Florian Święs

7.1. Vascular plant flora

Introduction to research problem and methods

The main aim of this chapter is to present the results of geobotanical studies on the vascular plants of the NW part of Wedel Jarlsberg Land on Spitsbergen and their adaptation to the surrounding environmental conditions. Preliminary information on the flora of the study area is available in two publications (Rzętkowska 1987; Święs 1988a). Rzętkowska (1987) described the region of Calypsostranda, with 55 species of plants found on glacial moraines, snow patches and among the deflation tundra and grass/moss tundra. On the other hand, Święs (1988b) presented a list of 63 plants found in four regions called Lyellstranda, Calypsostranda, Tomtodden and Chamberlin. Both studies, however, provided a very general and incomplete description of plant spatial distribution.

Looking at the data published to date, which dealt with the placement of vascular plants throughout the whole region of Svalbard, the publications by Rønning (1972) and Brochmann & Steen (1999) are noteworthy. However, the information presented in Rønning's work concerning the flora of Svalbard is already outdated and incomplete.

Therefore two main sources taken into consideration during this study were works by Brochmann & Steen (1999) and our own field-based observations. The first one presents the most recent and comprehensive information on the flora of Svalbard. The second source used in this analysis of vascular plants was the collection of floristic samples acquired by Maria Curie-Skłodowska University Expeditions from various parts of NW part of Wedel Jarlsberg Land. Sampling took place in the course of comprehensive environmental research carried out during the summer seasons of 1987, 1988, 1992 and 1995 (Repelewska-Pękalowa & Pękala 1997; Repelewska-Pękalowa & Bartoszewski 2006; Święs 2006). All identified plant taxa were documented, depending on the frequency of their occurrence many specimens were collected for herbaria. Plants were collected from places identified on phytosociological records, and partially from other areas. Quantitative ratios of plant locations were determined based on the collected herbarium specimens and the recorded points of their origin. Table 7.1.1 presents basic information on the floristic relations in eight distinguished regions of the

study area. It includes lists of all identified plant taxa in an alphabetical manner and, groups them into specific families. Table 7.1.1. also presents data on the affinity of discovered plants to specific geographical settings, the number of plant assemblages, and the information on plant presence within the characteristic physio-ecological group of local tundra vegetation.

The nomenclature and systematic order of plants is based on Rønning's (1996). His publication describes all plants found in the study area apart from the *Festuca edlundiae*. This, relatively lately described crucial species, has been included in the probably most recent description of the Svalbard flora prepared by Brochmann & Steen (1999). The identification of plant taxa was based on the aforementioned Rønning's publication, and the following widely recognised botanical monographs: Hadač (1944), Polunin (1959), Tutin *et al.* (1964, 1968, 1972, 1976, 1980) and Böcher *et al.* (1968). One of the most helpful methods of plant identification was comparison of collected species with herbaria of Svalbard plants stored in the Herbarium of the W. Szafer Institute of Botany, at the Polish Academy of Sciences in Kraków (Godzik & Wójcicki 1987).

Ecological groups of living forms were distinguished according to the assumptions made by Raunkiær (1905). In the case of identifying floristic geographical elements the information from: Hulten (1958), Rønning (1964, 1972, 1979, 1996), Tolmatchev & Jurtzev (1960-1987), Hofmann (1968), Bliss (1971), Aleksandrova (1983), and Hulten and Fries (1986) was used. The identification of selected two groups of plant elements was additionally verified with data published by Dubiel (1991).

The primary and secondary groups of local tundra communities listed in Table 7.1.1 have already been characterised with varying precision. The results were published separately and together with the bryological description of six regions delimited in the study area (Święs 1988ab, 2006; Karczmarz & Święs 1990ab; Święs & Karczmarz 1991ab, 1993ab). The provisionally identified tundra communities were grouped on the basis of main ecological properties of local soils, and the dominant type of herbaceous vegetation cover in the area, determined on the basis of vascular plants and bryophytes and sporadically, on types of lichens. In general, the studied types of tundra communities better represent the specified plant microformations rather than typical fully formed plant associations. It should be added that in this publication selected groups and subgroups of previously described tundra formations, were modified, unified and simplified.

The summary of research on taxonomic, ecological and spatial distribution of the NW part of Wedel Jarlsberg Land plants is presented in Tables 7.1.1 and 7.1.2 in the final section of this chapter. This work focuses also on the local vertical range of plants and the geobotanical location of the study area and its relation to other regions of Svalbard that had been a subject of similar geobotanical studies. The flowering plant samples from the region of Bellsund collected during this research were donated, in the form of several hundred herbarium sheets, to the Herbarium of the W. Szafer Institute of Botany at the Polish Academy of Sciences in Kraków.

Research area

The geobotanical research presented in this chapter was carried out in in the north-western part of the Wedel Jarlsberg Land, along the coasts of Bellsund, Svalbard Archipelago (Fig. 7.1.1). The research area covers eight constituent regions further differentiated into secondary, smaller physiographic units, e.g. mountain ranges, coastal plains, glacier valleys and river valleys, peninsulas and capes. The selected regions are[12]: (1) Dunder (Dunderdalen), (2) Logne (Lognedalsflya, Lognedalen), (3) Dyrstad (Dyrstadflya, Dyrstaddalen), (4) Lyell (Lyellstranda), (5) Calypsobyen (Calypsostranda), (6) Tomtodden (Aktivekammen), (7) Chamberlin (Chamberlindalen), (8) Svarthamaren (Reinodden, Reinsletta, Maria Theresiatoppen) (Fig. 7.1.1).

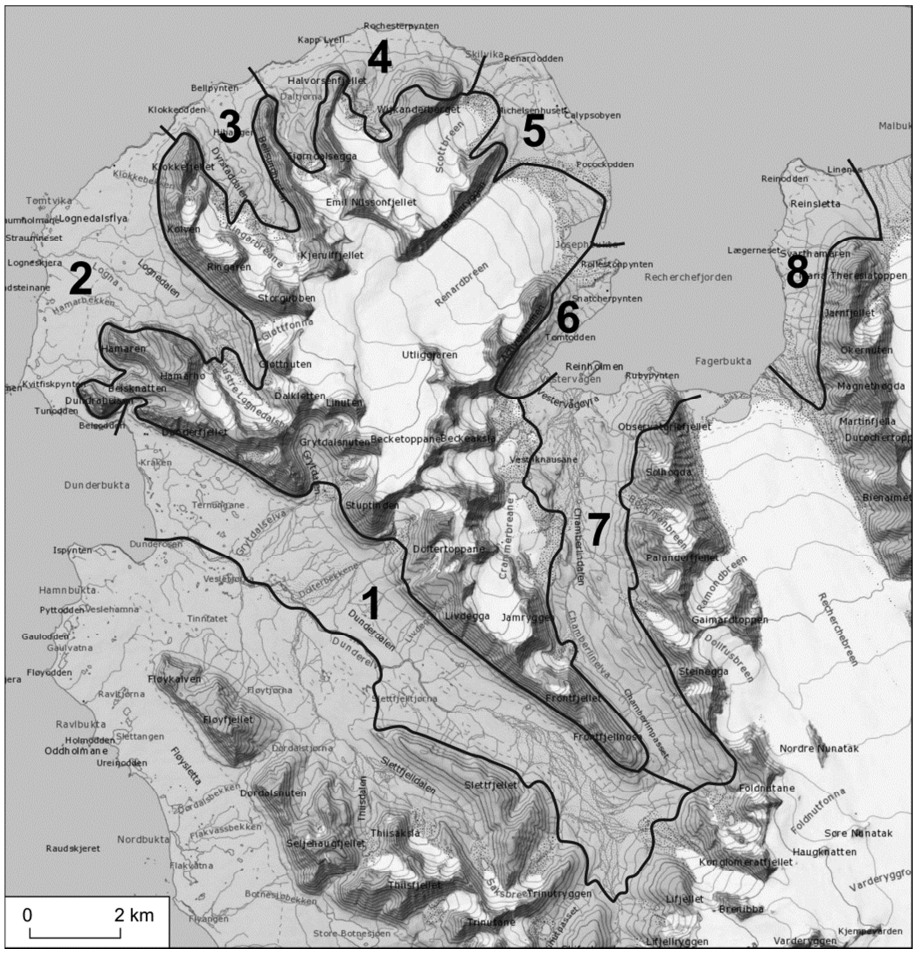

Fig. 7.1.1. Location of study area (background: Topo Svalbard, Norwegian Polar Institute): 1- Dunder, 2- Logne, 3- Dyrstad, 4- Lyell, 5- Calypsobyen, 6- Tomtodden, 7- Chamberlin, 8- Svarthamaren.

[12] The names of the regions - as proposed by the author.

Geobotanical studies were mostly carried out in areas ranging from the coastal zone to the mountain valleys. The research also focused on some of the more accessible mountain slope up to the level of approx. 400-500 m a.s.l. In the case of seven regions the study covered their entire area. This was the case with: Logne, Dyrstad, Lyell, Calypsostranda, Tomtodden, Chamberlin and Svarthamaren. The Dunder region was separated into two neighbouring areas. The first of these was the right-bank side of the main river of Dunder (Dunderdelva). The second was located in the upper, south-eastern part of Dunder. It stretches on the left-bank side of the main river all the way to the slopes of the Lifjellet (525 m a.s.l.) to Slettfjellet (520 m a.s.l.). In total, the area of geobotanical studies was approximately 65 km long and up to 25 km wide.

Basic information on the most important elements of the natural environment in the study area has been published by Święs (1988a, 2006), Karczmarz & Święs (1990ab), Święs & Karczmarz (1991ab, 1993ab). Various natural environment elements of the area were also reviewed by Repelewska-Pękalowa & Pękala (2006).

Geobotanical relations

Vegetation cover. One of the most interesting problems of geobotanical studies in the polar areas is the specific character of plant adaptation to the severe arctic conditions. Data on the subject is provided, among others, by: Aleksandrova (1983), Szczypek & Wika (1982), Klekowski & Opaliński (1984), Pirożnikow (1955). The vegetation cover in the study area is highly variable, depending on the habitat conditions, and includes examples of sparse arctic desert flora and dense patches of rich Arctic flora (Święs 1988a, 2006; Święs & Karczmarz 1991ab, 1993ab; Karczmarz & Święs 1990ab) (Table 7.1.1).

Arctic deserts are mostly be found on rocky slopes and mountain ridges as well as on stone fields covering slopes, coastal plains and bottoms of mountain valleys. Scattered Arctic desert habitats were also found on beaches, inselbergs, skerries, and on rocky slopes of larger canyon-type valleys and active coastal cliffs. Vascular plants, bryophytes and lichens occur sporadically in such areas spread-outacross favourable microhabitats, e.g. the humus waste accumulated in gaps between rock blocks, or old, muddy alluvial fans or outwash plane. It is also interesting how certain plants, especially deep-rooted grass, occur on local beaches or at the base of eroded moraines. On these seemingly barren surfaces the existence of plants is dependent conditioned on the presence of fossil soils near the surface.

Most of the local plant communities and their microhabitats have been characterised in Table 7.1.1. It turns out that within the study area, almost all types of known phytocoenoses identified on Svalbard (Elvebakk 1994) were found. Most of the area is occupied by flowery-mossy or mossy-flowery phytocoenoses and various raised bogs (Święs 1988a, 2006). It is important to mention the presence of rare transitional peatlands, occurring here in the form of mesophilic caps with partially flooded edges or

regular peaty-mineral hummocks or tundra hills (Klementowski 1979; Klimowicz *et al.* 2008).

The main, areas of fully formed tundra communities are coastal plains and at the mouths of mountain valleys. All of the local primary and secondary groups of tundra communities occur in these areas, e.g. scattered initial and deflation types as well as the mixed types (Photos 7.1.1 and 7.1.2). At the same time, this area is the most diverse in terms of micro- and macrohabitat conditions. The most characteristic tundra communities existing in this zone include bogs, peatlands, permanently or periodically flooded raised bogs, as well as mesophilic communities of the following type: flowery-mossy-licheny, mossy-flowery, mossy, licheny etc. (Table 7.1.1). Moreover, on the slopes with a mesophilic, clayey-stony surfaces the patches of tundra in the form of mesotrophic raised bogs or coprophilic raised bogs with varying content of vascular plants and lichens are found. Mesotrophic raised bogs located on slopes are very common, especially on gentle debris-covered or drift-mantled slopes. On the other hand, the coprophilic (ornithocoprophilous) raised bogs, are very rare on slopes and occur in sparse tufts. They are usually located in niche-like depressions in the vicinity of talus fans heavily fertilised by the birds nesting in the area (Little Auk – *Plautus alle*). Such tundra communities as those of the Bellsund region are probably the most common on Spitsbergen (Hadač 1946; Eurola & Hakala 1977; Gugnacka-Fiedor & Noryśkiewicz 1982ab; Dubiel & Olech 1990, 1992). As already mentioned the basic floristic differences between characterised local tundra communities, in particular with regard to groups of specific features and ecological factors (microformations), usually pertain to the quantitative ratio of mostly the same species of vascular plants, bryophytes and lichens (Święs 1988a, 2006).

The vertical range of local flora and its communities is very difficult to determine. This is due to a complex system of interactions between habitat-related conditions. The biggest concentration and variety of vegetation of different density occurs on coastal plains and at the mouths of mountain valleys. The maximum vertical range of these plants reaches up to 100-150 m a.s.l. Dense raised bogs located on the slopes reach the level of 150-200 m a.s.l. Additionally, dispersed patches of vascular plants have been found on some of the highest summits, such as Observatoriefjellet (565 m a.s.l.) or Wijkanderberget (581 m a.s.l.). Part of these highest peaks and mountain ridges is, to a different extent, constantly covered with snow. Finally, many of the lower rocky ridges covered with bryophytes and lichens were devoid of large assemblages of vascular plants (Orthophotomap, Appendix 1).

Vascular plant flora. According to the latest and arguably most accurate data published on the subject (Rønning 1979, Brochmann & Steen 1999), this type of flora in Svalbard includes 165 native species and approx. 20 alien species (synanthropic), partially isolated in lower taxa. The results of research on the structure of local flora are presented in Table 7.1.1. The table accounts for all the information published to date by the authors mentioned above, as well as unpublished data on the subject.

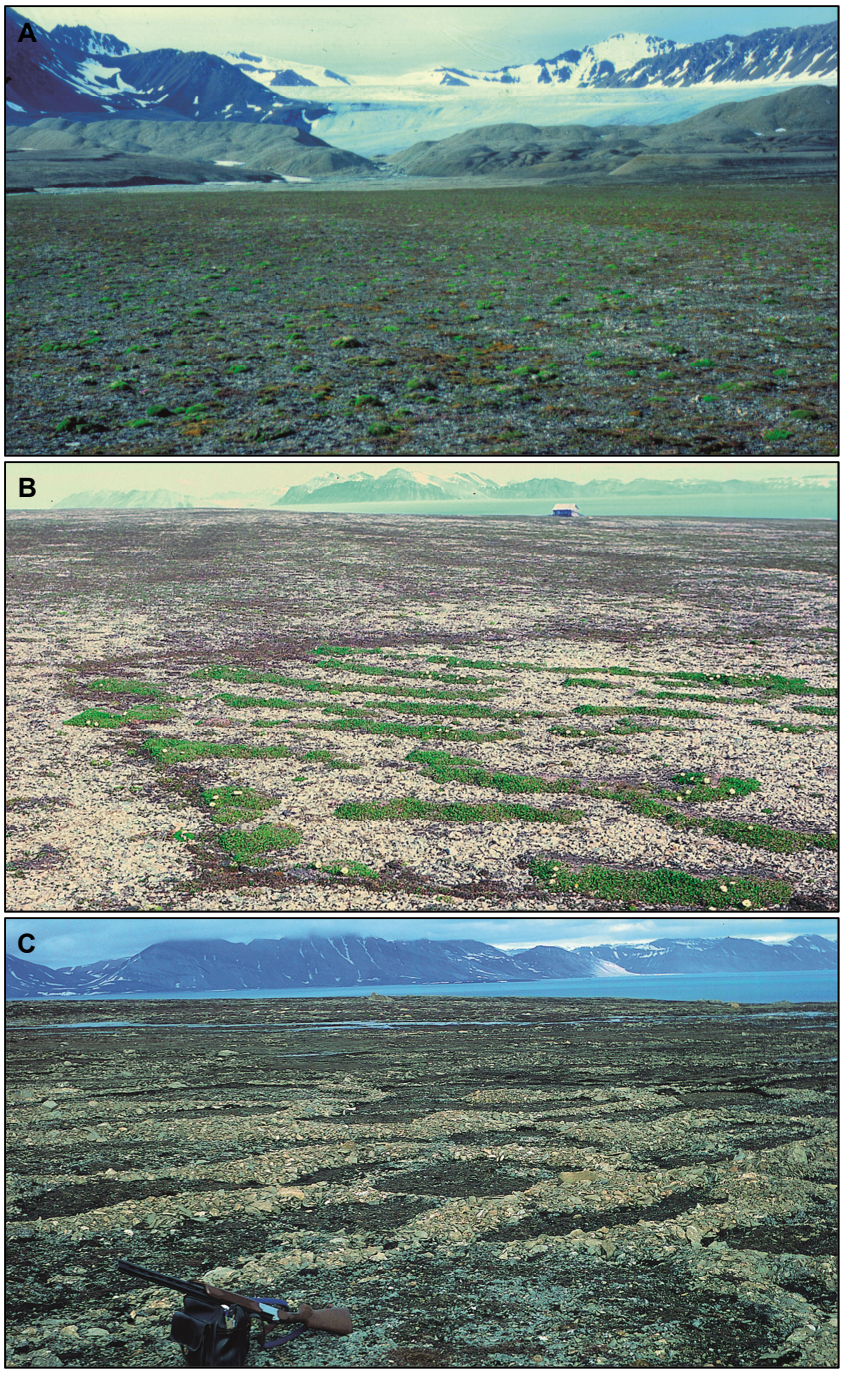

Photo 7.1.1. A- mixed mesophilic tundra (flowers/moss/lichens) on a marine terrace, W part of Calypsobyen Region (Photo F. Święs 1992); B- scattered deflation tundra (spotted) with *Dryas octopetala* on a marine terrace, SW part of Calypsobyen Region (Photo F. Święs 1992); C- scattered mixed tundra on structural soil of stony rings (rims), NE part of Calypsobyen Region (Photo F. Święs 1988).

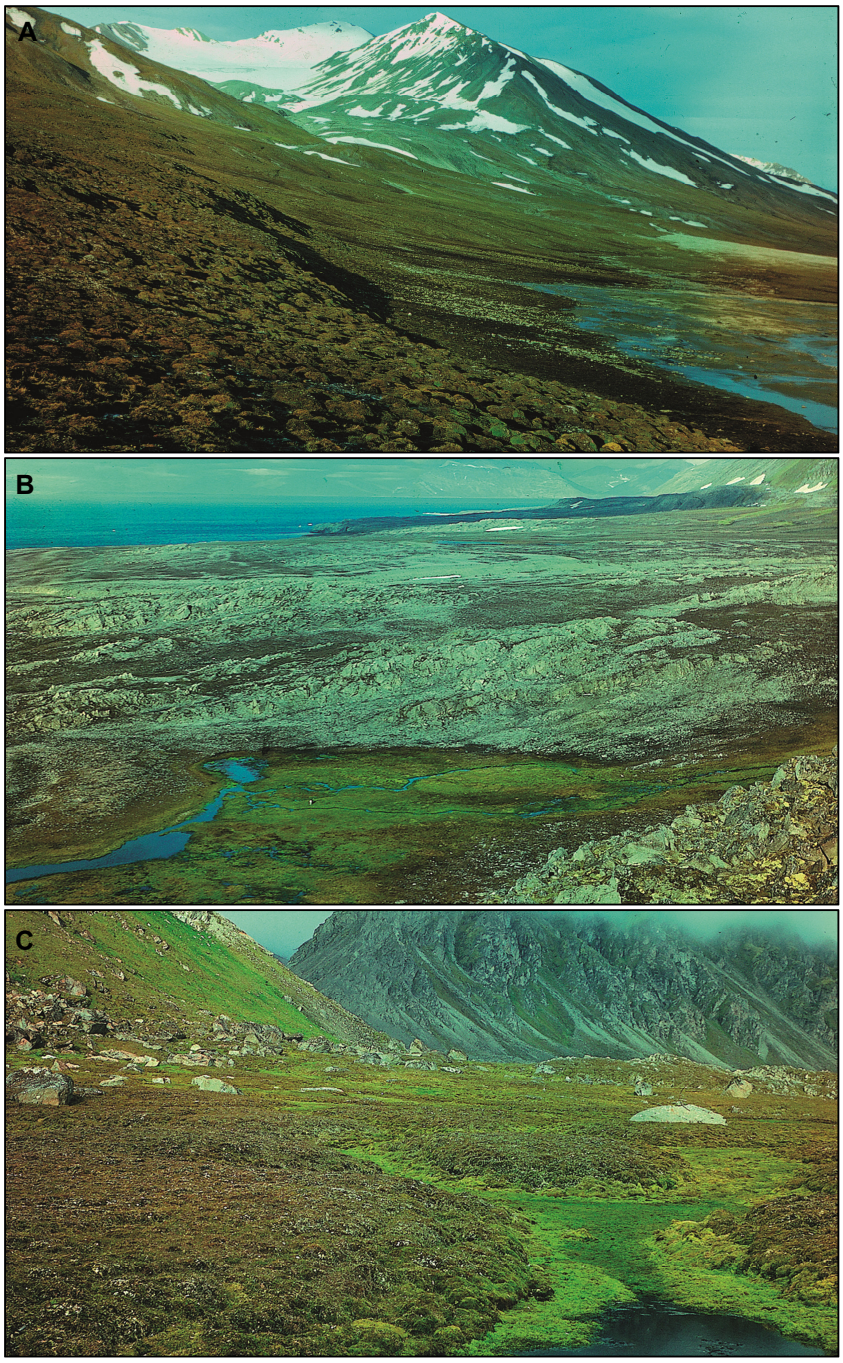

Photo 7.1.2. A- raised bog tundra (hillocky type) on an inclined slope at the foot of an elevation, central-eastern part of Chamberlin Region (Photo F. Święs 1995); B- flooded raised bog tundra on a marine terrace in a valley-like depression between the skerries at the foot of an elevation. SE part of Dyrstad Region (Photo F. Święs 1995); C- transitional raised bog tundra forming mesophilic caps with partially flooded edges – marine terrace at the foot of Dundrabelsen – extreme SE part of Logne Region (Photo F. Święs 1992).

The results show that in the case of the whole studied area the 46 species location sites were distinguished including those from lower taxa. These are plants found in singular, extremely coastal areas of six out of eight delimited regions. Detailed analysis of each of the regions allowed to distinguish between 9 and 48 species location sites.

In total, the flora of the study area consists of 109 species differentiated into 114 taxa (Table 7.1.1). About 30 of these plants belong to rarest in Svalbard (Brochmann & Steen 1999). One of these taxa is a hybrid (*Cerastium arcticum x C. regelii*). Four others are considered subspecies: *Equisetum arvense subsp. alpestre, Huperzia selago subsp. arctica, Ranunculus hyperboreus subsp. arnellii, Cerastium alpinum subsp. lanatum.* Two of the species occur in a total of four varieties: *Cerastium arcticum var.: arcticum, sordidum* and *vestitum* and *Poa alpina var. vivipara.* One of the plants occurs both as a species and a subspecies: *Poa alpigena, P. alpigena var. vivipara.* Another one is represented by a species, subspecies and variety: *Poa arctica, P. arctica subsp. caespitans* and *P. arctica var. vivipara.*

It seems that in the case of Bellsund region the location sites for the following 34 plants have not yet been described (Table 7.1.1): *Huperzia selago subsp. arctica, Cystopteris dickieana, Cerastium alpinum subsp. lanatum, Cerastium arcticum x Cerastium regelii, Minuartia rossii, Silene uralensis, Stellaria humifusa, Ranunculus hyperboreus subsp. arnellii, Draba fladnizensis, Eutrema edwardsii, Saxifraga hyperborea, Potentilla rubricaulis, Empetrum hermaphroditum, Mertensia maritima, Juncus albescens, Luzula arcuata, Carex glareosa, C. maritima, C. misandra, C. nardina, C. lachenalii, C. parallela, C. rupestris, C. saxatilis, C. ursina, Eriophorum scheuchzerii, Kobresia simpliciuscula, Colpodium vacillans, Festuca brachyphylla, F. hyperborea, F. vivipara, Poa arctica* and *Puccinellia svalbardensis.*

The site locations for some of the plants published previously have not been confirmed: *Festuca edlundiae, Petasites frigidus* and *Potentilla hyparctica.* Also, the site locations for plant taxa of lower rank have not been published including: *Cerastium arcticum* and its 3 varieties – *arcticum, sordidum* and *vestitum* or *Poa arctica* and its var. *vivipara* and subsp. *caespitans.*

Within each of the 8 studied regions there are between 51 and 91 plant taxa of different ranks (Table 7.1.1). These plants, in terms of frequency of occurrence of their site locations, can be divided into three groups: sporadic, frequent and most common. One interesting regularity has been identified, i.e. all three groups differ only slightly in terms of the number of taxa belonging to each of them (Table 7.1.1). The group of plants that occur sporadically, and only in one or two out of eight studied regions, consists of 38 items. The examples include: *Huperzia selago subsp. arctica, Cystopteris dickieana, Honkenya peploides, Cerastium alpinum subsp. lanatum, Stellaria crassipes, Arabis alpina, Potentilla pulchella, Empetrum hermaphroditum, Mertensia maritima, Petasites frigidus, Juncus albescens, Carex ursinea, Kobresia simpliciuscula, Festuca vivipara, Poa arctica subsp. caespitans* and *Puccinellia phryganodes.* The second group, i.e. plants that occur frequently, whose location sites can be found in approx. half of the

studied regions, includes 35 taxa. The most interesting of these are the following: *Cerastium arcticum var. sordidum, Minuartia rossii, Silene uralensis, Papaver dahlianum, Draba fladnizensis, Chrysosplenium tetrandrum, Saxifraga platysepala, Eriophorum scheuchzeri, Arctophila fulva, Calamagrostis stricta, Festuca brachyphylla, Colpodium vacillans, Deschampsia borealis* and *Poa alpigena*. The most common plants that occur in large numbers in all 8 local regions comprise a group of 39 taxa. Some examples include: *Salix polaris, Oxyria digyna, Polygonum viviparum, Cerastium arcticum var. vestitum, Silene acaulis, Cochlearia groenlandica, Draba oxycarpa, Saxifraga cespitosa, S. oppositifolia, Pedicularis hirsuta, Juncus biglumis, Luzula arctica, Colpodium vahlianum, Deschampsia alpina, Festuca cryophila* and *Poa alpina var. vivipara.*

It might be assumed that one of the largest concentrations of flora on Spitsbergen is located in its central-western part in the area of the largest fjords, in particular Isfjordfen and Bellsund. The flora of vascular plants of the NW part of Wedel Jarlsberg Land, in terms of the number of taxa and their location sites, is clearly the southernmost border of the aforementioned region (Brochmann & Steen 1999).

Based on the collected data on the vascular plants of Spitsbergen in northern Bellsund, we may conclude that in the case of as many as 17 species the area of Spitsbergen constitutes the southern border of their regional range. These species deserve special attention. They belong to three main groups of geographic elements and their subgroups (Tables 7.1.1 and 7.1.2). Within the group called 'arctic sub-element*'* the plants from the subgroup 'amphiatlantic-species' (6 sp.) occur in much greater numbers than those from the subgroup 'circumpolar-species' (4 sp.). These include the following plants: in the first subgroup – *Stellaria crassipes, S. humifusa, Draba daurica, Carex paralela, Puccinellia phryganodes* and *Festuca edlundiae,* and in the second subgroup – *Potentilla pulchella, Petasites frigidus, Carex ursina* and *Puccinellia angustata.* In the second group related to geographic elements, i.e. 'arctic-alpine sub-element', there are 5 species that represent the subgroups 'circumpolar-species' *(Saxifraga platysepala, Dryas octopetala, Empetrum hermaphroditum, Carex maritime* and *C. misandra).* Finally, the third and last group based on geographic elements called 'circumpolar sub-element' includes *Honkenya peploides* and *Festuca rubra.*

Other noteworthy plants are those whose southernmost extent line runs through the area of the southern border of Bellsund. These include, in particular: *Arnica angustifolia, Erigeron humilis, Polemonium boreale, Taraxacum arcticum, Carex lidii.* In the case of other plant species it is only *Sagina nivalis* that reaches here its northern extent (Dubiel 1990ab). This plant represents a geographic element belonging to the group 'arctic sub-element' and the subgroup 'circumpolar-species'. No plants that occurred only within the study area were found. It is interesting to note the floristic similarities and differences between the flora of the study, and the previously investigated flora, e.g. the flora of Oskar II Land (Gugnacka-Fiedor & Noryśkiewicz 1982a) and Sørkapp Land (Dubiel 1990ab; Kuc & Dubiel 1995). The Oskar II Land and Sørkapp Land are characterised by poorer flora variety when compared with the southern coast

of Bellsund. Respectively, 97 and 90 species were found within the region of Oskar II Land and Sørkapp Land. Also, each of the three regions is characterised by the presence of specific groups of vascular plants, both common and unique. For example, 19 species were found exclusively in Oskar II Land, and in Sørkapp Land – 10. In the case of the Bellsund 25 species were found whose presence was unrecorded in any of the two remaining regions. Another aspect deserving attention is the fact of identification of previously unknown plant site location, found in the area between Hornsund and Bellsund. This refers particularly to: *Salix herbacea, S. herbacea x polaris, Ranunculus glacalis, R. pallasi, Saxifraga svalbardensis, Potentilla cranzii, Campanula uniflora, Taraxacum arcticum, T. brachyceras* and *Arctagrostis latifolia.*

The local flora of vascular plants includes 18 families represented by between 1 and up to 24 species. 5 families with the highest number of species growing in the area were: *Poaceae* (24 sp.), *Brassicaceae* (17 sp.) *Caryophyllaceae* (14 sp.), *Saxifragaceae* (13 sp.) and *Cyperaceae* (12 sp.). The next 6 families were represented by 2-5 species: *Salicaceae* (2 sp.), *Equisetaceae*, *Polygonaceae* and *Rosaceae* (3 sp. each), *Ranulaceae* and *Juncaceae* (5 sp. each). Finally, in the case of the remaining 7 families only a single representative species has been found in the area: *Lycopodiaceae, Polypodiaceae, Papaveraceae, Empetraceae, Boraginaceae, Scrophulariaceae* and *Compositae.*

The characterised vascular plant flora of the Bellsund region was divided into specific groups of geographic elements and plant living forms. This division took into account the whole flora in the first case (Tables 7.1.1 and 7.1.2), and in the second case – selected examples of species. All the local plant taxa belong to the broadly defined holarctic zone. Only slight differences in terms of the number of plants representing two main groups of geographic sub-elements: 'Arctic-Alpine sub-element' (45 sp.) and 'Arctic sub-element' (54 sp.) were observed. In both these subgroups the vast majority are plants belonging to the geographic sub-element group called 'Circumpolar species'. These include such examples as, in the case of 'Arctic sub-element' (35 sp.): *Cochlearia groenlandica, Draba arctica, Saxifraga hyperborea, Luzula arctica, Festuca brachyphylla and Phippsia algida, Puccinellia angustata,* and in the case of 'Arctic-Alpine sub-element' (39 sp.): *Salix polaris, Oxyria digyna, Cardamine nymanii, Draba fladnizensis, Saxifraga caespitosa, Juncus biglumis* and *Trisetum spicatum.* In the local flora belonging to the 'Amphiatlantic' species group the representatives of the 'Arctic sub-element' (17 sp.) were much more numerous than those of the 'Arctic-Alpine sub-element' (5 sp.). The 'Amphiatlantic' species group includes: in the case of 'Arctic sub-elements' – e.g. *Cerastium regelii, C. arcticum, Minuartia rossii, Draba daurica, Papaver dahlianum, Pedicularis hirsuta, Puccinellia phryganoides*, and in the case of 'Arctic-Alpine sub-elements' – only the following: *Cerastium alpinum subsp. lanatum, Arabis alpina, Saxifraga aizoides, Mertensia maritime* and *Deschampsia alpina.*

Floristic territorial elements from two subgroups – 'Eurasiatic species' and 'Endemic' species – were represented by singular species of regional flora: *Phippsia concinna* and *Puccinellia svalbardensis* (Tables 7.1.1 and 7.1.2).

The local flora of vascular plants, in terms of the number of representative of specific living forms (Raunkiær 1905), had a typically 'Arctic' character. Most importantly, a clear quantitative advantage of 'hemicryptophytes' over „chamaephytes', and particularly 'cryptophytes' was observed. Among the 'hemicryptophytes' the most numerous subgroup was 'semi-rosette hemicryptophytes', which was larger than 2 other subgroups: 'rosette hemicryptophytes' and 'hemicryptophytes not forming rosettes'. Examples of these living forms include: in the first group – *Braya purpurascens, Cardamine nymanii* and *Deschampsia alpina,* in the second – *Oxyria digyna*, *Papaver dahlianum, Saxifraga foliosa, S. nivalis, Carex lachenalii,* and in the third one – *Equisetum scirpoides, E. variegatum* and *Saxifraga hirculus.* Within the 'chamaephtes' group, the plants from the subgroup 'short-stem chamaephtes' were slightly more numerous than those from the subgroups 'passive chamaephytes' and 'cushion-like chamaephytes'. Examples of these include: in the first subgroup – *Cardamine bellidifolia* and almost all taxa of the *Draba* genus; in the second subgroup – *Salix polaris, S. reticulata, Saxifraga aizoides, S. oppositifolia*; and in the third subgroup – *Cerastium regelii, Minuartia bilora, Sagina caespitose* and *Silene acaulis.*

In 'Cryptophytes' group only slight differences in the number of plants belonging to the 'geophytes' and 'helophytes' subgroups were noted. Representatives of the former subgroup include: *Equisetum arvense, Alopecurus alpinus, Dupontia pelligera, Poa alpina,* and the latter – *Ranunculus hyperboreus, R. spetsbergensis, Carex subspathacea, Eriophorum scheuchzeri* and *Arctophila fulva.* Living forms of plants from the 'terrophtes' group represented only by *Koenigia islandica.*

It seems that the spectrum of geographic elements living forms of regional plants (Table 7.1.1 and 7.1.2) is similar to that found, e.g. on the southern coast of Sørkapp Land (Dubiel 1991).

Geobotanical zones. To date, the area of Wedel Jarlsberg Land from the Bellsund to Hornsund was subject to only fe floristical and geobotanical investigations (Brochmann & Steen 1999). Therefore previous work on geobotanical zones of the study area were rather provisional and inaccurate. Generalised geobotanical maps of Svalbard have been published, among others, by Brattbakk (1986) and EIvebakk (2005).

In general geobotanical terms the study area, is located within the zone of so-called arctic desert (Aleksandrova 1971, 1979, 1980, 1983). According to the zoning system related to circumpolar arctic vegetation (Walker *et al.* 2005), Svalbard is located in the geobotanical province of northern-Atlantic deserts of the carbonate-free mountain complex. On the other hand, according to Elvebakk (1985), Svalbard is positioned within the borders of three vegetation regions: arctic desert, the poorly vegetated northern tundra and richer central tundra. Based on the ecological classification of tundra formations prepared by French (1974), the local tundra should be classified as 'cold oceanic' tundra. From a geobotanical perspective the study area shows transitional features that qualify it to all of three mentioned vegetation zones.

Taking into account the ecological zones of Spitsbergen determined by Summerhayes & Elton (1928), the study area lies within the borders of the *Cassiope* zone located on the central-western shores of Bellsund. According to the aforementioned authors the *Cassiope* vegetation zone borders on the *Dryas* zone in the NW and SW. It is important to note that that no species described as belonging to the *Cassiope* zone actually appeared in the study area, but the *Dryas octopetala* species was very common here.

Other notable examples include the more recent geobotanical zoning attempts dealing with the currently studied region prepared by, e.g. Brattbakk (1986) and Elvebakk (2005). According to Brattbakk, the study area located in the geobotanical region of Mid Arctic should be divided into two vegetation zones: eastern (Tomtodden, east part of Chamberlin and Svarthamaren) and western (from Dunder all the way to Calypsobyen and the west part of Chamberlin). This division covers the following vegetation zones: eastern – 'Mid Arctic', *Cassiope tetragona* zone (*oro-Cassiope tetragona belt*), and western – 'Mid Arctic', *Dryas octopetala* zone (*oro-Dryas octopetala belt*). Both these vegetation zones are also characterised by mountainous arctic deserts.

Elvebakk (2005) took a different approach. According to him, the study area should also be divided into two geobotanical zones, but of different characteristics: north-eastern (NE part of Chamberlin and Svarthamaren) and western (between Dunder and Tomtodden). According to this division, the north-eastern zone belongs to the mountainous arctic desert vegetation region, and the western zone – to the region of mesotrophic and dystrophic vegetation with *Luzula confusa*, with the exception of mountainous arctic desert.

Taking into account the currently available data on the flora of vascular plants on Spitsbergen, the study area can represent a separate geobotanical unit of unspecified rank, characteristic of the shores of Bellsund, and perhaps also of the shores of Isfjorden.

It turns out that geobotanical similarities and differences between selected regions in the study area are, in fact, very complex, but usually of little importance from a general geobotanical perspective. This is particularly evident in the case of the quantitative distribution of all plant taxons between regions, including those assigned to specific groups of geographic elements or living forms. This complex local geobotanical system is associated with variation in size of selected regions and the specific characteristics of regional habitats and microhabitats. In terms of frequency of occurrence of dense tundra patches, the following regions were distinguished: Dunder, Chamberlin, Tomtodden and Svarthamaren. as the Lyell and Calypsobyen regions were characterised by the most diverse tundra communities. Finally, the Dyrstad region was singled out due to the scarcity of tundra patches. The selected regions were also divided into three groups according to the number of site locations of differently-ranked plant taxa: (Table 7.1.1): Dunder, Svarthamaren and Calypsobyen (82, 83 and 94 taxa), Logne,

Lyell and Chamberlin (69, 69 and 77 taxa) and finally Tomtodden and Dyrstad (55 and 59 taxa).

No significant differences in terms of spatial range of vascular plants were found in the study area. It was observed that the occurence of 15 species was limited to only six of selected regions (Tables 7.1.1 and 7.1.2). Most of these grow in the central-eastern region of Calypsobyen, including the 5 following plants: *Potentilla pulchella, Festuca rubra, Poa arctica var. caespitans*, *Phippsia algida, Puccinellia phryganoides*. Site locations of two other plants were found in the north-eastern region of Svarthamaren. These plants are: *Ranunculus spitsbergensis* and *Kobresia simpliciuscula*. In the two neighbouring eastern regions of Tomtodden and Chamberlin the following two species occured exclusively: in the first region – *Potentilla rubricaulis* and *Festuca edlundiae,* and in the second one – *Empetrum hermaphroditum* and *Puccinellia svalbardensis*. The western regions and their neighbouring areas, like Dunder and Logne, were the only places where singular location sites of the following plants were found: *Petasites frigidus* and *Cystopteris dickieana*. This study shows that the only locations that did not have exclusively-occurring plants were the two mid-western neighbouring regions of Lyell and Dyrstad. Among the other plants found within the studied area some notable examples include *Carex glareosa* and *Puccinellia angustata*. These species were characteristic of the two central neighbouring regions – Lyell and Calypsobyen. Almost all of the plants described herein, with a specified local extent, generally belong to some of the rarest species, both within the studied region as well as in other regions of Svalbard.

It is possible to make a preliminary assumption that in terms of general geobotanical characteristics and habitat conditions the study area can be divided into three groups. The first one, western-type, is comprised of the region of Dunder. The second one includes the three neighbouring regions of Dyrstad, Lyell and Calypsobyen. These constitute the nearly central part of the studied area. The third group, located in the east, includes the regions of Tomtodden, Chamberlin and Svarthamaren. Preliminary, can be assumed that these three separate areas represent the region in the rank of phytogeographical subregions and regions.

This study presents a generally comprehensive image of the regional vascular plants focusing on their habitats and physio-ecological conditions (Table 7.1.1). Without a doubt, the studied area may contain other, previously unrecorded, plant species, particularly critical ones, rare ones or ones that are difficult to find in the field.

I would like to give special thanks to Prof Eugeniusz Dubiel, Ph.D. of the Jagiellonian University of Kraków who took part in the geobotanical research in the south-western Spitsbergen. He reviewed my taxonomic description of herbaceous vascular plants collected from the region of Bellsund and agreed to assign them to specific geographical elements and living forms. He was also a source of valuable advice and editorial insight.

Streszczenie

Flora roślin naczyniowych

Badania florystyczne w północno-zachodniej części Wedel Jarlsberg Land w rejonie Bellsundu na Spitsbergenie przeprowadzono w latach 1987, 1988, 1992 i 1995 podczas wypraw geograficznych organizowanych przez Uniwersytet Marii Curie-Skłodowskiej w Lublinie. Florę roślin naczyniowych zbadano w obszarze położonym wzdłuż wybrzeża o łącznej długości ok. 65 km, w pasie o zróżnicowanej szerokości, od kilkudziesięciu metrów do 2,5 km. Teren badań, wcześniej bardzo słabo rozpoznany pod względem florystycznym, obejmował równiny nadmorskie, dna dolin oraz dostępne zbocza górskie (ryc. 7.1.1). Sporządzono ok. 600 arkuszy zielnikowych roślin, które oznaczono na podstawie kilku opracowanych flor arktycznych i porównawczych okazów eksykatowych. Rewizji oznaczeń dokonał prof. Eugeniusz Dubiel z Uniwersytetu Jagiellońskiego w Krakowie.

Informacje o strukturze zbadanej flory przedstawiono syntetycznie w tabeli 7.1.1. Stwierdzono występowanie stanowisk 109 gatunków roślin w 114 niższych taksonach. Reprezentują one typowe arktyczne elementy, zarówno geograficzne jak i form życiowych roślin (tabela 7.1.1., 7.1.2). Większość gatunków uchodzi za ogólnie pospolite w Arktyce. Na uwagę zasługuje ok. 30 roślin, które w obszarze badań, jak i w innych rejonach Spitsbergenu, występują najrzadziej. Przykładem są: *Equisetum scirpoides, Huperzia selago subsp. arctica, Cystopteris dickjeana, Salix reticulata, Koenigia islandica, Honkenya peoploides, Cerastium alpinum subsp. lanatum, Cerastium arcticum x C. regelii, Sagina caespitosa, Ranunculus spetsbergensis, Arabis alpina, Chrysosplenium tetrandrum, Saxifraga hirculus, Stellaria humifusa, Potentilla rubricaulis, Empetrum hermaphroditum, Mertensia maritima, Petasites hybridus, Juncus albescens, Luzula arcuata, Carex nardina, C. ursina, C. maritima, C. lachenalii, Kobresia simpliciuscula, Dupontia psiloantha* i *Calamagrostis neglecta*. W tym obszarze występują prawie wszystkie główne postaci zbiorowisk tundry, jakie dotąd zostały opisane z różnych rejonów Svalbardu. Na uwagę zasługują torfowiska typu przejściowego o strukturze torfowisk mezofilnych, położonych wokół podtopionych czap i kopczyków (fot. 7.1.1, 7.1.2).

Wydzielono osiem regionów florystycznych, zróżnicowanych zarówno pod względem właściwości środowiska przyrodniczego (ryc. 7.1.1), jak i stosunków florystycznych (tabela. 7.1.1) oraz fitosocjologicznych. Porównanie z dotychczasowymi próbami rejonizacji fitogeograficznej obszarów sąsiednich wskazuje, że wymagają one rewizji i uzupełnienia. Według obecnego stanu zbadania florystycznego charakteryzowanego obszaru można przyjąć, że wchodzi on w skład wyższej jednostki fitogeograficznej, charakterystycznej dla rejonu Bellsundu oraz Isfjordu. Wyodrębniono trzy grupy regionów fizjograficzno-geobotanicznych, które reprezentują samodzielne niższe jednostki fitogeograficzne w randze podokręgów lub nawet okręgów.

Objaśnienia

Ryciny

Ryc. 7.1.1. Położenie obszaru badań (tło: Topo Svalbard, Norwegian Polar Institute): 1- Dunder, 2- Logne, 3- Dyrstad, 4- Lyell, 5- Calypsobyen, 6- Tomtodden, 7- Chamberlin, 8- Svarthamaren.

Fotografie

Fot. 7.1.1. A- tundra mezofilna mieszana (kwiecisto-mszysto-porostowa) na podniesionej terasie morskiej, W część regionu Calypsostrandy (fot. F. Święs 1992), B- tundra luźna deflacyjna (plamista) postaci z *Dryas octopetala* na terasie morskiej, SW część regionu Calypsobyen (fot. F. Święs 1992), C- tundra luźna mieszana na gruncie strukturalnym pierścieni (wieńców) kamienistych. NE część regionu Calypsobyen (fot. F. Święs 1988).

Fot. 7.1.2. A- tundra mszaru tufurowego (kopczykowatego) na połogim zboczu u podnóża wzniesienia, środkowo-wschodnia część regionu Chamberlin.(fot. F. Święs 1995), B- tundra podtopionego mszaru na terasie morskiej w kotlinowatym obniżeniu między szkierami u podnóża wzniesienia, SE część regionu Dyrstad (fot. F. Święs 1995), C- Tundra torfowiska przejściowego o strukturze mezofilnych czap z podtopionym okrajkiem - terasa morska u podnóża zbocza Dundrabelsen, skrajnie SE część regionu Logne (fot. F. Święs 1992).

Tabele

Tabela 7.1.1. Syntetyczna charakterystyka badanej flory roślin naczyniowych.

Tabela 7.1.2. Elementy geograficzne charakteryzowanej flory roślin naczyniowych.

Table 7.1.1. A synthesis of characteristics of the studied vascular plant flora. Part 1.

Geographical elements (a) / Families with consecutively numbered representative plants		Consecutively numbered regions. Source materials of plants stations (b). Geographical location of sites of plant occurrence (c). Moreover, at 'B' categories of frequency of plant taxa (d)								The distribution of stations of plants in specific phys-io-gnomic-ecological communities of tundra vegetation (e)
		1. Dunder	2. Logne	3. Dyrstad	4. Lyell	5. Calypso-byen	7. Tomt-odden	6. Cham-berlin	8. Svar-thamaren	
1	2	3	4	5	6	7	8	9	10	11
Eguisetacae										
1. Eguisetum arvense L. subsp. boreale Löve	3.	A: – B: NE/3, NW/3, SE/2	A: – B: NE/2, SE/2, SW/2	A: – B: NE/3, NW/1	A: – B: SSEE/2	A: – B: NW/3	A: – B: NE/1	A: NNW B: NE/4, NW/4	A: NNW, NNE B: NE/3, NW/3, SE/1	1.1.2; 1.2.3.2; 2.2.1; 3.1; 3.3; 5.1; 6.1-2; 6.2; 6.3.2; 7.1; 7 2.1-2; 7.2.2; 8.1; 8.2
2. E. scirpoides Michx.	3.	A: – B: NE/2, NW/3, S/2, N/1, CS/1	A: – B: N/4, S/3, CE/3	A: – B: NE/3, NW/1, CE/3	A: – B: NE/3, NW/1	A: – B: N/3, SE/2, CW/1	A: – B: NE/2, SE/1	A: NNW B: NE/4, NW/3, SEE/1, C/1	A: – B: N/3, CW/2, S/3	1.1.2; 1.2 3.2; 2.2.1-2; 3.1; 3.3; 4; 5.1-2; 6.1.1-3; 7.1; 7.2.1-3; 7.2.2; 8.1-2
3. E. variegatum Schleich	3.	A: – B: NW/1, NNEE/1	A: – B: NW/2, CN/1	A: – B: CW/1, NNEE/1	A: – B: CE/1, SWW/1	A: NNE B: NW/1	A: CE B: NNE/1	A: NNW B: NW/1, NEE/1	A: NNW, NNE B: N/1	1.1.2; 2.2.1; 3.1; 5.1; 7.1; 7.2.1.2
Lycopodiaceae										
4. Huperzia selago (L) subsp. arctica (Grossh) A.et D.	3.	A: – B: CE/1, NWW/1	A: – B: –	A: – B: –	A: – B: –	A: – B: –	A: – B: NEE/1	A: – B: NNWW/1	A: – B: –	1.1.2; 5.1; 6.1.1-3
Polypodiaceae										
5. Cystopteris dickieana R. Sim.	3.	A: – B: –	A: – B: SSEE/1	A: – B: –	A: – B: –	A: – B: –	A: – B: –	A: – B: –	A: – B: –	6.3.3
Salicaceae										
6. Salix polaris Walenb.	2.1	A: NNWW B: NE/2, NW/4, SE/2, CN/2, CS/2	A: – B: N/4, S/4, CE/3.	A: – B: NE/3, NW/2, CS/2	A: – B: NE/4, NW/3, SW/2, SE/2	A: NNEE B: N/4, S/4, CW/3	A: CE B: NE/2, S/2, C/2	A: NNW B: NE/4, NW/3, SE/3, C/2	A: NNW, NNE B: N/3, S/3, C/2	1.1.2; 1.2.2.1; 1.2.4; 2.1-2; 3.1-3; 4; 5.1-2; 6.1.1-3; 6.2; 6.3.1-2; 7.1; 7.2.1-3; 7.2.2; 8.1-2
7. S. reticulata L.	2.1	A: NNWW B: NNW/2, NEE/1	A: – B: CN/1	A: – B: NE/1, SE/1	A: – B: NW/1, SW/1, NEE/2	A: – B: NW/2, SW/1, SE/1	A: – B: NE/1, NW/1	A: NNW B: NE/2, NW/3	A: NNW B: SE/3	1.1.2; 2.1.1; 2.2.1; 3.1; 5.1; 6.1.2-3; 6.2; 6.3.2-3; 7.1; 7.2.1.3; 7.2.2; 8.1-2

Table 7.1.1. Part 2.

1	2	3	4	5	6	7	8	9	10	11
Polygonaceae										
8. Koenigia islandica L.	2.1	A: NNWW B: NNW/1	A: – B: –	A: – B: –	A: – B: –	A: – B: NE/1	A: – B: –	A: – B: –	A: – B: –	5.1
9. Oxyria digyna (L.) Hill.	2.1	A: – B: NE/3, NW/4, SE/3, CN/2, CS/3	A: – B: N/5, S/5, CE/3	A: – B: NE/3, NW/3	A: – B: NNE/3, NNW/3, SSW/2	A: NNEE B: N/5, SE/4, CW/3	A: CE B: NE/3, CE/2, CW/2	A: – B: NE/5, NW/5, S/3, C/4	A: – B: NE/1, NW/2, SS/1, C/1	1.1.2; 1.2.2.1; 1.2.3.2; 2.2.1-2; 3.1; 4; 5.1; 6.1.1-2; 6.2; 6.3.1-3; 7.1; 7.2.1.1-3; 7.2.2; 8.1-2
10. Polygonum viviparum L.	2.1	A: – B: NE/3, NW/4, CN/3	A: – B: N/4, S/3, CE/3	A: – B: NE/3, NW/2, C/3	A: – B: NE/5, NW/4, SW/3, CS/3	A: NNEE B: N/5, S/5, SW/2	A: CE B: NE/3, NW/2, SE/1, C/3	A: – B: NE/5, NW/4, S/2, C/4	A: – B: NE/3, NW/3, S/3, C/4	1.1.1-2; 1.2.2.1-2; 2.2.1-2; 3.1-4; 4; 5.1-2; 6.1.1-3; 6.3.1-3; 7.1; 7.2.1.1-2; 7.2.2; 8.1-2
Caryophyllaceae										
11. Honkenya peploides (L.) Ehrh.	3.	A: – B: –	A: – B: –	A: – B: –	A: – B: –	A: – B: CEE/1	A: – B: –	A: – B: –	A: NNW B: NNWW/1	1.2.4
12. Cerastium alpinum L. subsp. lanatum (Lam.) Asch. et Graeben	2.2	A: – B: –	A: – B: –	A: – B: –	A: – B: –	A: – B: NE/1	A: – B: –	A: – B: NNWW/1	A: – B: –	5.1; 8.1
13 a. C. arcticum Lge. var. arcticum Hult.	1.2	A: – B: –	A: – B: –	A: – B: –	A: – B: –	A: – B: NE/3	A: – B: –	A: – B: –	A: – B: –	3.1-2; 5.1
13 b. C. arcticum Lge. var. sordidum Hult.	1.2	A: – B: NWW/2	A: – B: NEE/2, CE/1, SSEE/2	A: – B: NWW/1	A: – B: NNEE/1, CS/2	A: – B: NE/2, SE/1	A: – B: –	A: – B: CW/2	A: – B: S/1, CW/1	3.1; 5.1; 6.3.3; 7.1; 7.2.1.2
13 c. C. arcticum Lge. var. vestitum Hult.	1.2	A: – B: NW/4, NE/2, SE/3, CN/2	A: – B: N/5, S/4, CE/3	A: – B: NE/3, SW/3, CS/3	A: – B: SW/3, CS/2, EE/4	A: – B: NE/4, NW/3, SW/2, SE/3	A: – B: N/4	A: – B: NE/4, NW/3, SE/3, C/3	A: – B: NE/3, NW/3, SS/4, CW/3	1.1.1; 1.1.3; 1.2.2.1; 2.1.1; 2.1.3; 2.2.1; 3.1; 3.3; 4; 5.1; 6.1.1-3; 6.2; 6.3.1-3; 7.1; 7.2.1.1-3; 7.2.2; 8.1-2; 9
14. C. arcticum Lge. x C. regelii Ostf.	1.2	A: – B: NW/3, CN/1	A: – B: SSEE/1, CW/1	A: – B: –	A: – B: NWW/1, SSEE/1	A: – B: NW/1	A: – B: NE/1	A: – B: NE/1, NW/1, SSE/1, CE/1	A: – B: NE/2, SE/1	2.2.1; 3.1; 5.1; 6.1.1-2; 6.3.2-3; 7.1; 7.2.1-2; 7.2.2
15. C. regelii Ostf.	1.2	A: – B: NE/4, NW/5, SE/4, CN/3	A: – B: N/3, SW/3, CE/3	A: – B: NE/3, NW/2, CS/3	A: – B: NE/4, NW/4, CS/2	A: NNEE B: NE/3, NW/3, SE/3, CW/2	A: – B: NE/3, NW/2, SW/2, CE/3	A: NNW B: NE/5, NW/4, S/3, C/3	A: NNW B: NE/3, NW/3, S/3, SW/2	1.2.2.1; 2.1.3; 2.2.1; 3.1; 4; 5.1; 6.2; 6.3.1-3; 7.1; 7.2.1-3; 7.2.2; 8.1-2

Table 7.1.1. Part 3.

1	2	3	4	5	6	7	8	9	10	11
16. Minuartia biflora (L.) Schinz.	2.1	A: NNWW B: NE/1, NW/2, SE/1	A: SSWW B: NE/2, SE/2	A: – B: –	A: – B: –	A: – B: NEE/1, CSS/1	A: – B: NEE/1	A: – B: NW/2	A: NNW, NNE B: SS/1, CN/1, NW/1	2.1.2; 3.1; 5.1; 6.1.2; 8.1
17. M. rossii (R.Br.) Graeben	1.2	A: – B: NNEE/2, SSWW/1	A: – B: NNE/2	A: – B: –	A: – B: NE/1, EE/2	A: – B: NE/3, NWW/1, SSW/2	A: – B: –	A: – B: NE/2, CW/1	A: – B: NNE/1, N/2, SS/1	1.1.3; 1.2.2.2; 2.1.2; 2.1.4; 2.2.1-2; 3.1; 4; 5;1; 6.2; 6.3.2; 7.1; 7.2.1-3; 8.1-2
18. M. rubella (Wahlenb.) Hiern	2.1	A: NNWW B: NNW/1	A: – B: CW/2	A: – B: –	A: – B: CS/1, SSEE/1	A: – B: NW/2	A: – B: –	A: NNW B: NNW/1	A: NNEE B: NNE/1	1.2.2.1; 2.2.1; 3.1; 5.1; 6.3.3; 7.2.1.2-3
19. Sagina caespitosa (J. Vahl.) Lange	1.2	A: – B: –	A: – B: –	A: – B: –	A: – B: –	A: – B: NE/1	A: CE B: NE/1	A: – B: –	A: NNW B: NNW/1	8.1
20. S. nivalis (Lindb.) Fr.	1.1	A: NNWW B: NW/3, C/2, SEE/2	A: – B: N/3, S/3, CE/2	A: – B: NW/3	A: – B: NW/2, E/3	A: NNEE B: N/4, SE/3	A: CE B: CE/2	A: NNW B: NE/2, NW/3, C/1, SS/1	A: NNEE B: N/3	1.2 2.1; 1.2.3.1; 2.1.2; 2.2.1; 3.1; 3.3; 4; 5.1; 6.1.2
21. Silene acaulis (L.) Jacq.	2.1	A: – B: NW/3, NE/2, SE/2, CS/1, CN/2	A: – B: N/3, S/3, CE/2	A: – B: NE/2, NW/2, CS/2	A: – B: NE/4, NW/2, SW/2, CS/2	A: NNEE B: N/4, SE/3, SW/3	A: CE B: N/3, S/2, C/2	A: NN B: NE/3, NW/3, SE/2, C/2	A: NNW B: N/3, S/3, C/2	1.1.2; 1.2.2.1; 2.1.1-2; 3.1-3; 4; 5.1-2; 6.1.1-3; 6.2; 6.3.1; 7.1; 7.2.1.1-3; 7.2.2; 8.1-2
22. S. uralensis (Rupr.) Bocq.	2.1	A: – B: NW/1	A: – B: SSEE/1	A: – B: –	A: – B: NNEE/1, SWW/1	A: – B: NE/1, NW/1, SW/2, SSW/1	A: – B: NW/1	A: – B: –	A: – B: NE/1, SW/1, SSW/1	1.2.2.1; 1.2.3.2; 2.1.1-2; 2.2.2; 3.1; 5.1; 7.1; 7.2.1-3; 7.2.2
23. Stellaria crassipes Hult.	1.2	A: – B: NNW/1	A: – B: –	A: – B: –	A: – B: –	A: – B: –	A: – B: –	A: NNW B: CNN/1, C/1	A: NNEE B: –	2.1.2; 7.2.2
24. S. humifusa Rottb.	1.2	A: – B: –	A: – B: –	A: – B: –	A: – B: –	A: – B: SE/1	A: – B: –	A: – B: CNN/1	A: – B: –	1.2 3.2; 7.1
Ranunculaceae *25. Ranunculus hyperboreus Rotth. subsp. arnellii Sheutz.*	1.1	A: – B: NE/1, NW/3, SE/1, C/1	A: – B: N/3, S/2, CE/2	A: – B: NE/2	A: – B: NE/3, SW/1, CN/1	A: – B: N/3, C/1, SSEE/1	A: – B: NE/2	A: – B: NE/3, NW/2, SSE/1, CW/1	A: – B: –	2.2.1; 6.3.2; 7.1; 7.2.1.1-3; 7.2.2; 8.1

Table 7.1.1. Part 4.

1	2	3	4	5	6	7	8	9	10	11
26. R. nivalis L.	1.1	A: – B: –	A: – B: –	A: – B: –	A: – B: –	A: – B: –	A: – B: –	A: – B: –	A: NNW B: NW/1, CE/1	5.1
27. R. pygmaeus Wahlenb.	2.1	A: NNWW B: NNW/1	A: – B: NW/2, SSEE/2	A: – B: NE/1	A: – B: NEE/1, S/2, NW/1, CS/1	A: – B: NE/2	A: – B: CE/1	A: – B: NE/2, NW/1, CW/1	A: NNW B: NNEE/1, CW/1	1.2.2.1; 2.1.1-2; 2.2.1; 3.1.1-3; 4; 6.1.1-2; 6.2; 6.3.1-3; 7.1; 7.2.1.1-3; 7.2.2; 8.1-2
28. R. spetsbergensis (Nath.) Hadač	1.1	A: – B: –	A: – B: –	A: – B: –	A: – B: –	A: – B: –	A: – B: –	A: – B: –	A: NNW B: NNW/1	7.2.1.2
29. R. sulphureus Sol.	2.1	A: NNWW B: NEE/2, NW/3, SEE/1, CN/2	A: – B: NNEE/1, CE/1	A: – B: NWW/1	A: – B: NEE/1	A: – B: NE/1, SSWW/1	A: – B: –	A: NNW B: NEE/1, C/1, NW/1, S/2	A: NNEE B: CW/1	1.1.2; 5.1; 6.3.3; 7.1; 7.2.1.1; 7.2.1.3; 7.2.2; 8.1-2
Papaveraceae *30. Papaver dahlianum Nordh.*	1.2	A: – B: –	A: – B: NW/1, SW/1, SE/1	A: – B: CE/1	A: – B: NW/1, SW/1, E/2	A: NNEE B: NE/3, NW/3, E/3, CW/2	A: CE B: NE/1	A: – B: NE/2, CNN/1	A: NNW B: S/1	2.2.1; 3.1; 4; 5.1; 6.1.1-2; 7.2.1.1; 8.1
Brassicaceae *31. Arabis alpina L.*	2.2	A: SSEE B: NNWW/1, NN/W/2	A: SSEE B: SSEE/2	A: – B: SSWW/1	A: – B: SSEE/1	A: – B: NE/1	A: – B: –	A: – B: –	A: – B: –	2.2.1; 6.1.1; 6.3.2-3
32. Braya purpurascens (R.Br.) Bge.	1.1	A: – B: NWW/2	A: – B: –	A: – B: –	A: – B: EE/1	A: NNEE B: NE/3, SE/2, CW/1	A: – B: –	A: – B: –	A: NNW B: NNE/1, NW/1	2.2.1; 3.1; 5.1; 7.1; 7.2.1.1-2
33. Cardamine bellidifolia L.	2.1	A: – B: SSE/1	A: – B: CE/1	A: – B: –	A: – B: –	A: – B: –	A: – B: –	A: – B: –	A: NNEE B: NE/2, S/1	5.1; 6.1.1; 7.1; 8.2
34. C. nymanii Gand.	2.1	A: – B: NW/3, CN/1, SEE/2	A: – B: N/4, S/3, CE/2	A: – B: NE/3, NW/3	A: – B: NE/5, NW/3	A: NNE B: NE/4, NW/3, SE/4, SW/3	A: – B: NE/3, SE/1	A: – B: NE/4, NW/4, SE/2, C/1	A: – B: NE/1, NW/3	2.1.1; 3.1; 4; 5.1; 6.1.1-2; 6.2; 6.3.2; 7.1; 7.2.1.1-3; 7.2.2; 8.1-2
35. Cochlearia groenlandica L.	2.1	A: – B: NW/4, EE/2, CN/1	A: – B: N/4, S/4, CW/3	A: – B: NE/3, NW/3, CS/3	A: – B: NE/3, CW/1	A: NNE B: N/4, SE/2, CW/1	A: – B: NE/1, SE/1, CE/1	A: – B: NE/3, SE/1, CE/1	A: NNW B: N/2, C/1, SS/1	1.2.2.1; 2.1.1; 2.2 2; 3.1; 4; 5.1; 6.1.1; 6.2; 6.3.1-2; 7.1; 7.2.1.1-3; 7.2.2; 8.1-2; 9

Table 7.1.1. Part 5.

1	2	3	4	5	6	7	8	9	10	11
36. Draba alpina L.	2.1	A: NNWW B: NW/3	A: – B: NNEE/1, SSEE/1	A: – B: NW/2, SEE/1	A: – B: NNE/1, NW/1, SW/1	A: – B: N/3, SWW/2	A: – B: SE/1, C/1	A: NNWW B: NNEE/2, NN/W/1	A: NNWW B: NNE/1	2.2.1; 3.1; 4; 5.1; 6.1.1; 6.3.2-3; 7.1; 7.2.1.3; 7.2.2
37. D. arctica R. Br.	1.1	A: NNWW B: NNW/2	A: – B: SSEE/1	A: – B: NNWW/2	A: – B: –	A: – B: N/3, SSE/2	A: – B: –	A: NNWW B: NE/2, CW/1	A: – B: –	1.1.1; 2.1.1; 2.1.3; 2.2.2; 3.1; 4; 6.3.2-3; 7.2.1.2; 8.1
38. D. corymbosa R. Br.	1.1	A: – B: NW/2	A: – B: –	A: – B: –	A: – B: NE/3	A: NNEE B: N/3, SE/1, SW/1	A: CE B: CE/1	A: – B: CE/1	A: NNW B: NE/1	2.1.1; 2.2.1; 3.1; 4; 5.1; 6.2; 7.1; 7.2.1.1-2; 8.1
39. D. daurica DC.	1.2	A: NNWW B: NW/3	A: – B: –	A: – B: SW/1	A: – B: –	A: – B: N/2	A: – B: –	A: – B: NNEE/2, CW/1	A: – B: –	2.2.1; 6.1.1-2; 6.3.2
40. D. fladnizensis Wulf.	2.1	A: – B: NW/3, NNEE/1	A: – B: NNE/2, SSEE/1, CW/1	A: – B: CEE/1	A: – B: NE/2	A: B: CE/1	A: – B: –	A: – B: –	A: B: N/2	3.1; 5.1; 6.1.2; 7.1; 8.1-2
41. D. micropetala Hook.	1.1	A: – B: CN/1	A: – B: NNE/1	A: – B: –	A: – B: NE/3, SSW/1	A: NNEE B: N/3, S/3	A: – B: N/1	A: NNW B: NE/2, C/1, NW/1	A: – B: NE/1	3.1; 3.3; 4; 5.1; 6.1-2; 7.1; 8.1-2
42. D. nivalis Liljebl.	2.1	A: – B: NW/1	A: – B: NNE/1	A: – B: –	A: – B: SSW/1	A: – B: N/2, SW/1, SSE/1	A: – B: NE/1	A: NNW B: NE/3, NW/1	A: NNW B: NW/1	2.2.1; 3.1; 5.1; 6.3.2-3; 7.1; 7.2.1.2; 7.2.2
43. D. norvegica Gunn.	1.2	A: NNWW B: NW/2	A: – B: NW/2, SE/1	A: – B: –	A: – B: –	A: NNEE B: N/2, SS/1, CE/1	A: CE B: NE/1	A: – B: NE/3, NW/1	A: NNW B: NW/1	2.2.1; 3.1; 5.1; 6.1.1; 7.2.2; 8.1
47. Eutrema edwardsii R. Br.	2.1	A: – B: –	A: – B: –	A: – B: –	A: – B: –	A: – B: NE/1	A: – B: –	A: – B: –	A: – B: NNEE, CW	2.2.1; 3.1
Saxifragaceae *48. Chrysosplenium tetrandrum (N. Lund) Th. Fr.*	2.1	A: NNWW B: NNW/1, NNWW/2	A: – B: NEE/2, SSEE/2	A: – B: CEE/2, NWW/1	A: – B: SW/2, SWW/2, NNEE/1	A: NNEE B: NE/1, NNWW/1	A: – B: –	A: NNWW B: NNEE/1	A: – B: –	2.2.1; 3.1; 6.1.1; 6.3.2-3; 7.1; 7.2.1.1;

Table 7.1.1. Part 6.

1	2	3	4	5	6	7	8	9	10	11
49. Saxifraga aizoides L.	2.2	A: – B: NW/4, NE/3, C/2	A: – B: SE/3, NW/4, CE/2	A: – B: NE/2, SE/2, SW/2	A: – B: NE/3, NW/3, CS/2	A: NNEE B: NW/3, SE/3, CW/1	A: SSEE B: NE/2	A: – B: NE/3, NW/3, SW/1	A: NNWW B: NE/4, S/3	2.2.1; 3.1; 4; 5.1; 6.3.1-2; 7.1; 7.2.1.1-2; 7.2.2; 8.1-2
50. S. cespitosa L.	2.1	A: NNWW B: NE/3, NW/5, SE/3	A: – B: N/5, S/5, CE/4	A: – B: NE/4, NW/3, C/4	A: – B: E/5, W/4, SW/3, CS/2	A: NNEE B: N/5, S/5, CW/3	A: CE B: N/4, S/3	A: NEE B: NE/5, NW/4, C/4, S/2	A: – B: NNE/3, NW/4, S/3	1.2.1.2; 1.2.2.1; 2.1.1; 2.1.3; 2.2.1; 3.1-3; 4; 5.1; 6.1.1-3; 6.3.1-3; 7.1; 7.2.1.1-3; 7.2.2; 8.1-2; 9
51. S. cernua L.	2.1	A: – B: NE/3, NW/5, SE/2	A: – B: N/5, S/5, CE/3	A: – B: NE/4, NW/3, C/4	A: – B: E/5, W/5, SW/3, CS/2	A: NNEE B: NE/3, NW/3, SW/3, C/2	A: NEE B: NE/3, NW/3, SE/2	A: NNWW B: NE/5, NW/4, SE/3, C/3, SW/2	A: NNEE B: NEE/3, NW/4, S/3	1.2.1.1; 1.2.2.1; 1.2.3.1; 2.1.1; 2.1.3; 2.2.1; 3.1; 3.3; 4; 5.1; 6.1.1- 2; 6.3.1-3; 7.1; 7.2.1.1-2; 7.2.2; 8.1-2
52. S. foliolosa R. Br.	2.1	A: NNWW B: NE/2, NW/3, SE/1	A: – B: NE/2, SW/2, CE/2	A: – B: NE/2	A: – B: NE/3, NW/3	A: – B: SE/2, N/3, CW/1	A: – B: N/1	A: – B: NE/2, NW/1, S/1 C/2	A: – B: NW/1	1.2.3.2; 3.1; 5.1; 7.1; 7.2.1.1-2; 7.2.2; 8.1-2
53. S. hieracifolia Waldst.	2.1	A: NNWW B: NW/3	A: – B: N/2, S/2, CE/2	A: – B: NE/2, NW/2	A: – B: SSEE/1	A: – B: –	A: – B: –	A: – B: NE/1, NW/1, C/1	A: NNWW B: NW/1	5.1; 6.1.1; 6.3.2.3; 7.1; 7.2.1.1; 8.1-2
54. S. hirculus L.	2.1	A: – B: NE/3, NW/5, SE/1, C/3	A: – B: N/4, S/4, CE/3	A: – B: NE/4, NW/2, C/3	A: – B: NE/4, NW/3, CS/2	A: – B: NE/3, N/3, CE/2	A: – B: C/2	A: NNWW B: NE/3, NW/2, SWW/1, C/2	A: NNEE B: N/4, S/2, C/3	3.1; 5.1; 6.1.2; 7.1; 7.2.1.1-3; 7.2.2; 8.1
55. S. hyperborea R. Br.	1.1	A: – B: NW/2, EE/2, C/1	A: – B: NN/2, SS/1, CE/1	A: – B: NW/2, SEE/2	A: – B: SSEE/2	A: – B: N/3, SE/1, SSWW/1	A: – B: CE/1	A: – B: NE/1, NW/1, CW/1	A: – B: NW/1	2.2.1; 3.1; 4; 5.1; 6.1.1-2; 6.3.3; 7.1; 7.2.1.1-3
56. S. nivalis L.	1.1	A: NNWW B: NEE/1, NW/4, SEE/2, C/2	A: – B: N/4, S/3, CE/2	A: – B: NE/2, NW/2, CE/2	A: – B: NE/3, NW/3, CS/1	A: NNEE B: N/4, CS/2, SSWW/1	A: CEE B: N/1	A: NNW B: NE/3, NW/2, SSW/1, C/1	A: NNEE B: NW/2, C/1, SS/1	2.1.1; 2.1.3; 2.2.1; 3.1; 4; 5.1; 6.1.1-3; 6.3.2-3; 7.1; 7.2.1.1; 7.2.1.3; 7.2.2; 8.1-2; 9

Table 7.1.1. Part 7.

1	2	3	4	5	6	7	8	9	10	11
57. S. oppositifolia L.	2.1	A: – B: NE/3, NW/5, NE/3, SE/2, CS/2	A: – B: N/5, S/3, CE/3	A: – B: NE/3, NW/2, CS/3	A: – B: NE/4, NW/3, SW/3, SE/3	A: NNEE B: SE/3, N/4, SW/3	A: CE B: N/3, S/3, C/2	A: NNW B: NE/3, NW/3, SE/3, C/3	A: NW B: N/3, S/3, C/2	1.1.1-2; 1.2.1.1-3; 1.2.2.1; 1.2.3.1; 2.2.1-3; 3.1.1-3; 4; 5.1-2; 6.1.1-3; 6.3.1-2; 7.1; 7.2.1.1-3; 7.2.2; 8.1-2; 9
58. S. platysepala (Trautv.) Tolm.	2.1	A: – B: –	A: – B: –	A: – B: –	A: – B: NEE/1, CN/1	A: NNEE B: NE/2, SE/2, SW/1, CE/3	A: – B: –	A: – B: –	A: NNEE B: NW/1	2.2.1; 3.1; 8.2
59. S. rivularis L.	2.1	A: NNWW B: NW/3, SSEE/2	A: SSWW B: NW/2, S/3, CE/2	A: – B: NE/2, NW/2, C/2	A: – B: NE/2, NWW/2	A: – B: N/3	A: – B: N/3	A: – B: NE/3, NW/2, C/1, S/1	A: NNWW B: NW/1	2.2.1; 3.1; 4; 5.1; 6.1.1-2; 6.3.2-3; 7.1; 7.2.1.1-3; 7.2.2; 8.1-2; 9
60. S. tenuis (Wahlenb.) H. Sm.	1.1	A: – B: NE/3, NW/3, SE/2	A: SSWW B: NW/3, S/2, CE/2	A: – B: NE/3, CE/3	A: – B: NE/4, NW/3, CS/1	A: – B: E/3, N/3, CW/2	A: – B: N/2	A: NNW B: NE/4, NW/2, SE/2, C/3	A: – B: NW/3	2.1.1; 2.1.3; 2.2.1; 3.1; 3.3; 4; 5.1; 6.1.1-2; 6.3.1; 7.1; 7.2.1.2-3; 7.2.2; 8.1-2
Rosaceae *61. Dryas octopetala L.*	2.1	A: – B: NNW/3	A: – B: NE/2, SSEE/1	A: – B: CE/2	A: – B: SW/2, CS/1, SSEE/1	A: – B: SW/1, CE/1, CS/1	A: – B: NE/1	A: NNWW B: NE/3, NW/3, C/1	A: NNW B: NEE/1, S/2, C/2	2.2.1; 3.1; 5.1-2; 6.1.1-2; 6.3.3; 7.2.2
62. Potentilla hyparctica Malte.	1.1	A: – B: –	A: – B: –	A: – B: –	A: – B: –	A: – B: –	A: CE B: –	A: – B: –	A: – B: –	5.1
63. P. pulchella R. Br.	1.1	A: – B: –	A: – B: –	A: – B: –	A: – B: –	A: NNE B: NNE/1	A: – B: –	A: – B: –	A: – B: –	2.1
64. P. rubricaulis Lehm.	2.2	A: – B: –	A: – B: –	A: – B: –	A: – B: NNEE/1	A: – B: NE/1, CE/1, SSW//1	A: – B: –	A: – B: –	A: – B: SSW/1	2.2.1; 3.1; 5.1
Empetraceae *65. Empetrum hermaphroditum Hagerup.*	2.1	A: – B: –	A: – B: –	A: – B: –	A: – B: –	A: – B: –	A: – B: –	A: NNWW B: NNWW/1	A: – B: –	6.1.1; 7.2.2
Boraginaceae *66. Mertensia maritima (L.) S.F. Gray*	2.2	A: – B: –	A: – B: –	A: – B: –	A: – B: –	A: – B: NE/1	A: – B: –	A: – B: –	A: – B: –	1.2.4

Table 7.1.1. Part 8.

1	2	3	4	5	6	7	8	9	10	11
Scrophulariaceae										
67. Pedicularis hirsuta L.	1.2	A: – B: NW/3, SE/2, C/3	A: SSWW B: NW/3	A: – B: NE/3, NW/1, C/2	A: – B: NE/3, NW/2	A: NNEE B: NE/1, NW/3, SE/4, CW/2	A: – B: N/3	A: NNW B: NE/4, NW/3, SSEE/2, C/1	A: NNW B: NE/3, NW/3, S/3	2.2.1; 3.1; 4; 5.1-2; 6.1.1-3; 6.3.1; 7.1; 7.2.2; 8.1-2
Asteraceae										
68. Petasites frigidus L. Fr.	1.1	A:NNWW B: –	A: – B: –	A: – B: –	A: – B: –	A: – B: –	A: – B: –	A: – B: –	A: – B: –	6.3.2
Juncaceae										
69. Juncus albescens (Lange) Fern.	3.	A: – B: NW/2	A: – B: –	A: – B: –	A: – B: –	A: – B: –	A: – B: –	A: – B: –	A: – B: NE/3	5.1; 7.1; 8.1
70. J. biglumis L.	2.1	A: NNWW B: NW/4, NE/3, C/3	A: – B: NE/4, SW/3	A: – B: NE/3, NW/2, SW/2	A: – B: NE/4, NW/3	A: – B: SE/3, SW/1, N/4, C/3	A: NE B: NE/2, SEE/2, C/2	A: – B: NE/3, NW/3, CW/1	A: NWW B: N/3, C/3, SS/3	2.2.1; 3.1; 4; 5.1; 6.1.1-2; 6.3.2; 7.1; 7.2.1.1-2; 7.2.2; 8.1
71. Luzula arctica Blytt.	1.1	A: – B: NE/2, NW/3, SE/3, CE/2	A: – B: NE/4, NW/4, CE/2	A: – B: NE/3, SE/2	A: – B: NE/3, NW/2, CS/2	A: – B: NE/3, SE/2	A: CW B: NE/3	A: NN B: NE/4, NW/4, SE/3, C/2	A: NNEE B: NE/3, NW/2, S/3	3.1; 5.1-2; 6.1.1-3; 6.3.3; 7.1; 7.2.1.1-3; 7.2.2; 8.1-2; 9
72. L. arcuata Sw.	1.1	A: – B: NE/2, NW/3, C/1	A: – B: NE/3, SW/2, CE/2	A: – B: NE/2	A: – B: NE/2, NW/2	A: – B: NW/2	A: – B: C/2	A: – B: NE/3, NW/2, SE/1	A: – B: S/2	2.2.1; 3.1; 5.1; 6.1.2-3; 7.1; 7.2.2; 8.1-2
73. L. confusa (Hartm.) Lindeb.	2.1	A: NNWW B: NE/4, NW/5, SE/3	A: SSWW B: NE/5, SW/4, CE/3	A: – B: NE/4, NW/3, CS/3	A: – B: NE/3, NW/2, CS/2	A: – B: N/4, SE/3, CW/2	A: NEE B: NE/3, SW/2	A: NWW B: NE/5, NW/5, SE/3, C/4	A: NNEE B: NE/2, NW/3, S/3	2.1.3; 3.1.1; 4; 5.1-2; 6.1.1-3; 6.3.1-3; 7.1; 7.2.1.1-3; 7.2.2; 8.1
Cyperaceae										
74. Carex glareosa Wahlenb.	1.1	A: – B: –	A: – B: –	A: – B: –	A: – B: SSEE/1	A: – B: NE/1	A: – B: –	A: – B: –	A: – B: –	1.2.3.2; 3.1
75. C. maritima Gunn.	2.1	A: – B: SSEE/1	A: – B: –	A: – B: –	A: – B: –	A: – B: –	A: – B: –	A: – B: –	A: – B: CE/1	8.1-2
76. C. misandra R. Br.	2.1	A: – B: SSEE/1	A: – B: –	A: – B: NWW/1	A: – B: EE/1	A: – B: NE/1	A: – B: –	A: – B: NNWW/1	A: – B: NE/2, SS/3, C/1	5; 7.1; 7.2.1.3; 8.1

Table 7.1.1. Part 9.

1	2	3	4	5	6	7	8	9	10	11
77. C. nardina Fr.	1.2	A: – B: NW/1	A: – B: –	A: – B: –	A: – B: –	A: – B: CN/1	A: – B: –	A: – B: –	A: – B: NW/2, SS/3, C/1	7.1
78. C. lachenalii Schkuhr.	2.1	A: – B: NE/2	A: – B: –	A: – B: –	A: – B: NEE/1	A: – B: NE/1	A: – B: –	A: – B: NW/1	A: – B: –	7.1; 7.2.2
79. C. parallela (Laest.) Sommerf.	1.2	A: – B: –	A: – B: –	A: – B: –	A: – B: SSEE/1	A: – B: CN/1	A: – B: –	A: – B: –	A: – B: –	2.2.1; 3.1
80. C. rupestris All.	2.1	A: – B: NW/1, NEE/1	A: – B: –	A: – B: –	A: – B: –	A: – B: –	A: – B: –	A: – B: CN/1, CW/1	A: – B: NEE/1, CW/1	7.2.2; 8.1
81. C. saxatilis L.	3.	A: – B: NW/2, NS/1, SE/1	A: – B: –	A: – B: NWW/1	A: – B: –	A: – B: –	A: – B: –	A: – B: CN/1	A: – B: NE/1	7.1
82. Carex subspathacea Wormsk.	1.1	A: NNE B: NW/4	A: – B: –	A: – B: NWW/1	A: – B: –	A: – B: CN/1	A: – B: –	A: – B: –	A: – B: NEE/1, NW/1	7.1; 8.1-2
83.C. ursina *Dew.*	1.1	A: – B: NW/1	A: – B: –	A: – B: –	A: – B: –	A: – B: –	A: – B:–	A: – B: –	A: – B: NNEE/1, CN/1	2.2.1; 5; 7.1
84. Eriophorum scheuchzeri Hoppe	2.1	A: – B: NE/3, NW/4, SE/1	A: – B: CE/1	A: – B: –	A: – B: –	A: – B: NE/1, NWW/1	A: – B: –	A: – B: NNWW/1	A: – B: NE/3, NW/3	5; 7.1; 7.2.1.2; 7.2.2; 8.1-2
85. Kobresia simpliciuscula (Wahlenb.) Mac.	2.1	A: – B: –	A: – B: –	A: – B: –	A: – B: –	A: – B: –	A: – B: –	A: – B: –	A: – B: NW/1	5.
Poaceae *86. Alopecurus borealis Trin.*	2.1	A: – B: NE/1	A: – B: –	A: – B: NWW/1	A: – B: –	A: – B: NE/1	A: – B: –	A: NNW B: NE/1	A: NNEE B: NEE/1	3.1; 4; 5.1; 6.3.2; 7.1; 7.2.1.2; 7.2.2
87. Arctophila fulva (Trin.) Anderss.	1.1	A: – B: –	A: SSWW B: SW/1	A: – B: –	A: – B: SSWW/1	A: – B: NE/1	A: – B: –	A: – B: –	A: NNW B: NW/1	2.2.1
88. Calamagrostis stricta (Timm.) Koeler	3.	A: – B: NNWW/1	A: SSWW B: CWW/1	A: – B: –	A: – B: SEE/1	A: NNEE B: NE/1	A: – B: –	A: – B: NNWW/1	A: – B: –	7.1; 7.2.1.2
89. Colpodium vahlianum (Liebm.) Nevski	1.1	A: – B: NE/2, NW/3, SE/2	A: – B: NE/3, SW/3	A: – B: NE/2, SE/2, SW/1	A: – B: NEE/2, SE/1	A: NNEE B: NE/3, NW/3, SW/1	A: CE B: NE/2, SE/1, CW/1	A: NNW B: NE/3, C/3, NW/2, SE/1	A: – B: N/3, SS/2	3.1; 4; 5.1; 6.1.2

Table 7.1.1. Part 10.

1	2	3	4	5	6	7	8	9	10	11
90. C. vacillans (Th. Fr.) Polunin	1.2	A: – B: NW/2	A: – B: SE/2	A: – B: NWW/1	A: – B: NNW/1, E/1	A: – B: N/3, SE/2, CE/1	A: – B: CE/2	A: – B: NNWW/1, CE/1	A: – B: NNWW/1, NW/1	1.2.2.1; 3.1; 4; 5.1
91. Deschampsia alpina (L.) Roem. Sch.	2.2	A: – B: NE/2, NW/4, SE/2, CN/2	A: – B: NW/3, SW/3, CE/2	A: – B: NE/2, NW/2, CS/2	A: – B: NE/3, NW/3, CS/2	A: – B: NE/3, NW/3, SW/3, SE/3	A: – B: N/2, S/3, C/3	A: NNW B: NE/4, NW/3, SE/2, SW/2, C/3	A: NNEE B: NE/2, NW/2, SW/3, SE/2	3.1; 5.1; 6.1.1-3; 6.3.1-3; 7.1; 7.2.1.1-2; 8.1-2
92. D. borealis (Traut.) Rosh.	1.1	A: SSWW B: NW/2	A: – B: NW/2, SEE/1	A: – B: –	A: – B: –	A: NNEE B:SE/2, CE/2	A: – B: –	A: – B: CW/2, NNWW/2	A: – B: –	5.1; 6.3.3; 7.1; 7.2.1.2; 8.1-2
93. Dupontia pelligera (Rupr.) Á. Löve et Ritchte	1.1	A: – B: NW/2	A: – B: CN/1, CW/1	A: – B: SEE/1	A: – B: –	A: – B: N/2, SE/1, CE/2	A: – B: –	A: – B: NNWW/1	A: NNW B: NNEE/1	2.2.1; 3.1; 5.1; 7.1
95. Festuca brachyphylla Schultes	1.1	A: – B: –	A: – B: NE/1	A: – B: –	A: – B: NEE/1	A: – B: NE/1	A: – B: –	A: – B: –	A: – B: NW/1	2.2.1; 3.1; 5.1; 6.1.2; 7.1; 7.2.1.1-3; 8.2
96. F. cryophila Krecz. et Bobr.	1.1	A: – B: NW/3, SE/2, C/2	A: SSWW B: SW/3, N/3, CE/1	A: – B: NW/1, C/1	A: – B: NE/2, NW/2	A: NNEE B: N/3, SE/3, CE/1, SW/2	A: – B: NE/2, SE/1, C/1	A: – B: NE/2, SS/1, C/1	A: NNW B: S/1, C/2	1.2.3.2; 2.2.1; 3.1; 5.1; 6.1.1-3; 6.3.2-3; 7.1; 7.2.1.1-3; 8.1
97. F. edlundiae, S. Aiken, consaul et Letkovitch	1.2	A: – B: –	A: – B: –	A: – B: –	A: – B: –	A: – B: –	A: NNE B: –	A: – B: –	A: – B: –	5.1
98. F. hyperborea Holmen	1.1	A: – B: –	A: – B: CWW/1	A: – B: –	A: – B: –	A: – B: NE/1	A: – B: –	A: – B: –	A: – B: –	5.1; 6.2
99. F. rubra L	3.	A: – B: –	A: – B: –	A: – B: –	A: – B: –	A: NNEE B: CE/1	A: – B: –	A: – B: –	A: – B: –	2.2.1
100. F. vivipara (L.) Sm.	1.1	A: – B: –	A: – B: CE/1	A: – B: –	A: – B: –	A: – B: NE/1	A: – B: –	A: – B: CE/1	A: – B: SS/1	2.2.1
101. Phippsia algida (Sol.) R. Br.	1.1	A: – B: –	A: – B: –	A: – B: –	A: – B: NE/2	A: NNEE B: NE/3	A: – B: –	A: – B: –	A: – B: –	2.2.1; 4; 5.1
102. P. concinna (Th. F.) Lindeb	1.3	A: NNWW B: NNW/1	A: – B: –	A: – B: –	A: – B: –	A: NNEE B: NE/1	A: – B: –	A: NNW B: NNW/1	A: – B: –	1.2.2.1; 2.1.2; 2.2.1

Table 7.1.1. Part 11.

1	2	3	4	5	6	7	8	9	10	11
103 a . P. alpigena (Fr.) Lindm.	1.1	A: – B: NEE/1	A: – B: NE/2	A: – B: NNWW/1	A: – B: –	A: – B: –	A: – B: –	A: – B: NW/2	A: NNEE B: NE/1	6.1.1-2; 7.2.1.1-2
103 b. P. alpigena (Fr.) Lindm. var. vivipara (Malmgr.) Schol.	1.1	A: – B: –	A: – B: –	A: – B: SEE/1	A: – B: –	A: – B: NE/2	A: – B: SSEE/1	A: NNW B: NNW/1	A: – B: –	1.2.2.1; 2.2.1; 6.1.2; 6.3.2
104 a. P. arctica R. Br.	1.1	A: – B: NW/3, C/1, SEE/1	A: – B: NE/2, SS/1	A: – B: NW/2	A: – B: NEE/2, CS/1	A: – B: N/3	A: – B: CN/2	A: – B: NE/1, NW/1, C/2	A: – B: NW/2, SS/1, NNE/2	1.2.1.1; 2.2.1; 3.1; 5.1; 6.1.1; 6.3.3; 7.1; 7.2.1.2; 7.2.2; 8.1-2; 9
104 b. P. arctica R. Br. var. vivipara (Malmgr.) Schol.	1.1	A: – B: NW/3, SSE/1, C/1	A: – B: NE/2, SS/1	A: – B: NW/2	A: – B: NEE/2	A: – B: N/3	A: – B: CN/2	A: – B: NE/1, NW/2, C/2	A: – B: NNE/1, NW/2, SS/1	1.1.1; 1.2.1.2; 1.2.2.2; 2.1.3; 3.1; 4; 5.1; 6.1.2; 6.3.2-3; 7.1; 7.2.1.1-2; 7.2.2; 8.1
104 c. P. arctica R. Br. subsp. cespitans (Simm.) Nannf.	1.2	A: – B: –	A: – B: –	A: – B: –	A: – B: –	A: – B: NE/1	A: – B: –	A: – B: –	A: – B: –	2.2.1
105. Puccinellia angustata (R. Br.) Rand et Redfield	1.1	A: – B: –	A: – B: –	A: – B: –	A: – B: SSEE/1	A: NNEE B: NE/2	A: – B: –	A: – B: –	A: – B: –	3.1; 7.1; 7.2.1.2
106. P. phryganodes (Trin.) Scribn. et Merr.	1.2	A: – B: –	A: – B: –	A: – B: –	A: – B: –	A: NNEE B: N/2, SEE/2	A: – B: –	A: – B: –	A: – B: –	5.1
107. P. svalbardensis Rønning	1.4	A: – B: –	A: – B: –	A: – B: –	A: – B: –	A: – B: –	A: – B: –	A: – B: NE/2	A: – B: –	7.1
108. Trisetum spicatum (L.) Richt.	2.1	A: – B: –	A: – B: –	A: – B: NNW/1	A: – B: –	A: – B: –	A: – B: –	A: – B: NNWW/1	A: NNW B: NW/1	7.2.1.2; 7.2.2; 8.1
Total number of taxons (109/114) in:										
A		**29**	**9**	**0**	**0**	**34**	**23**	**35**	**46**	
B		**81**	**69**	**59**	**69**	**94**	**55**	**75**	**83**	
A+B		**82**	**69**	**59**	**69**	**94**	**55**	**77**	**83**	

Comments and explanation to the Table 7.1.1:

a: 1.- Arctic sub-element; 1.1- Circumpolar species; 1.2- Amphiatlantic species; 2.- Arctic-Alpine sub-element; 2.1- Circumpolar species; 2.2- Amphiatlantic species; 3.- Circumboreal sub-element.

b: A- according to the already published data (Brochmann, Steen 1999); B- according to the new (own) data, unpublished.

c: average (e.g. S, SW, NE), extreme (e.g. SS, NNE, SSEE), additional marking of direction as 'C' refers to the central part of the region.

d: (after the following mark '/'), 1- sporadic (1-5 locations), 2-rare (6-10 locations), 3- frequent (11-30 locations), 4- common (31-50 locations), 5- occurring en masse (in more than 50 places).

e: 1. Arctic deserts. Sporadic patches of flowering plants in suitable micro-habitats.

1.1. Bedrock, weathered steps and cracks; 1.1.1. Mountain slopes and ridges; 1.1.2. Inselbergs, on coastal areas and lower parts of mountains; 1.1.3. Slopes of active coastal cliffs; 1.2. Debris layers; 1.2.1 Slope processes; 1.2.1.1. Flat summits and slope ledges (rock terraces); 1.2.1.2. Niche-like depressions and slope gullies (rock terraces, talus fans); 1.2.2.3. Bottoms of elevation slopes (rock terraces, slope washes, nival terraces); 1.2.2. Impact of glaciers and glacial waters; 1.2.2.1. Younger glacial moraine ramparts, ridges, slopes (rubble); 1.2.2.2. Outer and inner outwash plains (stone/gravel); 1.2.3. Impact of rivers (alluvia); 1.2.3.1. Along the river channels (gravel-banks); 1.2.3.2. At the mouth of rivers (stone/gravel alluvial fans); 1.2.4. Impact of the sea, marine beaches (sand/gravel).

2. Tundra: flowery-mossy, mesophilic, scattered. Vegetation layer mostly in transverse frost cracks. Intensive substratum denudation and deflation.

2.1. Initial tundra; 2.1.1. Fossil coastal-cliffs, steep slopes, denudation sediments (clay/rubble); 2.1.2. Old glacial moraine ramparts, inclined ridges (rubble/clay); 2.1.3. Old, vast ridges, inclined ridges (sand/gravel); 2.1.4. 'Pingos', inclined slopes (clay/gravel); 2.2 Deflation tundra (spotted); 2.2.1. Marine terraces, wide ridges (stone/clay); 2.2.2. Fossil sea-cliffs, inclined slopes (clay/stone); 2.2.3. 'Pingos', inclined slopes (clay/gravel).

3. Tundra: gray-lichen with *Cetraria sp.*, dry, dense. Unmatched dominance of lichens from the *Cetraria* genus over other lichens, vascular plants and bryophytes.

3.1. Marine terraces, broad, flat and inclined ridges (stone/gravel); 3.2. Outer and inner outwash plains (gravel/stone); 3.3. Fossil coastal-cliffs, slopes (clay/gravel/ stone);

4. Tundra: In areas of snow patches, mesophilic. Various hollows on stony-clayey marine terraces, at the feet of elevation slopes etc. In terms of numbers, dominance of dispersed patches of bryophytes and vascular plants; usually no lichens.

5. Tundra: Mixed, mesophilic or hygrophilic. Generally more vascular plants and bryophytes than lichens. Groups of most common vascular plants or individual vascular

plants often dominate the area, e.g. *Salix polaris*, *Saxifraga oppositifolia*, *S. caesia*, *Silene acaulis* and plants from the genus of *Luzula, Poa, Festuca* and *Equisetum*.

5.1. Marine terraces, broad, flat ridges (gravel/stone/clay); 5.2. 'Pingos', inclined ridges (clay/gravel).

6. Tundra: Dense raised bogs, mesophilic. Among the dominant bryophytes a large proportion of vascular plants, often also lichens. Subsoil of different granulometric composition.

6.1. Purple-green raised bogs, dominance of *Racomitrium sp.*; 6.1.1. Marine terraces, flat ridges (sand/gravel/clay); 6.1.2. Slope ledges (weathered rock block deposit areas); 6.2. Light-brown raised bogs, synanthropic. Extreme coastal areas of marine terraces. In the vicinity of historical settlement buildings, 'husses' etc. In the past subsoil was compacted by walking and enriched with different kinds of debris, e.g. brick chips, plaster, furnace clinker, or whale bone; 6.2.1. Edges of raised marine terracs (stone/gravel); 6.2.2. Coastal-cliffs, denudation covers at the feet of the cliffs (clay/gravel); 6.3. Brown raised bogs, prevalence of different moss species; 6.3.1. 'Pingos', inclined ridges (clay/gravel); 6.3.2. Lower slopes (stone/gravel rich in rock waste, humus and smallest features fertilised by bird feces, mainly little auks).

7. Tundra: brown raised bogs, hygrophilic. In terms of numbers clear dominance of bryophytes over vascular plants, even more marked dominance over lichens.

7.1. Raised bogs with periodically highly variable values of subsoil moisture content. Subslope valleys, depressions on marine terraces (usually stone/clay/gravel); 7.2. Permanently flooded raised bogs with varied surface structure. Unmatched dominance of mosses over vascular plants; no lichens. Substratum usually made of stones and loam, shallow-reaching gleying process, located in various spots; 7.2.1. Uniform, compact surface. Landlocked bottoms of subslope depressions on marine terraces; 7.2.2. Hillocky surface with hummocks or tundra hills. Shores of permanent and periodic watercourses.

8. Tundra: Boggy. Tuft vegetation, usually with a higher number of bryophytes than vascular plants or lichens. Flat or slightly inclined substratum, usually made of stones and loam subjected to gleying processes.

8.1. Mossy-grassy. Among the vascular plants the unquestionably prevalent species is the *Deschampsia sp.*; 8.2. Made of moss/sedge/bulrush. In the case of monocotyledons a characteristic feature is the frequent occurrence, with various spatial distribution, of species from the *Juncus* and *Carex* genera, more rarely *Eriophorum scheuchzerii.*

9. Tundra: Peatlands, probably transitional. Takes the form of slightly protruding mesophilic caps with partially flooded edges. Vegetation layer includes few dispersed tufts of bryophytes and flowering plants. No lichens.

Table 7.1.2. Geographic elements of the researched flora of vascular plants. Part 1.

***Region No**)*	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**		**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
1. Arctic sub-element																	
1.1 Circumpolar species																	
1. Sagina nivalis	+	+	+	+	+	+	+	+	*19. L. arcuata*	+	+	+	+	+	+	+	+
2. Ranunculus nivalis	.	.	.	.	.	.	.	+	*20. Carex glareosa*	.	.	.	+	+	.	.	.
3. R. hyperboreus	.	+	+	+	+	+	+	.	*21. C. subspathacea*	+	.	+	.	+	.	.	+
4. R. spetsbergensis	+	.	.	.	.	.	.	+	*22. C. ursina*	+	.	.	.	.	.	.	+
5. Braya purpurascens	.	.	.	+	+	.	.	+	*23. Arctophila fulva*	.	+	.	+	+	.	.	+
6. Cochlearia groenlandica	+	+	+	+	+	+	+	+	*24. Colpodium vahlianum*	+	+	+	+	+	+	+	+
7. Draba arctica	+	+	+	.	+	.	+	.	*25. Deschampsia borealis*	+	+	.	.	+	.	+	.
8. D. corymbosa	+	.	.	+	+	+	+	+	*26. Dupontia pelligera*	+	+	+	.	+	.	+	+
9. D. micropetala	+	+	.	+	+	+	+	+	*27. D. psiloantha*	+	.	.	+	+	.	.	+
10. D. lactea	+	+	+	+	+	+	+	+	*28. Festuca brachyphylla*	.	+	.	+	+	.	.	+
11. D. subcapitata	+	+	+	+	+	+	+	+	*29. F. cryophila*	+	+	+	+	+	+	+.	+
12. Saxifraga hyperborea	+	+	+	+	+	+	+	+	*30. F. hyperborea*	.	+	.	.	+	.	.	.
13. S. nivalis	+	+	+	+	+	+	+	+	*31. F. vivipara*	.	+	.	.	+	.	+	+
14. S. tenuis	+	+	+	+	+	+	+	+	*32. Phippsia algida*	.	.	.	+	+	.	.	.
15. Potentilla hyparctica	+	.	.	.	.	+	.	.	*33. Poa alpigena*	+	+	+	.	+	+	+	+
16. P. pulchella	.	.	.	.	+	.	.	.	*34. P. arctica*	+	+	+	+	+	+	+	+
17. Petasites frigidus	.	.	.	.	.	.	.	.	*35. Puccinellia angustata*	.	.	.	+	+	.	.	.
18. Luzula arctica	+	+	+	+	+	+	+	+	**Total**	**23**	**22**	**17**	**22**	**30**	**17**	**20**	**25**
1.2. Amphiatlantic species																	
1. Cerastium regelii	+	+	+	+	+	+	+	+	*10. D. oxycarpa*	+	+	+	+	+	+	+	+
2. C. arcticum	+	+	+	+	+	+	+	+	*11. Pedicularis hirsuta*	+	+	+	+	+	+	+	+
3. Minuartia rossii	+	+	.	+	+	.	+	+	*12. Carex nardina*	+	.	.	.	+	.	.	+
4. Sagina caespitosa	.	.	.	.	+	+	.	+	*13. C. parallela*	.	.	.	+	+	.	.	.
5. Stellaria crassipes	+	.	.	.	.	.	+	+	*14. Colpodium vacillans*	+	+	+	+	+	+	+	+
6. S. humifusa	.	.	.	.	+	.	+	.	*15. Festuca edlundiae*	.	.	.	.	.	+	.	.
7. Papaver dahlianum	.	+	+	+	+	+	+	+	*16. Puccinellia phryganoides*	.	.	.	.	+	.	.	.
8. Draba daurica	+	.	+	.	+	.	+	.	*17. Poa arctica subsp. caespitans*	.	.	.	.	+	.	.	.
9. D. norvegica	+	+			+	+	+	+	**Total**	**10**	**8**	**7**	**8**	**15**	**9**	**11**	**11**
1.3. Eurasiatic species									**1.4. Endemic species**								
1. Phippsia concinna	+	.	.	.	+	.	+	.	*1. Puccinellia svalbardensis*	.	.	.	.	.	.	+	.
Total	**1**	**.**	**.**	**.**	**1**	**.**	**1**	**.**	**Total**	**.**	**.**	**.**	**.**	**.**	**.**	**1**	**.**

*)Regions: 1- Dunder, 2- Logne, 3- Dyrstad, 4- Lyell, 5- Calypsobyen, 6- Tomtodden, 7- Chamberlin, 8 - Svarthamaren. Data according to Table 7.1.1.

Table 7.1.2. Part 2.

Region No[*)]	1	2	3	4	5	6	7	8		1	2	3	4	5	6	7	8
2. Arctic- Alpine sub-element																	
2.1 Circumpolar species																	
1. Salix polaris	+	+	+	+	+	+	+	+	*21. S. foliolosa*	+	+	+	+	+	+	+	+
2. S. reticulata	+	+	+	+	+	+	+	+	*22. S. hirculus*	+	+	+	+	+	+	+	+
3. Koenigia islandica	+	.	.	.	+	.	.	.	*23. S. hieracifolia*	+	+	+	+	.	.	+	+
4. Oxyria digyna	+	+	+	+	+	+	+	+	*24. S. oppositifolia*	+	+	+	+	+	+	+	+
5. Polygonum viviparum	+	+	+	+	+	+	+	+	*25. S. platysepala*	.	.	.	+	+	.	.	+
6. Minuartia bilora	+	+	.	.	+	+	+	+	*26. S. rivularis*	+	+	+	+	+	+	+	+
7. M. rubella	+	+	.	+	+	.	+	+	*27. Dryas octopetala*	+	+	+	+	+	+	+	+
8. Silene acaulis	+	+	+	+	+	+	+	+	*28. Empetrum hermaphroditum*	.	.	.	.	.	.	+	.
9. S. uralensis	+	+	.	+	+	+	.	+	*29. Juncus biglumis*	+	+	+	+	+	+	+	+
10. Ranunculus pygmaeus	+	+	+	+	+	+	+	+	*30. Luzula confusa*	+	+	+	+	+	+	+	+
11. R. sulphureus	+	+	+	+	+	.	+	+	*31. Carex maritima*	+	.	.	.	.	.	.	+
12. Cardamine bellidifolia	+	+	.	.	.	.	.	+	*32. C. misandra*	+	.	+	+	+	.	+	+
13. C. nymanii	+	+	+	+	+	+	+	+	*33. C. lachenalii*	+	.	.	+	+	.	+	.
14. Draba alpina	+	+	+	+	+	+	+	+	*34. C. rupestris*	+	.	.	.	.	.	+	+
15. D. fladnizensis	+	+	+	+	+	.	.	+	*35. Eriophorum scheuchzeri*	+	+	.	.	+	.	+	+
16. D. nivalis	+	+	.	+	+	+	+	+	*36. Kobresia simpliciuscula*	.	.	.	.	.	.	.	+
17. Eutrema edwardsii	.	.	.	.	+	.	.	+	*37. Alopecurus borealis*	+	.	+	.	+	.	+	+
18. Chrysosplenium tetrandrum	+	+	+	+	+	.	+	.	*38. Poa alpina*	+	+	+	+	+	+	+	+
19. Saxifraga caespitosa	+	+	+	+	+	+	+	+	*39. Trisetum spicatum*	.	.	+	.	.	.	+	+
20. S. cernua	+	+	+	+	+	+	+	+	**Total**	**34**	**28**	**25**	**28**	**32**	**21**	**31**	**35**
2.2. Amphiatlantic species																	
1. Cerastium alpinum subsp. lanatum	.	.	.	.	+	.	+	.	*4. Potentilla rubricaulis*	.	.	.	+	+	.	.	+
									5. Mertensia maritima	.	.	.	.	+	.	.	.
2. Arabis alpina	+	+	+	+	+	.	.	.	*6. Deschampsia alpina*	+	+	+	+	+	+	+	+
3. Saxifraga aizoides	+	+	+	+	+	+	+	+	**Total**	**3**	**3**	**3**	**4**	**6**	**2**	**3**	**3**
3. Circumboreal sub-element																	
1. Eguisetum arvense	+	+	+	+	+	+	+	+	*6. Honkenya peploides*	.	.	.	.	+	.	.	+
2. E. scirpoides	+	+	+	+	+	+	+	+	*7. Juncus albescens*	+	.	.	.	.	.	.	+
3. E. variegatum	+	+	+	+	+	+	+	+	*8. Carex saxatilis*	+	.	+	.	.	.	+	+
4. Huperzia selago subsp. arctica	+	.	.	.	.	+	+	.	*9. Calamagrostis stricta*	+	+	.	+	+	.	+	.
5. Cystopteris dickieana	.	+	.	.	.	.	.	.	*10. Festuca rubra*	.	.	.	.	+	.	.	.
									Total	**7**	**5**	**4**	**4**	**6**	**4**	**6**	**6**

*)Regions: 1- Dunder, 2- Logne, 3- Dyrstad, 4- Lyell, 5- Calypsobyen, 6- Tomtodden, 7- Chamberlin, 8 - Svarthamaren. Data according to Table 7.1.1.