



National Environmental Research Institute
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NERI Technical Report No. 693, 2008

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A vegetation transect in Kobbefjord, West Greenland



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A vegetation transect in Kobbefjord, West Greenland

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Data sheet

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- Abstract: A permanent vegetation transect was established in July 2007 in order to monitor future changes in the location of boundary lines between vegetation zones and in the species composition of the plant communities. The transect lies in the study area at the head of Kobbefjord, Nuuk and consist of a main vegetation transect supplemented by a coastal transect including a salt marsh and a short transect including a special *Deschampsia-Juncus* community. The vegetation transect in Kobbefjord is called the NERO line. This report includes documentation of the establishment of the NERO line, results of Raunkjær analyses along the transect, a compilation of a list of vascular plants in the survey area, and ground truthings of vegetation types as a basis for a vegetation map. The surveys only included vascular plants.
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Summary

The NERO line is a permanent vegetation transect which was established in July 2007 in the NuukBasic study area in Kobbefjorden, Nuuk. The objective is to monitor future changes in the location of boundary lines between vegetation zones and in the species composition of the plant communities. The NERO line consists of a main vegetation transect supplemented by a coastal transect including a salt marsh and a short transect including a special *Deschampsia-Juncus* community.

Dwarf shrub heaths are dominating on all lowlands on level and moderately sloping terrain. Several types of dwarf shrub heaths are found, each dominated by one or few of the common shrubs species *Empetrum nigrum*, *Vaccinium uliginosum*, *Betula nana*, *Salix glauca*, *Loiseleuria procumbens*, and *Phyllodoce coerulea*. *Empetrum nigrum* is the most common species in the heaths and this species occurs in all types from the wind exposed, low type with a low species diversity to the more lush type with more species and a longer snow cover. Next to *Empetrum nigrum* the most abundant species are *Vaccinium uliginosum*, *Salix glauca*, and *Betula nana*. *Loiseleuria procumbens* is common on terrain with higher exposure to wind.

The vegetation was classified into eight types based on the species composition, physiognomy, and species diversity in addition to water contents of the soil, expected snow cover, and terrain aspects. The types are:

1. Dwarf shrub heath - different subtypes according to the dominating shrub species, e.g. *Vaccinium uliginosum*-*Betula nana*-*Salix glauca* heath
2. Snow patch
3. Herb slope
4. Fens
5. Copse
6. *Deschampsia-Juncus* community
7. Lake and pond vegetation
8. Salt marsh.

This report includes a detailed description of the NERO line, results of Raunkjær analyses along the transect, a compilation of a list of vascular plants in the survey area, and ground truthings of vegetation types as a basis for a vegetation map. The surveys only included vascular plants.

Resume

NERO linjen er et permanent vegetationstransekt, som blev etableret i juli 2007 i NuukBasis undersøgelsesområdet i bunden af Kobbefjorden ved Nuuk. Formålet er at overvåge udbredelsen af vegetationstyper og forandringer i sammensætningen af arter i de vigtigste plantesamfund. NERO linjen består af en hovedlinje samt to supplerende linjer, som inkluderer en strandeng ved kysten og et specielt *Deschampsia-Juncus* plantesamfund.

Flere typer af dværgbuskhede dominerer lavlandet og det moderat bakkede terræn. Dværgbuskhederne er domineret af en eller flere af arterne revling (*Empetrum nigrum*), mosebølle (*Vaccinium uliginosum*), dværgbirk (*Betula nana*), blågrå pil (*Salix glauca*), kryblyng (*Loiseleuria procumbens*), og blålyng (*Phyllodoce coerulea*). Revling er den hyppigst forekommende art i alle typer fra de vindeksponerede lave typer med lav artsrigdom til frodigere typer med flere arter og længerevarende snedække. Efter revling kommer mosebølle, blågrå pil, og dværgbirk, og på vindeksponerede steder kryblyng.

Vegetationen blev inddelt i 8 typer efter artssammensætning, livsform, artsdiversitet samt jordbundens fugtighed, det forventede snedække og terrænformer. Typerne er:

1. Dværgbuskhede - forskellige undertyper efter dominerende arter, f.eks. mosebølle dværgbirk og blågrå pil.
2. Sneleje
3. Urteli
4. Kær
5. Krat
6. *Deschampsia-Juncus* plantesamfund
7. Søer og damme
8. Strandeng.

Rapporten indeholder en detaljeret beskrivelse af NERO linjen, resultater af Raunkjær-analyser langs linjen, en liste over de karplanter der blev fundet i området samt geografisk dokumentation af vegetationstyper som basis for kortlægning af vegetation. Undersøgelserne omfattede kun karplanter.

Eqikkaaneq

NERO tassaavoq misissuiffimmi NuukBasisimi naasunik misissuiffik Nuup eqqaani Kangerluarsuup qinnguani ittoq. Naanerit assigiinngitsut aammalu naasut assigiinngitsukkuutaat naasuni pingaarutilinni qanoq agguataarsimanerannik malinnaaffiginninnissaq siunertaavoq. Misissuiffik NERO pingaarnermik killiligartaqarpoq marlunni ilaqarluni aappaa sissami masarsuulluni tarajornitsoq aappalu pingaartumik naasoqarfiuluni *Deschampsia-Juncus*imik taasamik.

Orpikkat assigiinngitsut qassiit nuna pukkinnerusoq qallersimasarpaat qattunerasaartorlu annikinnerusumik qallersimasarlugu. Orpigaqarfinni malunnarnerullutik naammattuugassaasarpur paarnaqutit (*Empetrum nigrum*), kigutaarnat nagguui (*Vaccinium uliginosum*), avaalaqiat (*Betula nana*), siit (*Salix glauca*), aappaluttunnguit (*Loiseleuria procumbens*), kiisalu paarnaqutikuluut (*Phyllodoce coerulea*). Paarnaqutit tamanit nalinginnaanerpaajupput anorituuni pukkitsujuusarlutik assigiinngitsullu ikittunnguusarlutik, aammalu naggorinnerusuni aputitunerusumilu assigiinngitsukkuutaarnerusarlutik. Paarnaqutinut tulliupput kigutaarnat nagguui, siit, aammalu siit, kiisalu anoritunerusuni aappaluttunnguit.

Naaneqarfiit arfineq pingasunut agguataagaapput naasut assigiinngitsukkuutaat agguataarsimani, uumassusii, assigiinngissitaarneri kiisalu nunap isugutassusia, aputitussusiatut naatsorsuutigineqartoq kiisalu nunap ilusaa apeqqutaatillugit. Assigiinngitsullu makkuupput:

1. Orpigaqarfiit – orpikkat sorliit naammattuugassaanerunersut apeqqutaatillugu agguataarsimasut, soorlu kigutaarnat nagguui, avaalaqiat aammalu siit
2. Aputitartuut
3. Naggorissut
4. Isugutasut
5. Orpigaqarfiit
6. Naaneqarfiit *Deschampsia-Juncus*
7. Tatsit taseqqallu
8. Masarsuit tarajornitsut.

Nalunaarusiami misissuiffik NERO sukumiisumik oqaluttuarineqarpoq, naaneqarfiup eqqaani Raunkjær atorlugu misissueqqissaarnermit paasisat saqqummiunneqarlutik, naasut taqaasallit tamaani nassaarineqartut allattorneqarlutik kiisalu naasut assigiinngitsukkuutaat naasunik nalunaarsuineri tunngavittut nunami qanoq ittumiinerit takussutissiorneqarlutik. Misissuineri naasut taqaasallit kisimik pineqarput.

1 Introduction

Arctic vegetation is expected to respond to climate change in several ways:

- Changes of boundary lines between vegetation zones
- Changes in species composition in vegetation zones
- Immigration of new plant species
- Extinction of plant species.

A permanent vegetation transect was established in July 2007 in order to monitor future changes in the location of boundary lines between vegetation zones and in the species composition of the plant communities. The transect lies in the study area at the head of Kobbefjord (51.4° W; 64.13° N), Nuuk (Figure 1) and consist of a main vegetation transect supplemented by a coastal transect including a salt marsh and a short transect including a special *Deschampsia-Juncus* community. We plan to survey the transect with five year intervals. The vegetation transect in Kobbefjord is called the NERO line and it will be a low arctic counterpart to the ZERO line in Zackenberg, Northeast Greenland (Fredskild & Mogensen 1996, Bay 2001, 2006).

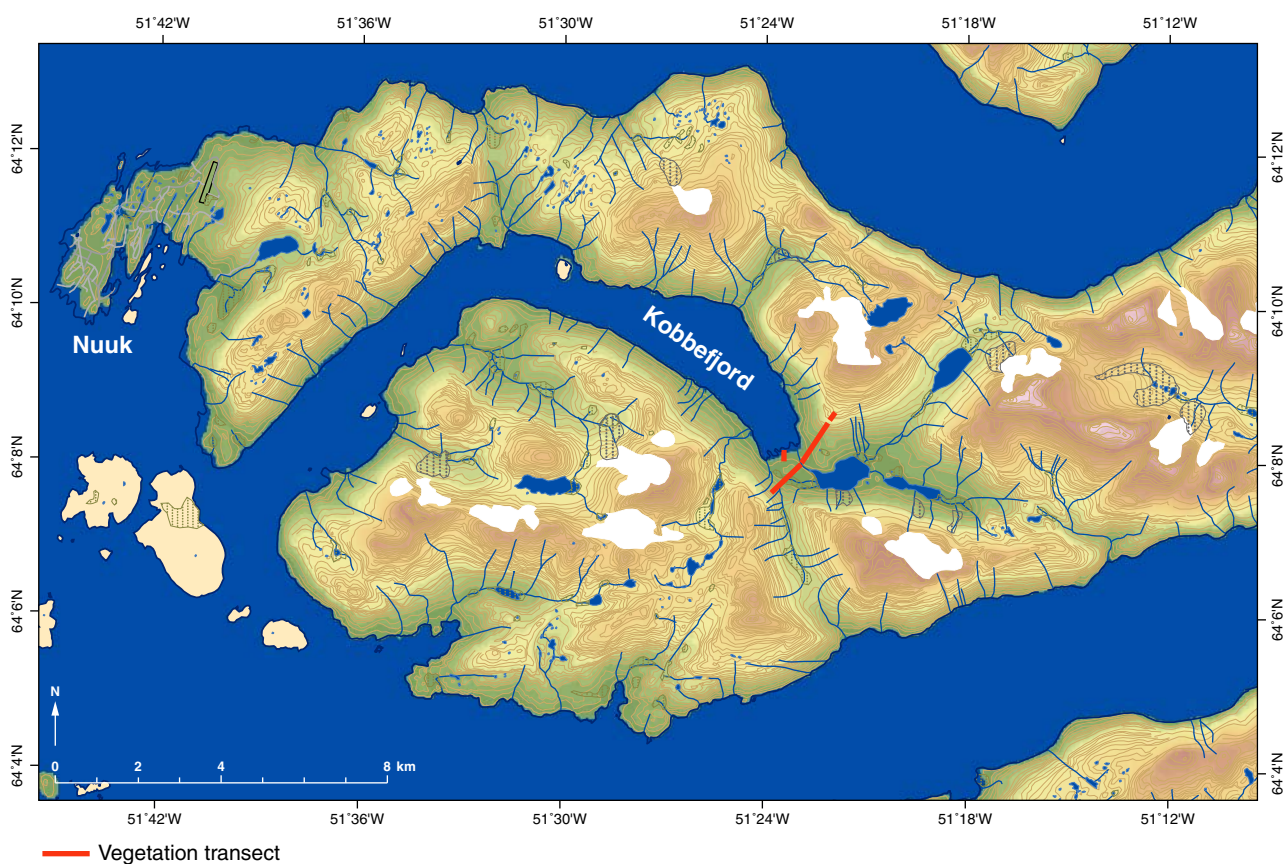


Figure 1. Map showing Kobbefjord, Nuuk and the vegetation transect.

The concept relies on the assumption that changes in the distribution of plant communities can be seen by changes of boundary lines between vegetation zones. Therefore each boundary between vegetation zones has been marked by pegs. The species composition of the vegetation zones has been documented by Raunkjær analyses. Immigration of new species is assumed to be documented by the surveys with five year intervals.

This report describes the activities that we carried out in July 2007 and includes establishment of the NERO line, results of Raunkjær analyses along the transect, compilation of a list of vascular plants in the survey area, and ground truthings of vegetation types as a basis for a vegetation map. The surveys only included vascular plants.

The present project has received financial support from the Danish Energy Agency as part of the climate support program to the Arctic. The authors are solely responsible for all results and conclusions presented in the report, and do not necessary reflect the position of the Danish Energy Agency.

2 Vegetation in the monitoring area

This description of the vegetation in Kobbefjord is based on information collected during the daily work along the vegetation transect, one day's survey in the valley towards Ameralikfjord, and a half day survey on the south facing slopes just north of the site, where the river drains into Kobbefjord.

As in other parts of low arctic Greenland dwarf shrub heaths are dominating in all lowlands on level and moderately sloping terrain. The specific species composition is a function of the local physical conditions: water and nutritional content of the soil, terrain exposure and aspect, and on the length, depth and duration of the snow cover. Several types of dwarf shrub heaths were found, each dominated by one or few of the common shrubs species *Empetrum nigrum*, *Vaccinium uliginosum*, *Betula nana*, *Salix glauca*, *Loiseleuria procumbens*, and *Phyllodoce coerulea*. *Empetrum nigrum* is the most common species in the heaths and this species occurs in all types from the wind exposed, low type with a low species diversity to the more lush type with more species and a longer snow cover. Next to *Empetrum nigrum* the most abundant species are *Vaccinium uliginosum*, *Salix glauca*, and *Betula nana*. *Loiseleuria procumbens* is common on terrain with higher exposure to wind.

Salix glauca copses are occurring on the south facing slope of the valley and locally on the north facing slopes south of the head of the fjord.

Snow beds dominated by *Salix herbacea* are covering only small areas in sheltered places where the snow cover persists until late summer.

Continuous *Alnus crispa* copses occur only as an element in *Salix glauca* copses on the south facing slopes near the head of the fjord. It has a patchy distribution in the valley towards Ameralik Fjord to the south of the monitoring area.

The diversity of species varies among the vegetation types. Herb slope and open *Salix glauca* copse have the highest species diversity with up to 22 species of vascular plants per square meter.

On dry, early snow free, south facing slopes a distinct vegetation type dominated by *Deschampsia flexuosa* and *Juncus trifidus* with *Viscaria alpina*, *Salix herbacea*, *Silene acaulis*, and *Potentilla tridentata*. This type is rich in lichens, and the vascular plants cover only few percent. This type occurs north of the lake west of "Badesøen" in the bottom of the valley (see figure 10).

Lush, mossy dwarf shrub heaths with *Empetrum nigrum*, *Betula nana*, and *Vaccinium uliginosum* dominate in the lowland in the valley east of the main vegetation transect. In the moist and wet areas in the lowland *Eriophorum angustifolium* and *Scirpus caespitosus* fens occur. Several places with polished bedrock are without vegetation. Few dry slopes were found on the south facing slopes.

Figure 2. Dwarf shrub heath dominated by *Empetrum nigrum* between peg VT055 and peg VT056.



Luxuriant herb slopes occur along a creek on a south facing slope west of the main transect. Within few square meters the following species occurred - some of which have a low frequency in the area: *Veronica wormskjoldii*, *Angelica arcangelica*, *Calamagrostis langsdorfii*, *Luzula parviflora*, *Oxyria digyna*, *Epilobium hornemanii*, *Alchemilla filicaulis*, *Saxifraga caespitosa*, *Gnaphalium supinum*, *Gnaphalium norvegica*, *Chamaenerion latifolium*, *Chamaenerion angustifolium*, *Luzula multiflora*, *Phleum pratense*, *Rhodiola rosea*, *Poa alpina*, *Polysticum longitis*, *Poa nemoralis*, *Viola labradorica* and *Veronica alpina*.

The rare lowarctic species *Gentiana nivalis*, *Epilobium lactiflorum*, *Veronica fruticans*, *Rhinanthus minor* and *Linnaea borealis* occurred only in this locality.

2.1 Vegetation classification

The vegetation is classified into 8 types based on the species composition, physiognomy, and species diversity in addition to water contents of the soil, expected snow cover, and terrain aspects.

The types are:

1. Dwarf shrub heath - different subtypes according to the dominating shrub species, e.g. *Vaccinium uliginosum*-*Betula nana*-*Salix glauca* heath
2. Snow patch
3. Herb slope
4. Fen
5. Copse
6. *Deschampsia*-*Juncus* community
7. Lake and pond vegetation
8. Salt marsh.

Photos of vegetation types are shown in figures 2 to 10.

Figure 3. Dwarf shrub heath dominated by *Salix glauca* between peg VT013 and peg VT014.



Figure 4. Snow patch with *Salix glauca* and *Empetrum hermaphroditum* between peg VT005 and peg VT006.



Figure 5. Herb slope with *Taraxacum* sp., *Salix glauca*, and *Alnus crispa* between peg VT075 and peg VT076.



Figure 6. Fen between peg VT068 and peg VT069. *Carex bigelowii* with *Betula nana*, *Empetrum nigrum*, *Vaccinium uliginosum* on tussocks. *Scirpus caespitosus* the last meters.

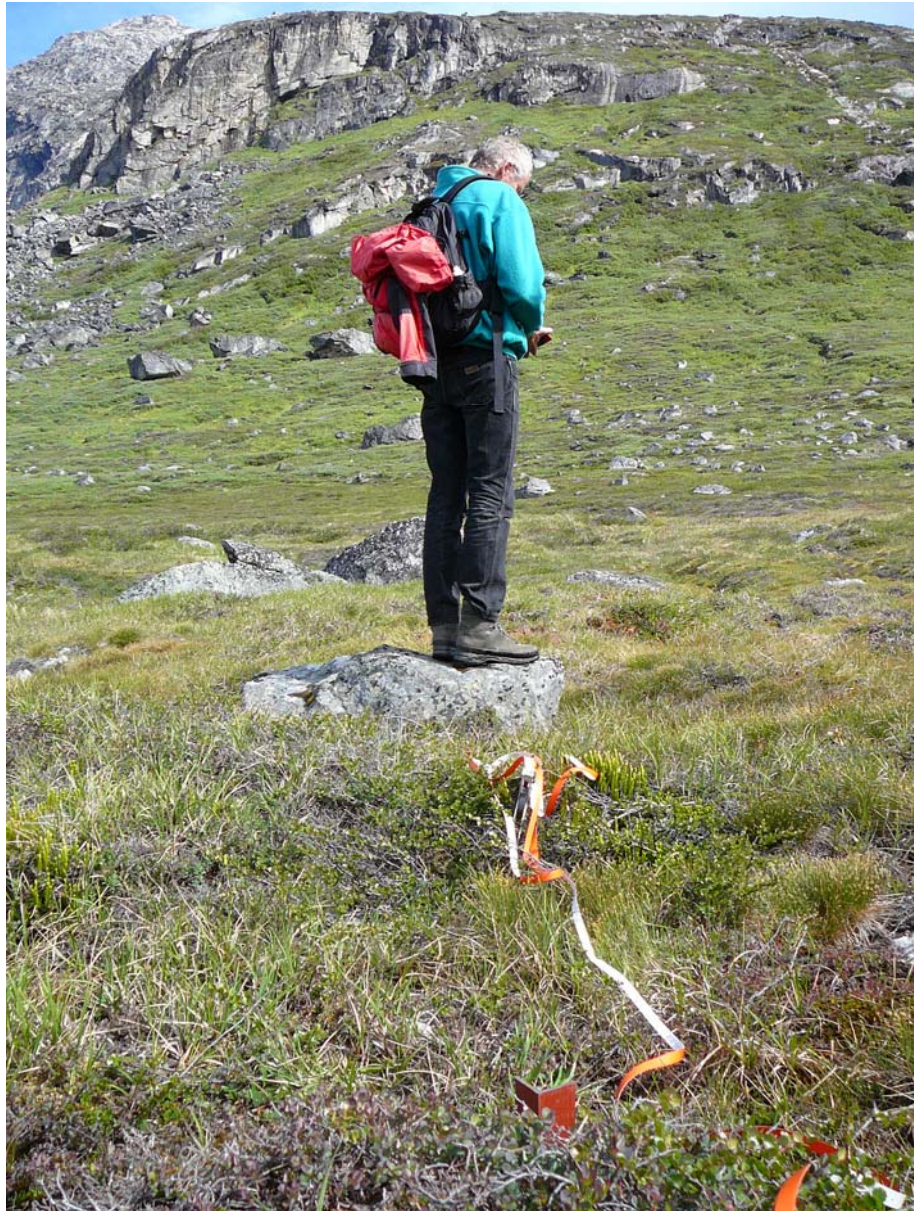


Figure 7. Fen between peg VT022 and peg VT023. Fen dominated by *Carex rariflora*, *Scirpus caespitosus*, *Eriophorum angustifolium*, in the most wet places and with *Vaccinium uliginosum* on few mossy hummocks.



Figure 8. *Salix glauca* copse between peg VT015 and peg VT016.



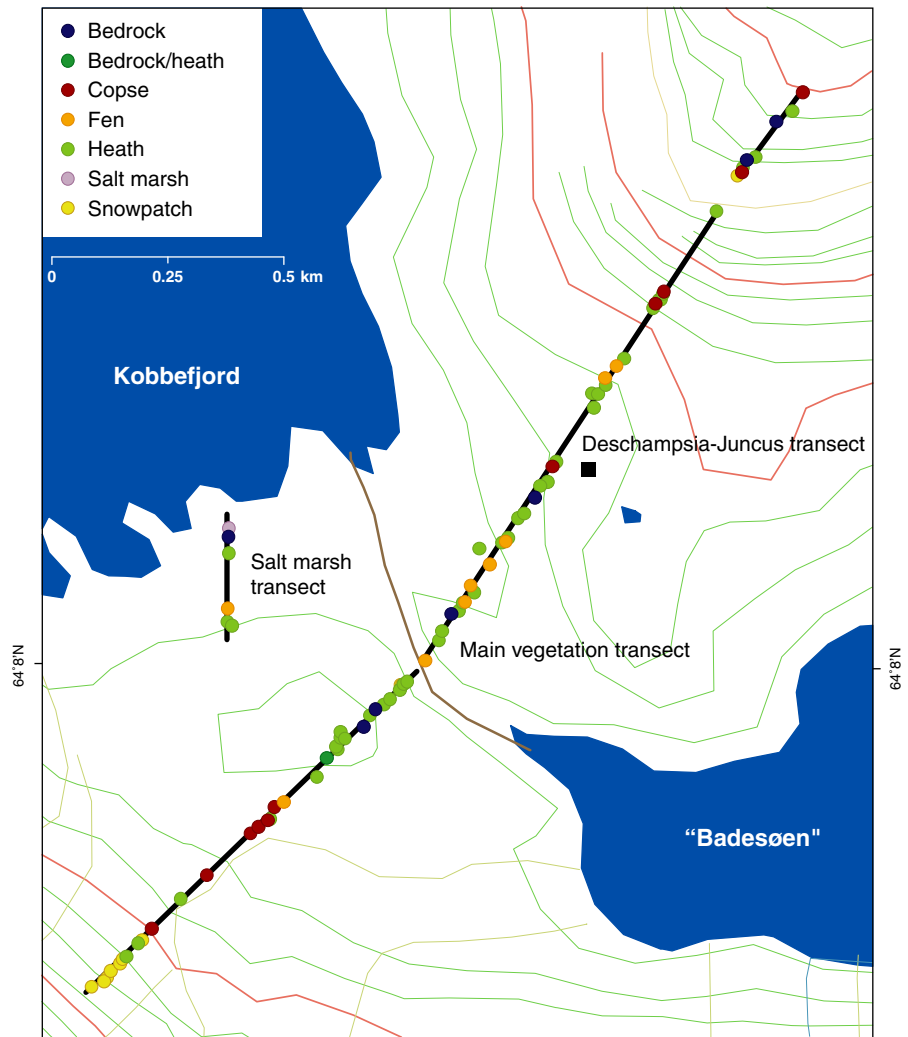
Figure 9. Salt marsh with *Carex glareosa* between peg VT101 and VT102.



Figure 10. *Deschampsia*-*Juncus* transect with *Deschampsia flexuosa* and *Juncus trifidus*.



Figure 11. The NERO line. The dots show the positions of the pegs and the colour indicate the vegetation zone east of the peg. Numbering of the pegs starts in the south-western corner. The break in the long line to the north-east marks a steep slope that was not analysed by Raunkjær analyses. The short line represents the coastal zone. The black square shows the position of the characteristic, but rare plant community dominated by *Deschampsia flexuosa* and *Juncus trifidus*, which is found on south facing, dry slopes. The map is based on GPS-positions (accuracy 5-10 m).



3 The NERO line

The NERO line (figure 1 and 11) consists of three transects: the main transect, a salt marsh transect, and a *Deschampsia-Juncus* transect. The main vegetation transect starts just below a snow drift at a north-east facing slope 166 m.a.s.l. and ends 400 m.a.s.l. at a south-west facing slope. The main transect was snow free on July 3. The main transect intersects all the dominating plant communities found in the study area except salt marsh and a distinct, but rare, dry community dominated by *Deschampsia flexuosa* and *Juncus trifidus*. The total length of the main vegetation transect is approximately 3 km and it intersects 83 vegetation zones.

In order to include the coastal zone with the salt marsh community and the *Deschampsia flexuosa-Juncus trifidus* community two shorter transects were established; the salt marsh transect which reach from the coast and 225 meters into the heaths including salt marsh, and the *Deschampsia-Juncus*-transect which crosses the *Deschampsia flexuosa-Juncus trifidus* community (figure 10).

All intersections between the vegetation transect and boundaries of vegetation zones are marked by pegs and documented by photos (www.nuuk-basic.dk) and GPS positions (Appendix 1). Figure 12 shows a close view of a part of the vegetation transect with a peg and the positions of Raunkjær tubes. The Raunkjær tubes define where we carried out Raunkjær analyses to describe the species composition and frequency.

The pegs were marked with codes VT001, VT002..... and so forth. Each peg has been tagged with a plastic tag with the code in permanent ink and further the code has been imprinted in the tag. The line was laid out by aiming along the pegs. Table 1 summarizes peg codes, vegetation types and field notes on the species composition of each zone. Apppendix 1 and 2 contain more detailed information on GPS positions, photo numbers, length of vegetation zones, vegetation type, and a short description of each vegetation zone.

Figure 12. Location of pegs and Raunkjær circle tubes. Tubes for Raunkjær circles are shown by yellow dots and numbering is indicated by yellow numbers. Numbering starts at the peg with the lowest number and ends with tube number 10 one meter before next peg.



Table 1. Summary of vegetation types along the NERO line. See appendix 2 for further details.

Main transect		
Zone – Peg numbers	Vegetation type	Description – field notes on species composition
VT 001-VT 002	Snow patch	Late snow patch in scree. Mossy organic crust with <i>Oxyria digyna</i> , <i>Luzula confusa</i> , <i>Empetrum nigrum</i> , <i>Poa alpina</i> , <i>Gnaphalium</i> cfr. <i>supinum</i> , <i>Sibbaldia procumbens</i> , <i>Solorina crosea</i> , <i>Cetraria rangiferina</i> , <i>Stereocaulon</i> sp., and <i>Polytricum</i> sp.
VT 002- VT 003	Snow patch	Mossy <i>Salix herbacea</i> snow patch with stones. <i>Sibbaldia procumbens</i> , <i>Polygonum viviparum</i> , <i>Taraxacum</i> sp., <i>Veronica alpina</i> , <i>Poa alpina</i> , <i>Huperzia selago</i> , <i>Luzula confusa</i> , <i>Empetrum nigrum</i> , <i>Alchemilla alpina</i> , <i>Oxyria digyna</i> , <i>Carex bigelowii</i> , <i>Cerastium cerastoides</i> , and <i>Solorina crosea</i> .
VT 003- VT 004	Snow patch	<i>Empetrum nigrum</i> - <i>Salix herbacea</i> snow patch with <i>Carex bigelowii</i> , <i>Poa pratensis</i> , <i>Sibbaldia procumbens</i> , <i>Taraxacum</i> sp., <i>Lycopodium annotinum</i> , <i>Alchemilla alpina</i> , <i>Veronica alpina</i> , <i>Diphasiastrum alpinum</i> , <i>Solorina crosea</i> , and <i>Stereocaulon</i> sp.
VT 004- VT 005	Snow patch	<i>Salix herbacea</i> snow patch with <i>Taraxacum</i> sp. <i>Sibbaldia procumbens</i> , <i>Carex bigelowii</i> , <i>Pyrola minor</i> , <i>Poa pratensis</i> , <i>Polygonum viviparum</i> , <i>Phleum commutatum</i> , <i>Cerastium alpinum</i> , and <i>Rhodiola rosea</i> .
VT 005- VT 006	Snow patch	<i>Empetrum nigrum</i> - <i>Salix herbacea</i> vegetation with <i>Poa pratensis</i> , <i>Carex bigelowii</i> , <i>Salix glauca</i> , <i>Polygonum viviparum</i> , <i>Cerastium alpinum</i> , <i>Pyrola minor</i> , <i>Bartsia alpine</i> , and <i>Taraxacum</i> sp.
VT 006- VT 007	Snow patch	Snow patch with <i>Salix glauca</i> , <i>Alchemilla alpina</i> , <i>Salix herbacea</i> , <i>Diphasiastrum alpinum</i> , <i>Taraxacum</i> sp., and <i>Veronica alpina</i> .
VT 007- VT 008	Heath	Mossy <i>Empetrum nigrum</i> - <i>Salix glauca</i> heath with <i>Polygonum viviparum</i> , <i>Salix herbacea</i> , <i>Carex bigelowii</i> , <i>Deschampsia flexuosa</i> , and <i>Vaccinium uliginosum</i> .
VT 008- VT 009	Heath	Low <i>Salix glauca</i> vegetation with <i>Empetrum nigrum</i> , <i>Carex bigelowii</i> , <i>Poa pratensis</i> , and <i>Polygonum viviparum</i> .
VT 009- VT 010	Snow patch	<i>Salix herbacea</i> snow patch with <i>Carex bigelowii</i> , <i>Veronica alpina</i> , <i>Oxyria digyna</i> , <i>Rhodiola rosea</i> , <i>Phleum commutatum</i> , <i>Taraxacum</i> sp., and <i>Pyrola minor</i> .
VT 010- VT 011	Copse	<i>Salix glauca</i> copse with <i>Empetrum nigrum</i> , <i>Deschampsia flexuosa</i> , <i>Lycopodium annotinum</i> , <i>Gymnocarpium dryopteris</i> , <i>Calamagrostis langsdorfii</i> , and <i>Polygonum viviparum</i> .
VT 011- VT 012	River bed	Stony river bed with <i>Chamaenerion latifolium</i> .
VT 012- VT 013	Heath	Mixed heath dominated by <i>Salix glauca</i> , <i>Empetrum nigrum</i> , with <i>Alchemilla alpina</i> , <i>Deschampsia flexuosa</i> , <i>Lycopodium annotinum</i> , and <i>Hierochloë alpina</i> .
VT 013- VT 014	Copse	<i>Salix</i> copse with <i>Empetrum nigrum</i> , <i>Deschampsia flexuosa</i> , <i>Lycopodium annotinum</i> , <i>Calamagrostis langsdorfii</i> , and <i>Ledum groenlandicum</i> .
VT 014- VT 015	River bed	River bed.
VT 015- VT 016	Copse	<i>Salix glauca</i> copse with <i>Calamagrostis langsdorfii</i> .
VT 016- VT 017	River bed	River bed.
VT 017- VT 018	Copse	Open <i>Salix glauca</i> copse with <i>Salix herbacea</i> , <i>Salix arctophila</i> , <i>Carex bigelowii</i> , and <i>Empetrum nigrum</i> .
VT 018- VT 019	River bed	No analyses.
VT 019- VT 020	Copse	Low <i>Salix glauca</i> copse with <i>Empetrum nigrum</i> , and <i>Calamagrostis langsdorfii</i> .
VT 020- VT 021	Heath	Mossy <i>Salix arctophila</i> vegetation with <i>Carex bigelowii</i> , <i>Calamagrostis langsdorfii</i> , <i>Salix glauca</i> , <i>Carex rariflora</i> , and <i>Corallorhiza trifida</i> .
VT 021- VT 022	Copse	<i>Salix glauca</i> copse (75 cm tall) with <i>Deschampsia flexuosa</i> and <i>Carex bigelowii</i> .
VT 022- VT 023	Fen	Fen dominated by <i>Carex rariflora</i> , <i>Scirpus caespitosus</i> , <i>Eriophorum angustifolium</i> , in the most wet places and with <i>Vaccinium uliginosum</i> on few mossy hummocks.
VT 023- VT 024	Heath	Mossy heath on north exposed slope dominated by <i>Empetrum nigrum</i> , <i>Vaccinium uliginosum</i> , <i>Salix glauca</i> with <i>Phyllodoce coerulea</i> and <i>Deschampsia flexuosa</i> .
VT 024- VT 025	Bedrock/heath	Scattered vegetation on rocks: <i>Betula nana</i> , <i>Loiseleuria procumbens</i> , and <i>Huperzia selago</i> .
VT 025- VT 026	Heath	Dry <i>Betula nana</i> heath with <i>Empetrum nigrum</i> and <i>Deschampsia flexuosa</i> .
VT 026- VT 027	Heath	Dry <i>Empetrum nigrum</i> , <i>Vaccinium uliginosum</i> , <i>Phyllodoce coerulea</i> heath with <i>Deschampsia flexuosa</i> .
VT 027- VT 028	Heath	<i>Betula nana</i> , <i>Empetrum nigrum</i> on dry wind exposed ground.
VT 028- VT 029	Heath	Dry <i>Empetrum nigrum</i> - <i>Betula nana</i> heath with <i>Vaccinium uliginosum</i> and <i>Deschampsia flexuosa</i> .

VT 029- VT 030	Heath	Mossy <i>Empetrum nigrum</i> heath with <i>Vaccinium uliginosum</i> , <i>Loiseleuria procumbens</i> , <i>Phyllodoce coerulea</i> , and <i>Carex bigelowii</i> .
VT 030- VT 031	Bedrock	
VT 031- VT 032	Heath	Hummucky heath dominated by <i>Empetrum nigrum</i> , <i>Vaccinium uliginosum</i> , <i>Carex bigelowii</i> , and <i>Ledum groenlandicum</i> .
VT 032- VT 033	Bedrock	Bedrock.
VT 033- VT 034	Heath	Hummucky mossy heath dominated by <i>Empetrum nigrum</i> and <i>Vaccinium uliginosum</i> , with <i>Betula nana</i> and <i>Phyllodoce coerulea</i> .
VT 034- VT 035	Heath	Dry mossy <i>Betula nana</i> lichen heath with <i>Empetrum nigrum</i> and <i>Ledum groenlandicum</i> .
VT 035- VT 036	Heath	Mossy <i>Empetrum nigrum</i> heath with <i>Ledum groenlandicum</i> and <i>Betula nana</i> .
VT 036- VT 037	Snow patch	Mossy late snow patch with <i>Salix herbacea</i> , <i>Carex bigelowii</i> , <i>Carex lachenalii</i> and <i>Saxifraga foliolosa</i> .
VT 037- VT 038	Heath	Low <i>Empetrum nigrum</i> heath with <i>Vaccinium uliginosum</i> and <i>Salix herbacea</i> .
VT 038- VT 039	Snow patch	Late mossy snow patch with <i>Salix herbacea</i> and <i>Carex bigelowii</i> .
VT 039- VT 040	Heath	Heath dominated by <i>Empetrum nigrum</i> , <i>Vaccinium uliginosum</i> with <i>Deschampsia flexuosa</i> and <i>Phyllodoce coerulea</i> .
VT 040- VT 041	Lake	
VT 041- VT 042	Fen	High diversity fen vegetation with <i>Scirpus caespitosus</i> , <i>Pinguicula vulgaris</i> , <i>Carex bigelowii</i> , and <i>Tofieldia pusilla</i> mixed with patches of heath dominated by <i>Empetrum nigrum</i> , <i>Salix glauca</i> , <i>Vaccinium uliginosum</i> , <i>Bartsia alpine</i> , <i>Tofieldia pusilla</i> , and <i>Carex bigelowii</i> .
VT 042- VT 043	River	
VT 043- VT 044	Heath	Low, mossy <i>Empetrum nigrum</i> heath with <i>Betula nana</i> and <i>Ledum groenlandicum</i> .
North of the river		
VT 044- VT 045	Heath	Hummucky, low <i>Betula nana</i> - <i>Empetrum nigrum</i> heath with <i>Carex bigelowii</i> and <i>Lycopodium annotinum</i> .
VT 045- VT 046	Bedrock	Bedrock with scattered <i>Empetrum nigrum</i> .
VT 046- VT 047	Heath	Hummucky <i>Empetrum nigrum</i> heath with <i>Carex bigelowii</i> , <i>Phyllodoce coerulea</i> , and <i>Deschampsia flexuosa</i> .
VT 047- VT 048	Heath	<i>Betula nana</i> - <i>Vaccinium uliginosum</i> - <i>Empetrum nigrum</i> heath.
VT 048- VT 049	Fen	Mossy <i>Carex rariflora</i> - <i>Scirpus caespitosus</i> fen with <i>Betula nana</i> , <i>Vaccinium uliginosum</i> , and <i>Empetrum nigrum</i> on hummocks.
VT 049- VT 050	Heath	Mossy hummocky, low scrub with <i>Empetrum nigrum</i> , <i>Betula nana</i> , and <i>Ledum palustre</i> with <i>Carex rariflora</i> and <i>Eriophorum angustifolium</i> .
VT 050- VT 051	Fen	<i>Scirpus caespitosus</i> - <i>Carex rariflora</i> - <i>Eriophorum angustifolium</i> fen with <i>Vaccinium uliginosum</i> , <i>Empetrum nigrum</i> in the first part of the analysis.
VT 051- VT 052	Fen	Mossy <i>Carex bigelowii</i> vegetation with <i>Coptis trifolia</i> and <i>Empetrum nigrum</i> .
VT 052- VT 053	Heath	Heath dominated by <i>Empetrum nigrum</i> , <i>Vaccinium uliginosum</i> with <i>Carex bigelowii</i> , <i>Ledum groenlandicum</i> , and <i>Deschampsia flexuosa</i> .
VT 053- VT 054	Heath	<i>Empetrum nigrum</i> - <i>Vaccinium uliginosum</i> heath with <i>Carex bigelowii</i> and <i>Coptis trifolia</i> .
VT 054- VT 055	Fen	Mossy <i>Scirpus caespitosus</i> vegetation (one meter with stones and water).
VT 055- VT 056	Heath	<i>Empetrum nigrum</i> heath with <i>Vaccinium uliginosum</i> , <i>Betula nana</i> , <i>Ledum groenlandicum</i> , and <i>Salix glauca</i> .
VT 056- VT 057	Heath	<i>Carex bigelowii</i> - <i>Vaccinium uliginosum</i> vegetation with <i>Ledum palustre</i> , <i>Empetrum nigrum</i> and <i>Salix arctophila</i> .
VT 057- VT 058	Heath	Species divers heath dominated by <i>Empetrum nigrum</i> and <i>Vaccinium uliginosum</i> with <i>Loiseleuria procumbens</i> and <i>Betula nana</i> .
VT 058- VT 059	Bedrock	Bedrock.
VT 059- VT 060	Heath	Mossy <i>Empetrum nigrum</i> heath on level ground with <i>Carex bigelowii</i> , <i>Deschampsia flexuosa</i> , <i>Betula nana</i> , <i>Carex deflexa</i> , and <i>Salix glauca</i> .
VT 060- VT 061	Heath	Crossing a creek. <i>Carex bigelowii</i> vegetation with <i>Vaccinium uliginosum</i> and <i>Calamagrostis langsdorfii</i> .
VT 061- VT 062	Copse	<i>Salix glauca</i> copse with <i>Betula nana</i> and <i>Calamagrostis langsdorfii</i> .
VT 062- VT 063	Heath	Hummucky <i>Empetrum nigrum</i> - <i>Betula nana</i> - <i>Salix glauca</i> heath with <i>Carex bigelowii</i> .
VT 063- VT 064	Heath	Low <i>Empetrum nigrum</i> heath with <i>Deschampsia flexuosa</i> and <i>Lycopodium annotinum</i> and <i>Diphasiastrum alpinum</i> .

VT 064- VT 065	Heath	<i>Empetrum nigrum</i> - <i>Salix glauca</i> heath with <i>Deschampsia flexuosa</i> .
VT 065- VT 066	Heath	Low <i>Empetrum nigrum</i> - <i>Vaccinium uliginosum</i> heath with lichens and <i>Carex bigelowii</i> .
VT 066- VT 067	Heath	Hummucky <i>Empetrum nigrum</i> - <i>Salix glauca</i> vegetation with <i>Carex bigelowii</i> and <i>Betula nana</i> .
VT 067- VT 068	Fen	<i>Scirpus caespitosus</i> - <i>Eriophorum angustifolium</i> fen with <i>Betula nana</i> and <i>Carex bigelowii</i> on mossy hummocks.
VT 068- VT 069	Fen	<i>Carex bigelowii</i> with <i>Betula nana</i> , <i>Empetrum nigrum</i> , <i>Vaccinium uliginosum</i> on tussocks. <i>Scirpus caespitosus</i> the last meters.
VT 069- VT 070	Heath	Lush heath with <i>Empetrum nigrum</i> , <i>Betula nana</i> , <i>Vaccinium uliginosum</i> , and <i>Salix glauca</i> .
VT 070- VT 071	Heath	Low <i>Vaccinium uliginosum</i> heath in depression with <i>Carex bigelowii</i> and <i>Deschampsia flexuosa</i> .
VT 071- VT 072	Copse	Tall, species divers <i>Salix glauca</i> - <i>Calamagrostis langsdorfii</i> vegetation with <i>Vaccinium uliginosum</i> and <i>Cerastium alpinum</i> .
VT 072- VT 073	Heath	<i>Deschampsia flexuosa</i> - <i>Empetrum nigrum</i> vegetation with <i>Cerastium alpinum</i> and <i>Salix glauca</i> .
VT 073- VT 074	Heath	Low <i>Salix glauca</i> vegetation with <i>Empetrum nigrum</i> , <i>Lycopodium annotinum</i> , and <i>Deschampsia flexuosa</i> .
VT 074- VT 0745	Heath	Low <i>Empetrum nigrum</i> - <i>Salix glauca</i> vegetation with <i>Deschampsia flexuosa</i> and <i>Carex deflexa</i> .
VT 075- VT 076	Copse	<i>Salix glauca</i> copse (up to 150 cm) with <i>Alnus crispa</i> (few up to 2 m), <i>Empetrum nigrum</i> and <i>Cerastium alpinum</i> . Patches with herb slope vegetation: <i>Calamagrostis langsdorfii</i> , <i>Stellaria calycantha</i> , <i>Rhodiola rosea</i> , <i>Gymnocarpium dryopteris</i> , <i>Dryopteris assimilis</i> , <i>Polysticum lonchitis</i> , <i>Taraxacum sp.</i> , <i>Hierachium sp.</i> , <i>Veronica alpina</i> , and <i>Angelica archangelica</i> .

The transect points below are situated above the steep slope with *Salix glauca* copse

VT 076- VT 077	Heath	Low heath dominated by <i>Empetrum nigrum</i> , <i>Vaccinium uliginosum</i> with <i>Loiseleuria procumbens</i> and <i>Carex bigelowii</i> .
VT 077- VT 078	Snow patch	Early <i>Salix herbacea</i> snow patch with <i>Carex bigelowii</i> , <i>Alchemilla alpina</i> , <i>Diphysastrum alpinum</i> , <i>Luzula spicata</i> , <i>Gnaphalium norvegicum</i> , and <i>Epilobium lactiflorum</i> .
VT 078- VT 079	Copse	Low <i>Salix glauca</i> copse with <i>Empetrum nigrum</i> and <i>Deschampsia flexuosa</i> .
VT 079- VT 080	Heath	Low <i>Empetrum nigrum</i> heath with <i>Vaccinium uliginosum</i> , <i>Deschampsia flexuosa</i> , <i>Juniperus communis</i> , and <i>Luzula spicata</i> .
VT 080- VT 081	Bedrock	Steep cliff.
VT 081- VT 082	Heath	Low heath dominated by <i>Empetrum nigrum</i> , <i>Vaccinium uliginosum</i> with <i>Betula nana</i> .
VT 082- VT 083	Bedrock	Bedrock.
VT 083- VT 084	Heath	Low heath dominated by <i>Empetrum nigrum</i> , <i>Vaccinium uliginosum</i> , <i>Loiseleuria procumbens</i> , <i>Salix glauca</i> with <i>Carex bigelowii</i> and <i>Juncus trifidus</i> .

VT 084 – last point!

Salt marsh transect

Zone	Vegetation type	Description – field notes on species composition
VT 100-VT 101	Heath	Low mossy <i>Empetrum nigrum</i> - <i>Betula nana</i> heath with lichens and <i>Ledum groenlandicum</i> , <i>Vaccinium uliginosum</i> , <i>Deschampsia flexuosa</i> , and <i>Carex bigelowii</i> .
VT 101-VT 102	Salt marsh	Salt marsh with <i>Carex glareosa</i> , <i>Potentilla egedii</i> , <i>Festuca rubra</i> , <i>Carex rariflora</i> , and <i>Stellaria humifusa</i> .
VT 102-VT 103	Sea & bedrock	Sea and bedrock.
VT 103-VT 104	Heath	Mossy <i>Empetrum nigrum</i> - <i>Vaccinium uliginosum</i> - <i>Betula nana</i> heath with <i>Ledum groenlandicum</i> , <i>Salix glauca</i> , and <i>Carex bigelowii</i> .
VT 104-VT 105	Fen	Mossy <i>Eriophorum angustifolium</i> fen with <i>Carex bigelowii</i> , <i>Vaccinium uliginosum</i> , and <i>Salix arctophila</i> .
VT 105-VT 106	Heath	<i>Calamagrostis langsdorfii</i> , <i>Vaccinium uliginosum</i> , <i>Salix arctophila</i> , <i>Salix glauca</i> with <i>Cornus suecica</i> and <i>Gymnocarpium dryopteris</i> . Crossing a narrow <i>Eriophorum angustifolium</i> vegetation along creek.

VT 106-VT 107 Heath Heath - first part dominated by *Ledum groenlandicum*, further by *Vaccinium uliginosum* with *Empetrum nigrum* and *Carex bigelowii* intersected by a creek with *Eriophorum angustifolium*.

VT 107 End point

Deschampsia-Juncus transect

Zone	Vegetation type	Description-field notes on species composition
VT 200-VT201	<i>Deschampsia-Juncus</i>	Gravel dominated by <i>Deschampsia flexuosa</i> , <i>Juncus trifidus</i> , <i>Potentilla tridentata</i> with <i>Empetrum nigrum</i> , <i>Silene acaulis</i> , <i>Juniperus communis</i> , and lichen.

3.1 Raunkjær analyses in the vegetation zones

Within each vegetation zone the vegetation was described focusing on the dominating vascular species and the results of 10 Raunkjær analyses. Permanent metal tubes mark the centre of the Raunkjær vegetation analyses. Five tubes (# 1-5) were placed with two metres intervals from the peg with the lower number and five tubes were placed before the peg with the higher number and numbered (# 6-10), see principle sketch in figure 12. In plant communities, which only cover few meters on the transect, the tubes which could not be placed on the transect, were placed on a line at a right angle to the transect, midway in the plant community, beginning at the western side – or less than ten analyses were carried out. Data and summary tables can be found at www.nuuk-basic.dk.

As on the Zero line (Fredskild and Mogensen, 1996) the Böcher-modified Raunkjær method (Böcher 1935) was used. The Raunkjær circling stick with marks indicating the radius of the three circles was placed in the tube and all vascular plant species within the three circles were recorded. In addition, it was recorded if moss and lichen occurred in the plots. A species gets 1 point if rooted or if a dwarf shrub has its buds within only the 1/10 m², 2 if found within the 1/100 m², and 3 if found within the 1/1000 m² circle. Thus, the maximum score in 10 circles is 30 for species with wide occurrence. In addition, it is recorded if the species is sexually reproductive (buds, flowers, or fruits) within the 1/10 m² circle. Photos were taken of all plots from the eastern side of the line and along the boundary line between the plant communities. Specimens, which are impossible to identify to species due to lack of flowers, fruits, or other diagnostic characters are given by the genus name or by cfr. (species should be checked, but most likely, e.g. *Carex* cfr. *lachenalii*). These species can be identified to species later during summers with better reproductive conditions.

Figure 13 summarizes the species composition in each of the vegetation types.

Among the vascular plants *Empetrum nigrum* appears in all vegetation types except salt marsh. *Carex bigelowii* occur in four vegetation types while *Vaccinium uliginosum* occur in three of the six types. Mosses appear with high frequency in all vegetation types. Species that are characteristic for only one vegetation type occurring among the ten most frequent species are marked with an asterisk in figure 13.

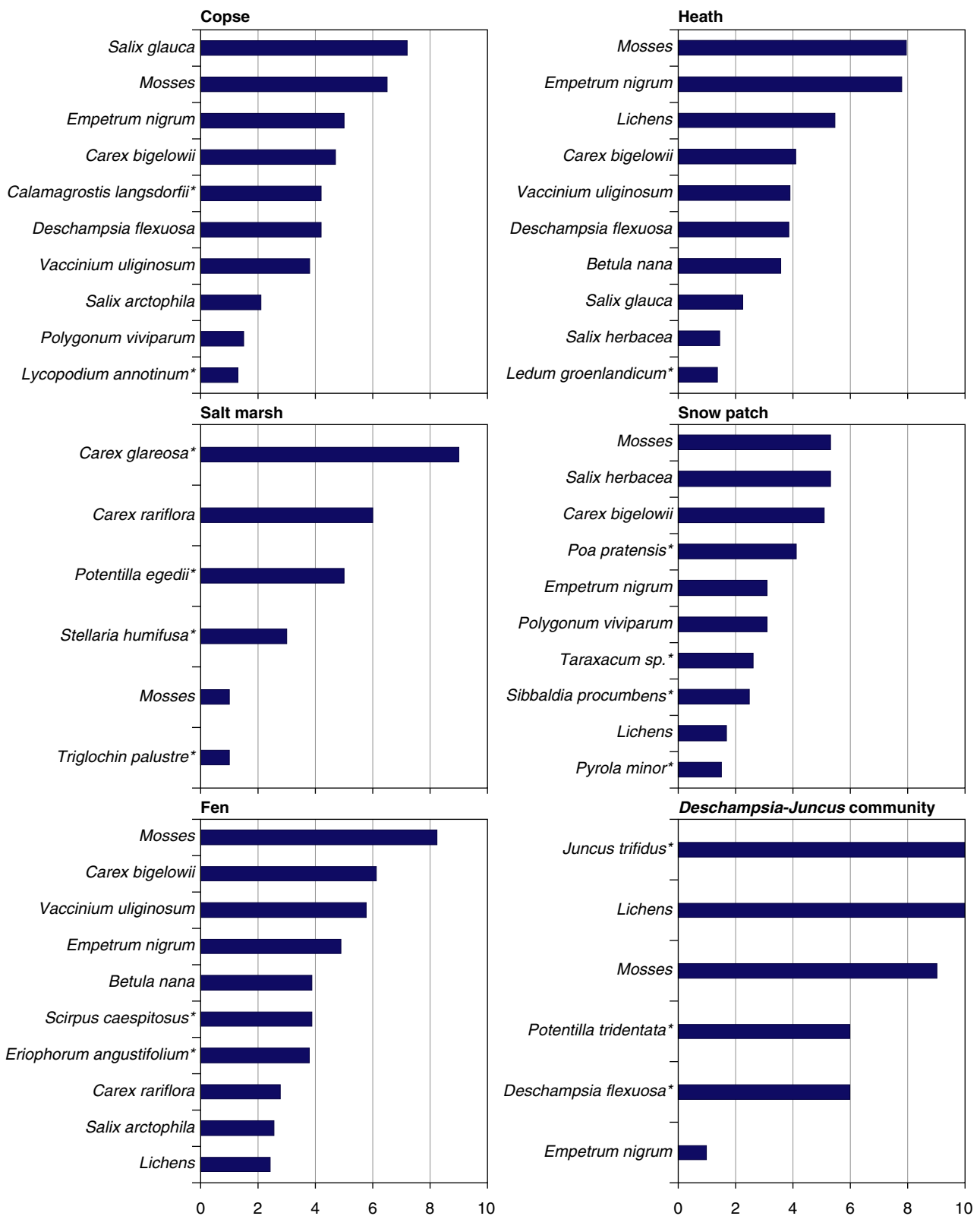


Figure 13. Summary of species composition of the vegetation types shown as number of hits (x-axis) per zone for each species in Raunkjær circles. Only the ten species with highest occurrences are shown. In the salt marsh transect and *Deschampsia-Juncus* transect only six species were recorded. An asterisk indicates that the species do not occur in other vegetation types among the ten highest frequencies.

Species which are specific for only one vegetation type are listed below:

Copse – *Calamagrostis langsdorfii* and *Lycopodium annotinum*.

Fen – *Scirpus caespitosus* and *Eriophorum angustifolium*.

Heath - *Ledum groenlandicum*.

Salt marsh – *Carex glareosa*, *Potentilla egedii*, *Stellaria humifusa*, and *Triglochin palustre*.

Snow patch – *Poa pratensis*, *Taraxacum sp.*, *Sibbaldia procumbens*, and *Pyrola minor*.

Deschampsia-Juncus community – *Juncus trifidus*, *Potentilla tridentata*, and *Deschampsia flexuosa*.

4 Floristics – vascular plant species

A list of vascular plant species was compiled including an index of abundance. The flora list is based on few floristic surveys in addition to the work along the vegetation transects. The total number of vascular species found is 138 and it is expected that additionally 10 to 15 species are occurring in the study area. Fredskild (1996) found that 155 species of vascular plants have been recorded at the Nuuk locality close by. This locality is the most intensively investigated locality in the southwest Greenland floristic region.

4.1 Flora list of the vascular plants of the study area

Data were collected during the period July 3 to July 22 and the abundance index of each species was estimated the last day in the field.

Table 2. List of vascular species in the Kobbefjord area. The frequency of the species has been assessed after a five point scale: 5 = very common, 4 = common, 3 = scattered occurrence, 2 = rare (3-5 finds), 1 = very rare (1-2 finds). Total number of vascular plant species is 138.

Taxon	Abb. taxon name	Abundance
<i>Agrostis mertensii</i>	Agrmer	3
<i>Alchemilla alpina</i>	Alcalp	4
<i>Alchemilla filicaulis</i>	Alcfil	3
<i>Alchemilla glomerulans</i>	Alcglo	3
<i>Alnus crispa</i>	Alncri	3
<i>Angelica archangelica</i> ssp. <i>norvegica</i>	Angarc	3
<i>Antennaria canescens</i>	Antcan	1
<i>Arabis alpina</i>	Araalp	1
<i>Bartsia alpina</i>	Baralp	4
<i>Betula nana</i>	Betnan	5
<i>Calamagrostis langsdorfii</i>	Callan	4
<i>Calamagrostis neglecta</i>	Calneg	1
<i>Campanula gieseckiana</i>	Camgie	3
<i>Cardamine bellidifolia</i>	Carbel	1
<i>Carex actogena</i>	Caract	1
<i>Carex bigelowii</i>	Carbig	5
<i>Carex brunescens</i>	Carbru	4
<i>Carex canescens</i>	Carcan	1
<i>Carex capillaris</i>	Carcap	2
<i>Carex deflexa</i>	Cardef	3
<i>Carex glareosa</i>	Cargla	3
<i>Carex lachenalii</i>	Carlac	1
<i>Carex rariflora</i>	Carrar	4
<i>Carex saxatilis</i>	Carsax	3
<i>Carex scirpoidea</i>	Carsci	3
<i>Carex subspathacea</i>	Carsub	3
<i>Cerastium alpinum</i>	Ceralp	3

<i>Cerastium cerastoides</i>	Cercer	3
<i>Chamaenerion angustifolium</i>	Chaang	3
<i>Chamaenerion latifolium</i>	Chalat	3
<i>Cochlearia groenlandica</i>	Cocgro	1
<i>Coptis trifolia</i>	Coptri	4
<i>Corallorhiza trifida</i>	Cortri	3
<i>Cornus suecica</i>	Corsue	4
<i>Cystopteris fragilis</i>	Cysfra	2
<i>Deschampsia flexuosa</i>	Desfle	5
<i>Diapensia lapponica</i>	Dialap	3
<i>Diphasiastrum alpinum</i>	Dipalp	4
<i>Diphasiastrum complanatum</i>	Dipcom	1
<i>Dryopteris dilatata</i>	Drydil	4
<i>Elymus arenarius</i>	Elyare	3
<i>Empetrum nigrum</i> ssp. <i>hermaphroditum</i>	Empnig	5
<i>Epilobium anagallidifolium</i>	Epiana	2
<i>Epilobium hornemanni</i>	Epior	1
<i>Epilobium lactiflorum</i>	Epilac	2
<i>Equisetum arvense</i>	Equar	3
<i>Equisetum silvaticum</i>	Equsil	3
<i>Erigeron uniflorus</i>	Eriuni	1
<i>Eriophorum angustifolium</i>	Eriang	5
<i>Eriophorum scheuchzeri</i>	Erisch	3
<i>Euphrasia frigida</i>	Eupfri	1
<i>Festuca brachyphylla</i>	Fesbra	2
<i>Festuca rubra</i>	Fesrub	3
<i>Festuca vivipara</i>	Fesviv	2
<i>Gentiana nivalis</i>	Genniv	1
<i>Gnaphalium norvegicum</i>	Gnanor	3
<i>Gnaphalium supinum</i>	Gnasup	3
<i>Gymnocarpium dryopteris</i>	Gymdry	3
<i>Harrimanella hypnoides</i>	Harhyp	3
<i>Hieracium hyparcticum</i>	Hiehyp	4
<i>Hierochloë alpina</i>	Hiealp	3
<i>Hippuris vulgaris</i>	Hipvul	3
<i>Huperzia selago</i>	Hupsel	4
<i>Juncus biglumis</i>	Junbig	1
<i>Juncus trifidus</i>	Juntri	4
<i>Juniperus communis</i>	Juncom	3
<i>Ledum groenlandicum</i>	Ledgro	5
<i>Ledum palustre</i> ssp. <i>descumbens</i>	Ledpal	3
<i>Leucorchis albida</i>	Leualb	3
<i>Linnæa borealis</i> ssp. <i>americana</i>	Linbor	1
<i>Listera cordata</i>	Liscor	3
<i>Loiseleuria procumbens</i>	Loipro	5
<i>Luzula confusa</i>	Luzcon	1
<i>Luzula groenlandica</i>	Luzgro	3
<i>Luzula multiflora</i>	Luzmul	3
<i>Luzula parviflora</i>	Luzpar	4
<i>Luzula spicata</i>	Luzspi	3
<i>Lycopodium annotinum</i>	Lycann	4

<i>Menyanthes trifoliata</i>	Mentri	1
<i>Minuartia groenlandica</i>	Mingro	2
<i>Montia fontana</i> ssp. <i>fontana</i>	Monfon	1
<i>Oxycoccus palustris</i> ssp. <i>microphyllus</i>	Oxypal	4
<i>Oxyria digyna</i>	Oxydig	3
<i>Pedicularis flammea</i>	Pedfla	3
<i>Pedicularis lapponica</i>	Pedlap	4
<i>Phleum commutatum</i>	Phlcom	3
<i>Phyllodoce coerulea</i>	Phycoe	4
<i>Pinguicula vulgaris</i>	Pinvul	3
<i>Plantago maritima</i>	Plamar	1
<i>Platanthera hyperborea</i>	Plahyp	2
<i>Poa alpina</i>	Poaalp	3
<i>Poa glauca</i>	Poagla	3
<i>Poa nemoralis</i>	Poanem	2
<i>Poa pratensis</i>	Poapra	3
<i>Polygonum viviparum</i>	Polviv	4
<i>Polysticum lonchitis</i>	Pollon	3
<i>Potamogeton</i> sp.	Potsp.	1
<i>Potentilla crantzii</i>	Potcra	3
<i>Potentilla egedii</i>	Potege	3
<i>Potentilla tridentata</i>	Pottri	3
<i>Puccinellia phryganodes</i>	Pucphr	3
<i>Puccinellia</i> sp.	Pucsp.	2
<i>Pyrola grandiflora</i>	Pygrfa	1
<i>Pyrola minor</i>	Pyrmin	3
<i>Ranunculus pygmaeus</i>	Ranpyg	1
<i>Rhinanthus minor</i>	Rhimin	1
<i>Rhodiola rosea</i>	Rhoros	3
<i>Rubus chamaemorus</i>	Rubcha	1
<i>Sagina saginoides</i>	Sagsag	1
<i>Salix arctophila</i>	Salarc	5
<i>Salix glauca</i>	Salgla	5
<i>Salix herbacea</i>	Salher	4
<i>Saxifraga caespitosa</i>	Saxcae	3
<i>Saxifraga foliolosa</i>	Saxfol	1
<i>Saxifraga nivalis</i>	Saxniv	1
<i>Saxifraga paniculata</i>	Saxpan	1
<i>Saxifraga oppositifolia</i>	Saxopp	1
<i>Saxifraga stellaris</i>	Saxste	3
<i>Scirpus caespitosus</i>	Scicae	5
<i>Sibbaldia procumbens</i>	Sibpro	3
<i>Silene acaulis</i>	Silaca	3
<i>Sparganium hyperboreum</i>	Spahyp	2
<i>Stellaria calycantha</i>	Stecal	3
<i>Stellaria humifusa</i>	Stehum	3
<i>Stellaria longipes</i>	Stelon	3
<i>Taraxacum croceum</i>	Tarcro	4
<i>Thalictrum alpinum</i>	Thaalp	3
<i>Thymus drucei</i>	Thydru	2

<i>Tofieldia pusilla</i>	Tofpus	4
<i>Triglochin palustre</i>	Tripal	3
<i>Trisetum spicatum</i>	Trispi	3
<i>Vaccinium uliginosum</i>	Vaculi	5
<i>Vahlodea atropurpurea</i>	Vahatr	1
<i>Veronica alpina</i>	Veralp	3
<i>Veronica fruticans</i>	Verfru	1
<i>Veronica wormskjoldii</i>	Verwor	3
<i>Viola labradorica</i>	Violab	3
<i>Viscaria alpina</i>	Visalp	3

5 Ground truthing for a vegetation map

It is intended to prepare a vegetation type map based on satellite images and ground truthings of the vegetation. Figure 14 shows the positions of ground truthing points and appendix 3 contains detailed positions and notes on vegetation type and on other species that are occurring at each of the sites. Each site has been selected as representative for a specific vegetation type.

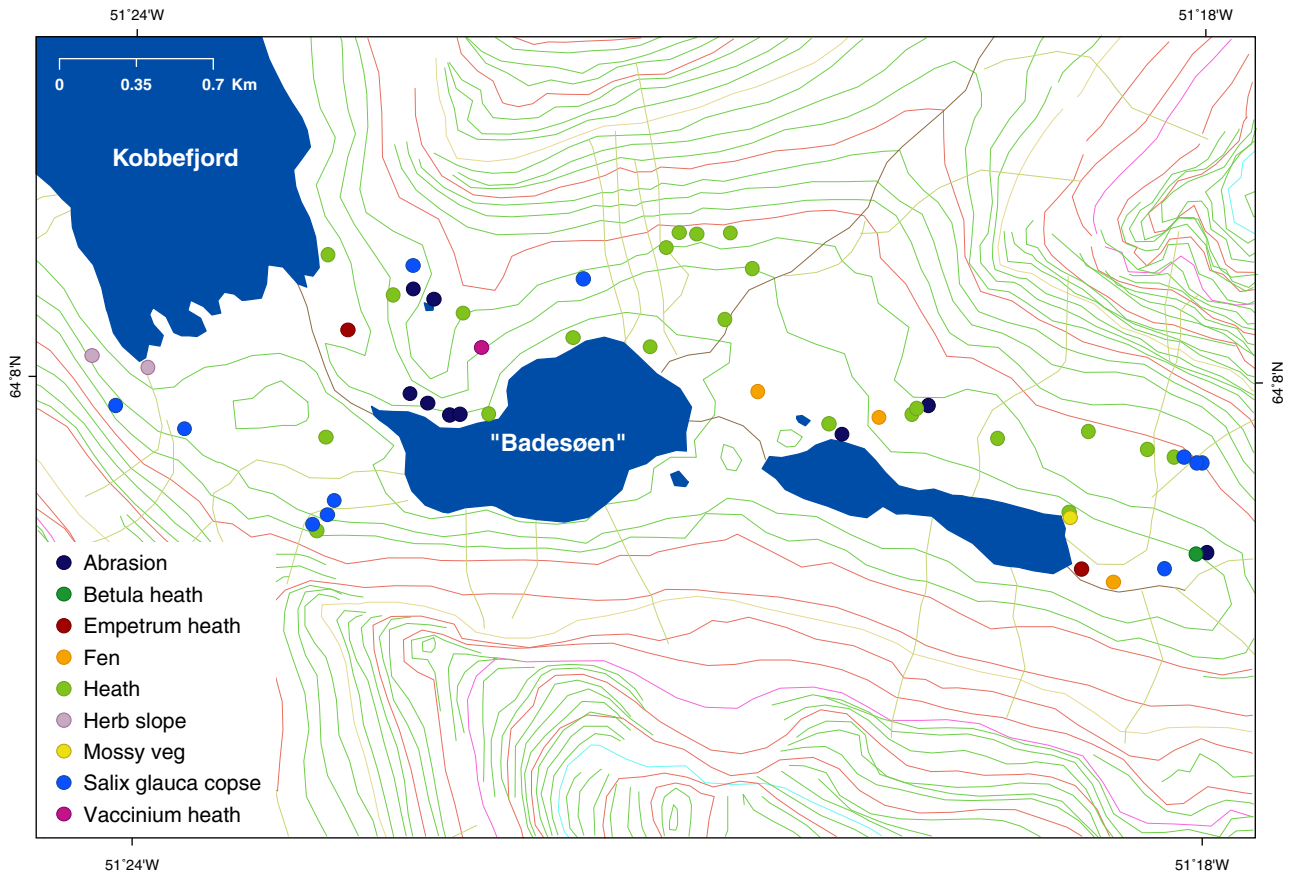


Figure 14. Sites to be used for ground truthing of the vegetation map. See Appendix 3 for details on positions and species composition.

6 References

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Appendices

Appendix 1. Positions of pegs marking boundaries between vegetation zones.

GPS-positions are based on WGS84. Accuracy of positions is 5-10 m.

Peg code	VEGTYPE	LAT	LONG	UTM Y_PROJ	UTM X_PROJ	ALTITUDE
VT 001	Snow patch	64,1271	-51,3963	7773909,482701990	2406844,842504170	166
VT 002	Snow patch	64,1273	-51,3956	7773947,728370170	2406859,262276280	169
VT 003	Snow patch	64,1272	-51,3958	7773936,214499570	2406858,235869860	144
VT 004	Snow patch	64,1274	-51,3955	7773963,672569730	2406855,657659750	156
VT 005	Snow patch	64,1275	-51,3951	7773990,501166120	2406861,307806160	131
VT 006	Snow patch	64,1276	-51,3949	7774001,291211510	2406860,303969330	125
VT 007	Heath	64,1277	-51,3948	7774010,931273620	2406863,269041590	116
VT 008	Heath	64,1279	-51,3943	7774051,666897990	2406864,469412140	117
VT 009	Snow patch	64,1280	-51,3941	7774061,840490320	2406867,335426600	108
VT010	Copse	64,1282	-51,3937	7774095,842990250	2406867,301643420	89
VT011	River bed	64,1286	-51,3927	7774163,416865640	2406874,631702040	53
VT012	Heath	64,1288	-51,3924	7774189,522203340	2406876,345200360	65
VT013	Copse	64,1293	-51,3912	7774267,415198180	2406889,017830240	53
VT014	River Bed	64,1296	-51,3903	7774330,002238090	2406898,811583960	50
VT015	Copse	64,1301	-51,3893	7774402,725193800	2406906,063040130	42
VT016	River Bed	64,1302	-51,3890	7774423,615766600	2406910,314906000	38
VT017	Copse	64,1302	-51,3890	7774425,057849920	2406909,790030740	44
VT018	River bed	64,1303	-51,3887	7774440,835517320	2406916,179886300	37
VT019	Copse	64,1303	-51,3886	7774449,566135850	2406917,239475460	48
VT020	Heath	64,1304	-51,3884	7774456,333285870	2406919,655862870	40
VT021	Copse	64,1306	-51,3883	7774482,740601260	2406909,961404430	55
VT022	Fen	64,1307	-51,3879	7774504,206046550	2406919,449341680	50
VT023	Heath	64,1312	-51,3864	7774595,015270110	2406942,783868100	28
VT024	Bedrock/Heath	64,1315	-51,3860	7774642,161433880	2406932,227448360	49
VT025	Heath	64,1317	-51,3855	7774673,113087570	2406939,435546760	58
VT026	Heath	64,1318	-51,3856	7774675,569191380	2406931,787484970	53
VT027	Heath	64,1319	-51,3854	7774697,524771430	2406927,432602940	0
VT028	Heath	64,1320	-51,3854	7774706,952885720	2406919,346887390	45
VT029	Heath	64,1319	-51,3852	7774702,085882650	2406936,761406030	0
VT030	Bedrock	64,1321	-51,3843	7774749,603706130	2406952,765367320	23
VT031	Heath	64,1324	-51,3841	7774777,690345950	2406948,076357510	49
VT032	Bedrock	64,1325	-51,3838	7774796,952222520	2406948,836424450	43
VT033	Heath	64,1326	-51,3834	7774816,953368440	2406956,583468270	37
VT034	Heath	64,1327	-51,3832	7774834,925037340	2406959,760244190	44
VT035	Heath	64,1329	-51,3828	7774865,247077810	2406963,382497130	44
VT036	Snow patch	64,1330	-51,3827	7774874,456531390	2406957,991159440	41
VT037	Heath	64,1330	-51,3826	7774879,994189640	2406962,244968450	38
VT038	Snow patch	64,1330	-51,3826	7774876,826864320	2406960,908822500	37
VT039	Heath	64,1330	-51,3824	7774890,441203420	2406965,106810370	0
VT040	Lake	64,1332	-51,3821	7774914,862588790	2406963,051540340	22
VT041	Fen	64,1334	-51,3816	7774952,303546600	2406966,482037300	12
VT042	River	64,1336	-51,3814	7774975,511352170	2406965,548488740	29
VT043	Heath	64,1338	-51,3810	7775006,731828120	2406962,012496100	30

VT044	Heath	64,1340	-51,3809	7775027,580372570	2406954,551223140	36
VT045	Bedrock	64,1343	-51,3805	7775070,772940400	2406946,470228350	34
VT046	Heath	64,1344	-51,3801	7775087,628418860	2406955,670976510	24
VT047	Heath	64,1346	-51,3800	7775106,692269910	2406950,994127280	26
VT048	Fen	64,1346	-51,3799	7775111,601623640	2406953,742167350	0
VT049	Heath	64,1348	-51,3795	7775141,800292490	2406956,177081490	29
VT050	Fen	64,1349	-51,3796	7775147,916027330	2406940,480539260	19
VT051	Fen	64,1353	-51,3788	7775212,219482930	2406943,530826610	10
VT052	Heath	64,1356	-51,3793	7775224,714322260	2406902,515302270	24
VT053	Heath	64,1357	-51,3783	7775267,475710210	2406933,750593690	24
VT054	Fen	64,1357	-51,3781	7775274,364155880	2406938,926290610	27
VT055	Heath	64,1358	-51,3780	7775284,142951880	2406937,732285750	23
VT056	Heath	64,1362	-51,3776	7775333,528930700	2406927,329527060	31
VT057	Heath	64,1363	-51,3773	7775349,382928060	2406931,966093390	38
VT058	Bedrock	64,1366	-51,3768	7775392,920064080	2406927,640731590	40
VT059	Heath	64,1369	-51,3763	7775438,275822500	2406927,212225870	59
VT060	Heath	64,1368	-51,3766	7775420,458245580	2406920,136016370	0
VT061	Copse	64,1372	-51,3760	7775472,308530940	2406914,455345300	42
VT062	Heath	64,1373	-51,3759	7775485,689324630	2406914,373896500	45
VT063	Heath	64,1383	-51,3742	7775633,946289120	2406903,236309150	44
VT064	Heath	64,1386	-51,3743	7775655,679413840	2406880,272804160	0
VT065	Heath	64,1386	-51,3741	7775663,409798580	2406891,483810890	68
VT066	Heath	64,1388	-51,3737	7775690,015348490	2406892,796596820	74
VT067	Fen	64,1389	-51,3737	7775700,885597530	2406881,312040330	71
VT068	Fen	64,1391	-51,3732	7775738,430594920	2406884,520938300	79
VT069	Heath	64,1393	-51,3729	7775761,940326220	2406886,993551890	74
VT070	Heath	64,1403	-51,3716	7775891,871148940	2406866,500739720	109
VT071	Copse	64,1404	-51,3715	7775902,470174940	2406864,642483750	106
VT072	Heath	64,1404	-51,3714	7775913,567865160	2406865,064354740	121
VT073	Heath	64,1404	-51,3713	7775917,816560910	2406867,001931120	117
VT074	Heath	64,1405	-51,3712	7775930,037928320	2406863,829957070	124
VT075	Copse	64,1406	-51,3712	7775936,229019920	2406861,508615860	139
VT076	Heath	64,1422	-51,3688	7776151,241342100	2406840,463267400	293
VT077	Snow patch	64,1428	-51,3679	7776242,746039240	2406826,886322010	310
VT078	Copse	64,1429	-51,3677	7776255,099177620	2406828,969621800	314
VT079	Heath	64,1430	-51,3677	7776265,296193330	2406824,720578610	318
VT080	Bedrock	64,1431	-51,3675	7776283,582301670	2406820,755025590	314
VT081	Heath	64,1432	-51,3671	7776300,760705920	2406831,384451070	349
VT082	Bedrock	64,1439	-51,3662	7776392,649800450	2406817,597833350	370
VT083	Heath	64,1441	-51,3655	7776433,385222550	2406831,363691760	0
VT084	End of main transect	64,1445	-51,3651	7776481,581192720	2406822,494928110	392
VT085		64,1361	-51,3904	7774917,893732930	2406423,367731720	12
VT101	Salt marsh	64,1360	-51,3904	7774905,828134160	2406436,107628130	4
VT102	Bedrock	64,1358	-51,3904	7774890,282930700	2406447,575051040	2
VT103	Heath	64,1355	-51,3903	7774862,195018730	2406471,340376370	4
VT104	Fen	64,1344	-51,3904	7774764,012030320	2406547,528046480	22
VT105	Heath	64,1342	-51,3904	7774740,134246000	2406565,981029430	6
VT106	Heath	64,1341	-51,3902	7774739,714299580	2406578,645012430	18
VT107	End of salt marsh transect	64,1338	-51,3904	7774709,032054720	2406589,181150000	21
VT200	<i>Deschampsia-Juncus</i> transect	64,1375	-51,3745	7775518,662637	2406980,79651	59
VT201	End of <i>Deschampsia-Juncus</i> transect	missing	missing	missing	missing	61

Appendix 2. Vegetation transect – details

Zone	Vegetation type	Length	Photos	Comments – Raunkjær analyses
VT 001- VT 002	Snow patch	27 m	419-433	No analysis.
VT 002- VT 003	Snow patch	8 m	432-435	No analysis.
VT 003- VT 004	Snow patch	28 m	436-438	First analysis!
VT 004- VT 005	Snow patch	23 m	439-444	
VT 005- VT 006	Snow patch	12 m	445-446	Five tubes on the transect, five one m west of the transect.
VT 006- VT 007	Snow patch	10 m	448-450	Starts with stones; three tubes on the transect, four one meter east of.
VT 007- VT 008	Heath	39 m	451-454	
VT 008- VT 009	Heath	12 m	455-457	Five tubes on the transect and five east of the transect.
VT 009- VT 010	Snow patch	32 m	458-460	
VT 010- VT 011	Copse	Not possible to measure	461-463	
VT 011- VT 012	River bed	10 m	464-468	No analyses
VT 012- VT 013	Heath	80 m	469-471	
VT 013- VT 014	Copse	60 m	472-474	
VT 014- VT 015	River bed	64 m	475-478	No analyses
VT 015- VT 016	Copse	19 m	479-481	.
VT 016- VT 017	River bed	4 m	482-485	No analysis
VT 017- VT 018	Copse	20 m	486-487	
VT 018- VT 019	River bed	9 m	488-490	River bed
VT 019- VT 020	Copse	14 m	491-493	One analysis on the transect, one west of and one east of.
VT 020- VT 021	Heath	4 m	494-497	Six on the transect, two west of and two east of.
VT 021- VT 022	Copse	24 m	498-500	4th tube at 9 m!
VT 022- VT 023	Fen	101 m	504-505	
VT 023- VT 024	Heath	37 m	504-506	
VT 024- VT 025	Bedrock/heath	15 m	507-509	No analyses.
VT 025- VT 026	Heath	13 m	510-512	Five on the transect (number three is bedrock), three west of, two east of.
VT 026- VT 027	Heath	6 m	513-515	Two on the transect, two west of, two east of.
VT 027- VT 028	Heath	15 m	516-518	Seven on the transect, two west of, one east of.
VT 028- VT 029	Heath	25 m	519-521	Only seven on the transect, the rest is bedrock.
VT 029- VT 030	Heath	33 m	522-524	
VT 030- VT 031	Bedrock	26 m	525-527	Bedrock
VT 031- VT 032	Heath	26 m	528-530	.
VT 032- VT 033	Bedrock	22 m	531-533	No analyses.
VT 033- VT 034	Heath	15 m	534-536	
VT 034- VT 035	Heath	25 m	537-539	.
VT 035- VT 036	Heath	6 m	540-541	Two analyses on the transect, seven west of, one east of.
VT 036- VT 037	Snow patch	6 m	542-544	Two analyses on the transect, one west of, one east of.
VT 037- VT 038	Heath	4 m	545-547	Two analyses on the transect, one west of, one east of.
VT 038- VT 039	Snow patch	3 m	549-550	Two analyses on the transect, one west of.
VT 039- VT 040	Heath	26 m	552-554	
VT 040- VT 041	Lake	XX m	555-556	
Lake				
VT 041- VT 042	Fen	14 m	557-559	Six on the transect, three west of, one east of.
VT 042- VT 043	River	Distance to the river 9 m	560-563	

VT 043- VT 044	Heath	13 m (4 m of bedrock)	564-567	Four on the transect, two west of, 4 east of.
North of the river				
VT 044- VT 045	Heath	53 m	570-572	
VT 045- VT 046	Bedrock	20 m	573-574	No analyses
VT 046- VT 047	Heath	15 m	575-577	Seven on the transect, two west of, one east of.
VT 047- VT 048	Heath	16 m	578-580	Seven on the transect, two west of, one east of.
VT 048- VT 049	Fen	24 m	581-583	
VT 049- VT 050	Heath	6 m	584-586	Two on the transect, one west of, one east of.
VT 050- VT 051	Fen	71 m	587-590	
VT 051- VT 052	Fen	4 m	591-593	
VT 052- VT 053	Heath	46 m	594-596	
VT 053- VT 054	Heath	5 m	597-599	Two on the transect, one east of.
VT 054- VT 055	Fen	4 m	600-602	Two on the transect, three west of.
VT 055- VT 056	Heath	48 m	603-605	
VT 056- VT 057	Heath	5 m	606-609	Two on transect, one west of, one east of.
VT 057- VT 058	Heath	63 m	615-616	
VT 058- VT 059	Bedrock	34 m	610-614	No analyses.
VT 059- VT 060	Heath	37 m	617-619	
VT 060- VT 061	Heath	5 m	620-621	Two on the transect, two west of, and two east of the transect.
VT 061- VT 062	Copse	11 m	622-623	Five on the transect, two east of.
VT 062- VT 063	Heath	152 m	624-625	
VT 063- VT 064	Heath	6 m	626-628	Three on the transect, one east of the transect
VT 064- VT 065	Heath	20 m	629-630	
VT 065- VT 066	Heath	25 m	631-633	
VT 066- VT 067	Heath	20 m	634-635	
VT 067- VT 068	Fen	21 m	636-637	
VT 068- VT 069	Fen	29 m	638-640	
VT 069- VT 070	Heath	129 m	641-642	
VT 070- VT 071	Heath	10 m	646-648	
VT 071- VT 072	Copse	12 m	649-650	
VT 072- VT 073	Heath	8 m	651-653	
VT 073- VT 074	Heath	16 m	654-656	
VT 074- VT 0745	Heath	7 m	657-660	
VT 075- VT 076	Copse	XX m	661-663	Beginning of Salix copse before steep slope
Above the steep slope with Salix glauca copse				
VT 076- VT 077	Heath	90 m	988991	
VT 077- VT 078	Snow patch	17 m	992-995	
VT 078- VT 079	Copse	11 m	996-998	
VT 079- VT 080	Heath	11 m	999-002	
VT 080- VT 081	Bedrock	XX m	003-005	No analyses
VT 081- VT 082	Heath	84 m		
VT 082- VT 083	Bedrock	25 m		
VT 083- VT 084	Heath	64 m		
VT 084 – last point!		394		

Salt marsh transect

VT 100-VT 101 Heath 17 m
VT 101-VT 102 Salt marsh 16 m
VT 102-VT 103 Sea & bedrock 2
VT 103-VT 104 Heath 123 m
VT 104-VT 105 Fen 13 m1
VT 105-VT 106 Heath 18 m

Crossing a narrow
Eriophorum angus-
tifolium vegetation
along creek.

VT 106-VT 107 Heath 38 m

VT 107 End point

***Deschampsia-Juncus* vegetation transect**

VT 200-201 46 m 026-032 10 on the transect, 10 2 m south of.

VT 201 End point 034-039

Appendix 3. Positions used for ground truthing of vegetation types

Altitude figures should be taken with caution. See Table 2 for species name abbreviations.

LATITUDE	LONGITUDE	UTM Y_PROJ	UTM X_PROJ	ALTITUDE	VEGETATION TYPE	DOMINATING SPECIES	OTHER SPECIES
64,133723750	-51,398789720	7774434,101629650	2406264,098811250	5	Herb slope	Salher	
64,134179810	-51,404027070	7774309,355631200	2406022,943661200	48	Herb slope		
64,132157760	-51,401749880	7774197,695910680	2406260,308710310	0	Salix glauca copse		
64,131213200	-51,395315510	7774316,030330020	2406584,521293470	53	Salix glauca copse		
64,132714740	-51,374249020	7775121,531848520	2407312,007616880	35	Abrasion	Desfle, Juntri	Lichen, Mos, Silaca, Visalp, Juntri, Luzspi
64,132327330	-51,372593930	7775138,871621840	2407405,893799300	35	Abrasion	Desfle, Juntri	
64,131849890	-51,370553360	7775160,272685490	2407521,633223300	33	Abrasion	Desfle, Juntri	Phycoe
64,131881490	-51,369585410	7775193,892823060	2407557,769792050	42	Abrasion	Juntri	Desfle, Pottri, Lichen, Mos
64,131903870	-51,366883670	7775281,751608320	2407663,417549880	24	Heath	Empnig, Vaculi, and Betnan	Ledgro, Carbig
64,135038200	-51,359035700	7775816,046806790	2407747,048173330	28	Heath	Empnig, Vaculi, and Betnan	
64,134677700	-51,351814100	7776012,720001350	2408059,929856640	21	Heath	Empnig, Vaculi, and Betnan	Ledgro, Carbig
64,135814030	-51,344829630	7776337,964476410	2408254,482637140	39	Heath	Empnig, Salgla, and Ledpal	Lichen
64,137908670	-51,342293940	7776608,945940540	2408202,714203980	21	Heath		
64,139343480	-51,344375080	7776673,233653380	2408015,735821750	78	Heath	Vaculi and Empnig	Salgla, Ledgro
64,139295700	-51,347510580	7776569,261505390	2407894,786595780	81	Heath	Empnig, Desfle, Lichen	
64,139357980	-51,349159470	7776522,533163560	2407824,821375020	87	Heath	Empnig, Desfle, Lichen	Salgla
64,138732190	-51,350357410	7776427,585352890	2407822,805183910	85	Heath	Empnig, Desfle, Lichen	
64,137449840	-51,358102790	7776064,938927340	2407608,677140320	59	Salix glauca copse	Salgla	Empnig, Vaculi, Betnan, Led
64,136018630	-51,369312580	7775578,742308280	2407267,779297480	71	Heath	Empnig	Vaculi, Carbig, Loipro, Lichen
64,136573090	-51,372079870	7775541,270599380	2407117,603464060	72	Abrasion	Desfle, Juntri	Lichen, Mos, Silaca, Visalp, Juntri, Luzspi
64,136987500	-51,373979540	7775518,624775860	2407012,056076980	65	Abrasion	Desfle, Juntri	Lichen, Mos, Silaca, Visalp, Juntri, Luzspi
64,130908190	-51,382088030	7774708,287531340	2407132,046268910	38	Heath	Empnig, Betnan, Vaculi	phycoe, carbig, salgla
64,128329910	-51,381259730	7774500,113652780	2407352,362108470	41	Salix glauca copse	Salgla	callan, angans, equarv
64,127738900	-51,381927260	7774425,163170470	2407368,809938850	36	Salix glauca copse	Salgla	callan, angans, equarv
64,127086960	-51,382906770	7774334,761897190	2407377,293005720	59	Heath	Vaculi, Empnig, Salgla	corsue, phycoe, pedlap
64,127340930	-51,383283790	7774345,885498810	2407343,856678600	55	Salix glauca copse	Salgla	vaculi, empnig, gymdry
64,135292930	-51,380100180	7775170,167314280	2406892,244169980	16	Empetrum heath	Empnig	vaculi, carbig, betnan, ledgro, salarc

64,132876170	-51,341725810	7776169,558668780	2408591,422596170	25	Fen	Carrar and Eriang	Oxypal
64,131572450	-51,335062030	7776262,882629550	2408950,780701890	42	Heath	Empnig, Vaculi, and Betnan	Carbig, Ledgro, Salgla,
64,131153520	-51,333832570	7776263,891736960	2409030,064975220	40	Abrasion	Loipro, Betnan, Dialap	Oragnic crust, Juntri
64,131849220	-51,330386020	7776436,700239620	2409116,226589650	14	Fen	Scicae, Eriang	Carbig, Oxypal
64,131980730	-51,327295020	7776546,931353800	2409229,328060180	50	Heath	Empnig, Betnan, Vaculi, Ledgro	Carbig, Lycann, Desfle
64,132229590	-51,326857070	7776583,473798560	2409228,595518980	53	Heath	Emp	Vaculi, Carbig, Salgla
64,132344170	-51,325774710	7776628,302486970	2409263,209556870	76	Abrasion	Desfle, Juntri, Lichen	Silaca, Pottri, Salgla, Phycoc, Loipro
64,131014550	-51,319258870	7776714,672106280	2409618,572518980	52	Heath	Vaculi, Empnig	Betnan, Salgla, Carbig
64,128016430	-51,312565670	7776655,116297700	2410102,462421180	50	Heath	Empnig, Vaculi, and Betnan	Mos, Lichen, Carbig, Desfle
64,127782660	-51,312448490	7776637,601232310	2410124,133137840	36	Mossy vegetation	Carrar	Vaculi, Empnig, Betnan, Carbig
64,125691960	-51,311380720	7776481,587905640	2410318,731741440	29	Empetrum heath	Empnig, Vaculi	Carrar, Eriang
64,125165910	-51,308399780	7776528,628309090	2410475,345047760	34	Fen	Carrar, Eriang	Salarc, Carcan
64,125723640	-51,303603240	7776731,927244840	2410625,092920010	48	Salix glauca copse	Salgla	Vaculi, Empnig, Carbig, Boulders
64,126325550	-51,300659770	7776880,281597440	2410698,068334760	42	Betula heath	Betnan, Empnig, Lichen	Desfle, Lycann, Carbig
64,126392600	-51,299631220	7776919,104437370	2410734,000925800	50	Abrasion	Desfle, Juntri, Loipro, Lichen, Alcalp, Dipalp Moss	
64,130050050	-51,300120980	7777235,822636880	2410448,198198790	94	Salix glauca copse	Salgla	Ledgro, Callan, Desfle, Empnig, Vac
64,130054320	-51,300626830	7777220,115392620	2410427,816771990	94	Salix glauca copse	Salgla	Angarc, Gymgly, Callan, Ledgro
64,130289100	-51,301827200	7777203,254111070	2410363,091450540	92	Salix glauca copse	Salgla	Led, Empnig, Callan,
64,130294970	-51,302763540	7777173,996432090	2410325,512622780	86	Heath	Betnan, Empnig, Desfle	Vaculi, Lycann, Ledgro
64,130600320	-51,305262440	7777122,237852040	2410204,125519580	89	Heath	Vaculi, Empnig	Carbig, Tofpul
64,131315460	-51,310768170	7777012,072436140	2409933,591198940	96	Heath	Empnig, Betnan	Vaculi, Salgla, Desfle, Bedrock
64,138375540	-51,382003960	7775390,050124280	2406592,571172010	11	Heath	Betnan, Vaculi, Empnig	Ledgro, Carbig, Lycann, Callan, Desfle
64,136745430	-51,375860020	7775436,896544680	2406954,999090830	51	Heath	Betnan, Empnig, Loipro	Ledpal, Carbig, Lycann
64,137950740	-51,374039140	7775604,320783010	2406939,657124310	57	Salix glauca copse	Salgla, Betnan	Ledgro, Desfle, Mos
64,134616000	-51,367596720	7775505,705601350	2407437,891051010	50	Vaccinium heath	Vaculi, Empnig, Carbig	Salarc, Ledgro

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A permanent vegetation transect was established in July 2007 in order to monitor future changes in the location of boundary lines between vegetation zones and in the species composition of the plant communities. The transect situated in the study area at the head of Kobbefjord, Nuuk and consist of a main vegetation transect supplemented by a coastal transect including a salt marsh and a short transect including a special *Deschampsia-Juncus community*. The vegetation transect in Kobbefjord is called the NERO line. This report includes documentation of the establishment of the NERO line, results of Raunkjær analyses along the transect, a compilation of a list of vascular plants in the survey area, and ground truthings of vegetation types as a basis for a vegetation map. The surveys only included vascular plants.