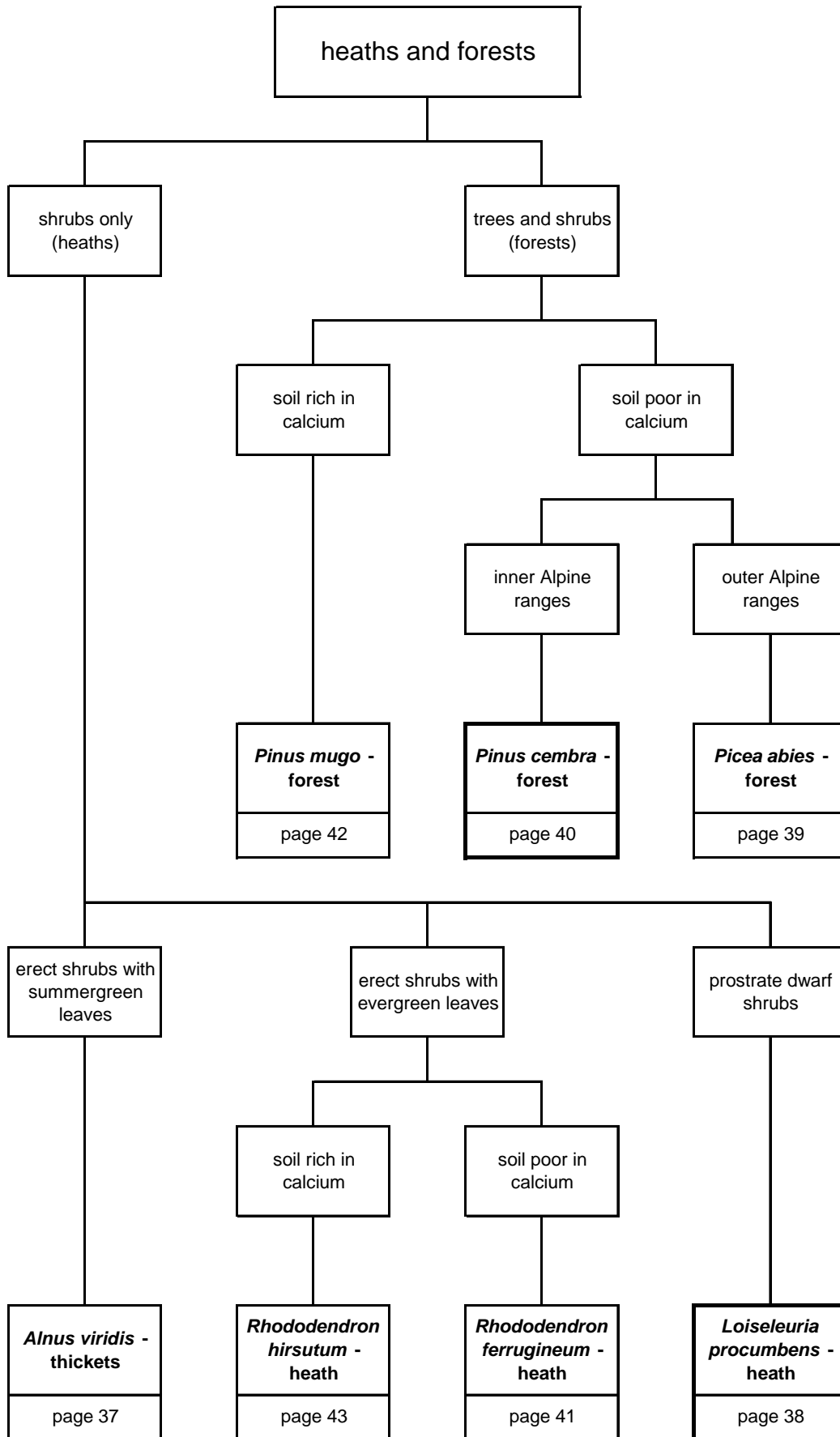
<i>Achillea macrophylla</i>	ASTERACEAE	broad-leaved yarrow
<i>Aconitum neomontanum</i>	RANUNCULACEAE	blue monkshood
<i>Adenostyles alliariae</i>	ASTERACEAE	hedge-garlic adenostyle
<i>Athyrium distentifolium</i>	ATHYRIACEAE	Alpine lady-fern
<i>Chaerophyllum villarsii</i>	APIACEAE	Villars' chervil
<i>Cicerbita alpina</i>	ASTERACEAE	Alpine sow-thistle
<i>Epilobium alpestre</i>	ONAGRACEAE	Alpine willowherb
<i>Peucedanum ostruthium</i>	APIACEAE	masterwort
<i>Ranunculus platanifolius</i>	RANUNCULACEAE	large white buttercup
<i>Saxifraga rotundifolia</i>	SAXIFRAGACEAE	round-leaved saxifrage
<i>Tozzia alpina</i>	SCROPHULARIACEAE	tozzia
<i>Viola biflora</i>	VIOLACEAE	Alpine yellow-violet

**Distribution:**

Widely distributed in the European Alps, especially in the rainy northern chains.

Corresponding communities outside of the European Alps:

- *Geranium sylvaticum* – communities: Scandinavia, Greenland.
- *Ligusticum filicinum/Trollius laxus* – communities: Rocky Mountains (Colorado Front Range).
- *Doronicum carpaticum/Chaerophyllum hirsutum* – community: Carpathians.
- *Valeriana rotundifolia/Adenostyles briquetii* – community: Corsica.
- *Peucedanum ostruthium/Adenostyles alliarie* – community: Pyrenees.
- *Aconitum nevadense/Senecio elodes* – community: Sierra Nevada (Spain).
- *Cirsium flavispinum/Eryngium variifolium* – community: High Atlas.
- *Cirsium tympheum/Veratrum album* – community: Greek Mountains.





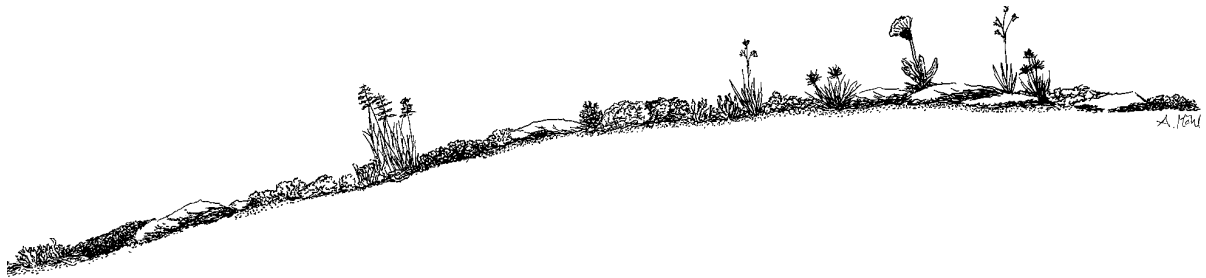
## **Loiseleuria procumbens – heath**

**Phytosociological unit:** Ass.: *Loiseleurio – Cetrarietum* (All.: *Loiseleurion*).

### **Site characteristics:**

Lower alpine zone between 2000 and 2500 m. On wind-swept hilltops, ridges, and crests. Short-lasting and scanty snow cover in winter, therefore very low temperatures prevail.

On siliceous bedrock, but also on clay-rich calcareous rocks. Weakly-developed, shallow raw soils; rather dry, acid (pH 4 – 5.5) and nutrient-poor.



### **Stand characteristics:**

The evergreen trailing azalea forms a close-meshed network of prostrate stems with more or less erect shoots reaching about 4 cm in height. The dense canopy of azalea causes a microclimate with lower wind velocity, but higher humidity and temperature compared to the ambient air. Lichens, such as *Alectoria ochroleuca*, *Cladonia arbuscula* and *rangiferina*, *Cetraria cucullata*, *islandica*, and *nivalis* or *Thamnolia vermicularis*, are typically anchored in the azalea network. Herbaceous\* species are sparse and only colonize gaps caused by wind erosion.

On less wind-exposed locations transitions to the *Carex curvula* – grasslands are frequent. The *Loiseleuria procumbens* – heath is a species-poor community containing solely four to seven vascular plant\* species per m<sup>2</sup>.

### **Typical species:**

<i>Empetrum hermaphroditum</i>	ERICACEAE	mountain crowberry
<i>Loiseleuria procumbens</i>	ERICACEAE	trailing azalea
<i>Vaccinium gaultherioides</i>	ERICACEAE	Alpine bilberry

### **Distribution:**

Widely distributed, especially in the siliceous regions of the European Alps.

Corresponding communities outside of the European Alps:

- *Loiseleuria procumbens* – communities: Scandinavia, Iceland, Greenland, Alaska, Carpathians, Pyrenees.

## *Picea abies* – forest

**Phytosociological unit:** Ass.: *Homogyne* – *Piceetum* (All.: *Vaccinio* – *Piceion*).

### Site characteristics:

Subalpine zone between 1400 and 2100 m. On horizontal surfaces or slopes of different exposures, but not on steep, south-faced slopes. Snow covered for about five months.

On siliceous and calcareous bedrock. Deep, developed soil of the podsol\* type, with a substantial layer of weakly decomposed organic material (raw humus); fresh; acid (pH of the upper layer 3 – 4) and nutrient-poor.

### Stand characteristics:

Open forest dominated by the Norway spruce. The spruces are slim, up to 30 m tall, and typically grow in small groups. Since the forest canopy is not closed, there is light enough for the development of a luxuriant understory that is often dominated by shrubs of the *Ericaceae* family, such as bilberry, or – on steeper slopes – by *Calamagrostis villosa*.

In the past, these forests were often cut in order to gain alpine pastures. Consequently, grasslands of the *Poa alpina* and *Nardus stricta* type or *Rhododendron ferrugineum* – heaths colonize the previously wooded surfaces.

### Typical species:

<i>Avenella flexuosa</i>	POACEAE	wavy hair-grass
<i>Calamagrostis villosa</i>	POACEAE	villous smallreed
<i>Homogyne alpina</i>	ASTERACEAE	purple colt's-foot
<i>Listera cordata</i>	ORCHIDACEAE	lesser twayblade
<i>Luzula sieberi</i>	JUNCACEAE	greater woodrush
<i>Melampyrum sylvaticum</i>	SCROPHULARIACEAE	small cow-wheat
<i>Oxalis acetosella</i>	OXALIDACEAE	wood-sorrel
<i>Picea abies</i>	PINACEAE	Norway spruce
<i>Pyrola rotundifolia</i>	ERICACEAE	round-leaved wintergreen
<i>Vaccinium myrtillus</i>	ERICACEAE	bilberry

### Distribution:

Widely distributed in the European Alps, especially in the outer chains (higher precipitations).

Corresponding communities outside of the European Alps:

- *Picea abies* – forests: Carpathians.
- *Picea engelmannii*/*Abies lasiocarpa* – forests: Rocky Mountains.

## *Pinus cembra* – forest

**Phytosociological unit:** Ass.: *Larici – Pinetum cembrae* (All.: *Rhododendro – Vaccinion*).

### Site characteristics:

Upper subalpine zone between 1700 and 2300 m. On horizontal surfaces or slopes of different exposures, but not on steep, south-faced slopes. Long-lasting snow cover of about seven months.

Chiefly but not exclusively on siliceous substrata. Developed soil of the podsol\* type with a thick humus layer; fresh; acid (pH of the upper layer 3 – 4) and nutrient-poor.



### Stand characteristics:

Very sparse forest dominated by the summer-green larch and/or the evergreen Arolla pine. The larch is a light-demanding, anemochorous\* pioneer species\* colonizing mineral soils, thus indicating early stages of forest development. The Arolla pine, on the other hand, is more typical for mature forests. Its seeds are rather heavy and are buried by the nutcracker (*Nucifraga caryocatactes*) as food reserves for the winter. Since this bird forgets some of his stocks or does not find all of them, it contributes to the dissemination\* of the Arolla pines. Both tree species are very frost resistant and may survive temperatures of  $-40$  to  $-60^{\circ}$  in winter. The understory of this forest type is often formed by a dense scrub of species of the *Ericaceae* family, such as rust-leaved alpenrose or lingberry.

This forest type has often been cut giving way to pastures corresponding to *Poa alpina* – and *Nardus stricta* – grasslands, or to *Rhododendron ferrugineum* – heaths.

### Typical species:

<i>Larix decidua</i>	PINACEAE	European larch
<i>Linnaea borealis</i>	CAPRIFOLIACEAE	twinflower
<i>Lonicera caerulea</i>	CAPRIFOLIACEAE	blue-berried honeysuckle
<i>Pinus cembra</i>	PINACEAE	Arolla pine
<i>Rhododendron ferrugineum</i>	ERICACEAE	rust-leaved alpenrose
<i>Vaccinium vitis-idea</i>	ERICACEAE	lingberry

### Distribution:

Distributed in the regions with more continental climate (inner chains).



## *Rhododendron ferrugineum* – heath

**Phytosociological unit:** Ass.: *Rhododendretum ferruginei* (All.: *Rhododendro* – *Vaccinion*).

### Site characteristics:

Upper subalpine zone between 1800 and 2300 m. On horizontal surfaces, or slopes of different exposures, but not on steep, south-faced slopes; also in depressions. Long-lasting snow cover of about seven months.

On siliceous and calcareous bed rock. Weakly-developed soils of the ranker\* type, but also deeper and more developed soils of podsol\* type; fresh; acid (pH of the upper soil layer 3 – 4.5) and nutrient-poor.

### Stand characteristics:

Dwarf shrub heath dominated by the rust-leaved alpenrose, often together with other dwarf shrubs of the *Ericaceae* family, such as bilberry (*Vaccinium myrtillus*). The evergreen alpenroses (*Rhododendron ferrugineum* and *hirsutum*) are sensitive to temperatures below  $-20^{\circ}\text{C}$  and therefore only colonize places with a protecting snow cover during the whole winter.

In most cases, dwarf shrub heaths are the result of clear cutting in order to obtain alpine pastures. However, they also occur in situations where trees cannot establish, for example in avalanche paths. Where grazing occurs, the alpenrose heath often forms a patchy mosaic with the *Nardus stricta* – grassland.

### Typical species:

*Rhododendron ferrugineum*                      ERICACEAE                      rust-leaved alpenrose  
for further species → see *Picea abies* – or *Pinus cembra* – forest

### Distribution:

Widely distributed throughout the European Alps.

Corresponding communities outside of the European Alps:

- *Rhododendron caucasicum* – communities: Caucasus.
- *Rhododendron ferrugineum/Saxifraga geranioides* – community: Pyrenees.
- In the Himalaya, heaths are formed by other *Rhododendron* species (*Rhododendron anthopogen*, *R. setosum*).

## *Pinus mugo* – forest

**Phytosociological unit:** Ass.: *Erico – Pinetum montanae* (All.: *Erico – Pinion*).

### Site characteristics:

Subalpine zone between 1600 and 2300 m. Especially on steep, south- and west-faced slopes, also on scree slopes and ridges. Snow covered for five to six months.

Predominantly, but not exclusively, on calcareous bedrock. Weakly developed, shallow soil of rendzina\* type; fresh to rather dry; neutral to slightly acid (pH 6 – 7) and relatively nutrient-poor.

### Stand characteristics:

The light-demanding mountain pine exists in two subspecies: *Pinus mugo* ssp. *uncinata*, the erect mountain pine and the crooked *Pinus mugo* ssp. *mugo*, the prostrate mountain pine, that rarely exceeds 3 m in height. The first subspecies is a forest forming species in the western parts of the European Alps, whilst the latter occurs especially in the eastern parts. The prostrate mountain pine is well-adapted to resist snow pack and avalanches, it colonizes sites in the upper subalpine zone, that are unfavourable for tree growth. The understory of these forest types are generally formed by dwarf shrubs, such as winter heath, striped daphne, or, in more shady and humid environments, hairy alpenrose.

### Typical species:

<i>Calamagrostis varia</i>	POACEAE	variegated smallreed
<i>Daphne striata</i>	THYMELAEACEAE	striped daphne
<i>Erica carnea</i>	ERICACEAE	winter heath
<i>Gymnadenia odoratissima</i>	ORCHIDACEAE	short-spurred fragrant orchid
<i>Pinus mugo</i>	PINACEAE	dwarf mountain pine
<i>Polygala chamaebuxus</i>	POLYGALACEAE	shrubby milkwort
<i>Rhododendron hirsutum</i>	ERICACEAE	hairy alpenrose
<i>Rhodothamnus chamaecistus</i>	ERICACEAE	dwarf alpenrose
<i>Sorbus chamaemespilus</i>	ROSACEAE	false medlar

### Distribution:

Patchily distributed in the calcareous regions of the European Alps.

Corresponding communities outside of the European Alps:

- *Pinus mugo* – forests: Carpathians, Dinaric Alps, Pyrenees.
- *Pinus heldreichii* – forests: Greek Mountains.

## ***Rhododendron hirsutum* – heath**

**Phytosociological unit:** Ass.: *Rhododendretum hirsuti* (All.: *Erico* – *Pinion*).

**Site characteristics:**

Upper subalpine zone between 1800 and 2300 m. On ridges and slopes of different exposure, especially in shady situations with high air humidity. Snow cover for about seven months.

On calcareous substrata, especially on stable calcareous scree slopes. Weakly-developed, shallow soil of rendzina\* type; fresh; neutral to rather acid (pH 5 – 7) and relatively nutrient-poor.

**Stand characteristics:**

Dwarf shrub heath dominated by the hairy alpenrose and other shrub species of the *Ericaceae* family such as winter heath (*Erica carnea*). More or less identical to the *Pinus mugo* – forest with the exception of the missing tree layer. However, this heath colonizes locations where trees cannot establish, e.g. in the upper treeline ecotone or in avalanche paths.

**Typical species:**

<i>Rhododendron hirsutum</i>	ERICACEAE	hairy alpenrose
for further species → see <i>Pinus mugo</i> – forest		

**Distribution:**

Distributed in the calcareous regions of the European Alps.

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## Glossary

- Anemochorous:** Plant species producing seeds that are dispersed by wind.
- Brown earth:** Developed and slightly leached (alkalic salts and calcium) soil type with discrete soil horizons. Moderately humid, weakly acid to acid, and rather nutrient-rich.
- Bryophytes:** Mosses and liverworts.
- Chasmophyte:** Plant rooting in rock fissures.
- Chomophyte:** Plant rooting on rock ledges.
- Clonal:** Vegetative reproduction of a plant by means of stolons\* or rhizomes\* from which new plants develop. The new plants are genetically identical to one another and to the parent (i.e. they form a “clone”).
- Colluvial:** Transport of fine soil by surface wash and accumulation in a depression.
- Coriaceous:** Having a leathery texture.
- Cryoturbation:** Freezing and thawing cycles in soils leading to the mixing of soil horizons, the displacement of rocks and sediments, as well as to the formation of mounds and characteristic patterns (stone stripes or stone polygons).
- Dioecious:** Plant species with male and female individuals.
- Dissemination:** Dispersal by seeds.
- Endemic:** Taxon (species, genus, ...) that occurs in a relatively small and more or less clearly delimited geographical area. Using this term without specifying the geographical context is meaningless.
- Entomogamous:** Plant species that are pollinated by insects.
- Gley:** Soil type of waterlogged conditions. The anaerobic environment promotes the reduction of iron compounds by micro-organisms and often causes mottling of soil into a patchwork of grey and rust colours.
- Graminoid:** Grass-like plants.
- Hemicryptophyte:** Perennial plant species whose perennating buds are at ground level, the aerial shoots dying down at the onset of unfavourable conditions.
- Herb/Herbaceous:** Non-graminoid\* and non-lignified vascular plant\* species.
- Lithophyte:** Plant growing on rock surfaces.
- Mesomorphic:** Plant species showing morphological properties adapted to humid and relatively nutrient-rich habitats.
- Mesotrophic:** Plant species colonizing relatively nutrient-rich habitats.
- Pioneer species:** Species colonizing a new physical environment.
- Podsol/Podsolic:** Developed soil type with a heavily bleached horizon resulting from the leaching of humic acids and oxides of iron and aluminium, that are accumulated in the subsoil. Moderately humid, generally acid, and nutrient-poor.
- Ranker:** Weakly developed soil type consisting of a shallow soil layer lying directly upon physically weathered mother rock that is poor in calcium (siliceous substrata). Moderately humid, weakly acid to acid, and rather nutrient-poor.
- Rendzina:** Weakly developed soil type consisting of a shallow soil layer lying directly upon physically weathered mother rock that is rich in calcium (calcareous substrata). Rather dry, neutral to weakly basic, and rather nutrient-rich.
- Rhizome:** Horizontally creeping underground stem which bears roots and shoots.
- Solicfluction:** Gradual downhill movement of saturated soil upon an impermeable layer of frozen ground or bedrock; produces terraces and lobes.
- Stolon/Stoloniferous:** Horizontally growing stem that produces roots and shoots at its nodes.
- Succulent:** Plant species that conserves water by storing it in large cells in stems or leaves; as a result these organs become swollen and fleshy.
- Tufa:** Rock type whose formation in springs is often favoured by the presences of mosses.
- Vascular plant:** Taxonomic group of plants that have vascular tissues, comprising the Spermatophyta (seed plants) and the Pteridophyta (horsetails, lycopods, and ferns).

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<i>Erica carnea</i>	42, 43	Kerner's lousewort	24
<i>Erigeron acer</i>	17	<i>Kerneria saxatilis</i>	11
<i>Erigeron gaudinii</i>	10	kidney vetch	30



king of the Alps	10	one-flowered fleabane	32
Ladin hunger flower	11	one-flowered mouse-ear	12
large bittercress	5	<i>Oreochloa disticha</i>	23, 24
large blue fescue	28	<i>Oxalis acetosella</i>	39
large white buttercup	34	<i>Oxyria digyna</i>	12
large yellow-sedge	8	<i>Oxytropis campestris</i>	32
large-flowered leopard's-bane	16	<i>Oxytropis halleri</i>	32
<i>Larix decidua</i>	40	<i>Oxytropis jacquinii</i>	30
leafy lousewort	28	<i>Papaver aurantiacum</i>	14
<i>Lecanora</i> sp.	11	<i>Parnassia palustris</i>	8
<i>Leontodon helveticus</i>	24	parnassia-leaved crowfoot	15
<i>Leontodon hispidus</i>	26	<i>Pedicularis foliosa</i>	28
<i>Leontodon montanus</i>	15	<i>Pedicularis kernerii</i>	24
<i>Leontopodium alpinum</i>	30	<i>Pedicularis rostratocapitata</i>	30
lesser twayblade	39	<i>Pedicularis verticillata</i>	30
<i>Leucanthemopsis alpina</i>	24	<i>Petasites paradoxus</i>	16
<i>Ligusticum mutellina</i>	26	<i>Peucedanum ostruthium</i>	34
<i>Ligusticum mutellinoides</i>	32	<i>Philonotis calcarea</i>	6
<i>Linaria alpina</i>	13, 14	<i>Philonotis seriata</i>	5
lingberry	40	<i>Phleum alpinum</i>	26
<i>Linnaea borealis</i>	40	<i>Phleum hirsutum</i>	28
<i>Listera cordata</i>	39	<i>Physoplexis comosa</i>	11
live-long saxifrage	11	<i>Phyteuma betonicifolium</i>	25
<i>Loiseleuria procumbens</i>	38	<i>Phyteuma hemisphaericum</i>	24
long-peduncled mouse-ear	12	<i>Picea abies</i>	39
<i>Lonicera caerulea</i>	40	<i>Pinguicula vulgaris</i>	8
low hawkweed	11	<i>Pinus cembra</i>	40
<i>Luzula lutea</i>	24	<i>Pinus mugo</i>	42
<i>Luzula sieberi</i>	39	<i>Pleospora elynae</i>	23
many-flowered rock-jasmine	10	<i>Poa alpina</i>	26
marsh felwort	8	<i>Poa laxa</i>	12
marsh helleborine	8	<i>Pohlia drummondii</i>	19
marsh violet	7	<i>Polygala chamaebuxus</i>	42
masterwort	34	<i>Polytrichum sexangulare</i>	19
mat-grass	25	<i>Potentilla aurea</i>	25
<i>Melampyrum sylvaticum</i>	39	<i>Potentilla brauneana</i>	21
<i>Minuartia rupestris</i>	11	<i>Potentilla caulescens</i>	11
<i>Minuartia sedoides</i>	24	<i>Potentilla crantzii</i>	32
<i>Moehringia ciliata</i>	14	<i>Primula auricula</i>	11
Mont Cenis bellflower	15	<i>Primula farinosa</i>	8
moss champion	31	<i>Primula hirsuta</i>	10
mossy saxifrage	12	<i>Primula latifolia</i>	10
mountain avens	31	<i>Pritzelago alpina</i>	14
mountain crowberry	38	<i>Pseudorchis albida</i>	25
mountain hawkbit	15	<i>Pulsatilla alpina</i>	28
mountain hawksbeard	28	purple colt's-foot	39
mountain lovage	26	purple oxytropis	32
mountain milk-vetch	30	purple saxifrage	15
mountain sorrel	12	pygmy hawksbeard	15
mountain valerian	16	pyramidal saxifrage	10
musk milfoil	12	<i>Pyrola rotundifolia</i>	39
myricaria	17	<i>Ranunculus alpestris</i>	21
<i>Myricaria germanica</i>	17	<i>Ranunculus glacialis</i>	12
naked rush	32	<i>Ranunculus parnassifolius</i>	15
narcissus-flower thimbleweed	28	<i>Ranunculus platanifolius</i>	34
<i>Nardus stricta</i>	25	<i>Ranunculus pygmaeus</i>	19
narrow-leaved hawkweed	24	reed-like reedgrass	17
net-leaved willow	21	Rhaetian poppy	14
nodding willowherb	5	<i>Rhizocarpon geographicum</i>	10
Norway spruce	39	<i>Rhododendron ferrugineum</i>	40, 41
<i>Nucifraga caryocatactes</i>	40	<i>Rhododendron hirsutum</i>	41, 42, 43
nutcracker	40	<i>Rhodothamnus chamaecistus</i>	42

rock kenera	11	statice-leaved hawkweed	17
rock stitchwort	11	stinking primrose	10
rough hawkbit	26	striped daphne	42
round-headed orchid	28	sweet-flower rock-jasmine	31
round-leaved penny-cress	14	<i>Swertia perennis</i>	8
round-leaved saxifrage	34	Swiss bedstraw	14
round-leaved wintergreen	39	Swiss hawkbit	24
<i>Rumex nivalis</i>	21	swiss rock-jasmine	11
rust-leaved alpenrose	40, 41	<i>Taraxacum alpinum</i>	15
rusty sedge	28	<i>Thamnolia vermicularis</i>	23, 32, 38
<i>Salix herbacea</i>	19	<i>Thlaspi repens</i>	13, 14
<i>Salix reticulata</i>	21	three-leaved rush	24
<i>Salix retusa</i>	21	tofield's asphodel	8
<i>Salix sp.</i>	17	<i>Tofieldia calyculata</i>	8
<i>Saxifraga aizoides</i>	6, 17	tomentose draba	11
<i>Saxifraga androsacea</i>	21	tozzia	34
<i>Saxifraga aphylla</i>	14	<i>Tozzia alpina</i>	34
<i>Saxifraga bryoides</i>	12	trailing azalea	38
<i>Saxifraga caesia</i>	31	<i>Traunsteinera globosa</i>	28
<i>Saxifraga cotyledon</i>	10	<i>Trichophorum caespitosum</i>	7
<i>Saxifraga exarata</i>	10	<i>Trifolium alpinum</i>	25
<i>Saxifraga oppositifolia</i>	15	<i>Trifolium badium</i>	26
<i>Saxifraga paniculata</i>	11	<i>Trifolium pratense subsp. nivale</i>	26
<i>Saxifraga rotundifolia</i>	34	<i>Trisetum distichophyllum</i>	16
<i>Saxifraga stellaris</i>	5	<i>Trollius europaeus</i>	28
saxifrage with naked stems	14	trumpet gentian	25
<i>Scabiosa lucida</i>	30	twinflower	40
<i>Scapania undulata</i>	5	two-flowered sandwort	19
Scheuchzer's cotton-grass	7	two-lined sesleria	24
<i>Sedum alpestre</i>	19	<i>Umbilicaria sp.</i>	10
<i>Sedum atratum</i>	15	<i>Vaccinium gaultherioides</i>	38
<i>Senecio incanus</i>	24	<i>Vaccinium myrtillus</i>	39, 41
<i>Sesleria caerulea</i>	30	<i>Vaccinium vitis-idea</i>	40
shaggy hawkweed	30	<i>Valeriana montana</i>	16
short-spurred fragrant orchid	42	variegated oat	24
shrubby milkwort	42	variegated smallreed	42
sibbaldia	19	<i>Veronica bellidioides</i>	24
<i>Sibbaldia procumbens</i>	19	<i>Verrucaria sp.</i>	11
<i>Silene acaulis</i>	31	verticillate lousewort	30
<i>Silene vulgaris subsp. glareosa</i>	16	Villars' chervil	34
small cow-wheat	39	villous smallreed	39
small scabious	30	<i>Viola biflora</i>	34
small-flowered sedge	21	<i>Viola palustris</i>	7
small-white orchid	25	watercress-leaved rocket	17
snow clover	26	wavy hair-grass	39
snow dock	21	wavy meadow-grass	12
<i>Soldanella alpina</i>	26	white musky saxifrage	10
<i>Soldanella pusilla</i>	19	winter heath	42
<i>Sorbus chamaemespilus</i>	42	<i>Woodsia alpina</i>	10
spine-pointed sedge	11	wood-sorrel	39
spotted gentian	25	yellow Alpine milk-vetch	28
stalked cinquefoil	11	yellow bellflower	28
star sedge	7	yellow oxytropis	32
starry saxifrage	5	yellow saxifrage	6
starwort mouse-ear	19	yellow wood-rush	24