Alpine Plants Climb Towards New Altitudes in Troms, Northern Norway

Fjellplantene klatrer mot nye høyder i Troms

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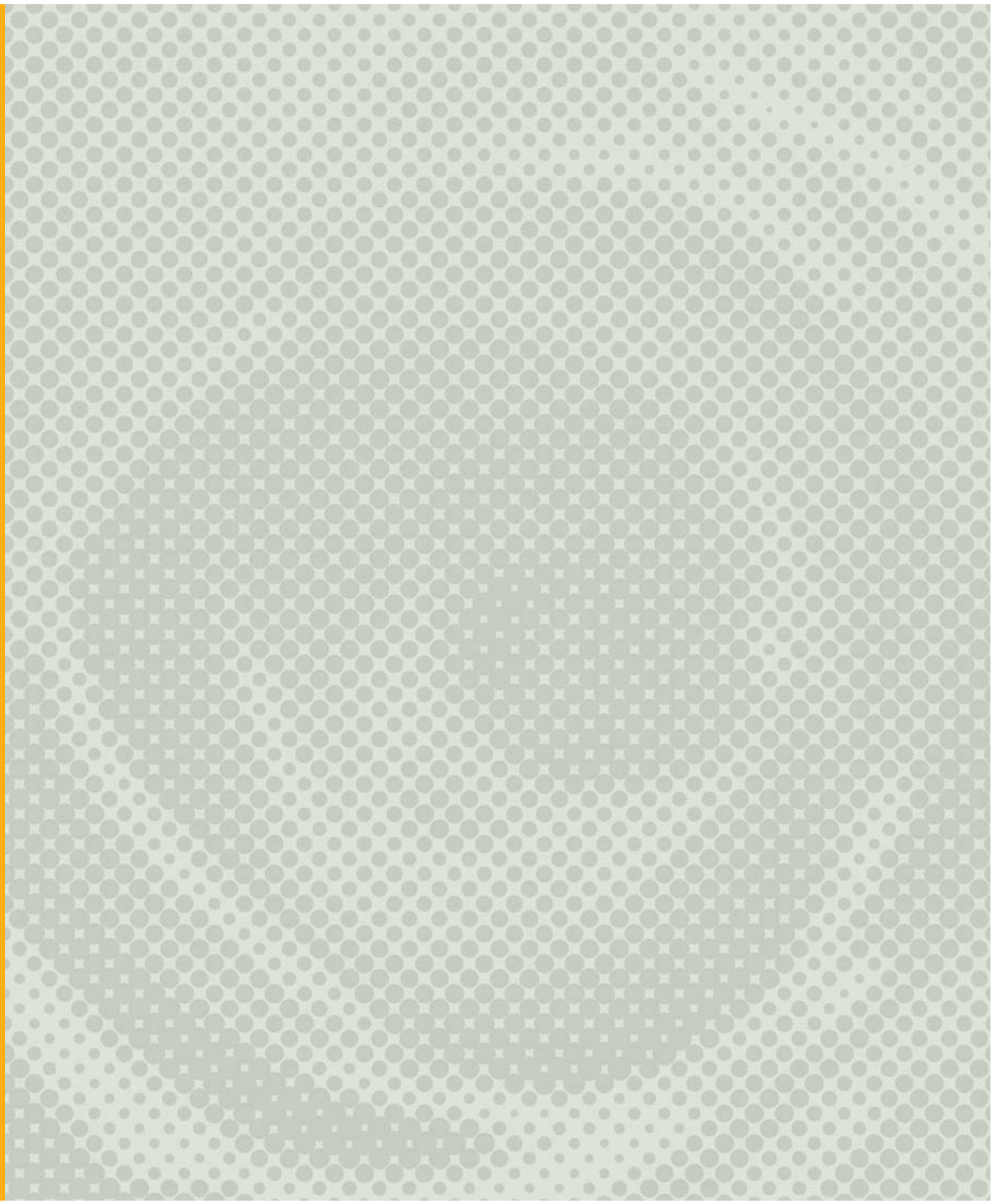

Preface

This is a master thesis at the Institute of Ecology and Nature Resource Management at the Norwegian University of Life Sciences, 2009. The topic is chosen out of interest and maybe not that much from field of specialisation, but it has been fun and I have learned a lot. The predicted climatic warming is a topic of great concern in the society today and a challenge for the future. It is also an important field for nature resource managers to have knowledge of, to be able to interpret the development and changes observed in nature. Only then can we hope to make better the right decisions for the future management of the vulnerable alpine and arctic ecosystems.

First of all I want to say thank you to my supervisors Mikael Ohlson and Kari Klanderud for all help, correction and encouragement during my work with this thesis. To Kåre Lye for helping me out with the identification of the most difficult species. Thank you to Mom and Dad for being supportive as always. Åsmund for accompanying me at eight of the mountains and for being you. Eilen for joining me at a couple of mountains, and for, along with Solveig Karin, encouraging me all the way. Helene, thank you for correcting my English and for being there whenever needed. What is life without good friends? To the rest of you; no one mentioned, no one forgotten.

Ås, 14.05.2009

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Hanne Henriksen

Abstract

This study compares the abundance of vascular plants between samplings done in 1935 and 2008 at 12 mountains in Troms county. Quite many similar studies have been carried out in the Alps and in southern parts of the Fennoscandian mountain range, but this is the first time a comparative study of historic plant records has been conducted as far north, at a latitude of 68 to 69°N. On a global scale a further climatic warming is predicted. Alpine ecosystems are expected to be especially vulnerable for these changes. Not only due to the warming climate, but also to human fragmentation of the landscape that makes it harder for some species to spread between the individual summits. For many species, the solution for escaping the warmer climate or the indirect effects of it, such as increased competition, is to either travel north or increase in altitude. The last solution is the easiest one, but what will happen to the species when their ecological niche are moved beyond the summit? Most of the studied species in this thesis showed an increase in both maximum altitudinal observation and number of observations. Among the species showing a significant increase in maximum altitude are *Betula pubescens*, *Empetrum nigrum* ssp. *hermaphroditum, Hieracium alpina, Phyllodoce caerulea and Solidago virgaurea. B. pubescens* and *E. nigrum* ssp. *hermaphroditum* also show a considerable increase in the number of observations. *B. pubescens* has for example spread from four mountains in 1935 to be observed at all the surveyed mountains in 2008. These data supports theories of increasing tree line and shrub cover in alpine areas. The other tree and shrub species also show a similar increase in number of observations, but not all have significant changes in maximum altitude. There are several factors that can explain increases in maximum altitude for summit species; climatic changes, disturbances, grazing, succession and competition. The increase of shrubs might have lead to increased competition, and have had negative impacts on shade intolerant species. At the studied mountains the amount of grazing animals has increased between the years of study, but not enough to affect the number of plant species negatively. Most summits show an increase in the number of species. The observed changes in the alpine plant species in Troms might be a combination of several factors, both climatic changes and natural succession working together.

Sammendrag

Denne studien sammenlikner planteregistreringer fra årene 1935 og 2008 for å se hvordan de klimatiske endringene i dette tidsrommet har påvirket fjellplantene i Troms fylke. Mange liknende studier har blitt gjennomført i Alpene og i sørlige deler av Skandinavia, men dette er første gang en slik studie har blitt gjennomført så langt mot nord, ved 68-69°N. Det er spådd at klimaet i nordområdene vil fortsette å varmes opp i framtiden, og det er særlig fjellområdene som vil merke de største endringene, da disse økosystemene er de mest sårbare for et varmere klima. Det er ikke bare klimaet, men også fragmenteringen av landskapet rundt fjellområdene som er en trussel for det biologiske mangfoldet i fjellheimen. En slik fragmentering kan gjøre det vanskelig for en del arter å vandre nordover til deres foretrukne habitat i takt med klimaendringene. For disse artene er løsningen å klatre oppover i høyden. Dette går fint helt til de kommer til toppen og ikke lenger kan flykte unna klimaendringene. Blant artene som viser en signifikant økning i maksimal voksehøyde er bjørk (*Betula pubescens*), krekling (*Empetrum nigrum ssp. hermaphroditum*), fjellsveve (*Hieracium alpina*), blålyng (*Phyllodoce caerulea*) og gullris (*Solidago virgaurea*). Bjørk og krekling har økt betraktelig i antall observasjoner, og bjørka har spredt seg fra fire fjell i 1935 til alle de tolv undersøkte fjellene i 2008. Disse dataene støtter opp om teorier om stigende tregrense og spredning av buskvekster. De andre treslagene viser også en liknende økning i antall observasjoner, men da de fleste ikke var registrert på mer enn ett til to fjell i 1935 var det ikke mulig å regne ut signifikans for endring i maksimalhøyde ved t-test. Det finnes også andre faktorer som kan tenkes å forklare den økte maksimumshøydegrensa til fjellplantene; forstyrrelser, beiting, suksesjon og konkurranse. Den økte mengden buskvekster endrer konkurranseforholdene, og kan ha negativ påvirkning på lyskrevende arter. På de undersøkte fjellene har mengden beitedyr økt i tiden mellom registreringene, men det ble ikke observert noen negativ effekt på artsmangfoldet. De fleste toppene viser en økning i antall arter. Generelt viser undersøkelsen at plantesamfunnet har flyttet seg oppover på høydegradienten. Årsaken til dette kommer trolig av flere faktorer, både klimaendringer og en naturlig suksesjon.

Contents

Introduction

There is evidence that the climate on earth has changed several times though history (IPCC 2007). Alpine areas and species living there are sensitive to climatic changes (Grabherr et al. 1994), and many species living in these areas have shifted towards higher altitudes or closer to the poles, likely due to the warming of the climate that we now experience (Moen & Lagerström 2008; Pauli et al. 1996; Wilson et al. 2007). This means that there will be an increased number of species at higher altitudes and further north on the northern hemisphere (IPCC 2007; le Roux & McGeoch 2008; Moen & Lagerström 2008; Wilson et al. 2007). It is shown that the alpine communities might respond quicker to the climatic changes than many other types of communities (Jurasinski & Kreyling 2007). The reason for the fast response is that it is easier for species to move in altitude than in latitude, as the distance they have to move is shorter (Wilson et al. 2007). The northern latitudes will probably also experience a climatic warming that is greater than what is expected on average (Walther et al. 2005a). This makes alpine regions well suited for studies of how plants react to climatic changes over time (Holzinger et al. 2008; Jurasinski & Kreyling 2007). Climate is one of the factors that determines most for plants; their habitat, distribution, phenology, phenotype and their interaction with each other. A change in climatic conditions will thus influence all these characteristics (Walther 2004). The plants in alpine areas are maybe even more sensitive to changes in the climate, than in many other habitats (Klanderud & Birks 2003; Pauli et al. 1996). It is also expected that an upward shift of plant species and an increased species richness will be observed first, before competition is likely to reduce the number of species at high altitudes again (Moen & Lagerström 2008) .

The alpine mountain plants are thereby the most vulnerable group in face of the expected change towards a warmer climate (Parolo & Rossi 2008; Sætersdal & Birks 1997). One can roughly split the alpine plant species into two groups: one that tolerate quite wide temperature ranges, but are easily ousted by other species, and one group that require a cold climate to survive (Klanderud & Birks 2003; Sætersdal & Birks 1997). When there are no more habitats left for cold demanding alpine plants and other habitat specialists these move upwards in altitude (Klanderud & Birks 2003; Walther 2004). Such an upward shift of vegetation is documented in many alpine areas e.g. Grabherr et al. (1994), Klanderud & Birks (2003), Kullman (2002), Moen & Lagerström (2008), Parmesan & Yohe (2003), Walther et al.

(2005a). Other species may face local extinctions due to ousting by more competitive lowland species (Klanderud & Birks 2003; Walther 2004).

This study was conducted in the Fennoscandian mountain range and is a resurvey based on historical data from 1935 (Jørgensen 1936). Jørgensen examined the altitudinal limits and distributions of vascular plants at 17 mountains in Troms County, Northern Norway. Some other comparable resample studies have been done. One of these studies was done by Klanderud & Birks (2003), who studied the change of altitudinal limits and distributions at 23 mountains in Jotunheimen, Norway. Klanderud & Birks (2003) was also a resurvey of Jørgensen's studies. Another comparable study about changes in altitudinal distribution limits in the Fennoscandian subarctic was conducted by Lagerström in Jämtland the summer of 2002 (Lagerström 2003; Moen & Lagerström 2008). These two studies were done at 61 and 63°N, respectively. The study area in my thesis is situated at the latitude of 68-69°N, and is thereby, as far as I know, the northernmost study of its kind.

In this thesis I have looked at how the mountain vegetation in Troms has changed since the 1930's. The main questions I have asked are: Have the vascular plant species changed their altitudinal distribution compared to the altitude registered in 1935? Have they stood their ground, or have they decreased in maximum altitude? Are there any new species coming in? And which species have disappeared? The most expected prediction is that the plants have shifted upwards in altitude.

Study area

The study area (Figure 1) is situated between 68°44'-69°38'N and 18°57'-20°32'E, and is located within the municipalities Lyngen, Storfjord, Balsfjord, Målselv and Bardu in the county of Troms. Two of the mountains, Fastdalstind and Kavringtind, are situated at the Lyngen peninsula, while the rest is situated in central parts of Troms. The mountains make a gradient going in a northeast-southwestern direction. The distance between the northernmost (Fastdalstind) and the southernmost (Dreggfjell) mountain is about 101 kilometers, and between the westernmost (Brøran) and the easternmost (Rihpogáisi) mountain the distance is about 72 kilometers (Garmin Ltd. 1999-2006).

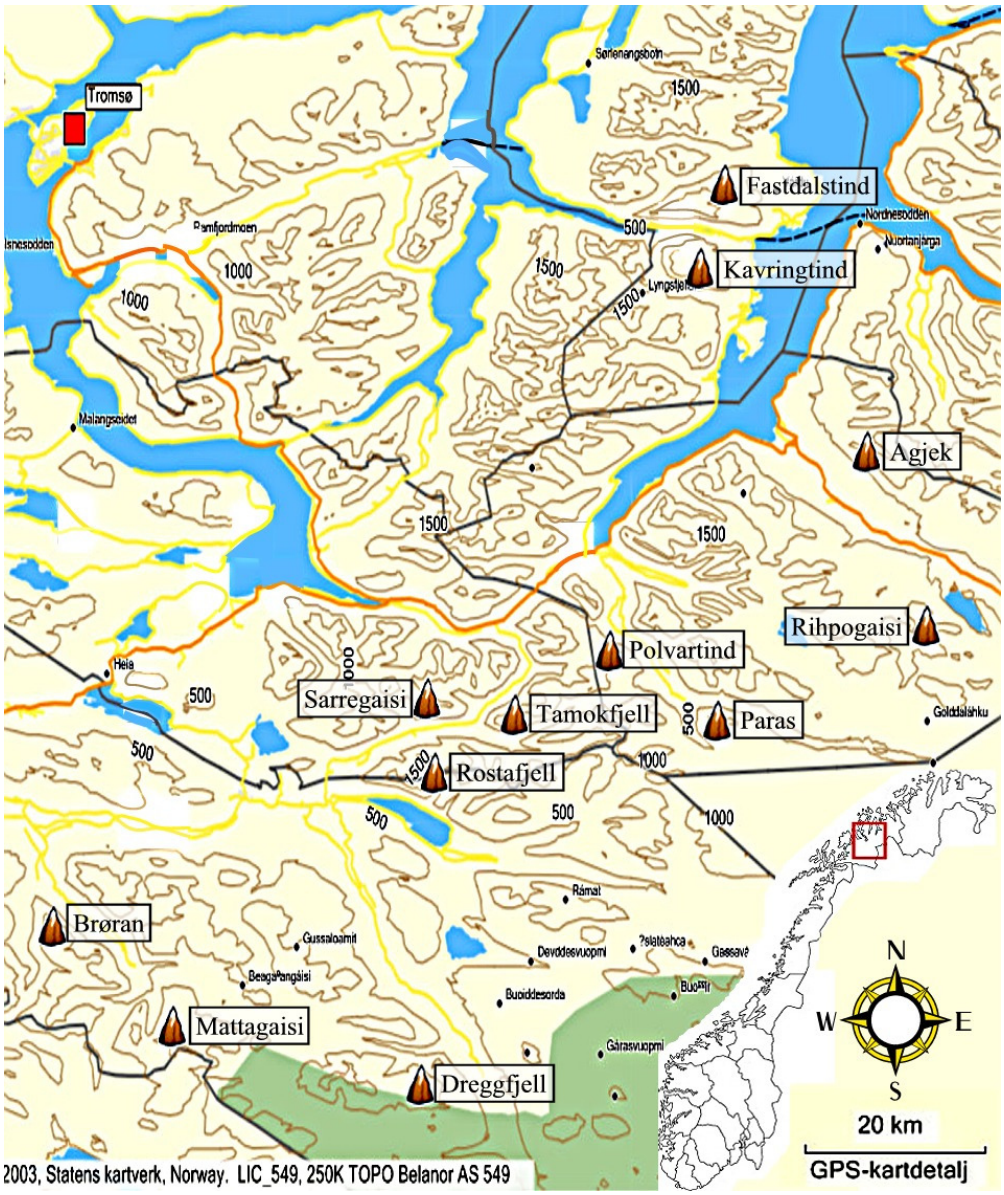


Figure 1: The location of the mountains in the study. The large green field at the bottom of the map is Øvre Dividal National Park.

The mountains

The mountains in the study (Table 1) have an approximate mean altitude of 1400 meters above sea level (m asl), and are all quite easy to climb for hikers with a little alpine experience. As one approaches the summit, the terrain gets more and more characterized by rocks and boulders instead of soil (personal observation). Further information is found in Appendix 1.

Table 1: The mountains in the study. Altitude from the M711map series, Statens Kartverk. UTM codes are from the highest visited point at the individual mountains in 2008.

Mountain	Altitude	UTM coordinates	Visited 1935	Visited 2008
Rihpogáisi	1195	34 W 0483621 7675681	18. July	04-05. July
Agjek	1262	34 W 0477324 7695447	19. July	07-08. July
Paras	1419	34 W 0466477 7665723	23. July	11. July
Polvartind	1275	34 W 0459211 7673679	24. July	14. July
Dreggfjell	1464	34 W 0443905 7626460	31. July	23. July
Tamokfjell	1342	34 W 0451102 7666007	27. July	24. July
Sarregáisi	1442	34 W 0445544 7668259	26. July	26. July
Rostafjell	1590	34 W 0444799 7659815	5. August	27. July
Máttagáisi	1636	34 W 0425708 7632917	7. August	31. July
Brøran	1427	34 W 0417853 7643846	9. August	1. August
Kavringtind	1289	34 W 0465854 7715613	15. July	3. August
Fastdalstind	1275	34 W 0467678 7724763	16. July	4. August

Climate

The average summer temperature, June – August, has been fairly stable at approximately 11,7°C for the period 1921-2008 (Figure 2) (DNMI 2009a). The average annual temperature shows an increase of approximately 0,5°C for the period 1921-2008 (Figure 3) (DNMI 2009b). A slight decrease in precipitation, about 2,3 mm, is registered in the snow covered period (Figure 4), while there is a slight increase in precipitation at about 7,3 mm in the snow free period for the period 1913-2008 (Figure 5) (DNMI 2009b). Neither of these changes are significant.

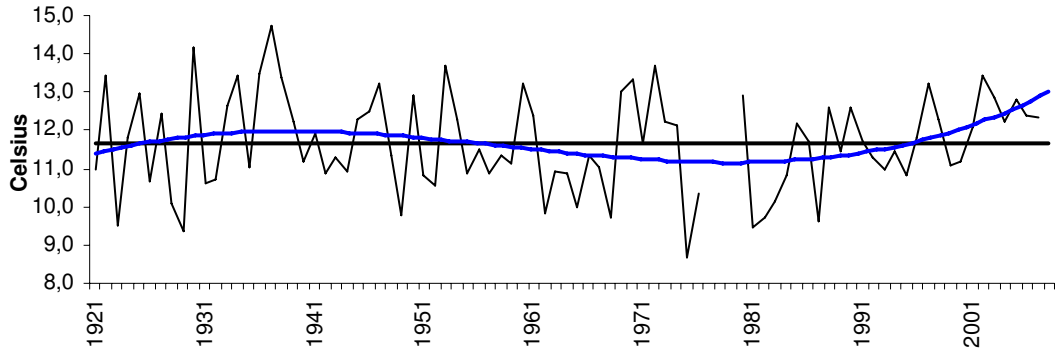


Figure 2: Average temperature for the months June - August, 1921-2008. Trend line (black) R^2=0,000. Polynomial trend line (blue) R^2=0,087.

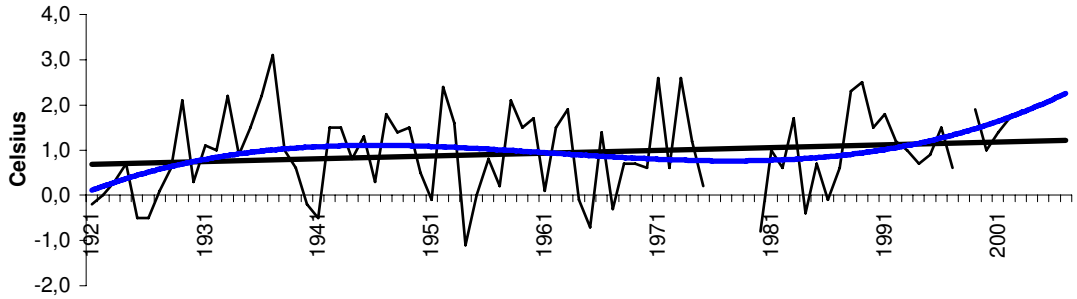


Figure 3: Average annual temperature 1921-2008. Trend line (black) R^2=0,026. Polynomial trend line (blue) R^2=0,089.

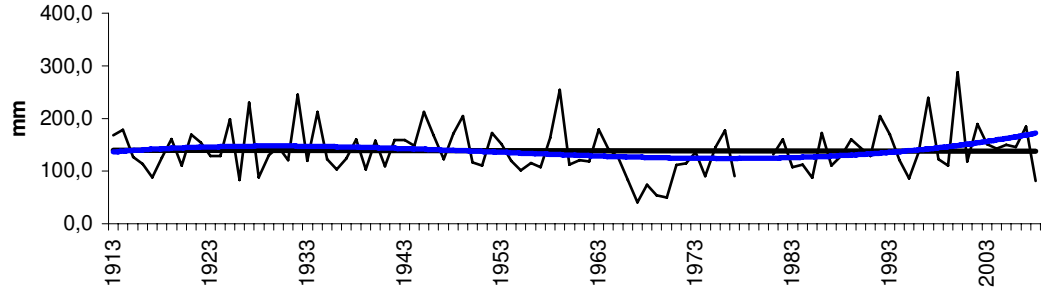


Figure 4: Total precipitation for 1913-2008 in the snow covered period, October-May. Trend line (black) R^2=0,000. Polynomial trend line (blue) R^2=0,057.

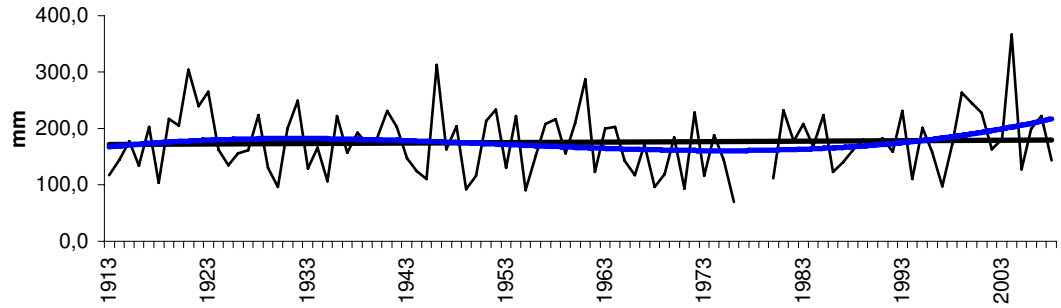


Figure 5: Total precipitation for 1913-2008 in the snow free period, June-September. Trend line (black) R^2=0,002. Polynomial trend line (blue) R^2=0,047.

Geology

The studied mountains belong to the Fennoscandian mountain range. The geology in the area consists mainly of metamorphic and magmatic rocks, but there are also overthrusts of sandstone and shale from late proterozoikum close to the mountain Paras, and some bedrock from arkeidum and proterozoikum nearby the southernmost mountains (Ramberg et al. 2007). The mountains at the Lyngen peninsula are mostly built up of gabbro, diorite, antrorthosite and ultramafic rocks, with some greenstone and amphibolite at the eastern side of the peninsula (Solli & Nordgulen 2007). The main type of rock in the rest of the area is mica schist and phyllite. There is also elements of granite and augen gneiss in the Signal valley, and a little marble and dolomite spread over most of the area (Solli & Nordgulen 2007).

Vegetation

The majority of the vegetation in the area belongs to the alpine zones (Moen 1999). The Lyngen peninsula is slightly oceanic, while the rest of the study area belongs to the indifferent section and borders to the slightly continental section in the easternmost parts. The study area is situated in the northern centric area of the two centric areas for alpine plant distribution in the Scandinavian mountain range. About 40 bicentric species, i.e. *Campanula uniflora*, and 25 unicentric species, i.e. *Pedicularis flammea* (Figure 6), belong to this area (Moen 1999).

Figure 6: ***Pedicularis flammea*** **in bloom at Rihpogáisi.** ***Rhododendron lapponicum*** **underneath.**

Impacts from humans and grazing animals

The human impacts in the study area have probably increased somewhat since Jørgensen's study, but not as much as expected before the field work. No cabins were observed nearby any of the surveyed locations. Most cabins are probably built lower in the terrain. The mountains Fastdalstind, Kavringtind, Rostafjell (Figure 7) and Paras had all well used trails to the top and seem to be popular summits to hike at (personal observation).

The number of semi-domesticated reindeer (*Rangifer tarandus*) and sheep (*Ovis aries*) grazing has increased on a general basis in Norway since Jørgensen's time (Austrheim & Eriksson 2001). There were by the 31st of July 2008 38.323 sheep (adults and lambs) in the five municipalities were the studied mountains are situated, of these 11.314 were at the Lyngen peninsula (Statens Landbruksforvaltning 2009). The number of grazing reindeer has doubled in the county of Troms in the period 1961 to 2007 (Askild Solberg, senior adviser Reindriftsforvaltningen in Alta, Per. Comm.). By the 31st of March 2007 there were 11.972 registered reindeer in Troms (SSB 2009).

Figure 7: A well used trail, marked with the red T's of the Norwegian Trekking Association, to the summit at Rostafjell.

Methods

Fieldwork

The fieldwork took place between the 4th of July and 4th of August 2008.

The study is done as close as possible to what Jørgensen did in 1935. I have read his report carefully while I studied maps over the different areas to find the routes he used up the different mountains, and followed them as well as I could in the terrain. However, there will always be some differences since I did not have the exact positions of his locations. For each mountain I registered the presence of vascular plant species from about 500 m asl (the approximate tree line in the area in 1935) and to the summits. It is also worth to mention that I have done my sampling alone while Jørgensen had another botanist with him.

To measure the altitude on the mountains, Jørgensen (1936) used an aneroid barometer. I used a GPS (Garmin GPSmap 60CSx). All the locations were also marked in the GPS, and are downloaded and saved along with the track log of how I climbed the mountains. Thus all the UTM codes for the locations are now known. Maps in the series M711 from Statens Kartverk were also used as a back-up to the GPS and to get a better overview of the terrain.

Jørgensen chose to start his registrations at about 500 m asl and he registered continuously the presence of vascular plant species to the summit of each mountain, or to the highest accessible altitude. The registrations were done within approximately 100 meter altitudinal bands, towards the summit, sometimes for every 50 meter or less, unless the topography did not put any big obstacles in the way. The localities are for example recorded in this way:

7. 900 m: 34 W 0484205 7674958. Below a talus.
8. 948 m: 34 W 0484092 7675093. Slope towards SE. Dry.

This means that plants at locality 7 in this example are found between an elevation of 900 and 948 m asl, and that the registrations started just below a talus.

I spent one day per mountain, the same as Jørgensen, except for the two mountains I visited first. Here I spent two days at each mountain to get familiar with the method and the plant species. The entire period of my fieldwork I had the benefit of long arctic summer nights, and could therefore work independently of the clock.

Five of the mountains in this study have changed name since Jørgensen's study; Goalsevarre to Kavringtind, Reppovarre to Rihpogáisi, Sarrevarre has changed to Sarregáisi (Blåbærtinden), Isdalstind to Brøran and Njunnesvarre to Dreggfjell. Due to some minor changes in spelling of names, some of the other mountains now have names that can appear slightly different in my study. I have chosen to use the names found at the map series M711, 5-NOR edition, from Statens Kartverk.

Temperature and precipitation data were collected from the metrological climate station number 89950 in Dividalen (228 m asl) from the Norwegian Metrological Institute (DNMI).

Species identification

Most species were identified in the field. Species that I could not identify in the field were sampled and pressed for later identification at the herbarium at the Department of Ecology and Natural Resource Management, Norwegian University of Life Sciences. I have used the floras by Lid & Lid (2005), Mossberg & Stenberg (2007) and Nilsson (1995). The last mentioned flora was my field flora, while the other two has been used mainly indoors.

There have been some changes in taxonomy and nomenclature after Jørgensen published his study in 1936. I have chosen to use the names from Lid & Lid (2005). This means that I have changed all the old names in Jørgensen's species lists, and that the new names will be used in this thesis (Appendix 2). In addition to this I have, due to identification problems, chosen to pool the willows (*Salix* spp.) in both studies, with exception of *Salix herbacea* and *S. reticulata*, to increase the reliability of the data. The same is also done for other genera or groups of species where identification was uncertain (i.e. *Alchemilla* spp., *Calamagrostis* spp., *Draba* spp., *Epilobium* spp., *Hieracium* spp., *Myosotis* spp., *Pyrola* spp., *Rumex* spp. and *Woodsia* spp.).

Analyses

I have compared the results from Jørgensen's 1936 study with my own by comparing the number of species and observations, and the change in average maximum altitude for the species.

The locations were sorted into 100 meter altitudinal bands, from 500 to 1400+. For example does the altitudinal band 500 consist of plants recorded between 500 to 600 m asl. This was

done to even out possible sampling errors between the two studies, since I most probably have not found the exact locations that Jørgensen used, and our samplings will be different due to the fact that we are different persons. The locations were placed into the altitudinal band where it had the most meters of altitude. For example: location SA05 starts at an altitude of 820 m asl and runs up to the start of location SA06 at 940 m asl. SA05 has then the most altitudinal meters between a height of 8-900 m asl and were therefore placed in category 800 m asl. If a location had just as many altitudinal meters in two categories, it was placed in the lowest category.

To check the significance of the changes observed I used a 1-tailed t-test. This was performed on the change in the total number of species found, at the mean number of species per altitude band for all mountains, average change in altitudinal limits for each plant species, for the minimum and maximum altitudinal change for all species, and for change in the number of summit species. All tests were for the changes observed between the years 1935 and 2008, and all *P*-values presented in the text refer to results from these t-tests.

Obstacles and exclusion of some mountains

Some bias in the recordings can have occurred due to personal mistakes, for example by incorrect identification of species or trouble with finding the route Jørgensen used. I have stopped before the summit/Jørgensen's end point at two mountains. At Paras I stopped just before the summit because of my own fear of heights, and at Tamokfjell I stopped at 1150 m asl due to thick fog. In addition I lost Jørgensen's track completely at 850 m asl at the mountain Mannfjell, and have therefore eliminated this mountain from the study. Four mountains in Jørgensen's study are not revisited. Kistefjell is dropped because of the long hike and lack of time. Lack of time and the fact that the mountains was not visited by Jørgensen, but by Devold instead, were the reason why I did not revisit the mountains Markenestind, Rismålstind and Blåbærfjell.

Results

The total number of species showed a significant average increase of 15 species per mountain, *P*=0,011 (Figure 8). All but one mountain, Tamokfjell, experienced more new establishments of species than what they had lost (Figure 9). The mountains in the southwest had the highest number of species in both 1935 and 2008, while the largest increase in number of species seems to have occurred in the northeast (Figures 8 and 9).

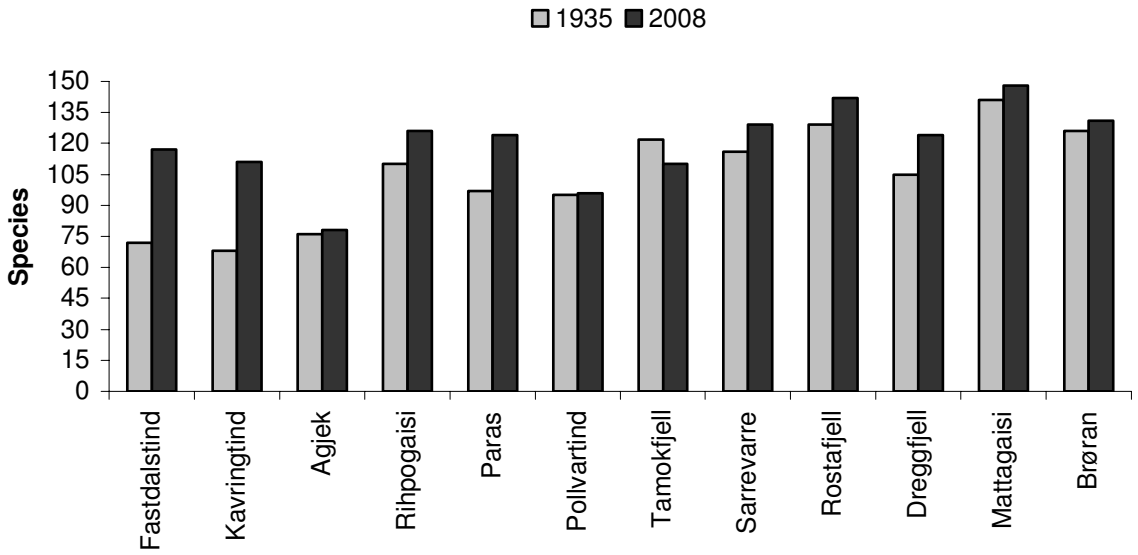


Figure 8: The total number of species at each mountain. The mountains are arranged from northeast (left) towards southwest (right).

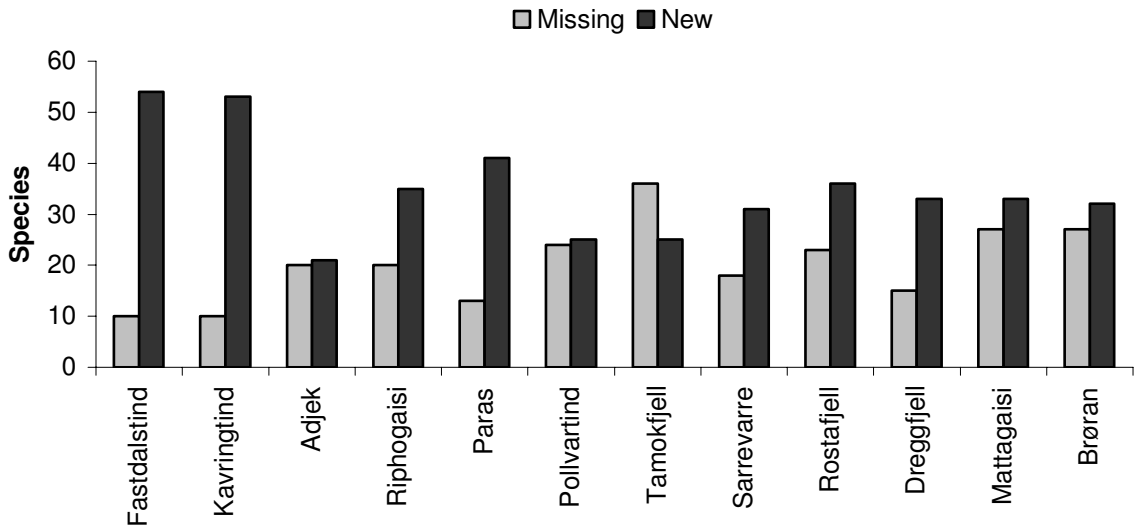


Figure 9: Species that were found in 1935 only (Missing), at the individual mountains, and new species that were only found in 2008 (New). The mountains are arranged from northeast towards southwest.

There has been a significant increase (*P*=0,001) in the number of species at all altitudes except above 1400 meters (m), where the average number of species did not differ between 2008 and 1935 (Figure 10).

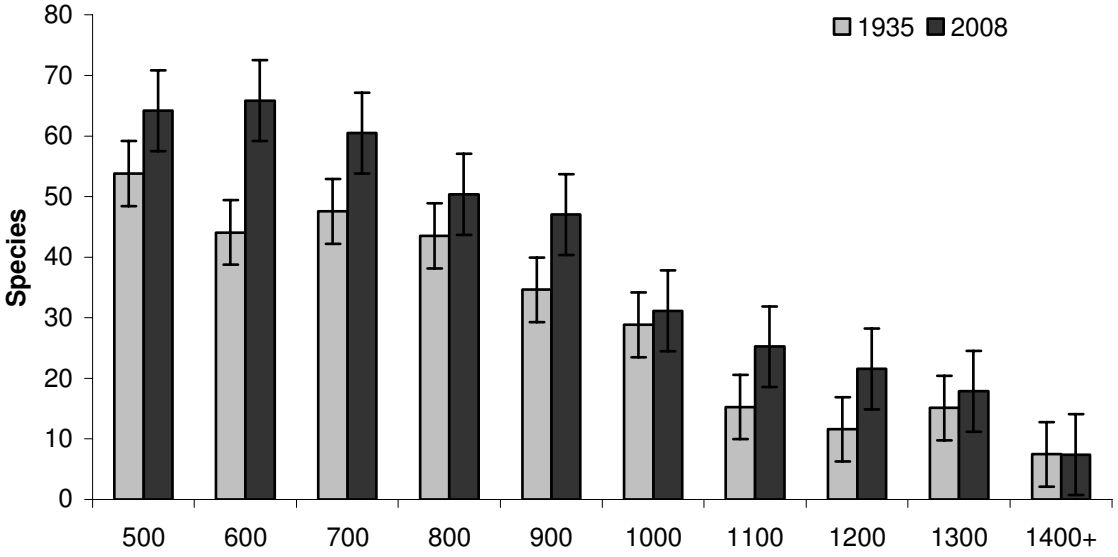


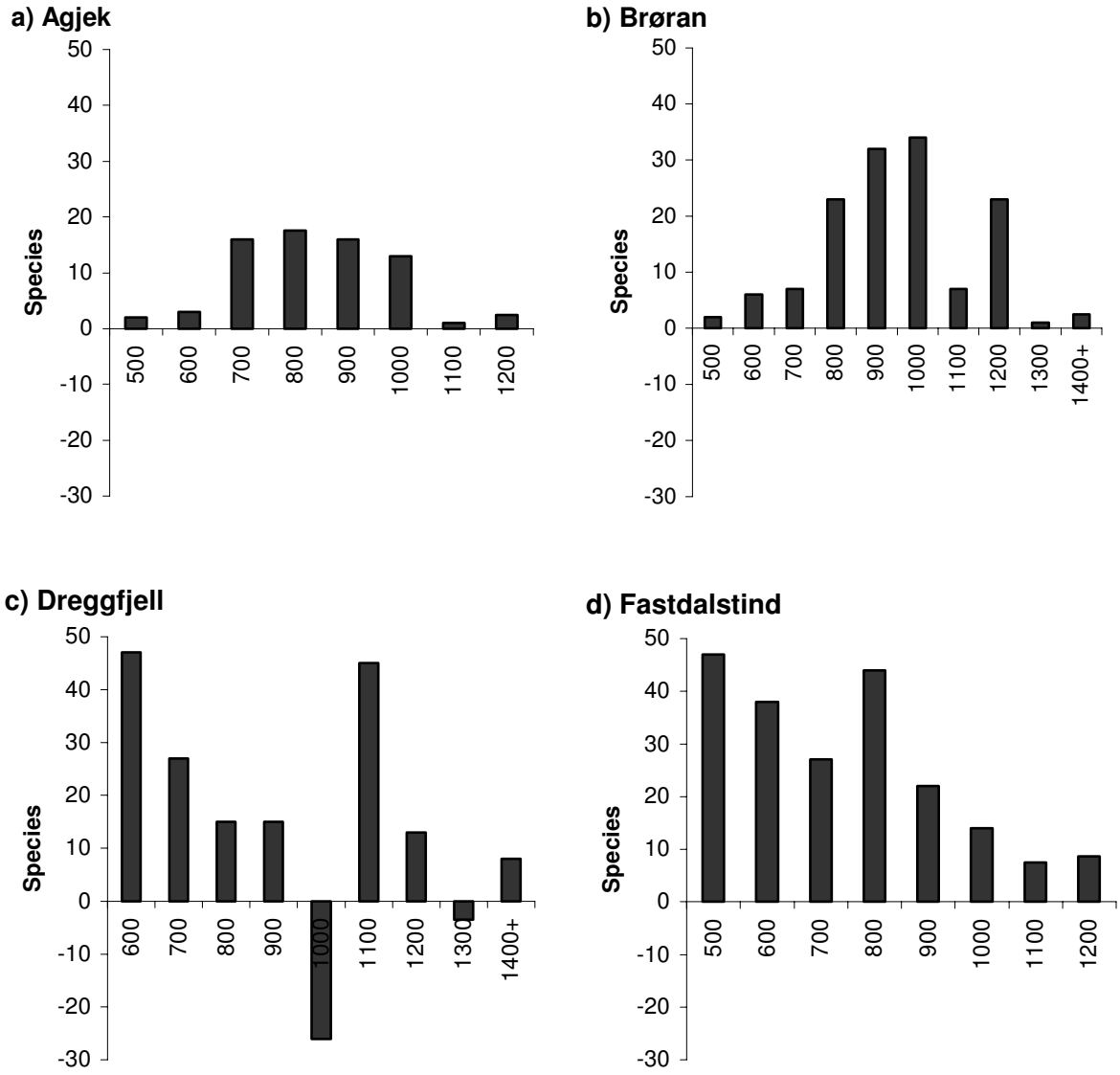
Figure 10: The mean number of species per altitude category for all mountains; 1935 vs. 2008. Error bars showing the standard error.

The average maximum altitude for all species was 799 m in 1935 and 847 m in 2008, showing a significant increase of 47,2 m (*P*=0,000). The mean minimum altitude has been relatively stable, 624 m in 1935 and 630 m in 2008, an increase of 5,7 m, which represents a marginally significant increase in elevation (*P*=0,049).

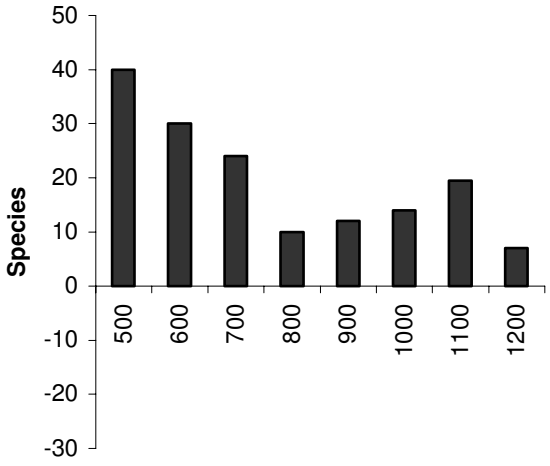
In 2008, 57 of the species in Jørgensen's study were missing at one or more mountains. Out of these 57, 27 were not found at all in 2008 (Appendix 3). There were 89 species that were found at one or more new mountains in 2008, and of these, 33 species were not found by Jørgensen. In addition 67 species showed a mixed response, and 28 species were found at the same mountain(s) in 2008 as in 1935. The 67 species showing a mixed response do on average disappear from 1,6 mountains, while they have established themselves at 2,4. Out of the 181 species found both years, 136 show an increase in mean maximum altitude, 33 a decrease, while 12 species had not changed their altitudinal distributions. When looking at the change in number of observation for these 181 species; 41 showed a decrease, 15 had the same number, and 125 species showed an increase in the number of observations. The mean change in number of observations was 6,5 and the median 5 observations. This change in

number of observations was significant (P<0,001) between the years 1935-2008. The two species showing the largest increase in the number of observations were *Betula pubescens* (+ 47 observations) and *Empetrum nigrum ssp. hermaphroditum* (+ 45 observations). *E. nigrum ssp. hermaphroditum* also showed the largest change in altitudinal distribution (+ 317 m) between the years.

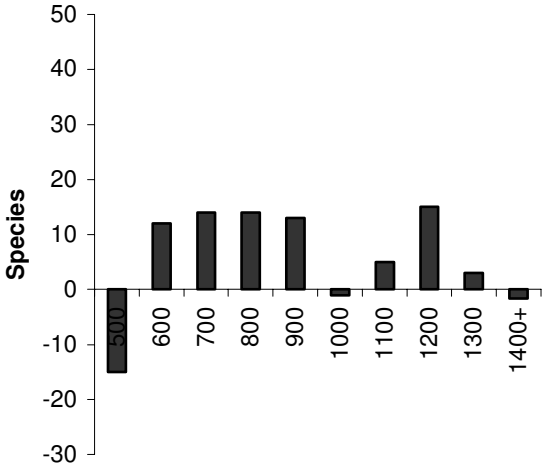
When looking at the observed changes in the number of species per 100 meter altitudinal band at the individual mountains, one can see that each mountain displays an individualistic pattern of change for the altitudinal bands (Figure 11).



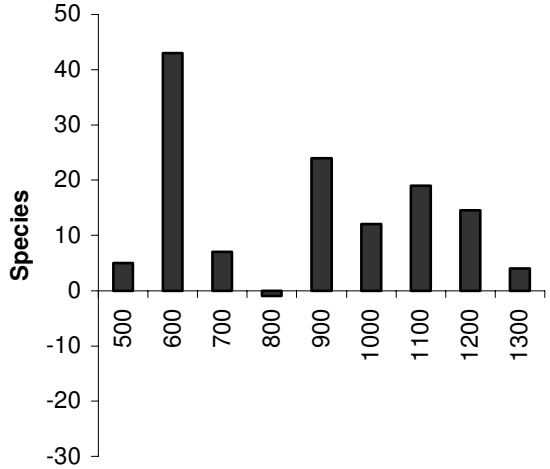
e) Kavringtind



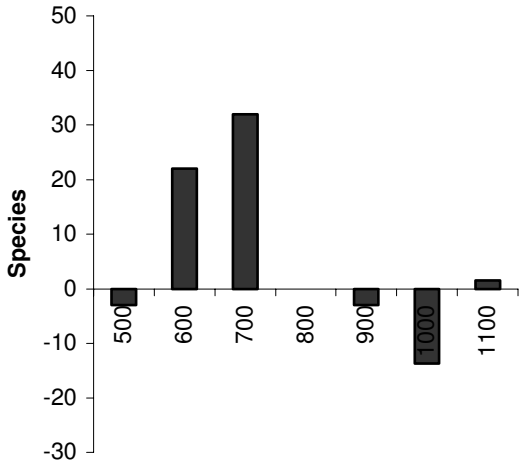
f) Mattagaisi



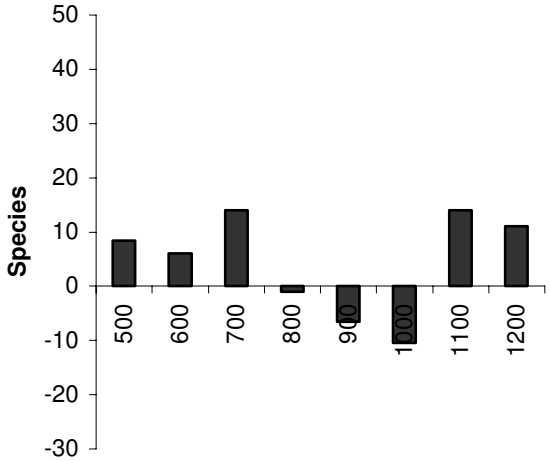
g) Paras



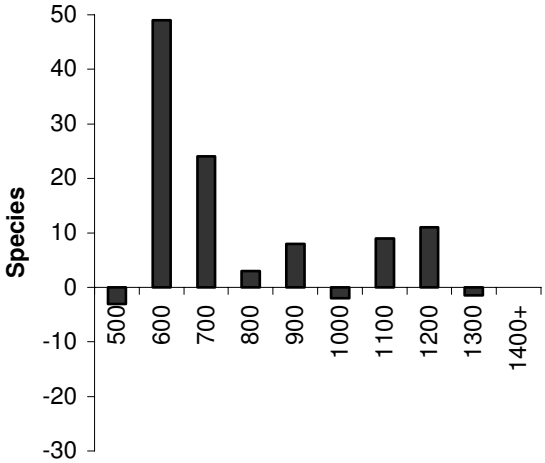
h) Polvartind



i) Rihpogaisi



j) Rostafjell



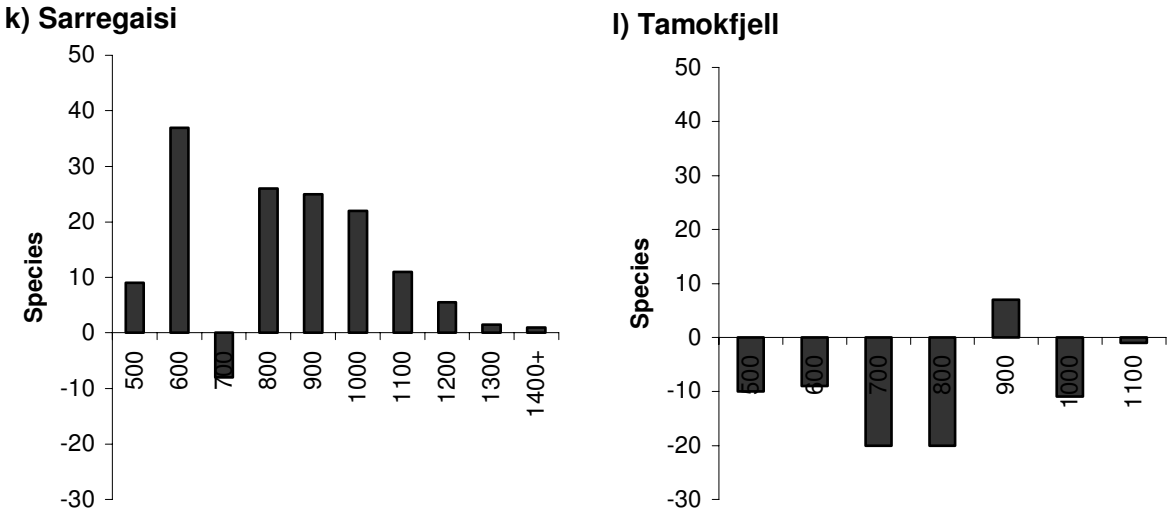


Figure 11 a-l: Observed changes in number of species, 1935-2008, per 100 meter altitudinal bands at the individual mountains.

Out of the total 241 species, 29 showed a significant (P≤0,05) maximum altitudinal change between the years 1935 and 2008 (Table 2). These species show a wide variety in types of plants, e.g. trees, ferns, herbs, heath etc. Eight of the species are species found at one or more summits in 2008.

Table 2: Species with a significant change, P≤0,05 (1-tailed T-test), in maximum altitude between 1935 and 2008 when comparing the maximum altitudes at the mountains where the species were found. The table also shows the number of mountains where the different species where found, the number of observations in total and the maximum altitude for each species both years. The *Pinus sylvestris* is also in the table, but without any significant value. The species was only found at one mountain in 1935, and therefore the T-test could not be preformed.

Species	Mountains		Observations		Max altitude		T-test (P≤0,05)
	1935	2008	1935	2008	1935	2008	1-tailed
Angelica archangelica	4	6	11	15	770	870	0,029
Antennaria dioica	10	11	23	60	1160	1190	0,022
Athyrium distentifolium	6	11	9	43	680	1100	0,006
Betula pubescens	4	12	16	63	940	1302	0,034
Bistorta vivipara	12	12	72	91	1380	1330	0,014
Campanula rotundifolia	5	10	8	27	720	770	0,026
Chamerion angustifolium	11	9	20	29	880	1060	0,033
Diapensia lapponica	12	12	48	51	1160	1447	0,048

Diphasiastrum alpinum	10	12	28	55	1060	1203	0,013
Empetrum nigrum spp. Hermaphroditum	12	12	30	75	880	1200	0,000
Equisetum arvense	12	9	33	24	1060	1210	0,006
Euphrasia wettsteinii	6	10	11	31	770	1160	0,022
Gymnocarpium dryopteris	5	10	5	23	710	940	0,050
Harrimanella hypnoides	12	12	81	92	1360	1434	0,005
Hieracium alpina	12	12	42	77	1160	1210	0,000
Hierochloë alpina	8	10	28	30	1340	1267	0,039
Juncus trifidus	12	12	54	85	1060	1380	0,012
Luzula confusa	12	12	81	64	1637	1637	0,041
Omalotheca supina	9	7	31	34	1160	1302	0,023
Oxyria digyna	11	12	64	81	1450	1400	0,026
Phyllodoce caerulea	12	12	70	108	1160	1400	0,001
Pinguicula alpina	12	9	35	34	1000	1090	0,025
Pinus sylvestris	1	4	3	12	900	1000	-
Pyrola spp.	9	12	18	54	900	990	0,005
Salix reticulata	10	8	43	42	1200	1165	0,043
Solidago virgaurea	11	12	41	70	990	1252	0,003
Sorbus aucuparia	5	9	10	20	760	820	0,029
Vaccinium uliginosum	12	12	50	72	1060	1160	0,014
Vaccinium vitis-idaea	11	12	68	89	1210	1350	0,037
Viola biflora	12	12	67	82	1190	1252	0,045

The 12 species that had the highest significant values in regard of change in maximum altitude also increased in the number of observations (Figure 12). The two species *Equisetum arvense* and *Harrimanella hypnoides* also seems to retreat from the lower altitudes. Several of these species are woody species.

When looking at the nine summits visited (Figures 13 and 14), there was an average increase of 1,8 species per summit, which was marginally significant (P=0,054). Five summits show an increase in number of species, two show a decline and two summits had the same number of species in 2008 as in 1935. Only one of the summits, i.e. Máttagáisi, had both the same number of species and the same species. The northeastern mountains show the highest increase in summit species.

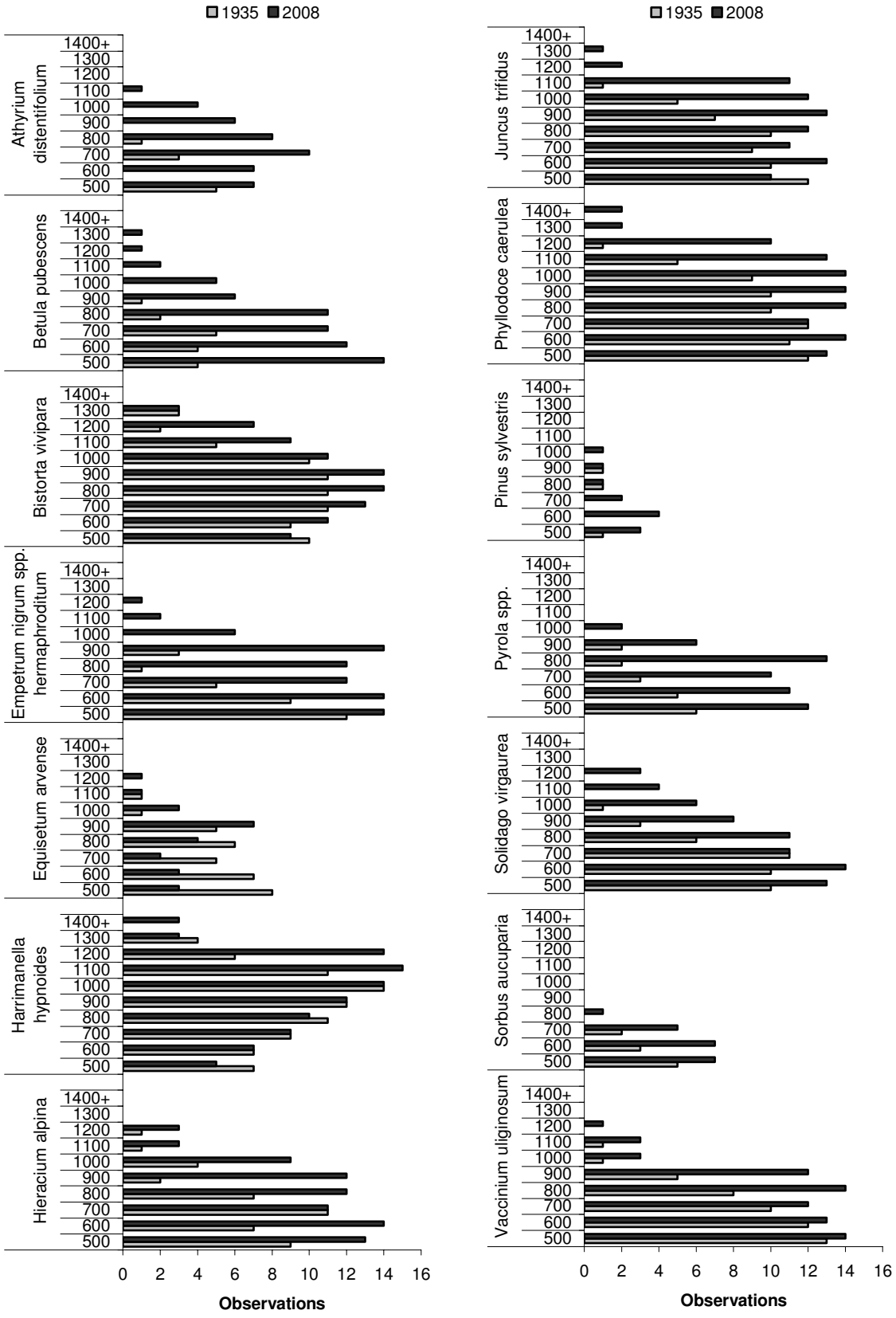


Figure 12: The number of total observations at each altitudinal band of the 12 most significant species when tested for change in maximum altitude, with the two tree species *Pinus sylvestris* and *Sorbus aucuparia* in addition.

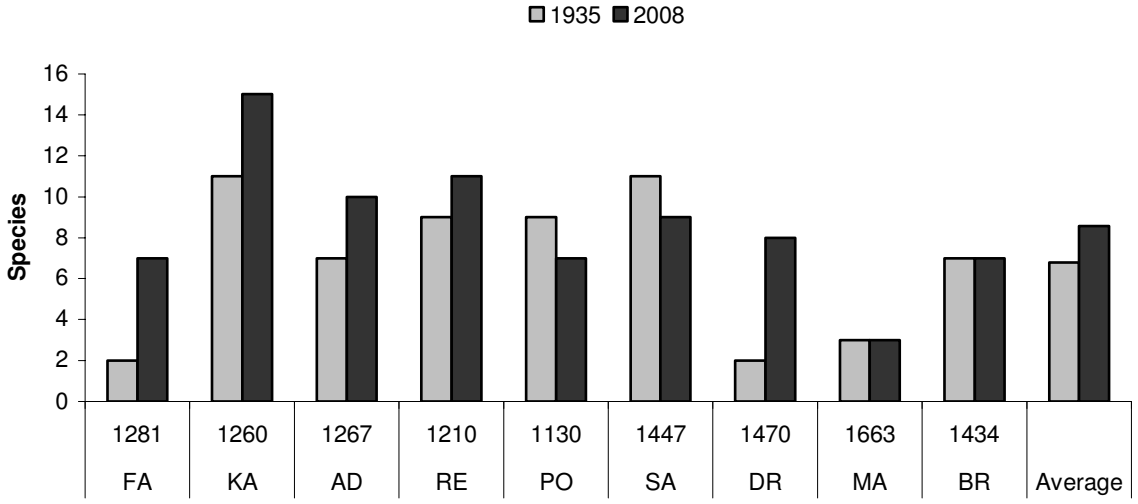


Figure 13: The number of species at the different summits, 1935-2008. FA=Fastdalstind, KA=Kavringtind, AD=Agjek, RE=Rihpogáisi, PO=Polvartind, SA=Sarregáisi, DR=Dreggfjell, MA=Máttagáisi and BR=Brøran. The numbers are the GPS measured altitude in m asl of each summit. The summits are arranged from northeast towards southwest.

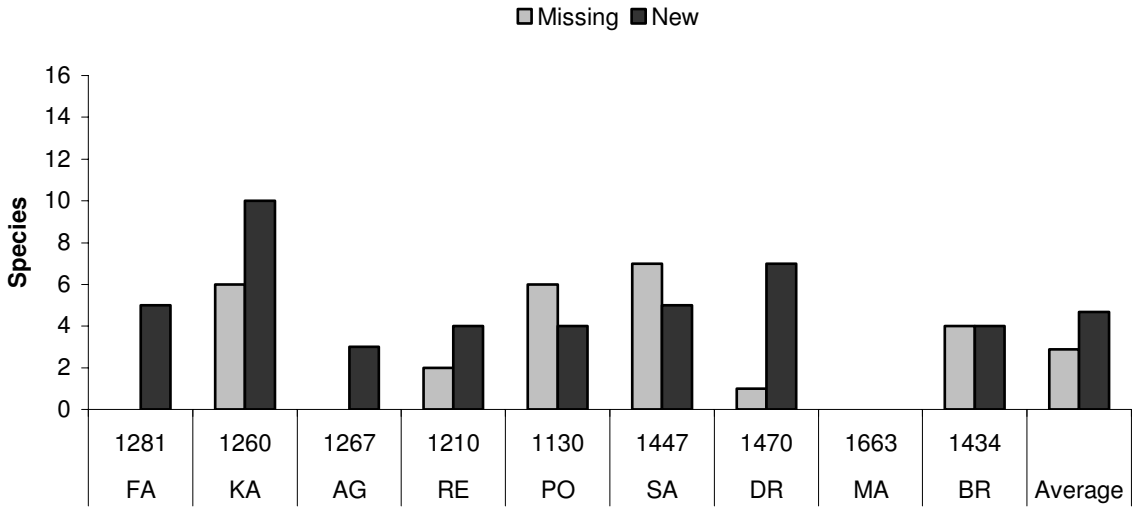


Figure 14: Species that were found at the nine summits in 1935 only (Missing), and new species that were only found at the summits in 2008 (New). The mountains are arranged from northeast towards southwest. Abbreviation of summits found in figure 10.

The three species found at Máttagáisi; *Beckwithia glacialis, Huperzia selago* and *Luzula confusa,* were also the three most common summit species, all found at seven or eight of the summits in 2008. In 1935, 22 different species were found at these summits, while 35 different species were found in 2008 (Table 3). In total 17 species were found at the summits both years. After looking more in detail at the preferred habitat for the summit species, most

of these are snow bed species. As much as 27 of the total 40 species found both years have snow beds as one of their preferred habitats according to Lid & Lid (2005).

Table 3: The species found at each of the nine surveyed summits. = found both years, - found in 1935 only, + found in 2008 only.

Summit	Species		Summit	Species	
Fastdalstind	*Beckwithia glacialis*	=	**Polvartind**	*Beckwithia glacialis*	=
	Cardamine bellidifolia	+		*Cardamine bellidifolia*	=
	Cassiope tetragona	+		*Carex lachenalii*	+
	Harrimanella hypnoides	+		*Harrimanella hypnoides*	+
	Huperzia selago	+		*Hierochloë alpina*	-
	Luzula arcuata	+		*Huperzia selago*	-
	Luzula confusa	=		*Luzula arcuata*	+
				Luzula confusa	=
Kavringtind	*Beckwithia glacialis*	=		*Ranunculus nivalis*	-
	Cardamine bellidifolia	=		*Salix herbacea*	+
	Cassiope tetragona	+		*Salix spp.*	-
	Cerastium alpinum	-		*Silene acaulis*	-
	Festuca ovina	-		*Vaccinium vitis-idaea*	-
	Harrimanella hypnoides	+			
	Huperzia selago	=	**Sarregáisi**	*Beckwithia glacialis*	=
	Luzula confusa	=		*Cardamine bellidifolia*	-
	Lycopodium clavatum	+		*Cerastium alpinum*	-
	Minuartia biflora	+		*Diapensia lapponica*	+
	Omalotheca supina	+		*Festuca ovina*	-
	Oxyria digyna	-		*Huperzia selago*	=
	Phyllodoce caerulea	+		*Luzula confusa*	+
	Poa alpina var. vivipara	+		*Poa alpina*	-
	Saxifraga cernua	-		Poa arctica	+
	Saxifraga cespitosa	=		*Salix herbacea*	-
	Saxifraga nivalis	-		*Saxifraga aizoides*	+
	Saxifraga oppositifolia	-		*Saxifraga cernua*	-
	Saxifraga tenuis	+		*Saxifraga cespitosa*	=
	Silene acaulis	+		*Saxifraga nivalis*	-
	Trisetum spicatum	+		*Saxifraga oppositifolia*	=
				Trisetum spicatum	+
Agjek	*Beckwithia glacialis*	=			
	Cardamine bellidifolia	=	**Dreggfjell**	*Beckwithia glacialis*	=
	Cassiope tetragona	=		*Carex bigelowii*	+
	Festuca ovina	+		*Festuca ovina*	+
	Festuca vivipara	+		*Huperzia selago*	+
	Hierochloë alpina	=		*Luzula confusa*	-
	Huperzia selago	=		*Ranunculus pygmaeus*	+
	Luzula confusa	=		*Saxifraga cernua*	+
	Salix herbacea	=		*Saxifraga oppositifolia*	+
	Silene acaulis	+		*Silene acaulis*	+
Rihpogáisi	*Arabis alpina*	+	**Máttagáisi**	*Beckwithia glacialis*	=
	Beckwithia glacialis	-		*Huperzia selago*	=
	Cassiope tetragona	-		*Luzula confusa*	=
	Draba spp.	+			

	Dryas octopetala	+	**Brøran**	*Anthoxanthum nipponicum*	+
	Harrimanella hypnoides	+		*Beckwithia glacialis*	=
	Hierochloë alpina	=		*Festuca vivipara*	+
	Huperzia selago	=		*Harrimanella hypnoides*	+
	Luzula confusa	=		*Huperzia selago*	-
	Pedicularis hirsuta	=		*Luzula confusa*	=
	Salix herbacea	=		*Poa alpina*	=
	Silene acaulis	=		*Poa alpina var. vivipara*	+
	Vaccinium vitis- idaea	=		*Ranunculus pygmaeus*	-
				Saxifraga oppositifolia	-
				Trisetum spicatum	-

Discussion

The climatic change that has been observed over the latest years is documented to affect how plants behave with pole ward and up ward migration and with shifts in seasonal patterns (Walther 2004). The most pronounced increases in temperatures have occurred in winter and early spring (IPCC 2007). This influences plant species that blossom early in the spring the most. The results of my study show an increase in number of species at all mountains except one, Tamokfjell, which showed a decrease. The increase in species number was expected according to what previous studies from other geographical areas have shown, see e.g. Klanderud & Birks (2003), Kullman (2001), le Roux & McGeoch (2008), Parmesan & Yohe (2003), Parolo & Rossi (2008), Pauli et al. (1996), Root et al. (2003) and Sætersdal & Birks (1997). The total number of species was also higher in 2008 than what was registered by Jørgensen (1936).

Changes in temperature and precipitation

Two main factors are thought to influence the diversity of alpine plants when it comes to climatic changes; temperature and the length of the snow cover season (Kammer & Möhl 2002). Interestingly, from 1935 to 2008 there has been no significant change in temperature or precipitation recorded at the climate station that is located within my study area, i.e. Dividalen (DNMI 2009a; DNMI 2009b). The average temperature has actually been rather stable for the entire period of measurements. The 1930s and 40s were warmer, while the 60s, 70s and 80s were somewhat colder than the average. The change in precipitation is not large either. There can only be observed a slight decrease in the winter, and a slight increase in the summer precipitation. During the 1930s and 40s there was an increase in precipitation, while in the 60s, 70s and 80s the precipitation decreased (DNMI 2009a; DNMI 2009b). Klanderud and Birks (2003) linked their findings of less increase in species richness and a relatively high amount of species that were not re-found in the western mountains of Jotunheimen to the increased precipitation and longer period with snow cover in the western part of their study area. It is predicted that the snow covered period will become shorter, giving an increase in the length of the growing season in the future, if the climate change scenarios are fulfilled (Schöb et al. 2009). This will be due to earlier snow melt off, rather than to later snow arrival (Schöb et al. 2009). In the predicted climate scenarios, the largest temperature increase is expected in the eastern and northern parts of Norway (Engen-Skaugen et al. 2007). A larger increase in the winter temperatures compared to in the summer is also predicted in the area

(Engen-Skaugen et al. 2007). Such a change in precipitation pattern and snow cover could also have explained some of the observed difference between the southwestern and northeastern mountains in my study, but I have no data to confirm or invalidate this.

Climate change has an impact on the selection of species (Jump & Penuelas 2005). Many species are able to adapt to moderate changes, but when the changes accelerate, or the landscape the species have to migrate across becomes too fragmented to make migration possible, changes in the environment can happen faster than adaptations, and species can be eradicated (Jump & Penuelas 2005). There might already exist individuals within a species that is adapted to tolerate the coming climatic changes, and these only need to increase in numbers to make the species adapted to the changes on a broader scale (Jump & Penuelas 2005). This can work, for individual populations, against the changes on a short time scale, but it will not help on the loss of suitable habitat (Jump & Penuelas 2005). The more variability a species has considering plasticity and genetics, the higher is the chance that the species will tolerate climatic changes (Jump & Penuelas 2005). But then again; if a population is isolated from other populations, the needed flow of genes between populations is lost and thereby variability is lost, and the population will lose its ability to adapt to further changes (Jump & Penuelas 2005). Not only changes in temperature and precipitation should be considered when exploringfuture scenarios, one should also take into account how the ecosystems are affected by other indirect effects like disturbances across trophic levels (Zimov et al. 1995).

Heating experiments by the use of open top chambers (OTC) have been used in several studies, e.g. Alatalo & Totland (1997), Molau (1997), Totland & Alatalo (2002). The study done by Molau (1997) on the species *Ranunculus nivalis* (Figure 15) and *Cassiope tetragona* (Figure 16) show the difference in how some species will react to the predicted climatic warming. Both species showed an increased reproduction (Molau 1997). The evergreen *C. tetragona* was not that affected by temperature changes regarding growth, but became more vulnerable for competition when temperature increased (Molau 1997). *R. nivalis* changed more annually to the climatic conditions in different years, and the species showed also a larger dependency on solar radiation to increase its reproduction (Molau 1997). For this species a moderate warming would be positive regarding to reproduction, but it will on a longer term suffer from competition from grasses (Molau 1997). There has also been done a similar OTC experiment on the species *Silene aucalis* (Figure 17) (Alatalo & Totland 1997).

That study showed that the *S. aucalis* responded to increased temperatures by earlier flowering, faster development, and earlier maturation of capsules which contained more seeds, which in turn were also more mature (Alatalo & Totland 1997). From these results it is assumed that a climatic warming will lead to a larger seed production for alpine plants in the future instead of increased growth (Alatalo & Totland 1997; Vittoz et al. 2009). This gives each individual a higher chance of successful reproduction if the seedling survives the changing conditions (Alatalo & Totland 1997). This is one possible explanation of the increased number of observation of most species. The increased number of observations at the mountains can also, according to Kammer et al. (2007), be a consequence of a still ongoing re-colonization after the little ice age in the first half of the 19th century. Both re-colonization and an upward shift of species due to climatic warming leads to the same result, i.e. an increased number of species at higher altitudes (Kammer et al. 2007). Anyhow, there can also be differences in responses to climatic changes between study areas (van Wijk et al. 2004). This means that habitats can be just as important as the geographic location when one shall determine the effects of climatic changes (van Wijk et al. 2004).

IPCC Scenarios

The IPCC (2007) worst case scenario is a global climatic warming of 4,0°C until the end of the 21st century. This is a scenario where the economic development goes fast, with a human population peak around 2050 and by use of fossil fuel intensive technologies (IPCC 2007). On the other hand there is a scenario that is assumed to give a temperature increase of only approximately 0,6°C until the end of the 21st century, if the levels of green house gases and aerosols are kept at the same level as in the year 2000 (IPCC 2007). Predictions, regardless of scenario, given by IPCC (2007) are that the greatest increase in temperatures will occur at high latitudes and over land. A climatic warming will give a decrease in areas with snow cover, less extensive sea ice, and thawing of permafrost. Extreme weather happenings will also probably become more frequent, e.g. heat waves and extreme storms (IPCC 2007). When it comes to precipitation, there is predicted an increase in northern Norway of about 10-20 % in the winter and 10 % in the summer (IPCC 2007). The predicted rise in temperature will in the artic mean a increased species invasion, and especially mountain ecosystems will suffer from the increased temperatures (IPCC 2007). These predicted trends can in the long term lead to several different effects on the vascular plants in the studied area.

As an example; *Dryas octopetala* (Figure 18), is one of the most important species of

Figure 15: ***Ranunculus nivalis*****.**

Figure 16: ***Cassiope tetragona*****.**

Figure 17: ***Silene aucalis.***

Figure 18: ***Dryas octopetala***

European tundra and heath land (Skrede et al. 2006). The species is long lived and dispersed by wind (Skrede et al. 2006). As a response to the earlier snow melt off dates, it will flower earlier (Høye et al. 2007). The predicted temperature rises will lead to shorter time between the snow melt off date and flowering regardless of early or late melt off date (Høye et al. 2007). This means that the species will flower earlier and more abundantly than what is seen now in areas were snow melt off is early, while it will not change, or respond negatively, in areas with a late melt off date (Høye et al. 2007). Such changes in snow regimes due to changes in climate will therefore not only affect the *D. octopetala*, but also population dynamics and community structure for many other species at several different trophic levels in the long term (Høye et al. 2007). In my study, the species has increased its maximum altitude by approximately 84 m in average, but the increase is not significant (P=0,268). Regarding the number of observations, it has only been recorded at two more locations in 2008 than in 1935. It might also be worth to mention that at one of the mountains, i.e. Agjek, where the species was sampled in 1935, I did not find it.

Migration

Paleorecords show that in the past plants have been able to migrate fast enough to keep up with the climatic changes occurring then, and that they might be capable of migrating even faster (Pitelka et al. 1997). Even though they might be able to migrate faster than what they are shown to have done before, human fragmentation of habitats at present can be a contributing factor to slowing down the migration speed of the plants (Pitelka et al. 1997). Plant migration due to climatic warming can happen quite rapidly in areas that are not too fragmented by human activity (Kelly & Goulden 2008). On the other hand, human activities have not only made earlier migration routes impossible to use, but due to human traveling around the globe, other routes that were impossible earlier are made possible (Walther 2004). The impacts of human activity are on a general basis relatively small in alpine areas as compared to areas at lower altitudes, thus also the amount of human disturbance is relatively small in alpine areas (Holzinger et al. 2008). Disturbance is known to be negative for some species and positive for others (Lindgren et al. 2007). In my study area, generally little human disturbance was observed. Only four of the mountains had well used trails to the summit. Otherwise, it is mostly grazing and trampling that causes disturbances for the plants at the studied mountains. Considering fragmentation of the areas in between the mountains there are

relatively few people living in the study area, compared to in the Alps, and there are no large scale built out areas.

The number of different species and the pattern the species make in the terrain also depend on the structure and properties of the terrain (Gottfried et al. 1998). According to Holzinger et al. (2008) the speed of migration is higher at calcareous ground and for wind dispersed species. In the study area there are three mountains that differ from the rest in a geological manner, i.e. Kavringtind, Fastdalstind and Dreggfjell. The two first mentioned mountains are mainly made up of gabbro, while Dreggfjell is mainly granite (Jørgensen 1936). The rest of the mountains mainly consist of mica schist (Jørgensen 1936). This means that all the mountains, except for Dreggfjell, are calcareous to some extent. The germination of seeds are temperature dependent, and it is shown that seeds at high altitudes are more dependent on the right temperature than seeds from lower altitudes (Graae et al. 2008), and annual plants are thought to be more adaptable than perennials to climatic changes (Pitelka et al. 1997). The course to success in spreading is repeated attempts at doing so. Sooner or later the species will succeed in establishing at a new site (Pitelka et al. 1997). Increased disturbance, e.g. from weather extremes, can make habitats more vulnerable for invasive species, especially if species belonging naturally to the habitat dies of the same disturbances (Pitelka et al. 1997).

Competition

In my study area it apperars that some species have started to retreat from the lower altitudes while they increase their maximum altitude. This applies for example to the small dwarf shrub *Harrimanella hypnoides* (Figure 19). A warming climate with a following plant migration

Figure 19: *Harrimanella hypnoides*.

will increase competition at higher altitudes (Vittoz et al. 2009). Vascular plants compete with each other for light, a competition which trees and shrubs usually wins (Vittoz et al. 2009; Zimov et al. 1995). Another source of competition between plant species is the access to water. Nutrients are not linked directly to climate changes, but plant growth affect their abilities to compete for other resources (Zimov et al. 1995). The environment that the species are dependent of can be affected and altered by the predicted climate change (Gottfried et al. 1998). Due to climatic warming a change in the dominant species is expected (Walker et al. 2006). More competitive species will gain ground and fewer species will make up the dominant part of the vegetation cover (Walker et al. 2006). This can be the first step towards local extinctions (Walker et al. 2006). Klanderud & Birks (2003) suggested that species from lower altitudes will achieve new altitudes, and competition will increase. Such an increase will force the alpine specialist species to climb upwards, as they might be ousted at lower altitudes resulting in a lower abundance of these alpine species at the low altitudes (Klanderud & Birks 2003). Tape et al. (2006) showed for example that an increased shrub cover ousted shade intolerant species from the Alaskan tundra.

Summit species

Five out of nine summits show an increase, two an equal number and two a decrease in the number of species. At only one of the studied mountain summits, i.e. Máttagáisi, did I observe exactly the same species in 2008 as were observed in 1935. Climate determines the distribution of different habitats (Walther 2004). When species shift upward in altitude, the species composition at the different summits will become more homogenous and the beta diversity will thereby decrease (Jurasinski & Kreyling 2007). Snow bed species are especially threatened by the climate warming due to the loss of habitat (Schöb et al. 2009). In the central Alps, ousting of snow bed species by grassland species is already recorded (Schöb et al. 2009). In the artic, the snowdrifts which the snow bed species are dependent on, are limited by the amount of precipitation received, whereas the snowdrifts in the European alps are limited by wind (Björk & Molau 2007). The snow bed species can be seriously affected by the climatic warming in several ways (Totland & Alatalo 2002). The scenarios of a warmer climate in the future, with fewer days with snow cover, earlier melt off and lesser amounts of snow will increase the productivity in the snow beds and make them more vulnerable for invading species (Björk & Molau 2007). The plants preferring snow beds can be divided into two types of species; those who are restricted to the snow bed habitat, and those who also live

at higher altitudes, but prefer snow beds at lower altitudes to escape competition (Björk & Molau 2007). The snow beds are also important habitats for lemmings (*Lemmus lemmus*) and reindeer in the summer, and a decrease in this type of habitat will affect several trophic levels. The low annual productivity in this habitat is linked to the short growing season rather than to lacking resources (Björk & Molau 2007).

The most common summit species in this study, i.e. *Beckwithia glacialis* (Figure 20), is also the alpine plant species that grows at the highest altitude of all vascular plants in Scandinavia (Totland & Alatalo 2002). The species is a specialist of high attitudes (Schönswetter et al. 2004) and is especially well adapted to low temperatures during the growing season (Totland & Alatalo 2002). When exposed to a warming experiment, it showed interesting results by reducing the number of seeds and the seed-to-ovule ratio, a result opposite of the expected (Totland & Alatalo 2002). The species did not show any changes in size of stem and leaves in the experiment (Totland & Alatalo 2002). Such a result can be interpreted in the direction that warming will reduce the efficiency of spreading for the species, and in the long run lead to decreasing populations.

Figure 20: *Beckwithia glacialis*, the toughest of them all.

The Lyngen peninsula

Two of the mountains in my study stand out with a more extreme increase in the number of species than the others. These are the mountains Kavringtind and Fastdalstind, both at the Lyngen peninsula. This can partly be explained by the difference in time of the survey. Jørgensen examined the mountains almost three weeks earlier than me, on the 15th and 16th of July 1935, while I surveyed these mountains on the 3rd and 4th of August 2008. The reason why I waited so long to visit these two mountains was simply that I first had to wait for the snow to melt off. At the study dates in 2008, i.e. the same as when Jørgensen visited them in 1935, there were still good skiing conditions at both mountains. I also waited an extra week due to weather conditions that made it more reasonable to finish the survey in inner parts of Troms before heading to the coastal mountains at the Lyngen peninsula. Considering figures 21 and 22, I might have waited too long. The difference in snow cover is obvious, and at Fastdalstind Jørgensen made most of his registrations close to a glacier (Rotenvikbreen). This glacier had retreated considerably since the 1930s (personal observation), and none of my registrations were done especially close to it. The retreat of perennial snowdrifts was also experienced at Rostafjell. Here the visiting dates for both years were almost the same, but where Jørgensen was stopped from further ascent by a large snowdrift, I could easily pass. This decrease in glacier size suggests that there is something going on, even though the temperature and precipitation data show little change.

Grazing

I observed quite a large number of grazing sheep at two mountains at the Lyngen peninsula. At Kavringtind I observed grazing sheep at an altitude of 1150 m asl. There had been grazing animals, most likely reindeer, at the summit too, evidenced by manure and grazed flowers of *Beckwithia glacialis*. I only observed sheep grazing at one of the other mountains, Agjek, in the study in 2008. Reindeer was observed in a various degree at most of the mountains in the study, and at Máttagáisi I observed grazing cattle (*Bos taurus*) to a height of about 750 m asl. An increasing grazing pressure between 1935 and 2008 at the different mountains can also be a factor that influences the plants, and thereby the difference between my results and Jørgensen's. A Swedish study linked the observed decrease in species richness at most of the studied mountains to the increased amount of reindeer in the studied area (Moen & Lagerström 2008). A general increase in the numbers of both sheep and semi-domesticated reindeer (Figure 23) is registered in Norway in the last part of the 20th century

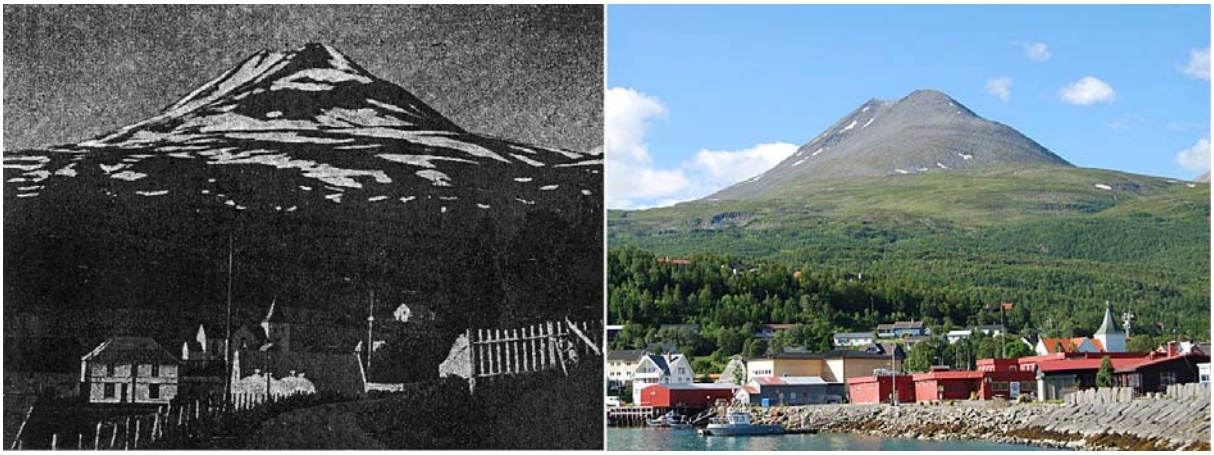


Figure 21: Kavringtind seen from Lyngseidet, 16th of July 1935 and 3rd of August 2008.

Figure 22: Fastdalstind seen from the highland south of the mountain, 16th of July 1935 and 4th of August 2008.

(Austrheim & Eriksson 2001). The alpine ecosystems are considered to have been grazed naturally since the end of the last ice age (Austrheim & Eriksson 2001), and the grazing and changes in grazing regimes are also believed to be important for the diversity of plant species (Zimov et al. 1995). It is not only the grazing in general that influences the plant communities, but also the density of grazing animals (Austrheim et al. 2008; Evju et al. 2006). It is shown that grazing by reindeer does not influence the increase in birch tree line significantly (Kullman & Öberg 2009). Other species, i.e. *Juniperus communis* and *Betula nana*, are found to gain by a moderate amount of grazing/disturbance (Austrheim et al. 2008), while species too small to be grazed efficiently can show negative effects due to trampling (Austrheim et al. 2008). There are also differences between species of grazers. Reindeer, for example, prefer flowers before leaves (Cooper 2006), while sheep show a preference to grasslands (Austrheim et al. 2008). Rodents can also affect the alpine plant communities severely (Austrheim et al. 2007), but the rodent population in 2008 had collapsed during the

winter and only dead individuals were seen during the study period (personal observation). In general, grazing is supposed to decrease the species richness in snow bed communities and at heaths, while an increase in species richness at productive sites can be observed when the grazing pressure is at a moderate level (Klanderud & Birks 2003). It is especially in transition zones between different biomes, e.g. alpine - nival, that grazing mammals would be able to impact the vegetation in such a way that a vegetation shift will occur due to grazing (Zimov et al. 1995). The modeling done by Zimov et al. (1995) shows that the severe human harvesting of herbivores could alone have lead to the shift in vegetation from grass-dominated steppe in the Pleistocene period to the moss-dominated tundra that is seen in the Beringia area today. Anyhow, changes in climate and ground conditions have also been contributing factors, especially for the growth of woody species (Zimov et al. 1995). I do not think that the increased amount of grazing animals should explain the increased maximum altitude for the alpine plants in the study area. If the increase in animals should have had any impact, it would have to be at a moderate level of disturbance, as is shown to trigger increased species richness at productive sites (Klanderud & Birks 2003).

Figure 23: Reindeer seen at Rostafjell.

Species decrease on one mountain

One of the mountains in my study, Tamokfjell, showed an opposite trend compared to the other. Here both the number of species and total observations had decreased. This is the same trend shown in a study in Jämtland in Sweden (Moen & Lagerström 2008). Why Tamokfjell

did show a decrease is uncertain. The route followed to the summit was at the southern slope of the mountain, which in other studies has been the slope with the largest increase in the number of species (Bahn & Körner 2003). Geologically does this mountain not differ from the other mica schist mountains, and it did not seem to be neither more people nor animals using it compared to the other mountains. The sampling went on just as on the other mountains, and the time spent was the same. The only difference were that I had to stop about 200 m below the summit due to thick fog, but this should not influence the number of species found at the lower parts of the mountain. There were none of the species which Jørgensen found above the point where I had to stop, that were not found at lower locations at the mountain when he did his study. I have no good explanation on why this mountain show a decrease in the number of species, since there is nothing special about the mountain that should indicate such an opposite result compared to the other mountains.

Advancing tree line

Not only the plant species in general are predicted to increase in altitude and numbers due to a warmer climate (Bahn & Körner 2003). The tree line is also assumed to rise (Kullman 2001; Walther et al. 2005b). My study also indicates such an increase. The tree species *Betula pubescens* showed the largerst increase in number of observations of all species found, and it also shows increasing maximum altitude. *B. pubescens* was found at only four of the mountains in 1935, while it now had established itself at all the studied mountains. Many of the individuals I recorded at high altitudes were young individuals (Figure 24). The uppermost individual I found was growing above 1300 m asl, whereas the uppermost individual Jørgensen (1936) found occurred at about 940 m asl. The species had on average increased its maximum altitude with 93 m. This was also observed in general during the field studies in 2008. Jørgensen placed the first location at the different mountains just above the tree line in 1935. In the summer of 2008 this location was, in most cases, in the birch forest (Figure 26).

Of the other tree species found in 1935, all were also found in 2008, except for *Alnus incana*. The ones found in 2008 all showed an increase in number of observations, but the average maximum altitude had decreased for *Pinus sylvestris* (Figure 25) and *Juniperus communis. P. sylvestris* were found at only one mountain in 1935, while at four in 2008, which gives me a

Figure 24: A young individual of *Betula pubescens* found at Brøran at 1150 m asl.

Figure 25: *Pinus sylvestris* observed above 1.000 m asl at the mountain Agjek.

Figure 26: Location 1 at the mountain Paras, 500 m asl. In 1935 this location was approximately 50 m above the tree line.

very unreliable maximum altitude to compare the 2008 study with. According to previous studies, *P. sylvestris* should have experienced a larger increase in altitude than *B. pubescens* (Kullman & Öberg 2009). *Sorbus aucuparia* and *Populus tremula* showed an increase in both the number of observations and the average maximum altitude.

A Swedish study shows that the increase in tree line is not a random happening due to the amount of individuals and the age of these, but rather an effect of changes in the environment (Kullman 2002). A large part of the increased amount of young trees in the Swedish study area had germinated before the area experienced a rapid temperature increase in the 1990s. Kullman (2002) therefore believes that an increased spread of seeds to the area was not the cause, but rather better germinating and growing conditions for the seedlings due to climatic warming.

Increasing dwarf shrubs

Along with the trees, also other woody species show large increases in both observations and altitude. These dwarf shrubs have a tendency to dominate in alpine ecosystems, and in the Nordic heathlands it is often *Empetrum nigrum ssp. hermaphroditum* that dominates (Tybirk et al. 2000). The species has the third largest increase in number of observations and the largest observed increase in average maximum altitude. These observations are in line with the results from Klanderud & Birks' (2003) study in Jotunheimen. *Empetrum* is a very strong competitor, even though it is a weak competitor for light (Tybirk et al. 2000). The species is shown to inhibit growth and seed germination in other species (Tybirk et al. 2000). It is the phenolic compound batatasin-III produced by the *Empetrum* species and released to the environment by contact with water, e.g. rain and dew, which is the inhibitor (Tybirk et al. 2000). This compound also makes the litter useless for species that do not have ericoid mycorrhiza, which is needed to be able to use the nutrients within the litter (Tybirk et al. 2000). The formation of dense mats, wind pollination and being spread far by animals and birds eating its berries, are other advantages of the species (Tybirk et al. 2000). The spread by birds also gives a high genetic diversity to the species (Szmidt et al. 2002). On the other side, it is sensitive to disturbances such as fire and trampling. It is also dependent on snow cover during winter to prevent freezing damage (Tybirk et al. 2000). When the species establishes new populations it is done mainly by seeds, and seeds is also the most common way of spreading in young populations (Szmidt et al. 2002). In older populations, clonal formation

become more frequent (Szmidt et al. 2002). In heating experiments it has been shown that a slight temperature increase of 1-2°C, can stimulate growth, while a further increase will act negatively on the species. However, the real effect of a climatic warming will vary with the different habitats and altitudes where the species is found (Tybirk et al. 2000). It has also been shown that *Empetrum,* since it is a slow germinating species, will benefit from warmer summers and a longer growing season (Graae et al. 2008).

Phyllodoce caerulea (Figure 27), which is another common and wide spread dwarf shrub in alpine areas, also showed a significant increase in altitude in my study area along with shrubs like *Salix reticulata*, *Vaccinium uliginosum* and *V. vitis-idaea*. In Alaska, a general increase in shrub cover is observed (Tape et al. 2006). This tendency seems also to be ongoing in Canada and Scandinavia (Tape et al. 2006). Tape et al. (2006) linked these findings to a warming climate, which was the most likely disturbance large enough to cause such a large scale change in shrub cover. Shrubs seem to gain from a warmer climate with warm summers and increased winter precipitation (snow) (Tape et al. 2006). Such a combination gives an increased nutrient availability that the shrubs can exploit better than other plants (Tape et al. 2006). The same tendencies are also shown in a warming experiment at tundra sites across the northern hemisphere (Walker et al. 2006). Walker et al. (2006) also showed that at low arctic and alpine sites, warming would trigger the greatest effect at the cover of deciduous shrubs and canopy height.

Figure 27: A white individual of *Phyllodoce caerulea* found at Agjek.

Time spent surveying

As discussed, there can be several explanations to the observed changes. A last explanation could be that I probably spent more time on each mountain, compared to Jørgensen (1936),

which seems likely when reading his notes carefully. The time I spent surveying each of the mountains, relative to altitudinal meters surveyed, is very equal between the mountains. This is except for at the first mountain surveyed, where I spent about the double amount of time. Despite the fact that I did my sampling alone, I found more species, and had a larger number of observations compared to the 1935 study where they were two persons doing the sampling. At Agjek we were three persons doing the survey, but we did not find more species or more observations than compared to when I did the registrations alone.

Conclusion

When climate warms, alpine plants will have three options; to stay, to migrate or to die (Walther et al. 2005b). It is predicted that a change towards a warmer climate most likely will lead to migration of species. Anyhow, there are several factors influencing the plants, not only the climate. The amount of received precipitation, disturbances and competition are amongst other factors to be considered when evaluating data from studies over long time spans, like in this study. My data show a significant increase in the number of species (P=0,011) and in the average maximum height for all species (P<0,001). An increase in the number of new species, not found in 1935, was also observed at most mountains. When looking more specifically at the individual species and their change in maximum altitude, 29 of the total 181 species that were found both years had significant values of change (P≤0,05). Amongst these 29 species several were trees or shrubs. The main focus has been on the warming climate, but since the temperature data for the study area show near to no change since the measurements started in 1921, I feel that there can be other elements influencing the alpine plants in the area as well. Grazing and trampling has been suggested to be a disturbing factor leading to either decreasing richness, if too little or too much of it, or to an increase in species abundance and richness when at a moderate level (Klanderud & Birks 2003). The amount of grazing animals in the study area has increased between the studied years, but as an increase in both abundance and richness of species on the mountains has been observed, I have to assume that the increasing amount of animals grazing is at a moderate level. The large increase registered for the species *B. pubescens* and *E. nigrum* ssp. *hermaphroditum* at the studied mountains is very interesting. It supports theories of increasing tree line (Kullman 2001) and the predicted increase of shrub cover (Tape et al. 2006; Walker et al. 2006). In general, an increase in maximum altitude is predicted to lead to the establishment of plants from lower altitudes, and in most cases thereby to an increased competition between species in the long run (Vittoz et al. 2009). The observed increase in shrub cover can for example lead to local extinction of shade intolerant species (Walker et al. 2006). It is also a question of whether the observed changes can be due to natural succession since the little ice age (Kammer et al. 2007). This theory is absolutely probable, especially when looking at the climatic data for the area. On the other hand, one have a visible retreat of the glaciers in the area. This suggests that there are climatic changes going on, even though they do not show on the Dividalen climate data. I believe that the observed changes in the alpine plant species can be a combination of several factors, both climatic changes and natural succession working together.

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Appendix 1

Site descriptions and species list

The mountains are listed here in the same range as they was visited. UTM codes are registered with a GPS (Garmin GPSmap 60CSx).

Rihpogáisi (Riphočohkka) (1195 m asl)
04.-05.07.2008

Map sheet 1633 II (Helligskogen).

The ascent started from Helligskogen mountain lodge. The weather was sunny, some wind and 13°C. It seemed like the mountain birch forest stopped at about 525 m asl. The registrations started at 500 m asl at the edge of a bog. Continued up a rich slope towards east and went over the mountain ridge between Basejávri and Rihpojávri. Then I crossed the river Roggejohka that runs between Rihpojávri and Roggejávri at a bridge. I stopped and camped beside the cabin that belongs to NVE south of Rihpojávri. At 10 pm the temperature was at 3°C at 515 asl. At 34 W 0485704 7675220 I found remains of an old sami turf hut. I believe this was the same as the one described by Jørgensen (1936). The 5th of July was the weather slightly cloudy and 8°C at 9 am. I tried to keep as close to Jørgensen's descriptions as possible on my way to the top. I arrived the top at 7:30 pm, the temperature was then 4°C.

Picture 1: Rihpogáisi towards south, seen from the ridge between Basejávri and Rihpojávri the 18th of July 1935 and the 4th of July 2008.

1. 500 m: 34 W 0486991 7676604. Edge of bog under slope towards E by a little creek.
2. 501 m: 34 W 0485625 7675196. By a creek running towards Reppojavre.

3. 534 m: 34 W 0485463 7675130. A barren ridge with heather and rocks.
4. 645 m: 34 W 0485056 7675001. Slope towards NEE with quite many rocks.
5. 710 m: 34 W 0484915 7674939. Slope towards NEE. Moist.
6. 809 m: 34 W 0484572 7674997. Starting at an E slope moist of snowmelt. Quite many rocks and snowbeds.
7. 900 m: 34 W 0484205 7674958. Below a talus.
8. 948 m: 34 W 0484092 7675093. Slope towards SE. Dry.
9. 1000 m: 34 W 0484029 7675216. Steep slope towards SEE.
10. 1060 m: 34 W 0484032 7675353. Steep slope towards SE. Dry. Rocky.
11. 1090 m: 34 W 0484003 7675382. Steep slope towards SE.
12. 1210 m: 34 W 0483621 7675681. Summit plateau. Poor. Rocks.

Location	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Meters asl	**500**	**500**	**534**	**645**	**710**	**809**	**900**	**948**	**1000**	**1060**	**1090**	**1210**
1 *Aethusa cynapium*	1											
2 *Agrostis capillaris*	1											
3 *Agrostis mertensii*			1									
4 *Alchemilla spp.*	1	1	1	1	1		1					
5 *Andromeda polifolia*			1	1	1	1						
6 *Angelica archangelica*				1								
7 *Angelica sylvestris*	1				1							
8 *Antennaria alpina*								1	1		1	
9 *Antennaria dioica*				1				1				
10 *Anthoxanthum nipponicum*	1	1						1				
11 *Anthriscus sylvestris*	1											
12 *Arabis alpina*					1							1
13 *Arctous alpinus*	1	1	1	1	1	1		1				
14 *Astragalus alpinus*	1		1									
15 *Astragalus frigidus*		1			1							
16 *Athyrium distentifolium*	1				1							
17 *Bartsia alpina*	1	1	1	1	1	1	1	1	1	1	1	
18 *Beckwithia glacialis*											1	
19 *Betula nana*	1		1	1	1	1	1	1				
20 *Betula pubescens*	1	1	1									
21 *Bistorta vivipara*	1			1	1	1	1	1	1	1	1	
22 *Calamagrostis phragmitoides*	1											
23 *Caltha palustris*	1											

24	*Campanula rotundifolia*			1									
25	*Cardamine bellidifolia*			1									
26	*Carex aquatilis*	1	1		1	1	1		1	1			
27	*Carex bigelowii*							1				1	
28	*Carex dioica*					1							
29	*Carex fuliginosa ssp. misandra*					1				1			
30	*Carex nigra*	1		1									
31	*Carex rupestris*										1		
32	*Carex vaginata*	1	1	1	1	1	1	1	1	1			
33	*Cassiope tetragona*			1	1	1	1	1	1	1	1	1	
34	*Cerastium alpinum*			1									
35	*Chamaepericlymenum suecisum*	1	1	1									
36	*Chamerion augustifolium*	1	1	1									
37	*Cicerbita alpina*	1											
38	*Cirsium heterophyllum*	1	1										
39	*Coeloglossum viride*	1	1										
40	*Comarum palustre*	1	1										
41	*Cystopteris fragilis*				1								
42	*Deschampsia cespitosa*								1				
43	*Diapensia lapponica*	1		1	1	1	1		1		1	1	
44	*Diphasiastrum alpinum*			1	1	1			1				
45	*Draba spp.*												1
46	*Dryas octopetala*	1		1	1	1	1	1	1	1	1	1	1
47	*Dryopteris filix-mas*			1									
48	*Empetrum nigrum spp. hermaphroditum*	1	1	1	1	1	1	1	1				
49	*Equisetum arvense*							1		1			
50	*Equisetum pratense*		1	1		1							
51	*Equisetum sylvaticum*	1				1							
52	*Equisetum variegatum*					1	1	1	1		1	1	
53	*Erigeron uniflorus*										1		
54	*Eriophorum angustifolium*	1											
55	*Eriophorum vaginatum*	1											
56	*Festuca ovina*												
57	*Festuca vivipara*	1	1										
58	*Filipendula ulmaria*	1											
59	*Geranium sylvaticum*	1	1			1							
60	*Gymnocarpium dryopteris*	1											
61	*Harrimanella hypnoides*	1		1	1	1	1	1	1	1	1	1	1

62	*Hieracium alpina*	1	1	1	1						1	1	
63	*Hieracium spp.*	1	1		1								
64	*Hierochloë alpina*	1		1				1				1	1
65	*Huperzia selago*				1	1	1	1	1		1	1	1
66	*Juncus trifidus*	1											
67	*Juniperus communis*	1	1	1									
68	*Linnaea borealis*		1										
69	*Listera cordata*	1	1										
70	*Loiseleuria procumbens*	1		1	1	1							
71	*Luzula confusa*												1
72	*Luzula multiflora ssp. frigida*		1										
73	*Lycopodium annotinum ssp. alpestre*	1	1										
74	*Lycopodium clavatum*	1	1	1	1						1		
75	*Melampyrum pratense*	1	1										
76	*Minuartia biflora*						1						
77	*Myosotis decumbens*	1											
78	*Omalotheca norvegica*					1							
79	*Omalotheca supina*				1		1			1			
80	*Oxyria digyna*	1	1	1	1	1	1	1		1			
81	*Oxytropis lapponica*	1	1	1	1	1	1	1	1	1	1	1	
82	*Parnassia palustris*	1											
83	*Pedicularis flammea*	1			1	1	1			1	1	1	
84	*Pedicularis hirsuta*				1	1	1					1	1
85	*Pedicularis lapponica*	1	1	1	1	1	1	1		1			
86	*Phegopteris connectilis*	1											
87	*Phyllodoce caerula*	1	1	1	1	1		1	1	1		1	
88	*Pinguicula alpina*	1		1	1	1	1	1		1	1	1	
89	*Pinguicula vulgaris*	1		1									
90	*Pinus sylvestris*	1											
91	*Poa pratensis*		1										
92	*Potentilla crantzii*	1		1	1	1	1	1	1	1	1	1	
93	*Pseudoorchis straminea*	1				1							
94	*Pyrola spp.*	1	1		1	1	1	1	1				
95	*Ranunculus nivalis*				1	1	1	1	1				
96	*Rhodiola rosea*	1	1		1	1	1	1	1	1	1	1	
97	*Rhododenron lapponicum*				1	1	1	1		1	1	1	
98	*Rubus chamaemorus*	1	1	1	1								
99	*Rubus saxatilis*	1	1										

100	*Rumex spp.*	1	1		1	1							
101	*Sagina cespitosa*						1						
102	*Salix herbacea*			1	1					1		1	1
103	*Salix reticulata*	1	1		1	1	1	1	1		1	1	
104	*Salix spp.*	1	1	1	1	1	1	1	1	1	1	1	
105	*Saussurea alpina*	1	1	1	1		1	1	1	1		1	
106	*Saxifraga aizoides*				1	1	1						
107	*Saxifraga cernua*			1			1						
108	*Saxifraga nivalis*	1		1									
109	*Saxifraga oppositifolia*	1		1	1	1	1	1		1	1	1	
110	*Saxifraga tenuis*				1								
111	*Sibbaldia procumbens*				1			1	1	1		1	
112	*Silene aucalis*	1		1	1	1	1	1	1	1		1	1
113	*Silene dioica*	1											
114	*Solidago virgaurea*	1	1	1	1								
115	*Stellaria nemorum*	1											
116	*Taraxacum section Taraxacum*				1	1	1	1	1				
117	*Thalictrum alpinum*	1	1		1	1	1	1	1	1	1	1	
118	*Tofieldia pusilla*	1		1	1	1	1	1		1	1	1	
119	*Trichophorum cespitosum*			1	1								
120	*Trientalis europaea*	1	1	1									
121	*Trollius europaeus*	1	1	1	1	1	1	1	1				
122	*Vaccinium myrtillus*	1	1		1	1							
123	*Vaccinium uliginosum*	1	1	1	1	1	1	1	1		1		
124	*Vaccinium vitis- idaea*	1	1	1	1	1		1	1	1	1	1	1
125	*Viola biflora*	1	1	1	1	1	1	1	1	1		1	
126	*Woodsia spp.*	1			1							1	

Agjek (Ádjit) (1262 m asl)
07.-08.07.2008

Map sheet 1633 I (Manndalen) and 1633 IV (Skibotn).

The ascent started at the south side of the mountain from a forest road, just above the UiTØ field station in the Skibotn valley. The weather was sun from a cloudless sky and about 13°C. The first day did I sample the sites 1-4 and 8-12. The sites 5-7 were at the other side of the mountain and were sampled the next day. At the top was the temperature about 5°C. At the 8th of July the weather was sunny, cloudless and 16°C. I then started from a little parking lot at the northern side of the mountain. At Agjek did the mountain birch forest grow up to a height of about 625 m asl, but individual trees of both birch and pine was registered above 1000 m asl. At the north side of the mountain did both sheep and semi-domesticated reindeer graze.

Picture 2: Adjek seen from the south (left), the 7th of July 2008, and from the north, the 8th of July 2008.

1. 521 m: 34 W 0475874 7695518. Dry heather covered slope towards SW.
2. 590 m: 34 W 0475842 7695721. Dry slope towards SW.
3. 700 m: 34 W 0475764 7696172. Relatively dry slope towards SWW.
4. 802 m: 34 W 0475833 7696289. At a mountain edge with mica schist. Dry.
5. 800 m: 34 W 0476852 7697112. Green area N of the river.
6. 900 m: 34 W 0477032 7696525. At the mountain ridge towards N of the summit. Hikes towards NE in direction of green spot at the other side of the river.
7. 970 m: 34 W 0477102 7696254. Slope towards N. Snowbeds and tiny creeks.
8. 1000 m: 34 W 0476350 7695972.
9. 1080 m: 34 W 0476506 7696110. At the N side of the mountain. Rocks. Dry.
10. 1140 m: 34 W 0476863 7695774. Rocky. Snowbeds.

11. 1210 m: 34 W 0477146 7695549. At the N side of the mountain. Rocks. Dry.

12. 1267 m: 34 W 0477324 7695447. The summit.

Location	1	2	3	4	5	6	7	8	9	10	11	12
Meters asl	**521**	**590**	**700**	**802**	**800**	**900**	**970**	**1000**	**1080**	**1140**	**1210**	**1267**
1 *Andromeda polifoila*	1	1			1							
2 *Antennaria alpina*					1	1	1					
3 *Arctous alpinus*	1	1	1	1				1				
4 *Athyrium distentifolium*							1					
5 *Avenella flexuosa*	1	1	1	1		1						
6 *Bartsia alpina*					1	1						
7 *Beckwithia glacialis*								1	1	1	1	1
8 *Betula nana*	1	1	1	1	1	1						
9 *Betula pubescens*	1	1	1	1	1			1				
10 *Bistorta vivipara*			1	1	1	1	1	1		1		
11 *Calluna vulgaris*	1	1			1							
12 *Cardamine bellidifolia*					1	1	1	1	1	1	1	1
13 *Carex aquatilis*		1										
14 *Carex bigelowii*		1	1	1	1	1	1	1	1			
15 *Carex nigra*	1											
16 *Carex nigra*		1			1							
17 *Cassiope tetragona*		1	1	1	1	1	1	1	1	1	1	1
18 *Cerastium cerastoides*						1						
19 *Chamaepericlymenum suecisum*	1	1										
20 *Chamerionaugustifolium*			1									
21 *Diapensia lapponica*	1	1	1	1		1	1	1	1			
22 *Diphasiastrum alpinum*	1	1	1	1		1	1					
23 *Empetrum nigrum spp. hermaphroditum*	1	1	1		1	1	1	1	1			
24 *Equisetaceae arvense*					1							
25 *Equisetaceae sylvaticum*	1											
26 *Eriophorum anustifolium*						1						
27 *Eriophorum scheuchzeri*					1							
28 *Eriophorum vaginatum*	1				1							
29 *Festuca ovina*		1	1				1	1	1			1
30 *Festuca rubra spp. rubra*	1		1	1	1	1		1				
31 *Festuca vivipara*									1		1	1
32 *Gymnocarpium dryopteris*	1											
33 *Harrimanella hypnoides*					1	1	1	1	1	1	1	

34 *Hieracium alpina*	1	1	1	1	1	1	1	1			1	
35 *Hierochloë alpina*			1	1			1	1	1		1	1
36 *Huperzia selago*			1	1	1	1	1	1	1	1	1	1
37 *Juncus trifidus*	1	1	1	1	1	1	1	1	1	1		
38 *Juniperus communis*	1	1	1	1				1				
39 *Linnaea borealis*		1										
40 *Listera cordata*	1											
41 *Loiseleuria procumbens*	1	1	1	1	1	1		1				
42 *Luzula arcuata*								1				
43 *Luzula confusa*		1	1		1	1	1	1	1	1	1	1
44 *Luzula multiflora*		1							1			
45 *Luzula pilosa*	1											
46 *Luzula spicata*								1				
47 *Lycopodium clavatum*	1	1	1	1	1							
48 *Melampyrum pratense*	1				1							
49 *Oxyria digyna*					1	1						
50 *Pedicularis hirsuta*					1	1	1		1			
51 *Pedicularis lapponica*	1	1	1	1	1							
52 *Phyllodoce caerulea*	1	1	1	1	1	1	1	1	1	1	1	
53 *Pinguicula vulgaris*	1	1	1		1	1						
54 *Pinus sylvestris*	1	1	1					1				
55 *Populus tremula*	1											
56 *Pyrola spp.*					1							
57 *Ranunculus nivalis*						1	1					
58 *Rhodiola rosea*					1	1	1					
59 *Rhododendron lapponicum*				1								
60 *Rubus chamaemorus*	1			1								
61 *Salix herbacea*	1	1	1	1	1	1	1	1	1	1	1	1
62 *Salix spp.*	1	1	1	1	1	1		1	1			
63 *Saussurea alpina*							1					
64 *Saxifraga stellaris*						1						
65 *Saxifraga tenuis*											1	
66 *Sibbaldia procumbens*							1					
67 *Silene acaulis*						1	1	1	1	1	1	1
68 *Solidago virgaurea*	1	1	1			1		1				
69 *Sorbus aucuparia*	1											
70 *Taraxacum section taraxacum*					1	1						
71 *Thalictrum alpinum*					1							

72 *Trichophorum cespitosum*	1			1							
73 *Trientalis europaea*	1		1								
74 *Trisetum spicatum*								1			
75 *Vaccinium myrtillus*	1	1	1	1	1						
76 *Vaccinium uliginosum*	1	1	1	1	1	1	1		1		
77 *Vaccinium vitis-idaea*	1	1	1		1	1	1	1	1	1	1
78 *Viola biflora*					1	1	1				

Paras (Bárrás) (1419 m asl)

11.07.2008

Map sheet 1633 III (Signaldalen).

Parked the car at the parking lot furthest up in the Signal valley. Walked at a forest road for about one kilometer before I started the ascent of the mountain. The entire mountain is pretty steep, and I stopped at 1402 m asl because I did not dare to climb to the main summit. The weather was cloudy, but no precipitation. At 9:30 am at 500 m asl was the temperature about 10 °C. The mountain birch forest reached here up to about 620 m asl. At the southern side of the mountain is there a path to the summit. I came onto this one at a height of about 1180 m asl.

Picture 3: Paras seen from the Signal Valley, 23rd of July 1935 and 11th of July 2008.

1. 500 m: 34 W 0464971 7666969. Steep slope towards NWW. A rich mountain birch forest.
2. 580 m: 34 W 0465069 7666889. Half dry, steep slope towards W.
3. 650 m: 34 W 0465158 7666488. Old river-/creek bed. Steep slope towards W.
4. 760 m: 34 W 0465389 7666160. By a creek. Slope towards NW.
5. 840 m: 34 W 0465623 7665883. Slope towards W. Some talus. A little moist.

6. 940 m: 34 W 0465852 7665780. Under a cliff at the top of a talus. Steep towards WSW.
7. 990 m: 34 W 0466008 7665557. Grass covered rock field/talus towards WSW.
8. 1070 m: 34 W 0466136 7665524. Stones and rocks. Steep towards WSW.
9. 1120 m: 34 W 0466347 7665394. Stones and rocks. Steep towards SW.
10. 1165 m: 34 W 0466563 7665381. Steep towards S.
11. 1200 m: 34 W 0466620 7665425. Steep rocky slope towards SSE.
12. 1260 m: 34 W 0466558 7665493. Steep rocky slope towards SSE.
13. 1300 m: 34 W 0466525 7665553. Steep rocky slope towards SSE.
14. 1350 m: 34 W 0466494 7665630. Steep rocky slope towards SSE.

1402 m: 34 W 0466477 7665723. Where I stopped.

Location	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
Meters asl	**500**	**580**	**650**	**760**	**840**	**940**	**990**	**1070**	**1120**	**1165**	**1200**	**1260**	**1300**	**1350**
1 *Alchemilla spp.*		1	1	1	1									
2 *Andromeda polifolia*			1	1										
3 *Angelica archangelica*		1												
4 *Antennaria alpina*				1	1	1	1	1	1	1	1	1	1	1
5 *Antennaria dioica*	1	1	1											
6 *Anthoxanthum nipponicum*	1	1		1	1	1								
7 *Arabis alpina*				1	1	1	1	1	1	1	1			
8 *Arctous alpinus*			1	1										
9 *Armeria scabra*		1	1	1	1									
10 *Asplenium viride*		1												
11 *Astragalus alpinus*	1													
12 *Astragalus frigidus*			1											
13 *Avenella flexuosa*	1	1	1		1									
14 *Bartsia alpina*	1	1	1	1		1	1	1	1	1				
15 *Beckwithia glacialis*					1	1			1	1	1	1	1	1
16 *Betula nana*		1	1	1										
17 *Betula pubescens*	1	1	1	1	1	1								
18 *Bistorta vivipara*		1	1	1	1	1	1	1	1	1	1			
19 *Campanula rotundifolia*	1	1												
20 *Campanula uniflora*											1			
21 *Cardamine bellidifolia*													1	1
22 *Carex aquatilis*				1		1								
23 *Carex atrata*	1													

24 *Carex atrofusca*			1												
25 *Carex bigelowii*			1	1	1	1	1								
26 *Carex fuliginosa ssp. misandra*				1											
27 *Carex lachenalii*					1										
28 *Carex rupestris*							1		1						
29 *Carex vaginata*		1	1	1		1	1								
30 *Cassiope tetragona*	1	1	1	1			1								1
31 *Cerastium alpinum*		1	1		1	1			1						
32 *Chamaepericlymenum suecicum*	1														
33 *Chamerion augustifolium*	1	1				1									
34 *Coeloglussum viride*	1	1	1	1											
35 *Corallorhiza trifida*		1	1	1											
36 *Diapensia lapponica*		1	1			1									
37 *Diphasiastrum alpinum*			1												
38 *Draba spp.*						1			1		1	1	1		
39 *Dryas octopetala*	1	1	1	1		1	1	1	1	1	1				
40 *Dryopteris filix-mas*		1	1			1		1							
Empetrum nigrum spp.															
41 *hermaphroditum*	1	1	1	1		1									
42 *Equisetum arvense*						1									
43 *Equisetum pratense*		1	1	1											
44 *Equisetum variegatum*	1	1		1	1		1		1						
45 *Erigeron uniflorus*					1	1		1	1	1	1				
46 *Eriophorum anustifolium*				1											
47 *Euphrasia wettsteinii*	1														
48 *Festuca ovina*	1				1	1			1						
49 *Festuca vivipara*									1		1				
50 *Geranium sylvaticum*	1	1	1												
51 *Gymnadenia conopsea*		1													
52 *Gymnocarpium dryopteris*	1	1													
53 *Harrimanella hypnoides*		1	1				1								
54 *Hieracium alpina*		1		1	1	1									
55 *Hieracium spp.*	1	1													
56 *Huperzia selago*			1	1		1					1	1	1	1	
57 *Juncus trifidus*		1			1	1									
58 *Juniperus communis*	1	1	1												
59 *Linnaea borealis*	1	1													
60 *Luzula arcuata*									1		1	1			

61 *Luzula confusa*		1										1	1	1	
62 *Luzula multiflora*				1	1										
63 *Luzula spicata*						1			1		1	1			
64 *Lycopodium clavatum*	1		1												
65 *Melampyrum pratense*	1														
66 *Minuartia biflora*					1	1									
67 *Myosotis spp.*	1	1		1	1										
68 *Omalotheca norvegica*		1													
69 *Orthilia secunda*		1													
70 *Oxyria digyna*		1	1	1	1	1	1	1	1	1					
71 *Oxytropis lapponica*	1	1	1	1	1	1	1	1		1					
72 *Papaver radicatum*									1	1					
73 *Parnassia palustris*		1													
74 *Pedicularis hirsuta*			1												
75 *Pedicularis lapponica*	1	1	1	1		1									
76 *Phegopteris connectilis*	1														
77 *Phleum alpinum*	1														
78 *Phyllodoce caerulea*	1	1	1	1	1	1	1		1						
79 *Pinguicula alpina*		1	1	1		1	1								
80 *Pinguicula vulgaris*	1	1	1												
81 *Poa alpina*		1	1	1	1		1	1	1	1	1	1	1	1	
82 *Poa alpina var. vivipara*						1		1	1						
83 *Poa arctica*							1								
84 *Polystichum lonchitis*		1													
85 *Potentilla crantzii*	1	1	1	1	1	1	1	1	1	1	1	1			
86 *Pseudorchis straminea*		1	1												
87 *Pyrola spp.*	1	1	1	1	1										
88 *Ranunculus acris*					1										
89 *Ranunculus nivalis*								1		1					1
90 *Ranunculus pygmaeus*										1					
91 *Rhodiola rosea*		1	1	1	1	1	1	1	1	1	1	1			
92 *Rubus saxatilis*	1	1													
93 *Rumex spp.*	1	1	1	1	1	1									
94 *Salix herbacea*					1	1			1		1	1	1	1	
95 *Salix reticulata*	1	1	1	1	1	1	1	1	1	1					
96 *Salix spp.*	1	1	1	1	1	1	1	1	1	1					
97 *Saussurea alpina*	1	1	1	1	1	1	1	1	1	1	1				
98 *Saxifraga aizoides*		1	1	1											

99	*Saxifraga cernua*		1	1		1	1	1	1	1	1	1			1
100	*Saxifraga cespitosa*						1	1		1		1	1		
101	*Saxifraga nivalis*		1					1	1	1	1	1	1		1
102	*Saxifraga oppositifolia*				1	1	1		1		1	1	1		1
103	*Saxifraga stellaris*	1													
104	*Saxifraga tenuis*											1			
105	*Sibbaldia procumbens*				1		1			1	1				
106	*Silene acaulis*	1	1	1	1	1	1	1	1	1	1	1	1	1	1
107	*Silene dioica*	1	1												
108	*Silene wahlbergella*									1					
109	*Solidago virgaurea*	1	1	1	1	1	1								
110	*Sorbus aucuparia*	1	1												
111	*Stellaria nemorum*	1													
112	*Taraxacum section taraxacum*		1		1	1	1		1						
113	*Thalictrum alpinum*	1	1	1	1	1	1	1	1	1					
114	*Tofieldia pusilla*		1	1	1										
115	*Trichophorum cespitosum*			1	1								1		
116	*Trientalis europaea*	1	1												
117	*Trisetum spicatum*								1			1	1		1
118	*Trollius europaeus*	1	1	1	1	1	1								
119	*Vaccinium myrtillus*	1	1												
120	*Vaccinium uliginosum*	1	1	1	1		1	1							
121	*Vaccinium vitis-idaea*	1	1		1	1	1	1	1	1		1	1	1	1
122	*Veronica alpina*		1	1	1	1			1	1					
123	*Viola biflora*	1	1	1	1	1	1	1	1	1	1				
124	*Viscaria alpina*		1			1	1								

Polvartind (1275 m asl)

14.07.2008

Map sheet 1633 III (Signaldalen).

I started from the Vassdal farm in the Signal valley and followed a path to the Lake Signalnes from were I started my registrations. It was 18°C, cloudy, dry spell in the morning, but later I got rain and the clouds lowered down to the tree line. The mountain birch forest went here up to a height of about 400 m asl. The species *Alchemilla alpina* and *Cryptogramma crispa* was observed at the southern side of the lake, while my registrations started at the northern side according to Jørgensen's (1936) descriptions. The snow had quite recently melted off and the vegetation had not come very far above 650 m asl. The sami had a large camp in the nearby area, and one could notice that there had been quite much reindeer in the area recently from the amount of trampling and manure.

Picture 4: Polvartind seen from Lake Signalnes, the 14th of July 2008.

1. 528 m: 34 W 0460571 7672235. By the outlet of Lake Signalnes. Bog.
2. 600 m: 34 W 0460062 7672437. Slope towards S. Quite much *Salix.*
3. 680 m: 34 W 0460014 7672665. Slope towards S. Heather and rocks.
4. 780 m: 34 W 0459735 7673005. Steep snowbed towards S.
5. 840 m: 34 W 0459661 7673141. Steep slope towards SSW.
6. 910 m: 34 W 0459658 7673257. Steep slope towards SSW. Quite much rocks and block.

7. 990 m: 34 W 0459548 7673418. Steep slope towards S. At the S side of the ridge towards NWW to the summit.
8. 1030 m: 34 W 0459493 7673493. Steep, at the S edge of the ridge towards the summit. Lots of rocks.
9. 1070 m: 34 W 0459402 7673579. At the ridge towards the summit. Rocky.
10. 1100 m: 34 W 0459305 7673613. At the ridge towards the summit.
11. 1130 m: 34 W 0459211 7673679. Underneath the summit. To steep to hike further.

Location	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
Meters asl	**500**	**600**	**680**	**780**	**840**	**910**	**990**	**1030**	**1070**	**1100**	**1130**
1 *Alchemilla spp.*	1	1									
2 *Andromeda polifolia*	1	1	1	1							
3 *Antennaria alpina*		1		1	1						
4 *Antennaria dioica*	1					1	1		1	1	
5 *Anthoxanthum nipponicum*	1	1	1	1	1	1					
6 *Arctous alpinus*			1		1						
7 *Astragalus alpina*		*1*									
8 *Athyrium distentifolium*	1	1	1	1	1	1					
9 *Avenella flexuosa*	1	*1*	1			1		1			
10 *Bartsia alpina*	1	1	1	1							
11 *Beckwithia glacialis*				1		1	1			1	1
12 *Betula nana*	1	1	1	1	1						
13 *Betula pubescens*	1			1	1	1					
14 *Bistorta vivipara*	1	1	1	1	1	1	1				
15 *Cardamine bellidifolia*				1	1	1	1		1	1	1
16 *Carex aquatilis*		*1*		1		1	1	1			
17 *Carex bigelowii*	1	1	1	1					1		
18 *Carex lachenalii*			1	1							1
19 *Carex nigra*			1							1	
20 *Carex rotundata*	1										
21 *Carex vaginata*	1	*1*	1	1	1	1					
22 *Cassiope tetragona*				1	1	1	1	1	1		
23 *Cerastium cerastoides*	1	*1*	1								
24 *Chamaepericlymenum suecisum*		1	1								
25 *Chamerion augustifolium*				1	1						
26 *Comarum palustre*	1	1									
27 *Cryptogramma crispa*							1				

28	*Deschampsia cespitosa*		1			1						
29	*Diapensia lapponica*			1	1	1	1					
30	*Diphasiastrum alpinum*	1	1	1		1	1					
31	*Empetrum nigrum spp. hermaphroditum*	1	1	1	1	1	1	1		1		
32	*Epilobium anagallidifolium*		1									
33	*Equisetum pratense*		1									
34	*Equisetum variegatum*		1									
35	*Erigeron uniflorus*			1								
36	*Eriophorum anustifolium*	1	1	1								
37	*Euphrasia wettsteinii*		1									
38	*Festuca ovina*			1								
39	*Festuca rubra spp. Rubra*	1	1	1	1	1	1					
40	*Festuca vivipara*				1		1	1				
41	*Filipendula ulmaria*		1									
42	*Geranium sylvaticum*		1									
43	*Harrimanella hypnoides*	1	1	1	1	1	1	1	1	1	1	1
44	*Hieracium alpina*	1	1	1		1	1	1				
45	*Hierochloë alpina*							1	1		1	
46	*Hierochloë odorata*		*1*									
47	*Huperzia selago*	1	*1*	1	1	1	1	1	1	1	1	
48	*Juncus trifidus*	1	1	1	1	1	1	1	1	1	1	
49	*Juniperus communis*		*1*									
50	*Loiseleuria procumbens*	1		1				1				
51	*Luzula arcuata*				1	1	1	1	1	1		1
52	*Luzula confusa*								1	1	1	1
53	*Luzula multiflora*		1	1							1	
54	*Luzula parviflora*				1	1	1					
55	*Luzula spicata*		1				1					
56	*Lycopodium annotinum ssp. alpestre*		*1*	1								
57	*Lycopodium clavatum*					1						
58	*Nardus stricta*	1	1	1								
59	*Omalotheca spp.*	1	*1*								1	
60	*Omalotheca supina*							1				
61	*Oxyria digyna*	1									1	
62	*Oxytropis lapponica*		1									
63	*Pedicularis lapponica*	1	1	1	1	1	1					
64	*Phegopteris connectilis*		1									
65	*Phleum alpinum*		*1*	1	1							

66 *Phyllodoce caerula*	1	1	1	1	1	1	1	1	1	1	
67 *Pinguicula alpina*		1									
68 *Pinguicula vulgaris*	1	1	1	1							
69 *Potentilla crantzii*		1									
70 *Pyrola spp.*	1	1		1	1						
71 *Ranunculus acris*	1	1	1								
72 *Ranunculus nivalis*				1		1					
73 *Ranunculus pygmaeus*										1	
74 *Rhodiola rosea*	1	1	1	1	1	1					
75 *Rubus chamaemorus*	1		1	1		1					
76 *Rumex spp.*	1	1	1	1							
77 *Salix spp.*	1	1	1	1	1	1					
78 *Salix herbacea*	1	1	1	1	1	1	1	1	1	1	1
79 *Saussurea alpina*	1		1	1	1						
80 *Saxifraga stellaris*		1	1								
81 *Saxifraga tenuis*					1	1					
82 *Sibbaldia procumbens*	1	1	1	1	1	1	1		1	1	
83 *Silene acaulis*			1								
84 *Solidago virgaurea*	1	1	1	1	1	1					
85 *Taraxacum section taraxacum*	1	1	1	1		1				1	
86 *Thalictrum alpinum*	1	1									
87 *Tofieldia pusilla*		1	1								
88 *Trichophorum cespitosum*	1	1	1	1							
89 *Trientalis europaea*	1	1	1	1		1					
90 *Trollius europaeus*	1	1									
91 *Vaccinium myrtillus*	1	1	1	1							
92 *Vaccinium uliginosum*	1	1	1	1	1						
93 *Vaccinium vitis-idaea*	1	1	1	1	1	1	1	1	1		
94 *Veronica alpina*	1	*1*	1	1							
95 *Viola biflora*	1	*1*	1	1	1	1					
96 *Viola palustris*	1	*1*	1	1							

Dreggfjell (1140 m asl)

23.07.2008

Map sheet 1532 I (Dividalen).

I interpreted Jørgensen's descriptions of the mountain Bærhaugen to be the mountain Dreggfjellet. The ascent started from Frihetsli in Dividalen, and the River Dividalen was crossed at a bridge, not by horse as Jørgensen had to. The weather at start was 11°C, cloudy, but dry spell. The mountain birch forest stops at about 570 m asl. Trough the day was there some rain and a little fog, but it eased a little when I approached the summit. At the summit was the temperature 5°C, and there was some wind and light rain. I crossed a river at about 690 m asl.

Picture 5: Dreggfjell seen from the bog at the saddle between the Dreggfjell and Bærhaugen (Bearraloalgi), the 23rd of July 2008.

1. 600 m: 34 W 0446376 7627858. Hillside with heath towards ENE S of Bærhaugen (Bearraloalgi).
2. 680 m: 34 W 0446247 7627687. E slope with heath N of the river S of Bærhaugen (Bearraloalgi).
3. 820 m: 34 W 0445855 7627846. In the valley S of Bærhaugen (Bearraloalgi). Slope towards E.
4. 943 m: 34 W 0444751 7627712. At the saddle between the Dreggfjell and Bærhaugen (Bearraloalgi). A bog with a little creek.

5. 1055 m: 34 W 0444518 7627231. Talus towards NE. Moist. A little creek underneath the talus.
6. 1210 m: 34 W 0444604 7626529. At the plateau E of the summit. Small ponds and creeks.
7. 1362 m: 34 W 0444175 7626086. Steep. Sharp rocks in talus towards SE.
8. 1470 m: 34 W 0443905 7626460. The summit. Rock plain.

Location	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Meters asl	**600**	**680**	**820**	**943**	**1055**	**1210**	**1362**	**1470**
1 *Agrostis capillaris*		1						
2 *Alchemilla spp.*		1	1					
3 *Andromeda polifolia*		1		1				
4 *Angelica archangelica*		1						
5 *Antennaria alpina*					1			
6 *Antennaria dioica*	1	1	1	1				
7 *Anthoxanthum nipponicum*	1	1	1					
8 *Arabis alpina*		1	1	1	1			
9 *Arctous alpinus*	1	1		1				
10 *Astragalus alpinus*		1						
11 *Astragalus frigidus*	1							
12 *Athyrium distentifolium*			1					
13 *Avenella flexuosa*	1	1						
14 *Bartsia alpina*	1	1	1	1				
15 *Beckwithia glacialis*		1	1	1	1	1	1	1
16 *Betula nana*	1	1	1	1				
17 *Betula pubescens*	1	1	1					
18 *Bistorta vivipara*	1	1	1	1	1	1		
19 *Campanula rotundifolia*	1	1						
20 *Campanula uniflora*				1	1			
21 *Cardamine bellidifolia*				1	1	1	1	
22 *Carex aquatilis*		1	1	1		1		
23 *Carex bigelowii*	1	1				1		1
24 *Carex fuliginosa ssp. misandra*				1	1	1		
25 *Carex lachenalii*			1					
26 *Carex nigra*			1	1				
27 *Carex norvegica*				1				
28 *Carex rupestris*							1	

29 *Carex vaginata*			1	1				
30 *Cassiope tetragona*	1	1	1	1	1	1	1	
31 *Cerastium alpinum*		1	1	1	1	1		
32 *Chamaepericlymenum suecisum*	1							
33 *Chamerion augustifolium*	1	1	1					
34 *Diapensia lapponica*	1	1	1	1	1			
35 *Diphasiastrum alpinum*	1		1		1			
36 *Draba spp.*		1						
37 *Dryas octopetala*	1	1	1	1	1	1		
38 *Dryopteris filix-mas*			1					
39 *Empetrum nigrum spp. hermaphroditum*	1	1	1	1	1			
40 *Epilobium hornemannii*		1						
41 *Equisetum arvense*		1	1	1		1		
42 *Equisetum pratense*	1	1	1	1				
43 *Equisetum variegatum*	1	1	1	1	1			
44 *Erigeron uniflorus*		1	1	1	1			
45 *Eriophorum anustifolium*			1			1		
46 *Eriophorum scheuchzeri*				1		1		
47 *Eriophorum vaginatum*			1	1		1		
48 *Euphrasia wettsteinii*		1						
49 *Festuca ovina*	1	1	1	1				1
50 *Festuca rubra spp. rubra*	1	1	1	1				
51 *Festuca vivipara*			1		1			
52 *Geranium sylvaticum*	1	1	1					
53 *Gymnocarpium dryopteris*		1						
54 *Harrimanella hypnoides*		1	1		1	1	1	
55 *Hieracium alpina*	1	1	1	1	1			
56 *Hieracium spp.*	1							
57 *Hierochloë alpina*	*1*	1		1	1	1		
58 *Huperzia selago*	1	1	1	1	1	1	1	1
59 *Juncus trifidus*	1	1	1	1	1			
60 *Juniperus communis*	1	1	1					
61 *Linnaea borealis*	1	1						
62 *Listera cordata*		1						
63 *Loiseleuria procumbens*		1	1					
64 *Luzula arcuata*					1	1	1	
65 *Luzula confusa*	1	1	1	1	1		1	
66 *Luzula parviflora*		1				1		

67	*Luzula spicata*		1		1			
68	*Lycopodium clavatum*	1	1	1		1		
69	*Minuartia biflora*			1				
70	*Myosotis decumbens*		1	1				
71	*Nardus stricta*	1						
72	*Omalotheca norvegica*	1	1	1				
73	*Oxyria digyna*		1	1	1	1	1	
74	*Oxytropis lapponica*	1	1	1	1	1		
75	*Pedicularis flammea*				1			
76	*Pedicularis hirsuta*		1	1	1	1	1	
77	*Pedicularis lapponica*	1	1	1	1			
78	*Petasites frigidus*			1			1	
79	*Phleum alpinum*		1	1				
80	*Phyllodoce caerula*	1	1	1		1	1	
81	*Pinguicula alpina*		1		1			
82	*Pinguicula vulgaris*	1	1	1	1			
83	*Poa alpina*		1	1				
84	*Poa alpina var. vivipara*		1	1	1	1	1	
85	*Poa arctica*					1		
86	*Poa pratensis*						1	
87	*Potentilla crantzii*		1	1	1	1		
88	*Pyrola spp.*	1	1	1	1			
89	*Ranunculus acris*	1	1	1	1			
90	*Ranunculus hyperboreum*						1	
91	*Ranunculus nivalis*		1	1		1		
92	*Ranunculus pygmaeus*			1	1	1		1
93	*Rhodiola rosea*	1	1	1	1			
94	*Rubus chamaemorus*			1	1		1	
95	*Rumex spp.*	1	1	1				
96	*Salix herbacea*	1		1	1	1	1	
97	*Salix reticulata*		1	1	1	1		
98	*Salix spp.*	1	1	1	1	1	1	
99	*Saussurea alpina*	1	1	1	1	1		
100	*Saxifraga aizoides*				1			
101	*Saxifraga cernua*		1	1	1	1		1
102	*Saxifraga nivalis*		1			1		
103	*Saxifraga oppositifolia*		1		1	1	1	1
104	*Saxifraga stellaris*		1					

105	*Saxifraga tenuis*		1	1		1		
106	*Sibbaldia procumbens*		1	1				
107	*Silene acaulis*		1	1	1	1	1	1
108	*Silene dioica*		1					
109	*Silene wahlbergella*				1			
110	*Solidago virgaurea*	1	1	1	1	1		
111	*Sorbus aucuparia*	1	1					
112	*Stellaria nemorum*		1					
113	*Taraxacum section taraxacum*	1	1	1	1	1		
114	*Thalictrum alpinum*		1	1	1			
115	*Tofieldia pusilla*	1	1		1			
116	*Trisetum spicatum*		1	1		1		
117	*Tritentalis europaea*	1		1				
118	*Trollius europaeus*	1	1	1	1			
119	*Vaccinium myrtillus*		1	1				
120	*Vaccinium uliginosum*	1	1	1	1			
121	*Vaccinium vitis-idaea*	1	1	1	1		1	
122	*Veronica alpina*		1	1				
123	*Viola biflora*	1	1	1	1			
124	*Viscaria alpina*	1						

Tamokfjell (1342 m asl)

24.07.2008

Map sheet 1533 II (Tamokdalen).

I started from the farm Harkinn. Drove about two kilometers after a forest road and then I hiked about 1.2 kilometers further before arriving the place I assumed Jørgensen had started from, turned north and started my ascent up the mountain. The weather at start was cloudy, but dry spell, a little wind and 15°C. Later it turned to fog and rain. The sight became so bad that I stopped at a height of 1150 m asl. I did not consider it secure to hike any further because of the bad weather and the meeting with a large snowdrift. The temperature was then 4°C. The mountain birch forest stopped at a height of about 625 m asl.

1. 500 m: 34 W 0451391 7664756. Steep, rich and moist slope towards S in the birch forest.
2. 600 m: 34 W 0451357 7664915. Steep slope towards S in a tangle of birch.
3. 680 m: 34 W 0451193 7665065. Under steep S slope with some talus. Green section in the middle. Relatively dry.
4. 720 m: 34 W 0451100 7665142. In steep slope towards S. Talus. Steep cliff a little further up.
5. 800 m: 34 W 0451170 7665273. Steep slope towards S. Below a cliff.
6. 880 m: 34 W 0451206 7665383. Steep talus towards S.
7. 780 m: 34 W 0451217 7665548. Steep talus and solid rock towards S.
8. 1040 m: 34 W 0451175 7665647. In the lower edge of a green spot in talus towards S.
9. 1075 m: 34 W 0451207 7665707. Steep talus towards S. In the lower edge of a green spot.

Location	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Meters asl	**500**	**600**	**680**	**720**	**800**	**880**	**980**	**1040**	**1075**
1 *Alchemilla alpina*			1	1	1	1			
2 *Alchemilla spp.*	1								
3 *Antennaria dioica*	1	1	1	1	1	1	1	1	1
4 *Anthoxanthum nipponicum*	*1*	1	1	1	1	1			

5	*Anthriscus sylvestris*	1								
6	*Arabis alpina*						1	1		
7	*Arctous alpinus*		1	1	1	1				
8	*Asplenium viride*				1					
9	*Astragalus frigidus*	*1*								
10	*Athyrium distentifolium*			1	1			1		
11	*Avenella flexuosa*	1	1	1	1	1	1	1		
12	*Bartsia alpina*				1	1	1			
13	*Beckwithia glacialis*						1	1		1
14	*Betula pubescens*	1	1	1	1	1	1	1	1	
15	*Bistorta vivipara*				1				1	
16	*Calamagrostis sp.*	*1*								
17	*Camanula rotundifolia*	1	1	1	1					
18	*Cardamine bellidifolia*						1		1	1
19	*Carex aquatilis*							1	1	
20	*Carex rupestris*				1					
21	*Carex vaginata*	*1*								
22	*Cassiope tetragona*						1			
23	*Cerastium alpinum*					1	1			
24	*Cerastium cerastoides*						1			
25	*Cerastium sp.*						1			
26	*Chamaepericlymenum sueciscum*	1	1							
27	*Chamerion augustifolium*	1	1	1	1	1	1			
28	*Cicerbita alpina*			1						
29	*Cirsium heterophyllum*		1							
30	*Coeloglossum viride*	1								
31	*Cryptogramma crispa*			1	1	1	1	1		1
32	*Cystopteris fragilis*						1			
33	*Diapensia lapponica*		1				1			
34	*Diphasiastrum alpinum*		1	1	1	1	1	1	1	
35	*Dryas octopetala*		1		1					
36	*Dryopteris filix-mas*	1								
37	*Empetrum nigrum spp. hermaphroditum*	1	1	1	1	1	1	1		
38	*Epilobium anagallidifolium*						1			
39	*Epilobium spp.*		1	1			1	1		
40	*Equisetum hyemale*	*1*								
41	*Equisetum pratense*	1	1							
42	*Erigeron acer*		1							

43	*Erigeron uniflorus*				1		1	1	1	
44	*Euphrasia wettsteinii*	1	1		1					
45	*Festuca ovina*	*1*	1				1		1	1
46	*Festuca rubra spp. rubra*	1	1				1			
47	*Geranium sylvaticum*	1	1	1	1					
48	*Gymnocarpium dryopteris*	1	1							
49	*Harrimanella hypnoides*						1	1	1	1
50	*Hieracium alpina*	1	1	1	1	1	1	1	1	
51	*Hieracium spp.*	1	1	1	1	1				
52	*Hierochloë alpina*		1				1		1	
53	*Huperzia selago*				1	1	1	1	1	1
54	*Juncus trifidus*	1	1	1	1	1	1	1	1	1
55	*Juniperus communis*	1	1	1	1	1	1			
56	*Linnaea borealis*	1	1							
57	*Loiseleuria procumbens*		1		1					
58	*Lotus corniculatus*	1								
59	*Luzula arcuata*						1	1	1	1
60	*Luzula confusa*				1				1	1
61	*Luzula spicata*		1			1	1	1	1	1
62	*Lycopodium clavatum*	1								
63	*Melampyrum pratense*	1	1							
64	*Melica nutans*	1								
65	*Milium effusum*		1							
66	*Minuartia biflora*						1			
67	*Myosotis spp.*	1	1							
68	*Omalotheca norvegica*	1	1	1	1	1		1		
69	*Omalotheca supina*						1			1
70	*Orthilia secunda*	*1*								
71	*Oxyria digyna*						1	1	1	
72	*Oxytropis lapponica*	1	1							
73	*Pedicularis lapponica*	1	1	1	1	1				
74	*Phyllodoce caerula*	1	1	1	1	1	1	1	1	1
75	*Pinguicula vulgaris*		1		1					
76	*Pinus sylvestris*		1	1		1	1			
77	*Poa alpina*							1		
78	*Poa alpina var. vivipara*									1
79	*Polystichum lonchitis*	1	1							
80	*Populus tremula*	1	1							

81 *Potentilla crantzii*		1		1		1		1	
82 *Pyrola spp.*	1								
83 *Rhodiola rosea*		1				1			
84 *Ribes spicatum*	1								
85 *Rubus saxatilis*	1	1							
86 *Rumex spp.*	1	1	1		1	1			
87 *Sagina caespitosa*						1			
88 *Salix herbacea*		1	1	1	1	1	1		1
89 *Salix spp.*	1	1	1	1	1		1		
90 *Saussurea alpina*	1	1	1	1		1		1	
91 *Saxifraga cernua*						1	1		
92 *Saxifraga nivalis*		1				1			
93 *Saxifraga oppositifolia*						1			
94 *Sibbaldia procumbens*			1	1	1	1	1	1	
95 *Silene acaulis*		1		1		1	1	1	1
96 *Silene dioica*	1	1							
97 *Solidago virgaurea*		1	1	1	1	1	1	1	1
98 *Sorbus aucuparia*	1	1		1					
99 *Taraxacum section taraxacum*				1		1	1		1
100 *Trientalis europaea*	1	1	1						
101 *Trisetum spicatum*						1			1
102 *Trollius europaeus*	1								
103 *Vaccinium myrtillus*	1	1	1	1	1	1			
104 *Vaccinium uliginosum*	1	1	1	1	1	1			
105 *Vaccinium vitis-idaea*	1	1	1	1	1	1		1	
106 *Veronica alpina*		1	1			1	1	1	
107 *Veronica fruticans*				1					
108 *Viola biflora*			1	1	1	1	1	1	
109 *Viola riviniana*	1								
110 *Viscaria alpina*		1		1	1	1			

Sarregáisi (1450 m asl)

26.07.2008

Map sheet 1533 II (Tamokdalen).

I started the ascent of the southern side of the mountain about one kilometer west of the farm Høyset. It was a dry spell, cloudy and a little wind. The temperature was 11°C. At the summit was it 4°C, sunny and almost cloudless. The treeline was here at about 610 m asl.

Picture 6: Sarregáisi seen from the ascent at about 900 m asl, the 26th of July 2008.

1. 530 m: 34 W 0446840 7666530. Slope towards S. Open and rich birch forest.
2. 600 m: 34 W 0446763 7666691. Quite steep slope towards S. Almost at the treeline. Next to a talus.
3. 710 m: 34 W 0446722 7666911. Dry, very steep slope towards S.
4. 773 m: 34 W 0446766 7666963. Very steep slope towards SW. Rich.
5. 820 m: 34 W 0446730 7667059. Very steep slope towards SW. Right E of a tiny creek. Rich. It gets less steep after passing 900 m.
6. 940 m: 34 W 0446446 7667608. Steep slope W of the river course towards S. In the lower part of a green spot.
7. 990 m: 34 W 0446427 7667714. Rocky snowbeds towards S.
8. 1100 m: 34 W 0446858 7668085. Flat plateau by a small cairn.
9. 1190 m: 34 W 0446264 7668154. On top of a small ledge at the ridge towards SE.
10. 1252 m: 34 W 0446016 7668129. At the ridge towards W. At the edge.
11. 1280 m: 34 W 0445912 7668147. Just below a snowdrift.

12. 1330 m: 34 W 0445793 7668155. Slope towards W, at the ridge towards W.
13. 1380 m: 34 W 0445673 7668189. At the ridge towards the summit.
14. 1447 m: 34 W 0445544 7668259. The summit.

Location	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Meters asl	**530**	**600**	**710**	**773**	**820**	**940**	**990**	**1100**	**1190**	**1252**	**1280**	**1330**	**1380**	**1447**
1 *Alchemilla alpina*	1	1	1	1	1									
2 *Alchemilla spp.*	1	1		1	1									
3 *Angelica archangelica*		1		1	1									
4 *Antennaria dioica*		1	1	1	1	1	1		1					
5 *Anthriscus sylvestris*		1		1										
6 *Arabis alpina*					1	1	1		1	1		1	1	
7 *Arctous alpinus*					1									
8 *Astragalus alpinus*		1		1		1								
9 *Astragalus frigidus*				1										
10 *Athoxanthum nipponicum*	*1*	1	1	1	1	1	1							
11 *Athyrium distentifolium*	1	1	1	1	1	1	1							
12 *Avenella flexuosa*	1	1	1	1	1	1				1				
13 *Bartsia alpina*	1	1	1	1	1	1	1							
14 *Beckwithia glacialis*					1	1	1	1	1	1	1	1		1
15 *Betula pubescens*	1	1	1	1	1	1	1							
16 *Bistorta vivipara*	1	1	1	1	1	1	1		1			1		
17 *Botrychium boreale*	1	1												
18 *Campanula rotundifolia*	1	1	1	1										
19 *Cardamine bellidifolia*					1	1	1	1	1	1		1	1	
20 *Carex aquatilis*					1	1	1							
21 *Carex atrata*					1									
22 *Carex brunnescens*	*1*	1												
23 Carex capilaris						1								
24 Carex lachenalii						1	1		1					
25 Carex nigra						1		1						
26 Carex rupestris						1								
27 *Carex vaginata*					1	1	1							
28 *Cassiope tetragona*								1	1					
29 *Cerastium alpinum*			1	1	1	1	1		1	1	1	1	1	
30 *Cerastium cerastoides*			1	1										
Chamaepericlymenum														
31 *suecisum*	1													

32	*Chamerionaugustifolium*	1	1	1	1	1	1									
33	*Cicerbita alpina*	1	1		1											
34	*Cirsium heterophyllum*	1	1													
35	*Coeloglossum viride*		1			1	1									
36	*Cryptogramma crispa*	1	1	1	1	1	1	1								
37	*Cystopteris fragilis*					1	1									
38	*Diapensia lapponica*													1	1	
39	*Diphasiastrum alpinum*			1		1	1	1								
40	*Draba spp.*					1	1							1		
41	*Dryas octopetala*					1										
42	*Dryopteris filix-mas*			1												
43	*Empetrum nigrum spp. hermaphroditum*	1	1	1		1	1									
44	Epilobium anagallidifolium					1										
45	*Epilobium lactiflorum*				1											
46	*Equisetum pratense*		1		1	1										
47	*Equisetum variegatum*							1								
48	*Erigeron uniflorus*					1	1	1		1		1	1	1		
49	*Euphrasia wettsteinii*		1	1	1	1										
50	Festuca ovina									1	1		1			
51	*Festuca vivipara*								1	1		1	1	1		
52	*Geranium sylvaticum*	1	1	1	1	1										
53	*Gymnocarpium dryopteris*	1	1	1			1									
54	*Harrimanella hypnoides*					1	1	1	1		1					
55	*Hieracium alpina*	1	1	1	1	1	1	1		1						
56	*Hieracium spp.*	1	1	1												
57	*Hierochloë alpina*									1	1					
58	*Huperzia selago*					1	1	1	1	1	1			1	1	
59	*Juncus trifidus*	1	1	1	1	1	1	1	1							
60	*Junipericus communis*	1	1	1		1	1									
61	*Listera cordata*	1														
62	*Luzula arcuata*					1	1	1	1	1	1					
63	*Luzula confusa*		1			1				1		1	1			1
64	*Luzula spicata*					1	1	1								
65	*Lycopodium clavatum*					1										
66	*Melampyrum pratense*	1														
67	*Milium effusum*	1			1											
68	Minuartia biflora										1		1			

69	*Myosotis spp.*		1	1	1	1									
70	*Omalotheca norvegica*	1	1	1	1		1	1							
71	*Othilia secunda*	1	1												
72	*Oxyria digyna*			1		1	1	1	1	1	1	1		1	
73	*Oxytropis lapponica*		1		1	1	1	1							
74	*Parnassia palustris*					1									
75	*Pedicularis hirsuta*												1		
76	*Pedicularis lapponica*		1	1	1	1									
77	*Phegopteris connectilis*	1	1												
78	*Phleum alpinum*		1		1	1									
79	*Phyllodoce caerulea*	1	1	1	1	1	1	1		1	1			1	
80	*Pinguicula alpina*		1			1	1								
81	*Pinguicula vulgaris*		1												
82	*Poa alpina*		1	1	1		1								
83	*Poa alpina var. vivipara*					1	1	1		1		1	1	1	
84	Poa arctica														1
85	*Polystichum lonchitis*	1	1	1	1		1								
86	*Populus tremula*	1													
87	*Potentilla crantzii*		1		1	1	1	1		1	1				
88	*Pseudorchis straminea*					1									
89	*Pyrola spp.*	1	1	1	1	1		1							
90	*Ranunculus acris*			1	1										
91	*Ranunculus nivalis*						1	1							
92	*Ranunculus pygmaeus*							1			1		1	1	
93	*Ranunculus spp.*		1	1	1	1									
94	*Rhodiola rosea*		1	1	1	1				1					
95	*Rubus saxiatilis*	1	1	1	1										
96	*Rumex spp.*	1	1	1	1	1	1								
97	*Salix herbacea*		1	1	1	1	1	1	1	1	1	1	1	1	
98	*Salix reticulata*					1	1	1							
99	*Salix spp.*	1	1	1	1	1	1	1							
100	*Saussurea alpina*	1	1	1	1		1	1	1						
101	*Saxifraga aizoides*					1									1
102	*Saxifraga cernua*					1	1	1		1			1	1	
103	Saxifraga cespitosa														1
104	*Saxifraga nivalis*					1	1							1	
105	*Saxifraga oppositifolia*		1				1	1		1	1	1	1	1	1
106	*Saxifraga tenuis*		1		1	1	1	1						1	

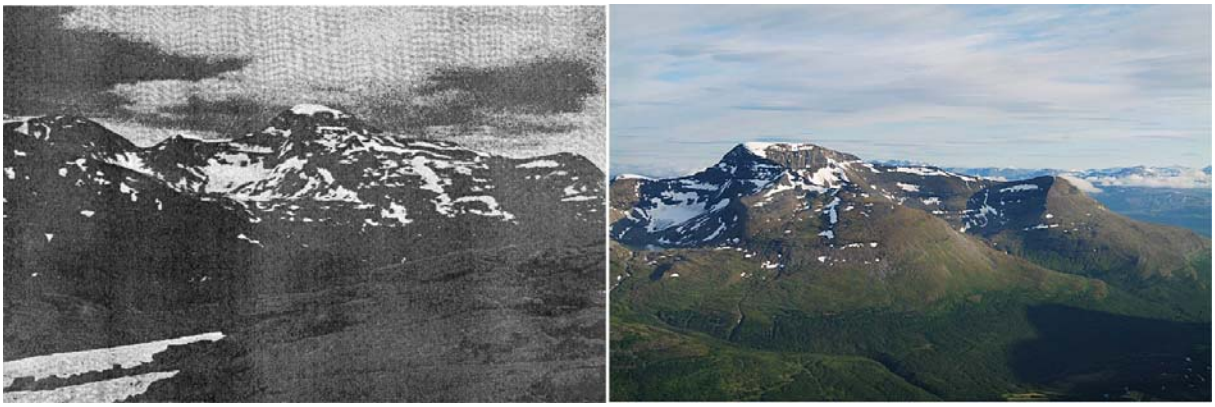
107 *Sibbaldia procumbens*		1	1	1	1	1	1		1		1				
108 *Silene acaulis*					1	1	1	1	1		1	1			
109 *Silene dioica*	1	1	1	1	1										
110 *Silene wahlbergella*					1	1									
111 *Solidago virgaurea*	1	1	1	1	1	1	1		1	1					
112 *Sorbus aucuparia*	1	1	1	1	1										
113 *Stellaria nemorum*	1	1													
114 *Taraxacum section taraxacum*	1	1	1	1	1	1	1		1	1			1		
115 *Thalictrum alpinum*					1	1	1								
116 *Tofieldia pusilla*					1										
117 *Trientalis europaea*	1	1													
118 *Trisetum spicatum*					1	1	1	1	1			1	1	1	
119 *Trollius europaeus*	1	1	1	1	1	1	1								
120 *Vaccinium myrtillus*	1	1	1	1	1	1	1		1						
121 *Vaccinium uliginosum*	1	1	1		1			1							
122 *Vaccinium vitis-idaea*	1	1			1			1							
123 *Veronica alpina*		1	1	1	1	1	1								
124 *Veronica fruticans*		1	1	1	1										
125 *Viola biflora*	1	1	1	1	1	1	1		1	1					
126 *Viola canina*		1													
127 *Viola palustris*	1	1	1												
128 *Viola riviniana*	1														
129 *Viscaria alpina*		1	1												

Rostafjell (1590 m asl)

27.07.2008

Map sheet 1533 II (Tamokdalen).

I started from the car at 34 W 0439512 7657856, about 600 m east from the farm Sverresvoll. The first The weather was partly cloudy and a little wind. At start was the temperature 18°C. At 1475 m asl was I in the clouds (thick fog) and the temperature was 6°C. The mountain birch forest ended here at about 475 m asl.



Picture 7: Rostafjell seen from Sarregáisi, 26th of July 1935 and 26th of July 2008.

1. 500 m: 34 W 0440380 7659765. Just above the treeline. At the ridge towards the first summit. Moist and rich towards the NW-edge of the ridge.
2. 600 m: 34 W 0440867 7659856. At the ridge towards the first summit. Hikes besides a t-marked trail towards the summit.
3. 700 m: 34 W 0441234 7659927. At the same ridge. Dry. Barren ridge. By a t-marked trail.
4. 800 m: 34 W 0441669 7660052. Slope towards W.
5. 900 m: 34 W 0441954 7660088. Rich and steep slope towards SW.
6. 1000 m: 34 W 0442125 7660117. Same as the previous, but a little dryer.
7. 1100 m: 34 W 0442295 7660108. Same as previous.
8. 1200 m: 34 W 0443062 7659832. Snowbed at the ridge between the summits. The lowest point at the ridge.
9. 1300 m: 34 W 0443734 7659747. At the SW-side of the ascent to the tallest summit.
10. 1380 m: 34 W 0444624 7659719. Under steep and rocky part towards S.
11. 1471 m: 34 W 0444799 7659815. At a flat area above steep talus. Snow in NE.

	Location	1	2	3	4	5	6	7	8	9	10	11
	Meters asl	**500**	**600**	**700**	**800**	**900**	**1000**	**1100**	**1200**	**1300**	**1380**	**1470**
1	*Alchemilla spp.*	1	1	1	1	1						
2	*Andromeda polifolia*	1	1	1	1							
3	*Antennaria alpina*					1	1	1				
4	*Antennaria dioica*	1	1	1	1	1						
5	*Anthoxanthum nipponicum*	1	1	1	1	1						
6	*Arabis alpina*			1	1	1	1	1	1	1		
7	*Arctous alpinus*	1	1	1								
8	*Armeria scabra*	1	1									
9	*Asplenium viride*		1									
10	*Astragalus frigidus*	1	1			1	1					
11	*Athyrium distentifolium*		1	1				1				
12	*Avenella flexuosa*	1	1	1								
13	*Bartsia alpina*	1	1	1	1	1	1	1				
14	*Beckwithia glacialis*					1		1	1	1	1	1
15	*Betula nana*	1	1	1	1							
16	*Betula pubescens*	1	1	1	1							
17	*Bistorta alpina*	1	1	1	1	1	1	1	1	1		
18	*Botrychium lunaria*				1							
19	*Campanula rotundifolia*	1	1									
20	*Campanula uniflora*						1	1				
21	*Cardamine bellidifolia*							1	1	1	1	
22	*Carex atrata*					1						
23	*Carex bigelowii*								1			
24	*Carex buxbaumii*	1										
25	*Carex capitata*	1										
26	*Carex dioica*	1										
27	*Carex fuliginosa ssp. misandra*	1	1	1	1	1	1	1				
28	*Carex glacialis*		1									
29	*Carex lachenalii*		1					1				
30	*Carex nigra*	1	1	1	1	1		1				
31	*Carex paralella*						1					
32	*Carex vaginata*	1	1	1	1		1					
33	*Cassiope tetragona*	1	1	1	1	1	1	1	1			
34	*Cerastium alpinum*		1	1	1	1	1	1	1	1	1	
35	*Cirsium heterophyllum*	1										

36	*Coeloglossum viride*	1	1	1	1							
37	*Dactylorhiza maculata*	1										
38	*Deschampsia cespitosa*	1	1	1								
39	*Diapensia lapponica*	1		1	1		1	1	1	1		
40	*Diphasiastrum alpinum*	1	1	1	1							
41	*Draba spp.*					1				1		
42	*Dryas octopetala*	1	1	1	1	1	1	1				
43	*Dryopteris expansa*				1							
44	*Dryopteris filix-mas*	1										
45	*Empetrum nigrum spp. hermaphroditum*	1	1	1	1	1			1			
46	*Epilobium anagallidifolium*		1	1								
47	*Epilobium hornemannii*				1	1						
48	*Epilobium lactiflorum*				1							
49	*Equisetum arvense*				1	1						
50	*Equisetum pratense*	1	1	1	1	1						
51	*Equisetum variegatum*	1	1	1	1		1	1				
52	*Erigeron uniflorus*		1		1	1	1	1		1		
53	*Eriophorum anustifolium*	1	1	1								
54	*Eriophorum vaginatum*	1	1									
55	*Euphraisa wettsteinii*	1	1									
56	*Festuca ovina*	1	1						1			
57	*Festuca rubra*	1										
58	*Festuca vivipara*							1		1		
59	*Filipendula ulmaria*	1										
60	*Gentiana nivalis*					1		1				
61	*Geranium sylvaticum*	1	1	1	1	1						
62	*Gymnadenia conopsea*	1										
63	*Harrimanella hypnoides*			1	1	1	1	1	1	1		
64	*Hieracium alpina*	1	1	1	1							
65	*Hieracium spp.*	1	1	1								
66	*Hierochloë alpina*								1			
67	*Hierochloë odorata*				1							
68	*Huperzia selago*	1	1	1	1	1		1	1		1	1
69	*Juncus biglumis*								1			
70	*Juncus trifidus*	1	1	1	1	1	1	1			1	
71	*Juncus triglumis*	1										
72	*Juniperus communis*	1	1									
73	*Linnaea borealis*	1										

74	*Loiseleuria procumbens*	1	1	1	1							
75	*Luzula arcuata*					1		1				
76	*Luzula confusa*						1		1		1	1
77	*Luzula multiflora*						1					
78	*Luzula spicata*	1	1	1	1			1			1	
79	*Lycopodium clavatum*	1	1		1							
80	*Myosotis spp.*				1							
81	*Nardus stricta*	1	1	1								
82	*Omalotheca norvegica*		1	1								
83	*Oxyria digyna*		1	1	1	1	1	1	1	1	1	
84	*Oxytropis lapponica*		1	1	1	1	1	1		1		
85	*Parnassia palustris*	1				1	1	1				
86	*Pedicularis flammea*	1		1	1	1	1					
87	*Pedicularis hirsuta*			1		1	1	1	1	1		
88	*Pedicularis lapponica*	1	1	1	1							
89	*Petasites frigidus*									1		
90	*Phleum alpinum*		1	1								
91	*Phyllodoce caerulea*	1	1	1	1	1	1	1	1		1	
92	*Pinguicula alpina*			1	1	1	1					
93	*Pinguicula vulgaris*	1	1	1	1							
94	*Pinus sylvestris*	1	1	1								
95	*Poa alpina*		1	1	1	1	1	1		1		
96	*Poa alpina var. vivipara*				1	1	1	1		1	1	
97	*Potentilla crantzii*	1	1	1	1	1	1	1				
98	*Pseudorchis albida*	1										
99	*Pseudorchis straminea*	1	1	1	1	1						
100	*Pyrola spp.*	1	1	1	1	1						
101	*Ranunculus acris*		1	1	1	1		1	1			
102	*Ranunculus nivalis*								1	1		
103	*Ranunculus pygmaeus*							1	1	1		
104	*Ranunculus spp.*			1	1	1		1		1		
105	*Rhodiola rosea*	1		1	1		1	1	1			
106	*Rhododendron lapponicum*	1	1									
107	*Rumex spp.*		1	1	1	1						
108	*Salix herbacea*		1	1		1	1	1	1	1	1	
109	*Salix reticulata*	1	1		1	1	1	1				
110	*Salix spp.*	1	1	1	1	1	1	1				
111	*Saussurea alpina*	1	1	1	1	1	1	1		1		

112	*Saxifraga aizoides*	1	1		1	1	1			1	
113	*Saxifraga cernua*			1	1	1	1	1	1	1	
114	*Saxifraga cespitosa*								1		
115	*Saxifraga nivalis*						1	1	1		
116	*Saxifraga oppositifolia*	1	1			1	1	1	1	1	
117	*Saxifraga rivularis*								1		
118	*Saxifraga stellaris*		1	1							
119	*Saxifraga tenuis*						1	1	1	1	1
120	*Sibbaldia procumbens*		1	1		1		1			
121	*Silene acaulis*	1	1	1	1	1	1	1	1	1	1
122	*Silene dioica*				1	1					
123	*Silene wahlbergella*			1							
124	*Solidago virgaurea*	1	1		1						
125	*Sorbus aucuparia*		1								
126	*Taraxacum section taraxacum*	1	1	1	1	1	1	1		1	
127	*Thalictrum alpinum*	1	1	1	1	1	1	1			1
128	*Tofieldia pusilla*	1	1	1	1	1	1				
129	*Trichophorum cespitosum*	1	1	1							
130	*Trientalis europaea*		1	1							
131	*Triglochin palustris*	1									
132	*Trisetum spicatum*							1	1		1
133	*Trollius europaeus*	1	1	1	1	1					
134	*Vaccinium myrtillus*	1	1	1							
135	*Vaccinium uliginosum*	1	1	1	1	1					
136	*Vaccinium vitis-idaea*	1	1	1	1		1		1		
137	*Veronica alpina*		1	1	1	1	1	1			
138	*Veronica fruticans*		1								
139	*Viola biflora*	1	1	1	1	1	1	1			
140	*Viola palustris*		1	1							
141	*Viscaria alpina*	1	1	1	1						
142	*Woodsia spp.*						1				

Máttagáisi (1636 m asl)

31.07.2008

Map sheet 1532 IV (Kirkesdalen).

I started from a bridge about 1,5 kilometers south of the farm Bjørkmoen, which is about 4,6 kilometers further in the Kirkesdalen than the farm Sandeggen where Jørgensen started. From here I hiked along a gravel road/path to Kirkessætra, before I started to ascent the mountain Máttagáisi. The tempereature is 12°C and the cloud cover is hanging low at start. At the top was I above the clouds and the sun was shining. -1°C and windless. Above 1500 m asl where there fresh snow at the snowdrifts. The mountain is grazed by cattle up to about 7-800 m asl, and by reindeer up to the summit. The treeline stops here at about 600 m asl.

1. 500 m: 34 W 0424355 7638307. Rich birch forest towards WSW. Some large sallies.
2. 580 m: 34 W 0424663 7638448. By a creek towards V. Close to the treeline.
3. 640 m: 34 W 0424844 7638380. By the same creek.
4. 770 m: 34 W 0425190 7638050. In the side of a creek. Slope towards NW.
5. 860 m: 34 W 0425347 7637825. Slight slope towards W.
6. 980 m: 34 W 0425456 7637402. Same slope. Moist.
7. 1080 m: 34 W 0425510 7637052. Green spot in a talus “light”.
8. 1180 m: 34 W 0425642 7636783. Snowbed in talus “light”.
9. 1270 m: 34 W 0425684 7635449. Ledge in the rock towards W. Steep. Green spot.
10. 1320 m: 34 W 0425696 7635274. The first plateau. Rock plain.
11. 1450 m: 34 W 0425817 7633980. Quite much large, flat blocks. Snowbed. A little slow moving water. Talus.
12. 1478 m: 34 W 0425808 7633882. Rock terrace towards NW.
13. 1525 m: 34 W 0425738 7633741. Rock terrace towards NW. Talus.
14. 1580 m: 34 W 0425677 7633284. Rock terrace towards NW. Talus.
15. 1637 m: 34 W 0425708 7632917. The summit. Rocky.

Location	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
Meters asl	**500**	**580**	**640**	**770**	**860**	**980**	**1080**	**1180**	**1270**	**1320**	**1450**	**1478**	**1525**	**1580**	**1637**
1 *Alchemilla spp.*	1	1	1	1	1										
2 *Angelica archangelica*	1	1	1	1											

3	*Angelica sylvestris*			1												
4	*Antennaria alpina*			1		1			1							
5	*Antennaria dioica*		1	1	1	1	1	1								
6	*Anthoxanthum nipponicum*	1	1	1	1	1										
7	*Anthriscus sylvestris*	1														
8	*Arabis alpina*		1	1	1	1	1	1	1		1					
9	*Arctous alpinus*		1	1												
10	*Astragalus alpinus*	1	1													
11	*Astragalus frigidus*	1	1	1												
12	*Athyrium distentifolium*	1	1	1	1	1	1									
13	*Avenella flexuosa*	1	1	1												
14	*Bartsia alpina*	1	1	1	1	1	1									
15	*Beckwithia glacialis*				1	1	1	1	1	1	1	1	1	1	1	1
16	*Betula nana*		1	1												
17	*Betula pubscens*	1	1	1		1										
18	*Bistorta alpina*	1	1	1	1	1	1	1	1	1	1					
19	*Calamagrostis lapponica*					1										
20	*Campanula rotundifolia*	1	1	1												
21	*Cardamine bellidifolia*					1	1	1	1	1	1	1	1	1	1	
22	*Carex atrata*		1	1	1	1										
23	*Carex bigelowii*			1		1	1	1	1							
24	*Carex brunnescens*			1												
25	*Carex capilaris*				1											
26	*Carex fuliginosa ssp. misandra*					1			1	1	1					
27	*Carex lachenalii*		1	1	1	1	1	1	1							
28	*Carex nigra*		1	1	1											
29	*Carex rupestris*				1											
30	*Carex vaginata*		1	1	1											
31	*Cassiope tetragona*			1	1	1	1	1	1		1					
32	*Cerastium alpinum*	1	1	1	1	1	1		1	1	1					
33	*Chamaepericlymenum suecisum*	1														
34	*Cicerbita alpina*	1														
35	*Cirsium heterophyllum*	1		1												
36	*Coeloglussum viride*	1	1	1												
37	*Comarum palustre*	1	1													

38	*Cystopteris fragilis*		1													
39	*Dactylorhiza maculata*	1														
40	*Deschampsia cespitosa*				1											
41	*Diapensia lapponica*				1	1										
42	*Diphasiastrum alpinum*		1	1		1	1									
43	*Draba norvegica*			1												
44	*Draba spp.*										1					
45	*Dryas octopetala*		1	1	1	1			1		1					
46	*Dryopteris expansa*	*1*														
47	*Dryopteris filix-mas*	1														
48	*Empetrum nigrum spp. hermaphroditum*	1	1	1	1	1										
49	*Epilobium hornemannii*	1		1	1		1									
50	*Epilobium lactiflora*	1	1		1											
51	*Equisetum arvense*		1		1	1	1									
52	*Equisetum pratense*	1	1	1												
53	*Equisetum variegatum*	1	1	1	1		1									
54	*Erigeron acer*		1													
55	*Erigeron uniflorus*			1	1	1	1		1							
56	*Eriophorum scheuchzeri*							1								
57	*Eriophorum vaginatum*						1									
58	*Euphrasia wettsteinii*	1	1	1	1											
59	*Festuca ovina*		1	1		1										
60	*Festuca rubra*	*1*	1	1	1				1							
61	*Festuca vivipara*		1					1	1	1						
62	*Filipendula ulmaria*	1														
63	*Geranium sylvaticum*	1	1	1												
64	*Gymnocarpium dryopteris*	1	1													
65	*Harrimanella hypnoides*			1	1	1	1	1	1	1	1					
66	*Hieracium alpina*	1	1	1		1	1									
67	*Hieracium spp.*	1	1	1												
68	*Hierochloë alpina*								1							
69	*Huperzia selago*		1	1		1	1	1	1	1	1	1	1	1	1	1
70	*Juncus biglumis*					1	1	1	1							
71	*Juncus trifidus*		1	1	1	1	1									
72	*Juniperus communis*	1	1	1												
73	*Linneae borealis*	1														

74	*Loiseleuria procumbens*			1	1	1										
75	*Luzula arcuata*				1		1	1	1	1		1				
76	*Luzula confusa*		1	1	1	1			1	1	1	1	1	1	1	1
77	*Luzula spicata*		1	1	1	1										
78	*Luzula wahlbergii*					1										
79	*Lycopodium clavatum*	1														
80	*Melampyrum pratense*	1	1													
81	*Milium effusum*	*1*														
82	*Minuartia biflora*				1	1	1		1		1					
83	*Myosotis spp.*	1	1	1	1											
84	*Omalotheca norvegica*	1	1	1		1										
85	*Omalotheca supina*		1	1	1	1	1	1	1							
86	*Orthilia secunda*	1	1													
87	*Oxyria digyna*	1	1	1	1	1	1	1	1	1	1					
88	*Oxytropis lapponica*	1	1	1	1	1	1		1							
89	*Papaver radicatum*									1	1					
90	*Paris quadrifolia*	1														
91	*Parnassia palustris*	1	1	1	1											
92	*Pedicularis hirsuta*					1	1		1		1					
93	*Pedicularis lapponica*			1												
94	*Petasites frigidus*						1									
95	*Phegoptheris connectilis*	1														
96	*Phleum alpinum*	1	1	1	1											
97	*Phyllodoce caerulea*		1	1	1	1	1		1							
98	*Pinguicula alpina*		1	1	1	1										
99	*Poa alpina*	*1*	1	1	1	1		1	1		1					
100	*Poa alpina var. vivipara*	*1*		1	1	1	1	1	1		1					
101	*Poa pratensis ssp. alpigena*		1				1									
102	*Polygonatum verticillatum*	1														
103	*Polystichum lonchitis*	1														
104	*Potentilla crantzii*	1	1	1	1	1	1		1							
105	*Pseudorchis straminea*			1												
106	*Pyrola spp.*	1	1	1	1	1										
107	*Ranunculus acris*	1	1	1	1	1	1									
108	*Ranunculus nivalis*				1	1	1	1	1	1	1					
109	*Ranunculus pygmaeus*				1	1	1	1	1	1	1					

110	*Ranunculus spp.*		1	1	1		1						
111	*Rhinanthus minor spp. groenlandicus*	1	1	1									
112	*Rhodiola rosea*		1	1		1							
113	*Rubus saxatilis*	1	1										
114	*Rumex spp.*	1	1	1	1	1							
115	*Salix herbacea*		1	1	1	1	1	1		1	1		
116	*Salix reticulata*		1	1	1	1							
117	*Salix spp.*	1	1	1	1	1		1					
118	*Saussurea alpina*	1	1	1	1	1	1		1				
119	*Saxifraga aizoides*	1	1	1	1	1							
120	*Saxifraga cernua*	1	1	1	1	1	1	1	1	1	1		
121	*Saxifraga cespitosa*					1			1		1		
122	*Saxifraga foliosa*					1		1	1	1		1	1
123	*Saxifraga nivalis*		1		1				1	1	1		
124	*Saxifraga oppositifolia*			1	1	1	1		1	1	1		
125	*Saxifraga rivularis*								1				
126	*Saxifraga sp.*										1		
127	*Saxifraga stellaris*		1			1	1		1				
128	*Saxifraga tenuis*			1	1	1	1	1	1	1	1	1	
129	*Sibbaldia procumbens*		1	1	1	1	1		1				
130	*Silene acaulis*		1	1	1	1	1	1	1	1	1		
131	*Silene dioica*	1	1	1									
132	*Solidago virgaurea*	1	1	1		1		1					
133	*Sorbus aucuparia*	1	1										
134	*Stellaria nemorum*	1	1	1									
135	*Taraxacum section taraxacum*	1	1		1	1	1	1	1				
136	*Thalictrum alpinum*	1	1	1	1	1	1		1				
137	*Tofieldia pusilla*		1	1	1	1							
138	*Trichophorum cespitosum*						1						
139	*Trisetum spicatum*		1			1							
140	*Tritentalis europaea*	1	1	1									
141	*Trollius europaeus*	1	1	1									
143	*Tussilago farfara*	1											
144	*Vaccinium myrtillus*	1	1	1									
145	*Vaccinium uliginosum*	1	1	1	1								
146	*Vaccinium vitis-idaea*	1	1	1	1	1							

147 *Veronica alpina*	1	1	1	1	1	1	1	1
148 *Viola biflora*	1	1	1	1	1	1		

Brøran (1427 m asl)

01.08.2008

Map sheet 1532 IV (Kirkesdalen).

I parked the car about 500 m west of the farm Evenstad. The weather was 12°C and partly cloudy at start. At the summit was it -3°C, drizzling rain and wind. The treeline stopped at about 520 m asl.

Picture 8: Brøran seen from the start of the ascent, 2nd of August 2008.

1. 500 m: 34 W 0419901 7642629. Steep relatively moist slope towards NW.
2. 570 m: 34 W 0419630 7642534. In an old creek bed towards N. The river is crossed at 595 m.
3. 680 m: 34 W 0419336 7642389. Rich slope towards NW.
4. 770 m: 34 W 0419212 7642410. Same as previous. More heather.
5. 870 m: 34 W 0419035 7642445. The same slope.
6. 970 m: 34 W 0418851 7642493. The same slope. Incline slightly more towards E. More rocks.
7. 1060 m: 34 W 0418546 7642333. Slope towards SE.
8. 1160 m: 34 W 0418406 7642531. Rocky slope towards S.
9. 1302 m: 34 W 0418378 7642914. Rocky slope towards S. Followed a track of vegetation from the last site.
10. 1400 m: 34 W 0418075 7643368. Flat plateau.
11. 1434 m: 34 W 0417853 7643846. The summit. Rocky.

	Location	1	2	3	4	5	6	7	8	9	10	11
	Meters asl	**500**	**570**	**680**	**770**	**870**	**970**	**1060**	**1160**	**1302**	**1400**	**1434**
1	*Alchemilla spp.*	1	1	1	1	1	1					
2	*Angelica archangelica*	1	1	1	1	1						
3	*Angelica sylvestris*	1		1		1	1					
4	*Antennaria alpina*								1			
5	*Antennaria dioica*		1	1	1	1	1	1				
6	*Anthoxanthum nipponicum*	1	1	1	1	1	1				1	1
7	*Anthriscus sylvestris*	1										
8	*Arabis alpina*	1	1	1	1	1	1					
9	*Arctous alpinus*	1	1									
10	*Astragalus frigidus*	1	1	1	1							
11	*Athyrium distentifolium*		1	1	1	1	1					
12	*Avenella flexuosa*	1	1	1	1		1					
13	*Bartsia alpina*	1	1	1	1	1	1		1			
14	*Beckwithia glacialis*						1	1	1	1	1	1
15	*Betula nana*		1									
16	*Betula pubescens*	1	1	1	1		1	1	1	1		
17	*Bistorta vivipara*	1	1	1	1	1	1	1	1			
18	*Botrychium lunaria*				1							
19	*Calamagrostis spp.*			1	1							
20	*Campanula rotundifolia*	1	1	1	1							
21	*Campanula uniflora*								1			
22	*Cardamine bellidifolia*						1	1	1	1	1	
23	*Carex aquatilis*		1									
24	*Carex atrata*	1	1									
25	*Carex atrofusca*		1									
26	*Carex bigelowii*		1			1	1	1	1			
27	*Carex capillaris*	1	1									
28	*Carex fuliginosa ssp. misandra*								1			
29	*Carex lachenalii*						1	1	1			
30	*Carex macloviana*		1									
31	*Carex nigra*		1	1	1	1	1					
32	*Carex norvegica*		1									
33	*Carex panicea*	1										
34	*Carex vaginata*	1	1									
35	*Cassiope tetragona*		1					1	1	1	1	

36 *Cerastium alpinum*	1	1		1	1	1		1	1			
37 *Cerastium cerastoides*						1						
38 *Chamerion augustifolium*		1	1	1	1							
39 *Cicerbita alpina*	1			1								
40 *Cirsium heterophyllum*				1								
41 *Coeloglussum viride*	1	1	1	1								
42 *Deschampsia cespitosa*								1				
43 *Diapensia lapponica*		1					1	1				
44 *Diphasiastrum alpinum*		1	1	1		1	1					
45 *Dryas octopetala*	1	1	1					1				
46 *Dryopteris filix-mas*			1									
47 *Empetrum nigrum spp. hermaphroditum*	1	1	1			1						
48 *Epilobium hornemannii*	1		1	1	1	1	1					
49 *Epilobium lactiflorum*	1	1	1	1	1	1						
50 *Equisetum arvense*	*1*	1	1		1	1	1					
51 *Equisetum pratense*	*1*	1	1	1	1							
52 *Equisetum variegatum*	1	1	1		1	1						
53 *Erigeron uniflorus*		1	1		1	1	1	1	1			
54 *Euphrasia wettsteinii*	1	1	1	1	1	1	1	1				
55 *Festuca ovina*	*1*	1			1							
56 *Festuca rubra*	1	1										
57 *Festuca vivipara*				1		1	1	1	1			1
58 *Filipendula ulmaria*		1										
59 *Geranium sylvaticum*	1	1	1	1	1							
60 *Gymnocarpium dryopteris*	1	1										
61 *Harrimanella hypnoides*		1	1		1	1	1	1	1	1	1	
62 *Hieracium alpina*	1	1	1	1	1	1	1	1				
63 *Hieracium spp.*	1	1		1								
64 *Hierochloë alpina*							1	1				
65 *Hierochloë odorata*		1		1	1							
66 *Huperzia selago*		1	1	1	1	1	1	1	1	1		
67 *Juncus trifidus*	1	1	1		1	1	1	1				
68 *Listera cordata*	1											
69 *Loiseleuria procumbens*						1		1	1			
70 *Luzula arcuata*						1	1	1	1	1		
71 *Luzula confusa*		1		1						1	1	
72 *Luzula multiflora*	1	1			1	1						
73 *Luzula spicata*		1				1						

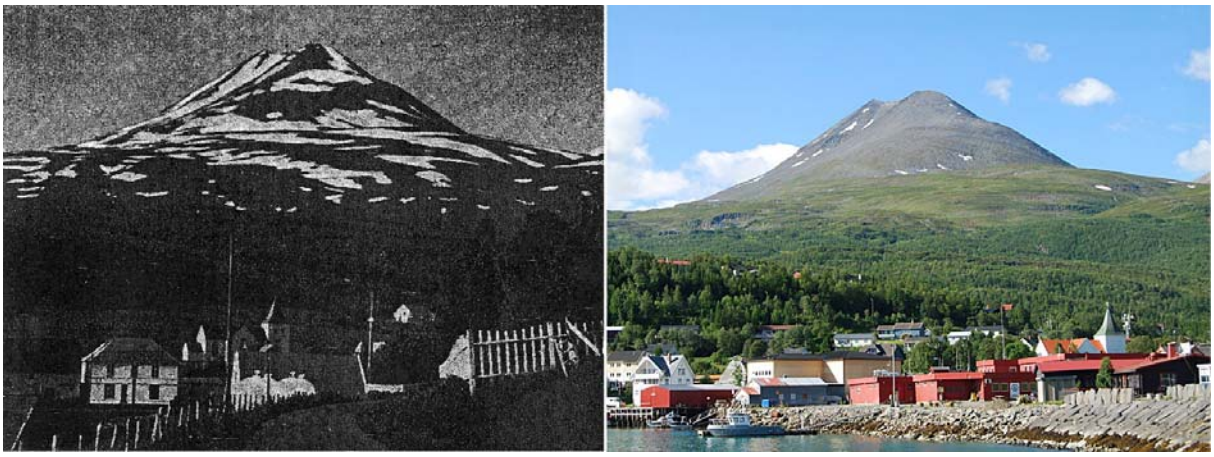
74	*Lycopodium clavatum*		1									
75	*Melampyrum pratense*			1	1							
76	*Minuartia biflora*			1								
77	*Myosotis spp.*	1	1		1	1	1					
78	*Omalotheca norvegica*	1	1	1	1	1	1					
79	*Omalotheca supina*					1	1	1		1		
80	*Oxyria digyna*	1	1		1	1	1	1	1	1	1	
81	*Oxytropis lapponica*	1	1	1		1	1					
82	*Papaver radicatum*								1			
83	*Parnassia palustris*	1	1	1	1							
84	*Pedicularis lapponica*	1	1	1	1			1				
85	*Pediularis hirsuta*	1					1	1	1			
86	*Peseudorchis straminea*	1	1									
87	*Phleum alpinum*	1	1	1	1	1						
88	*Phyllodoce caerulea*	1	1	1	1	1	1	1	1	1	1	
89	*Pinguicula alpina*		1	1								
90	*Pinguicula vulgaris*	1	1			1						
91	*Poa alpina*							1				1
92	*Poa alpina var. vivipara*	1	1	1		1	1	1	1	1	1	1
93	*Poa arctica*								1			
94	*Poa pratense ssp. alpingena*		1									
95	*Potentilla crantzii*	1	1	1		1	1		1			
96	*Pyrola spp.*	1	1	1	1	1	1					
97	*Ranunculus acris*	*1*			1	1						
98	*Ranunculus nivalis*						1	1	1			
99	*Ranunculusacris*	1	1	1	1	1	1	1				
100	*Rhodiola rosea*	1	1	1	1	1	1	1	1			
101	*Rubus saxatilis*			1								
102	*Rumex spp.*	1	1		1	1	1	1				
103	*Sagina nivalis*							1				
104	*Salix herbacea*		1	1	1	1	1	1		1		
105	*Salix reticulata*	1	1	1		1						
106	*Salix spp.*	1	1	1	1	1	1		1			
107	*Saussurea alpina*			1		1	1	1	1			
108	*Saxifraga aizoides*	1	1									
109	*Saxifraga cernua*		1	1	1	1	1	1	1	1		
110	*Saxifraga foliolosa*						1					
111	*Saxifraga nivalis*		1				1					

112 *Saxifraga oppositifolia*	1	1	1					1	1	1
113 *Saxifraga rivularis*						1				
114 *Saxifraga stellaris*				1	1		1			
115 *Saxifraga tenuis*		1				1				
116 *Sibbaldia procumbens*		1	1	1	1	1	1	1		
117 *Silene acaulis*	1	1	1			1	1	1		
118 *Silene dioica*	1	1		1	1					
119 *Solidago virgaurea*	1	1	1	1	1	1	1	1		
120 *Sorbus aucuparia*	1	1	1							
121 *Stellaria nemorum*	1	1	1		1					
122 *Taraxacum section taraxacum*	1		1	1	1	1	1			
123 *Thalictrum alpinum*	1		1	1		1		1		
124 *Tofieldia pusilla*	1	1	1					1		
125 *Trisetum spicatum*				1	1	1	1	1	1	
126 *Trollius europaeus*	1	1	1	1	1	1				
127 *Vaccinium myrtillus*		1	1	1						
128 *Vaccinium uliginosum*	1		1	1	1	1		1		
129 *Vaccinium vitis-idaea*	1	1		1		1	1	1		
130 *Veronica alpina*	1	1	1	1	1	1	1	1		
131 *Viola biflora*	1	1	1	1	1	1	1			

Kavringtind (1289 m asl)
03.08.2008

Map sheet 1634III – Lyngen.

The mountain is situated in the Lyngalpan landscape preservation area (Ryvarden 2005). The starting point for the ascent was from the farm Karnes, two kilometers south of Lyngseidet. Following the River Fyenelva, that was partly dried up, though the birch belt, before turning towards south at a height of about 600 m asl and walk in that direction for about a kilometer. Then do one have to hike up the steep eastern hill until one meets the north-southwards mountain ridge, and follow this to the summit The weather at start was sunny and 15°C. At the top was it 1°C, sunny and a little wind. The treeline stops at about 465 m asl. The mountain is grazed by sheep al the way to the summit. I observed sheep up to a height of about 1150 m, but I found manure at higher altitudes and at the summit the *Beckwithia glacialis* was healily grazed.



Picture 9: Kavringtind seen from Lyngseidet, 16th of July 1935 and 3rd of August 2008.

1. 520 m: 34 W 0467842 7716088. By the dried out river course of the Fyen river (Fyenelva).
2. 590 m: 34 W 0467586 7715820. In the lower edge of a depression where there can have been a large snowdrift earlier.
3. 660 m: 34 W 0467169 7715695. Plateau towards NNE under the smallest summit.
4. 730 m: 34 W 0466613 7715074. Steep slope towards E.
5. 825 m: 34 W 0466413 7715065. Steep slope towards E.
6. 880 m: 34 W 0466298 7715104. Steep slope towards E.

7. 940 m: 34 W 0466137 7715096. Rocky slope towards E.
8. 1030 m: 34 W 0465984 7715223. Steep talus towards SE.
9. 1060 m: 34 W 0465924 7715241. Gravel, crushed stone and rocks in a slope towards SE.
10. 1150 m: 34 W 0465751 7715291. Talus towards S.
11. 1203 m: 34 W 0465530 7715288. The lowest part of the saddle between the two summits. Some green oasis' at the E edge of the saddle.
12. 1220 m: 34 W 0465591 7715381. At the ridge towards the summit.
13. 1260 m: 34 W 0465859 7715687. At the N-side of the summit. Cleft/pass.

Location	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**
Meters asl	**520**	**590**	**660**	**730**	**825**	**880**	**940**	**1030**	**1060**	**1150**	**1203**	**1220**	**1260**
1 *Agrostis mertensii*		1		1			1		1				
2 *Alchemilla alpina*	1	1	1	1	1	1	1	1	1				
3 *Alchemilla spp.*	1	1	1	1									
4 *Antennaria dioica*	1	1	1	1	1	1	1		1				
5 *Anthoxanthum nipponicum*	1	1	1	1	1		1		1				
6 *Arabis alpina*		1											
7 *Arctous alpinus*	1	1					1						
8 *Athyrium distentifolium*	1			1	1	1							
9 *Avenella flexuosa*	1	1	1	1	1	1		1					
10 *Bartsia alpina*	1												
11 *Beckwithia glacialis*							1	1	1	1	1	1	1
12 *Betula nana*	1	1	1	1									
13 *Betula pubescens*	1	1	1	1			1		1				
14 *Bistorta alpina*	1	1	1	1	1	1	1		1				
15 *Calamagrostis lapponica*							1		1				
16 *Campanula rotundifolia*	1	1											
17 *Cardamine bellidifolia*				1			1	1	1	1	1	1	1
18 *Carex aquatilis*		1											
19 *Carex atrata*	1			1									
20 *Carex bigelowii*	1	1	1										
21 *Carex brunnescens*	1	1	1				1		1				
22 *Carex lachenalii*		1	1				1		1				
23 *Carex nigra*	1												
24 *Carex norvegica*	1	1											
25 *Carex vaginata*	1	1	1										

26	*Cassiope tetragona*		1					1				1	1	1
27	*Cerastium alpinum*	1	1	1	1		1	1	1	1	1	1		
28	*Chamaepericlymenum suecisum*	1												
29	*Chamerion augustifolium*									1				
30	*Cryptogramma crispa*	1	1	1	1	1	1	1	1	1		1		
31	*Deschampsia cespitosa*	1	1	1	1	1		1						
32	*Diapensia lapponica*	1	1	1										
33	*Diphasiastrum alpinum*	1	1	1	1	1	1		1			1		
34	*Dryas octopetala*	1												
35	*Dryopteris filix-mas*	1		1	1									
36	*Empetrum nigrum spp. hermaphroditum*	1	1	1	1	1	1	1						
37	*Epilobium anagallidifolium*					1								
38	*Epilobium hornemannii*	1			1	1	1					1		
39	*Equisetum arvense*			1				1						
40	*Equisetum pratense*	1	1	1	1									
41	*Equisetum variegatum*	1												
42	*Eriophorum anustifolium*	1		1										
43	*Eriophorum scheuchzeri*			1										
44	*Eriophorum vaginata*	1												
45	*Euphrasia wettsteinii*		1	1	1	1								
46	*Festuca ovina*	1		1		1		1	1	1	1			
47	*Festuca rubra spp. rubra*	1		1	1		1							
48	*Festuca vivipara*	1	1								1			
49	*Gentiana nivalis*	1	1											
50	*Geranium sylvaticum*	1												
51	*Gymnocarpium dryopteris*	1	1		1	1								
52	*Harrimanella hypnoides*	1	1	1	1	1		1		1	1	1	1	1
53	*Hieracium alpina*	1	1	1	1	1	1	1	1					
54	*Hieracium spp.*	1		1										
55	*Hierochloë alpina*										1			
56	*Huperzia selago*	1	1	1	1		1	1				1	1	1
57	*Juncus trifidus*	1	1	1	1	1	1	1	1	1	1			
58	*Juniperus communis*	1	1				1							
59	*Linnaea borealis*	1												
60	*Loiseleuria procumbens*	1	1	1			1	1						
61	*Luzula arcuata*							1	1		1	1		

62 *Luzula confusa*													1	1
63 *Luzula multiflora*			1				1						1	
64 *Luzula multiflora ssp. frigida*		1												
65 *Luzula spicata*	1	1		1			1	1	1	1				
66 *Lycopodium clavatum*		1	1	1		1	1			1				1
67 *Minuartia biflora*														1
68 *Nardus stricta*			1	1										
69 *Omalotheca supina*	1	1	1	1	1	1	1	1	1		1			1
70 *Oxyria digyna*	1	1	1			1			1		1			
71 *Pedicularis lapponica*	1	1	1	1		1	1							
72 *Phleum alpinum*	1	1	1	1	1									
73 *Phyllodoce caerulea*	1	1	1		1	1	1	1	1	1				1
74 *Pinguicula vulgaris*	1	1												
75 *Poa alpina*	1	1	1											
76 *Poa alpina var. vivipara*		1	1						1					1
77 *Poa pratensis*													1	
78 *Polystichum lonchitis*	1	1		1										
79 *Potentilla crantzii*	1	1												
80 *Pyrola spp.*	1	1	1	1	1									
81 *Ranunculus acris*	1	1	1	1	1	1								
82 *Ranunculus pygmaeus*											1			
83 *Rhodiola rosea*		1												
84 *Rubus chamaemorus*	1													
85 *Rumex spp.*	1	1	1	1	1		1	1	1					
86 *Salix herbacea*	1	1	1	1	1	1	1	1	1	1	1	1		
87 *Salix spp.*	1	1					1		1	1		1		
88 *Saussurea alpina*	1	1					1		1	1				
89 *Saxifraga cernua*	1	1	1	1								1		
90 *Saxifraga cespitosa*														1
91 *Saxifraga rivularis*											1	1		
92 *Saxifraga stellaris*	1	1		1										
93 *Saxifraga tenuis*														1
94 *Sibbaldia procumbens*	1	1	1	1	1	1	1	1	1		1			
95 *Silene acaulis*	1			1										1
96 *Solidago virgaurea*	1	1	1	1	1			1						
97 *Sorbus aucuparia*	1													
98 *Taraxacum section taraxacum*	1	1	1	1	1				1					
99 *Thalictrum alpinum*	1													

100 *Tofieldia pusilla*	1												
101 *Trisetum spicatum*				1	1		1	1	1	1	1	1	1
102 *Tritentalis europaea*	1	1	1				1						
103 *Vaccinium myrtillus*	1	1	1	1	1	1	1						
104 *Vaccinium uliginosum*	1	1	1	1	1	1	1		1				
105 *Vaccinium vitis-idaea*	1	1	1	1		1	1					1	
106 *Veronica alpina*	1		1	1	1	1	1	1	1		1		
107 *Viola biflora*	1	1	1	1	1	1	1	1	1				
108 *Viola canina*				1									
109 *Viola palustris*			1										
110 *Viscaria alpina*						1	1	1	1				
111 *Woodsia spp.*				1									

Fastdalstind (1275 m asl)

04.08.2008

Map sheet 1634 III (Lyngen).

I started the ascend of the mountain from the Rotenvik power station, which is about 2,3 kilometers from where I think Jørgensen started his ascent from. I chose to this to ease the descent, since the well used trail to Fastdaltind starts from here today. I hiked WSW from the powerstation until I met the river Hammerselv, and started to follow Jørgensen's trail. At about 500 m one arrives at a highland. This is crossed, and I passed Lake Rotenvik at the east side, before I turned west, and hiked up to the lowest point at the ridge between the mountains Fastdalstind and Store Kjostinden. From here I hiked towards the summit along a rocky ridge going in a north-south direction. The weather at start was 12°C, sunny and a little wind. At the top was it 2°C, sunny and a little wind.

Picture 10: Fastdalstind seen from the highland south of the mountain, 16th of July 1935 and 4th of August 2008.

1. 500 m: 34 W 0470247 7720705. By the river Hammer (Hammerselv).
2. 550 m: 34 W 0469786 7720833. By the river Hammer (Hammerselv).
3. 600 m: 34 W 0468815 7723502. Relatively steep slope towards SE.
4. 700 m: 34 W 0468446 7723463. Steep slope towards S.
5. 750 m: 34 W 0468124 7723536. Steep talus/snowbed towards S. By the edge of a snowdrift.
6. 856 m: 34 W 0467971 7723707. Almost a little flat area in the talus.
7. 1050 m: 34 W 0467511 7724113. At the ridge N/S towards the summit.
8. 1130 m: 34 W 0467584 7724289. Slope with gravel at the ridge.

9. 1150 m: 34 W 0467612 7724351. Pile of gravel at the ridge.
10. 1190 m: 34 W 0467652 7724474. Talus with small rocks at the ridge.
11. 1220 m: 34 W 0467659 7724566. Same as previous.
12. 1281 m: 34 W 0467678 7724763. The summit.

Location	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Meters asl	**500**	**550**	**600**	**700**	**750**	**856**	**1050**	**1130**	**1150**	**1190**	**1220**	**1281**
1 *Agrostis mertensii*		1	1									
2 *Alchemilla alpina*	1	1	1	1	1							
3 *Alchemilla spp.*	1	1	1	1								
4 *Andromeda polifolia*	1		1									
5 *Antennaria dioica*	1		1	1			1	1				
6 *Anthoxanthum nipponicum*	1	1	1	1	1							
7 *Arabis alpina*	1	1	1		1							
8 *Arctous alpinus*	1					1						
9 *Athyrium distentifolium*	1	1	1	1	1							
10 *Avenella flexuosa*	1	1	1	1	1							
11 *Bartsia alpina*	1	1	1	1								
12 *Beckwithia glacialis*		1	1	1	1	1	1	1	1	1	1	1
13 *Betula nana*	1	1										
14 *Betula pubescens*	1	1	1	1								
15 *Bistorta alpina*	1	1	1	1	1	1						
16 *Calluna vulgaris*	1	1										
17 *Campanula rotundifolia*		1	1	1								
18 *Cardamine bellidifolia*	1		1	1	1	1	1	1	1		1	1
19 *Carex atrata*	1	1	1									
20 *Carex bigelowii*	1	1	1									
21 *Carex brunnescens*	1											
22 *Carex capillaris*				1								
23 *Carex dioica*	1	1										
24 *Carex lachenalii*	1	1	1		1							
25 *Carex nigra*	1	1		1	1	1						
26 *Carex norvegica*	1		1									
27 *Carex rupestris*			1									
28 *Carex vaginata*	1	1	1									
29 *Cassiope tetragona*						1	1	1	1	1	1	1
30 *Cerastium alpinum*	1	1	1	1		1	1	1	1			
31 *Chamaepericlymenum suecisum*	1											

32	*Coeloglussum viride*	1		1	1								
33	*Corallorhiza trifida*	1											
34	*Cryptogramma crispa*		1	1	1	1	1						
35	*Cystopteris fragilis*		1										
36	*Deschampsia cespitosa*	1	1		1	1							
37	*Diapensia lapponica*			1	1		1	1					
38	*Diphasiastrum alpinum*		1	1	1	1							
39	*Dryas octopetala*			1	1								
40	*Dryopteris expansa*	1											
41	*Dryopteris filix-mas*	1	1	1									
42	*Empetrum nigrum spp. hermaphroditum*	1	1	1	1	1	1	1					
43	*Epilobium hornemannii*	1	1	1	1	1							
44	*Epilobium lactiflorum*	1											
45	*Equisetum arvense*	1	1										
46	*Equisetum pratense*	1		1									
47	*Equisetum variegatum*	1	1	1									
48	*Erigeron uniflorus*		1	1									
49	*Eriophorum angustifolium*	1	1										
50	*Eriophorum scheuchzeri*		1										
51	*Eriophorum vaginatum*		1	1									
52	*Euphrasia wettsteinii*	1		1	1								
53	*Festuca ovina*		1							1			
54	*Festuca vivipara*	1	1	1	1			1		1	1	1	
55	*Gentiana nivalis*		1		1								
56	*Gymnocarpium dryopteris*	1	1	1	1								
57	*Harrimanella hypnoides*		1	1	1	1	1	1	1	1	1	1	1
58	*Hieracium alpina*	1	1	1	1	1	1						
59	*Hieracium spp.*			1									
60	*Huperzia selao*	1	1	1	1	1	1	1	1	1	1	1	1
61	*Juncus biglumis*	1	1	1		1							
62	*Juncus trifidus*	1	1	1	1	1	1	1	1		1		
63	*Juniperus communis*	1	1	1	1	1							
64	*Listera cordata*			1									
65	*Loiseleuria procumbens*	1	1	1	1	1	1						
66	*Luzula arcuata*		1	1						1	1		1
67	*Luzula confusa*			1			1	1	1	1	1	1	1
68	*Luzula multiflora*						1	1					
69	*Luzula multiflora ssp. frigida*		1										

70	*Luzula spicata*	1	1	1	1	1						
71	*Lycopodium clavatum*		1									
72	*Nardus stricta*	1	1	1	1							
73	*Omalotheca supina*	1	1	1	1	1	1					
74	*Oxyria digyna*	1	1	1	1	1	1		1	1		1
75	*Pedicularis lapponica*	1		1			1					
76	*Phegopteris connectilis*	1	1	1	1	1						
77	*Phleum alpinum*	1	1	1	1							
78	*Phyllodoce caerulea*	1	1	1	1	1	1	1	1	1	1	1
79	*Pinguicula vulgaris*	1	1	1	1							
80	*Poa alpina*	1	1	1		1	1					1
81	*Poa alpina var. vivipara*		1			1		1	1		1	1
82	*Polystichum lonchitis*	1	1	1	1	1						
83	*Potentilla crantzii*			1	1							
84	*Pseudorchis straminea*			1								
85	*Pyrola spp.*	1	1	1	1	1						
86	*Ranunculus acris*	1	1	1	1							1
87	*Ranunculus nivalis*			1		1						1
88	*Ranunculus pygmaeus*	1	1	1								
89	*Rhodiola rosea*	1	1	1								
90	*Rubus chamaemorus*	1	1									
91	*Rumex spp.*	1		1	1							
92	*Sagina nivalis*	1	1				1					
93	*Salix herbacea*	1	1	1	1	1		1	1	1	1	1
94	*Salix reticulata*	1					1					
95	*Salix spp.*	1	1	1	1		1					
96	*Saussurea alpina*	1		1	1							
97	*Saxifraga cernua*	1	1	1		1						
98	*Saxifraga nivalis*	1										
99	*Saxifraga oppositifolia*		1						1	1	1	
100	*Saxifraga stellaris*	1	1	1	1	1						
101	*Saxifraga tenuis*	1	1	1	1		1					
102	*Sibbaldia procumbens*	1	1	1	1	1	1					
103	*Silene acaulis*	1	1	1	1		1	1	1	1	1	
104	*Solidago virgaurea*	1	1	1	1	1						
105	*Taraxacum section taraxacum*	1	1	1	1	1						
106	*Thalictrum alpinum*	1	1	1	1							
107	*Tofieldia pusilla*	1	1	1	1							

108 *Trichophorum cespitosum*	1	1	1									
109 *Trientalis europaea*	1	1										
110 *Trisetum spicatum*	1	1	1	1	1	1			1	1	1	
111 *Vaccinium myrtillus*	1	1	1	1	1	1						
112 *Vaccinium uliginosum*	1	1	1	1	1	1						
113 *Vaccinium vitis-idaea*	1	1	1	1	1	1	1					
114 *Veronica alpina*	1	1	1	1	1	1		1				
115 *Viola biflora*	1	1	1	1	1							
116 *Viscaria alpina*		1				1						
117 *Woodsia sp.*	1											

Appendix 2

Old and new names of species

New species names according to Lid & Lid (2005). Species, indicated with an *, is changed to another species.

Old name	New name
Agropyron violaceum	*Elymus kronokensis ssp. scandicus*
Agrostis borealis	*Agrostis mertensii*
Allosorus crispus	*Cryptogramma crispa*
Angelica silvestris	*Angelica sylvestris*
Antennaria carpathica	*Antennaria villifera*
Antennaria dioeca	*Antennaria dioica*
*Anthoxantum odoratum**	*Anthoxanthum nipponicum*
Arctostaphylos alpina	*Arctous alpinus*
Armeria sibirica	*Armeria scabra*
Arnica alpina	*Arnica angustifolia ssp. alpina*
Athyrium alpestre	*Athyrium distentifolium*
Bartschia alpina	*Bartsia alpina*
*Betula coriacea x pubescens * suecica x verrucosa f. subverrucosa*	*Betula pubescens*
Betula tortuosa x verrucosa f. intermedia	*Betula pubescens*
Calamagrostis purpurea	*Calamagrostis phragmitoides*
Carex alpina	*Carex norvegica*
Carex dioeca	*Carex dioica*
Carex inflata	*Carex rostrata*
Carex misandra	*Carex fuliginosa ssp. misandra*
Carex ridgida	*Carex bigelowii*
Cassiope hypnoides	*Harrimanella hypnoides*
Cerastium arcticum	*Cerastium arcticum*
Cerastium articum	*Cerastium arcticum*
Cerastium caespitosa	*Cerastium fontanum ssp. vulgare*
Cerastium caespitosum	*Cerastium fontanum ssp. vulgare*
Cerastium lapponicum	*Cerastium cerastoides*
Cerastium trigynum	*Cerastium cerastoides*
Chamaenerium augustifolium	*Chamerion angustifolium*

Cornus suecica	*Chamaepericlymenum suecicum*
Deschampsia flexuosa	*Avenella flexuosa*
Dryopteris austriaca	*Dryopteris expansa*
Dryopteris filix mas	*Dryopteris filix-mas*
Dryopteris Linnaeana	*Gymnocarpium dryopteris*
Dryopteris phegoteris	*Phegopteris connectilis*
Empetrum hemaphroditum	*Empetrum nigrum ssp. hermaphroditum*
Equisetum hiemale	*Equisetum hyemale*
Equisetum silvaticum	*Equisetum sylvaticum*
Erigeron unalaschkensis	*Erigeron humilis*
Eriophorum polystachium	*Eriophorum angustifolium*
Euphrasia minima	*Euphrasia wettsteinii*
Filipendula hexapetala	*Filipendula ulmaria*
Gentiana tenella	*Comastoma tenellum*
Geranium silvaticum	*Geranium sylvaticum*
Gnaphalium norvegicum	*Omalotheca norvegica*
Gnaphalium supinum	*Omalotheca supina*
Gymnadenia albida	*Pseudorchis albida*
Gymnadenia conopea	*Gymnadenia conopsea*
Hieracium alpinum	*Hieracium alpina*
Kobresia bellardii	*Kobresia myosuroides*
Linnea borealis	*Linnaea borealis*
Luzula campestris coll.	*Luzula campestris*
Luzula frigida	*Luzula multiflora ssp. frigida*
Lycopodium alpinum	*Diphasiastrum alpinum*
Lycopodium annotinum	*Lycopodium annotinum ssp. alpestre*
Lycopodium selago	*Huperzia selago*
Majanthemum bifolium	*Maianthemum bifolium*
Melampyrum silvaticum	*Melampyrum sylvaticum*
Melandium apetalum	*Silene wahlbergella*
Melandrium dioecum	*Silene dioica*
Melica nutens	*Melica nutans*
Mulgedium alpinum	*Cicerbita alpina*
Myosotis silvatica	*Myosotis sylvatica*
Papaver radicatum Læstadianum	*Papaver radicatum*
Papaver radicum Rottb. Subsp. Hyperboreum	*Papaver radicatum*
Parnasia palustris	*Parnassia palustris*
Pedicularis sceptrum carolinum	*Pedicularis sceptrum-carolinum*

Pinus silvestris	*Pinus sylvestris*
Poa alpigena	*Poa pratensis ssp. alpigena*
Poa glaucantha	*Poa glauca*
Polygonum viviparum	*Bistorta vivipara*
Popolus tremula	*Populus tremula*
Ranunculus acer	*Ranunculus acris*
Ranunculus glacialis	*Beckwithia glacialis*
Sagina linnaei	*Sagina saginoides*
Saxifraga caespitosa	*Saxifraga cespitosa*
Saxifraga groenlandica	*Saxifraga cespitosa*
Scirpus austriacus	*Trichophorum cespitosum*
Sedum roseum	*Rhodiola rosea*
Taraxacum croceum	*Taraxacum section Taraxacum*
Tofieldia palustris	*Tofieldia pusilla*
Vaccinium oxycoccus	*Oxycoccus palustris*
Vaccinium vitis idaea	*Vaccinium vitis-idaea*

Appendix 3

Missing, newly established and mixed response species

The table shows species that show a decrease in number of mountains were it was found between the years 1935 and 2008 (missing), those who was found at new mountains in 2008 compared to 1935 (new) and those who show a mixed response at one or more mountains. The number to the right of the species indicates the number of mountains the species show such a response at. Species that got a M next to its number is species that is not found at any mountains in 2008, while those who got a N next to its number is species that was not found at any mountains in 1935.

Missing			New			Mixed response	Missing	New
Alchemilla alpina	2		*Aethusa cynapium*	1	N	*Agrostis mertensii*	1	3
Alnus incana	1	M	*Agrostis capillaris*	2	N	*Angelica sylvestris*	1	2
Antennaria alpina	4		*Alchemilla spp.*	1		*Anthoxanthum nipponicum*	1	1
Antennaria villifera	6	M	*Andromeda polifoila*	2		*Asplenium viride*	1	2
Anthyllis vulneraria	1	M	*Angelica archangelica*	2		*Astragalus alpinus*	3	3
Arnica angustifolia ssp. alpina	1	M	*Antennaria dioica*	1		*Athyrium distentifolium*	1	6
Carex bigelowii	2		*Anthriscus sylvestris*	5	N	*Calamagrostis lapponica*	4	1
Carex canescens	2	M	*Arctous alpinus*	1		*Calamagrostis phragmitoides*	1	1
Carex microglochin	1	M	*Armeria scabra*	1		*Campanula uniflora*	4	2
Carex pedata	1	M	*Astragalus frigidus*	1		*Carex atrata*	1	4
Carex polygama	1	M	*Avenella flexuosa*	3		*Carex atrofusca*	1	1
Carex rostrata	1	M	*Bartsia alpina*	1		*Carex capillaris*	1	2
Carex rupestris	3		*Betula nana*	1		*Carex dioica*	1	1
Carex saxatilis	2	M	*Betula pubescens*	8		*Carex fuliginosa ssp. misandra*	1	1
Carex vaginata	1		*Botrychium boreale*	1	N	*Carex lachenalii*	2	2
Cerastium alpinum	1		*Botrychium lunaria*	2	N	*Carex paralella*	3	1
Cerastium arcticum	4	M	*Calamagrostis spp.*	2	N	*Carex rotundata*	1	1
Cerastium fontanum ssp. vulgare	4	M	*Calluna vulgaris*	1		*Cerastium cerastoides*	2	3

Comastoma tenellum	*1*	*M*	*Caltha palustris*	*1*	*N*	*Chamerion angustifolium*	*3*	*1*
Cystopteris montana	*7*	*M*	*Campanula rotundifolia*	*5*		*Coeloglossum viride*	*1*	*4*
Deschampsia alpina	*5*	*M*	*Cardamine bellidifolia*	*1*		*Dryopteris expansa*	*1*	*3*
Draba spp.	*3*		*Carex aquatilis*	*8*		*Epilobium anagallidifolium*	*1*	*5*
Dryas octopetala	*1*		*Carex brunnescens*	*2*		*Epilobium spp.*	*1*	*5*
Elymus kronokensis ssp. scandicus	*1*	*M*	*Carex buxbaumii*	*1*	*N*	*Equisetum pratense*	*1*	*8*
Equisetum arvense	*3*		*Carex capitata*	*1*	*N*	*Equisetum sylvaticum*	*1*	*1*
Equisetum scirpoides	*3*	*M*	*Carex glacialis*	*1*	*N*	*Equisetum variegatum*	*1*	*4*
Erigeron borealis	*1*	*M*	*Carex macloviana*	*1*	*N*	*Eriophorum scheuchzeri*	*2*	*4*
Erigeron humilis	*2*	*M*	*Carex nigra*	*10*	*N*	*Festuca rubra spp. Rubra*	*3*	*4*
Erigeron uniflorus	*1*		*Carex norvegica*	*4*	*N*	*Festuca vivipara*	*1*	*5*
Festuca ovina	*1*		*Carex panicea*	*1*	*N*	*Gentiana nivalis*	*2*	*3*
Kobresia myosuroides	*2*	*M*	*Cerastium sp.*	*1*	*N*	*Hieracium spp.*	*1*	*2*
Loiseleuria procumbens	*2*		*Chamaepericlymenum suecicum*	*5*		*Hierochloë alpina*	*1*	*3*
Luzula spicata	*1*		*Cicerbita alpina*	*3*		*Juncus biglumis*	*4*	*1*
Maianthemum bifolium	*1*	*M*	*Cirsium heterophyllum*	*3*		*Juncus triglumis*	*1*	*1*
Melica nutans	*2*		*Comarum palustre*	*1*		*Lotus corniculatus*	*1*	*1*
Minuartia biflora	*3*		*Corallorhiza trifida*	*2*	*N*	*Luzula multiflora ssp. frigida*	*5*	*1*
Omalotheca supina	*2*		*Cryptogramma crispa*	*3*		*Luzula parviflora*	*2*	*1*
Oxycoccus palustris	*1*	*M*	*Cystopteris fragilis*	*2*		*Luzula wahlenbergii*	*3*	*1*
Pedicularis flammea	*3*		*Dactylorhiza maculata*	*2*	*N*	*Lycopodium annotinum ssp. alpestre*	*4*	*1*
Pedicularis sceptrum-carolinum	*1*	*M*	*Deschampsia cespitosa*	*7*	*N*	*Omalotheca norvegica*	*1*	*1*
Pinguicula alpina	*3*		*Diphasiastrum alpinum*	*2*		*Oxytropis lapponica*	*1*	*5*
Poa alpina	*3*		*Dryopteris filix-mas*	*9*		*Papaver radicatum*	*1*	*2*
Poa glauca	*5*	*M*	*Epilobium lactiflorum*	*4*		*Pedicularis hirsuta*	*3*	*1*
Poa nemoralis	*3*	*M*	*Erigeron acer*	*2*	*N*	*Petasites frigidus*	*2*	*1*
Poa pratensis ssp. alpigena	*4*		*Eriophorum angustifolium*	*3*		*Phegopteris connectilis*	*1*	*3*
Pseudorchis albida	*5*		*Eriophorum vaginatum*	*5*		*Pinguicula vulgaris*	*1*	*4*
Ranunculus nivalis	*3*		*Euphrasia wettsteinii*	*4*		*Poa alpina var. vivipara*	*2*	*3*
Rubus idaeus	*1*	*M*	*Filipendula ulmaria*	*2*		*Poa arctica*	*2*	*2*
Rubus saxatilis	*2*		*Geranium sylvaticum*	*3*		*Ranunculus acris*	*1*	*2*

Rumex spp.	*1*		*Gymnadenia conopsea*	*1*		*Ranunculus pygmaeus*	*3*	*1*
Sagina saginoides	*2*	*M*	*Gymnocarpium dryopteris*	*5*		*Rhododendron lapponicum*	*3*	*1*
Salix reticulata	*2*		*Hierochloë odorata*	*1*		*Rubus chamaemorus*	*1*	*1*
Saxifraga cernua	*1*		*Juniperus communis*	*3*		*Sagina nivalis*	*1*	*2*
Saxifraga cespitosa	*3*		*Linnaea borealis*	*6*		*Saxifraga rivularis*	*1*	*2*
Saxifraga foliolosa	*3*		*Listera cordata*	*5*		*Saxifraga stellaris*	*1*	*3*
Saxifraga nivalis	*3*		*Luzula arcuata*	*11*	*N*	*Saxifraga tenuis*	*1*	*7*
Saxifraga oppositifolia	*1*		*Luzula multiflora*	*7*	*N*	*Silene dioica*	*1*	*2*
			Luzula pilosa	*1*	*N*	*Silene wahlbergella*	*2*	*3*
			Lycopodium clavatum	*8*		*Sorbus aucuparia*	*1*	*5*
			Melampyrum spp.	*4*		*Thalictrum alpinum*	*1*	*1*
			Milium effusum	*1*		*Tofieldia pusilla*	*1*	*2*
			Myosotis spp.	*1*		*Trisetum spicatum*	*2*	*1*
			Nardus stricta	*2*		*Trollius europaeus*	*1*	*1*
			Omalotheca spp.	*1*	*N*	*Veronica alpina*	*2*	*1*
			Othilia secunda	*4*	*N*	*Veronica fruticans*	*1*	*1*
			Oxyria digyna	*1*		*Viola palustris*	*1*	*2*
			Parnassia palustris	*4*		*Woodsia spp.*	*1*	*3*
			Phleum alpinum	*7*				
			Pinus sylvestris	*3*				
			Poa pratensis	*3*	*N*			
			Polygonatum verticillatum	*1*	*N*			
			Polystichum lonchitis	*4*				
			Populus tremula	*2*				
			Pseudorchis straminea	*7*	*N*			
			Pyrola spp.	*3*				
			Ranunculus spp.	*3*	*N*			
			Rhinanthus minor spp. Groenlandicus	*1*	*N*			
			Ribes spicatum	*1*	*N*			
			Sagina cespitosa	*2*	*N*			
			Saxifraga aizoides	*2*				
			Saxifraga sp.	*1*	*N*			
			Solidago virgaurea	*1*				
			Stellaria nemorum	*4*				
			Trichophorum cespitosum	*2*				

			Trientalis europaea	*5*			
			Triglochin palustris	*1*	*N*		
			Vaccinium vitis-idaea	*1*			
			Viola canina	*1*			
			Viscaria alpina	*3*			
Total:	*57*	*27*		*89*	*33*		*67*