# Data Report of the 2007 Expedition to Nadym, Laborovaya and Vaskiny Dachi, Yamal Peninsula Region, Russia



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#### **A**BSTRACT

This data report is a summary of information collected during the 2007 expedition to the Yamal Peninsula region of West Siberia, Russia as part of the Greening of the Arctic (GOA) project. The overarching goal of the Yamal portion of the GOA project is to examine how the terrain and anthropogenic factors of reindeer herding and resource development combined with the climate variations on the Yamal Peninsula affect the spatial and temporal patterns of vegetation change and how these changes are in turn affect traditional herding of the indigenous people of the region. The purpose of the expedition was to collect ground-observations in support of remote sensing studies at three locations along the southern part of a transect that traverses all the major bioclimate subzones in the Yamal region. Another expedition is planned for summer 2008 to the northern locations along the transect. The locations visited in 2007 were Nadym (northern taiga subzone), Laborovaya (southern tundra = subzone E of the Circumpolar Arctic Vegetation Map (CAVM), and Vaskiny Dachi (typical tundra = subzone D of the CAVM). Data are reported from 7 study sites – 2 at Nadym, 2 at Laborovaya, and 3 at Vaskiny Dachi. The sites are representative of the zonal soils and vegetation, but also included variation related to substrate (clayey vs. sandy soils). Most of the information was collected along 5 transects at each sample site, 5 permanent vegetation study plots, and 1-2 soil pits at each site. The expedition also established soil and permafrost monitoring sites at each location. This data report includes: (1) background for the project, (2) general descriptions and photographs of each locality and sample site, (3) maps of the sites, study plots, and transects at each location, (4) summary of sampling methods used, (5) tabular summaries of the vegetation data (species lists, estimates of cover abundance for each species within vegetation plots, measured percent ground cover of species along transects, site factors for each study plot), (6) summaries of the Normalized Difference Vegetation Index (NDVI) and leaf area index (LAI) along each transect, (7) soil descriptions and photos of the soil pits at each study site, (8) summaries of thaw measurements along each transect, and (9) contact information for each of the participants. One of the primary objectives was to provide the Russian partners with full documentation of the methods so that Russian observers in future years could repeat the observations independently.

This research is one component of the Greening of the Arctic (GOA) project of the International Polar Year (IPY) and is funded by NASA's Land-Cover Land-Use Change (LCLUC) program. It contributes to NASA's global-change observations regarding the consequences of declining Arctic sea ice and the greening of terrestrial vegetation that is occurring in northern latitudes. The work is also part of the Northern Eurasia Earth Science Partnership Initiative (NEESPI). It addresses the NEESPI science questions regarding the local and hemispheric effects of anthropogenic changes to land use and climate in northern Eurasia.

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#### INTRODUCTION AND BACKGROUND

#### **Project overview**

The terrain and vegetation of the Yamal Peninsula in northern Russia is experiencing rapid change due to a variety of natural and anthropogenic factors including unusual permafrost conditions, gas and oil development, grazing and trampling by the native Nenets' reindeer herds, and climate change (**Figure 1**).



Figure 1. A Nenets reindeer herder drives her sled by an oil derrick on heavily disturbed terrain in the Bovanenkova oil field, Yamal Peninsula, Russia. (Photo copyright and courtesy of Don and Cherry Alexander.)

The Yamal Land Cover/Land-Use Change project examines how the terrain and anthropogenic factors of reindeer herding and resource development, combined with the climate variations on the Yamal Peninsula, affect the spatial and temporal patterns of vegetation change and how these changes are in turn affecting traditional herding by the indigenous people of the region. One goal is to collect ground-based observations of the vegetation, soils, and spectral properties of vegetation along the climate gradient on the Yamal Peninsula to help interpret the information from space-based sensors.

This data report provides a record of the methods used and the data collected in the summer of 2007 at three sites along a transect in the Yamal region: Nadym, Laborovaya, and Vaskiny Dachi (Figure 2).

A second expedition is scheduled for summer 2008 and will visit Marresale, Kharasavey, and Ostrov Belyy. Scientists from Finland, Switzerland, Russia, and the United States participated in the 2007 expedition (see list of participants, **Appendix A**).

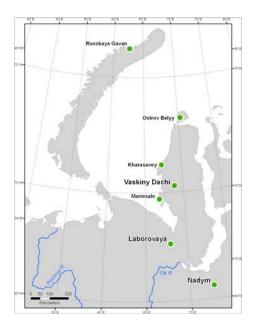


Figure 2. The 2007 study locations at Nadym, Laborovaya, and Vaskiny Dachi, and other proposed study locations.

The sites chosen for the studies were selected because they are representative of the bioclimate subzones described on the Circumpolar Arctic Vegetation (CAVM Team 2003) and because they have histories of previous research. Nadym has been studied since the early 1970s by Dr. Nataliya Moskalenko and scientists at the Earth Cryosphere Institute. Vaskiny Dachi has been studied since the late 1980s by Dr. Marina Leibman. Dr. Moskalenko and Leibman are chief research scientists at the Moscow unit of the Earth Cryosphere Institute, Siberia Branch of the Russian Academy of Science. Laborovaya is a research site of the Environmental and Social Impacts of Industrial Development in Northern Russia (ENSINOR) project, directed by Dr. Bruce Forbes of the Arctic Centre, University of Lapland, Rovaniemi, Finland.

#### **Description of the study sites**

#### Nadym (Nataliya Moskalenko)





Figure 3. Location of study sites near Nadym. Upper image shows the region southeast of Nadym and the study location (black rectangle). The large river in the upper image is the Nadym River. Lower image shows the location of the field camp and the two study sites. The river in the upper left of the lower image is the Hejgi-Jakha River. The extensive road network is associated with oil development in the region. Images by Google Earth, copyright Digital Earth.

The expedition established the Nadym study sites during the period 3-10 Aug 2007. The sites are situated about 30 km south-southeast of the city of Nadym at 65° 18.87' N, and 72° 52.84' E. (**Figure 3**). Researchers at the Earth Cryosphere

Institute have studied this location since 1970. It is a monitoring site for the Circumpolar Active Layer Monitoring (CALM) project, and there are long-term climate and permafrost records from numerous nearby localities, as well as detailed information regarding the geology, vegetation, permafrost, and anthropogenic disturbances (Melnikov et al. 2004; Moskalenko 1984, 1995, 1999, 2000, 2003, 2005a, b; Pavlov and Moskalenko 2002; Ponomareva 2005, 2007) plus ongoing studies of animals and insects.

#### Physiography and geology

The study sites are situated on a flat fluvial-lacustrine plain that is dissected by the Nadym and Hejgi-Jakha rivers. Two major terraces of the Nadym River cover much of the local area in the vicinity of the research sites. The Terrace II deposits (Karga age, 20-40 kya) have elevations between 14 and 20 m and are covered largely by better drained sandy soils and forests. The Terrace III fluvial-lacustrine plain (Zyranski age, 60-80 kya) is 25 to 30 m in elevation and is covered with many lakes and mires, peat up to 5 m thick, and a mix of tundra and open woodlands. Numerous large well-drained palsas rise above the boggy landscapes.

#### Climate

The climate of West Siberia is influenced by maritime air masses from the Atlantic Ocean and continental air masses from the Asia. Interaction of these opposing air masses causes highly variable weather. Winter (November-March) is characterized by low temperatures interspersed with periods of sharp warming accompanied by continuous overcast and snowfalls. In April the transition season begins with consolidation and destruction of the snow cover. In May sharp cold snaps accompanied by spring blizzards (burans) are possible. Spring is the driest, clearest, and windiest season. In summer (June-July), cloudy weather is typical with occasional intensive rains. Autumn (August-September) has long periods of continuous overcast conditions and precipitation. The climate of the Nadym site is summarized in Table 1.

#### Table 1. Climate conditions of the Nadym site.

#### Average air temperature (°C):

Annual -5.9 Summer 10.8

Winter -14.2

Annual amplitude (meteorological), °C 40.5 Mean-annual ground-surface temp. (°C) +1 to -3

**Date of transition of air temp through 0 °C** In the spring 27 May In the autumn 20 Oct

#### Precipitation (mm):

Annual 483 Liquid 237

#### Snow cover:

Date of formation 15 Oct Date of melting 27 May Maximum depth (April) (cm) 76 Average density (in April), kg m<sup>-3</sup> 290

#### Soils

The Nadym research sites are situated in the northern taiga bioclimate subzone. A wide variety of ecosystems are present due to Nadym's position within this transitional region. The parent materials for the soils are derived from fluvial-lacustrine deposits. Mainly sandy materials interbedded with loamy and clay deposits were repeatedly spread by the river systems. heterogeneous soil textures complicates the permafrost distribution patterns. Key soil processes are peat accumulation, gleying and podzolization. In well-drained forested ecosystems on Terrace II, podzolic soils are common with evidence of previous cryogenic attributes, such as networks of former ice wedges (pseudomorphs) that are filled with loamy and/or clayey materials. On Terrace III, superimposed on these sandy soils, are the effects of various bog-forming and metamorphic cryogenic processes (including paludification, thermokarst, frost heave, and thermoabrasion) that create a heterogeneous complex of soils with permafrost landforms and peatlands with peat-gley soils.

#### Vegetation



Figure 4. Nadym-1 (forest site). The trees are mainly Scots pine (Pinus sylvestris), and mountain birch (Betula tortuosa) mixed with Siberian larch (Larix sibirica). The understory consists of dwarf shrubs (Ledum palustre, Betula nana, Empetrum nigrum, Vaccinium uliginosum, V. vitis-idaea), lichens (mainly Cladonia stellaris) and mosses (mainly Pleurozium schreberi). Photo no. DSC\_0325, 8/09/07, P. Kuss.



Figure 5. Nadym-2 (CALM-grid site). Hummocky tundra consists of a complex of vegetation with a Ledum palustre-Betula nana-Cladonia spp. dwarf-shrub community on the hummocks and a Cladonia stellaris-Carex glomerata lichen community in the interhummock areas. Photo no. DSC\_0101 8/03/07, D.A. Walker.

Zonal northern taiga covers large areas of Terrace II. Here there are birch-larch (*Betula tortuosa-Larix sibirica*) and birch-pine shrub-lichen (*Betula tortuosa-Pinus sylvestris/Betula nana-Cladonia stellaris*) open woodlands.

Terrace III is characterized by peatlands occupied by *Rubus chamaemorus-Ledum* palustre-Sphagnum-lichen tundra on raised palsas and elevated microsites and *Eriophorum-Carex-Sphagnum* mires in the lower microsites. Large frost mounds also occur in these peatlands and are characterized by *Pinus sibirica-Ledum* palustre-Cladonia open woodlands.

Our Nadym-1 study site (forest site) is located on Terrace II in a lichen woodland (**Figure 4**), and the Nadym-2 study site (CALM Grid site) is located on Terrace III at the 100 x 100-m CALM grid in hummocky tundra (**Figure 5**). The study areas are currently not used by the Nenets for reindeer forage lands, so the lichen areas are well preserved at both sites.

#### Laborovaya (Bruce Forbes)



Figure 6. Location of the Laborovaya field camp and study sites. The Obskay-Paijuta railway/road corridor is evident, and a quarry used for construction of the railroad just north of the field camp is on a sandstone ridge. Another sandstone ridge is about 2 km west of camp. Several large thaw lakes are to the south of camp. Google Earth image, copyright Digital Globe.

The Laborovaya study sites were sampled during the period 13-21 Aug 2007. The expedition traveled to the site via rented truck from Labytnangi. The Laborovaya region has been studied since 1997 by Dr. Bruce Forbes and colleagues researching anthropogenic disturbances in the region and more recently in conjunction with the ENSINOR studies. No detailed climate or geological information is available for the

Laborovaya location. The following information is modified from Forbes (1997).



Figure 7. Base camp at the Laborovaya location. The Obskaya-Paijuta railway/road corridor is in the background, and the access road to a nearby quarry is in the foreground. Photo no. DSC\_0597, 8/14/07, D.A. Walker.

#### Location and physiography

The study sites are situated in the foothills at the northern end of the Polar Urals. Our base camp was at lat. 67° 42.21' N, long. 68° 01.08 E, about 21 km northeast of the small settlement of Laborovaya and at km 147 of the Obskaya-Paijuta railway/road corridor (**Figure 6**). The base camp was located near a small oxbow lake adjacent to an access road that leads to a gravel quarry used for construction of the road and railroad (**Figure 7**).

This section of the transport corridor was constructed in 1989, and the quarries have been essentially abandoned since that time. The road and railroad are in active use throughout the year, largely for the transport of construction materials and workers along the corridor, although a few small personal vehicles also use the road.

The local physiography consists of flat plains with thaw lakes to the east and north and hills with sandstone bedrock outcrops to the west and south. Surficial materials on the plains consist primarily of Pleistocene sands underlain by saline clays.

#### Climate

The nearest year-round meteorological station is at Salekhard, 150 km to the south,

near the mouth of the Ob River (Fig. 1), which is not comparable because Salekhard is in the forest and is warmer and calmer than the Laborovaya region. The location lies within the continuous permafrost zone.

#### Vegetation



Figure 8. Laborovaya-1 study site (clay site). The vegetation is a moist dwarf-shrub, sedge moss tundra dominated by Carex bigelowii, Eriophorum vaginatum, Betula nana, Vaccinium vitis-idaea, V. uliginosum, Aulacomnium palustre, Hylocomium splendens, and Dicranum spp. Photo no. DSC\_0188, 8/16/07, D.A. Walker.

Phytogeographically, the study site lies about 100 km north of the latitudinal treeline within the southern southern tundra subzone (= Subzone E of the Circumpolar Arctic Vegetation (CAVM Map, Team, D.A. Walker et al. 2003)). According to Yurtsev (1994), the Yamal-Gydan West Siberian subprovince is characterized by a low floristic richness due to gaps in the ranges of species with predominantly montane, east Siberian distributions and western (amphi-Atlantic) distributions. The region's vegetation has been mapped at small scale (Ilyina et al., 1976) and its community types described by Meltzer (1984).



Figure 9. Laborovaya-2 study site (sand site). The vegetation is moist/dry dwarf-shrub, lichen tundra dominated by Betula nana, Vaccinium vitis-idaea, V. uliginosum, Carex bigelowii, Cladonia arbuscula, Sphaerophorus globosus, and Polytrichum strictum. Photo no. DSC\_0596, 8/17/07, D.A. Walker.

Ridge tops on the sandstone hills are dry. Well-developed stands of alder (Alnus fruticosa) are common on slopes in the vicinity of the study site and especially in riparian zones. Shrub willows (Salix spp.) are generally <30 cm in height, although individuals >2 m occur in riparian zones and on hillslopes. The areas between hills are a mix of wetlands and more mesic vegetation. Much of the tundra is overgrazed, with the ruderal lichens. The study area is extensively grazed in summer by reindeer herds belonging to the Nenets, a group of aboriginal nomadic pastoralists. Vilchek & Bykova (1992) estimated that the number of reindeer on Yamal is already 1.5 to 2 times greater than the optimum for the region.

We had two study sites at Laborovaya – one was moist dwarf-shrub, sedge tundra on wet clayey soils located about 1.1 km west-northwest of basecamp in a valley between two sandstone ridges (**Figure 8**), and the other was relatively dry dwarf-shrub, lichen tundra on a sandy site located about 1.2 km southeast of the basecamp near a small stream (**Figure 9**).

#### Vaskini Dachi (Marina Leibman)



Figure 10. Location of the camp and study sites at Vaskiny Dachi. The eastern end of the road network in the Bovanenkova gas field is in the upper left. Google Earth image, copyright Digital Earth.



Figure 11. Vaskiny Dachi Camp at the far end of the small lake. Photo no. MG\_9350, 8/28/07, D.A. Walker.

The Vaskiny Dachi location was visited and sampled during the period 21-30 Aug 2007. The location is southeast of the main Bovanenkova gas field in the central part of the Yamal Peninsula (70° 17.21' N, 68° 53.65' E ) (**Figure 10** and **Figure 11**). Travel to and from the location was by helicopter. Vaskiny Dachi is the name of a field camp established by Dr. Marina Leibman, who leads a team of scientists in the study of cryogenic processes at Vaskiny Dachi (Leibman 1994, 1995, 1998, 2001; Leibman et al. 1991, 1993 a, 1993 b, 1997; Leibman and Stretskaya 1996, 1997;

Romanovskii et al. 1996; Stretletskii et al. 2003). The site is visited annually and has been a CALM monitoring site since 1993. Much of the work has focused on landslides and considerable information is available for vegetation response to landslide disturbances (Ukraintseva 1997, 1998; Ukraintseva and Leibman 2000, 2007; Ukraintseva et al. 2000, 2002, 2003).

#### Topography and geology

The research sites are located in the watersheds of the Se-Yakha and Mordy-Ykha rivers (Figure 10). The study sites are located in a region with a number of highly-dissected alluvial-lacustrine-marine plains and terraces. The deposits are sandy to clayey, most are saline within the permafrost, and some are saline in the active layer. Hilltops in sandy areas are often windblown with sand hollows, some covering large areas. Saddles between the hilltops are often occupied by polygonal peatlands. The topography of the region is defined by a series of marine terraces and plains.

The highest plain is the *Salekhardskaya* marine plain (Terrace V) with maximum heights (up to 58 m). Depths of dissection at this level are 20-50 m. The geological section is composed of clay with clastic inclusions of marine and glacio-marine origin. The top several centimeters to several decimeters of soil consist of silty sand enriched with clasts through wind erosion. Lowered surfaces are often occupied by peatlands. This terrace covers a relatively small portion of the landscape.

The *Kazantsevskaya* coastal-marine plain (Terrace IV) is 40-45 m high built of interbedding of clayey and sandy deposits with a considerable amount of organic matter dispersed in the section. The surfaces sometimes have windblown sands, but are mainly tussocky, hummocky or frost-boil tundras and peatlands in the lower areas. Our Vaskiny Dachi-1 study site was on a gentle terrace hill-top (

Figure 12).



Figure 12. Vaskiny Dachi-1 study site on Terrace IV. The soils are clay and the vegetation is heavily grazed sedge, dwarf-shrub-moss tundra dominated by Carex bigelowii, Vaccinium vitis-idaea, Salix glauca, Hylocomium splendens, and Aulacomnium turgidum. Photo DSC 0146, 8/23/07, D.A. Walker.



Figure 13. Vaskiny Dachi-2 study site on Terrace III. The soils are a mix of sand and clay. The vegetation is heterogeneous, but dominated by Betula nana, Calamagrostis holmii, Carex bigelowii, Vaccinium vitisidaea, Aulacomnium turgidum, Hylocomium splendens, and Ptilidium ciliare. Photo DSC 0344, 8/25/07, P. Kuss.

The third fluvial-marine or fluvial lacustrine terrace (Terrace III) is up to 26 m high, built of fine interbedding of sandy, silty, loamy, and organic layers of several milimeters to several centimeters thick. Flat hilltops are often occupied by polygonal sandy landscapes with windblown sand hollows on the tops of high-centered polygons. Lowered surfaces are hummocky tundras.



Figure 14. Vaskiny Dachi-3 study site on Terrace II. The soils are sandy and the vegetation is a dry dwarf-shrub-lichen tundra dominated by Carex bigelowii, Vaccinium vitis-idaea, Cladonia arbuscula, Sphaerophorus globosus, Racomitrium lanuginosum, and Polytrichum strictum. Photo DSC 0112, 8/27/07, D.A. Walker.

Our Vaskiny-Dachi-2 study site was on a broad hill top of terrace III (**Figure 13**).

Lower terraces (such as our terrace II site, **Figure 14**) are of fluvial origin, probably ancient river terraces of the Mordy-Yakha and Se-Yakha rivers.

Up to 60% of the study area is represented by gentle slopes (less than 7°), steep slopes (7-50°) occupy about 10% of the area, and the remaining 30% of the landscape is composed of flat hilltops, valleys and lake depressions.

#### Climate

The closest climate station is Marresale, which about 100 km southeast and located at the coast, where summer temperatures are somewhat cooler than at Vaskiny Dachi. The average annual air temperature for the last 15 years at Marresale is -7.5°C. The average January temperature over the same period is -21.5°C, and the July mean temperature is 7.5°C. There has been a 1.3°C warming trend of over the past 45 years. In 1962-1976 the mean annuaul temperature was -8.8°C, and in 1992-1997 it was -8.2°C.

The total precipitation is around 300 mm per year – half of this is snow (8.5-9 months), and half is rain (3-3.5 months), which falls

mainly in August-September. The end-of-winter-snow depth on flat surfaces is about 30 cm, snow drifts on leeward slopes may be up to 6 m deep. The average period with positive air temperatures at Marresale weather station is 59 days, and the transition to above freezing daily mean temperatures is usually in late June and early October.

#### Active layer and permafrost

dynamics Active-laver depend upon surfacial deposits, gravimetric moisture content in the fall, organic and vegetative covers, and air temperature in summer. Maximum active-layer depths (1-1.2 m) are found in sands on bare surfaces or with sparse vegetation and low moisture content (up to 20%). Minimum active layer depths (50-60 cm) are found in peat or clay deposits covered by thick moss and with moisture contents more than 40%. The region has continuous permafrost. Open taliks are possible only below the great lakes 30-50 m deep and big river channels (such as Mordy-Yakha and Se-Yakha). Smaller lakes several meters deep have closed taliks 5-7 m deep under the lake bottoms. The older surfaces have the thickest permafrost. Permafrost thickness ranges from 270 to 400 m and more on the marine and coastal-marine plains, and is 100-150 m at the younger river terraces and 50 m at the modern sea level. The average annual ground temperatures at the depth of zero annual amplitude ranges between 0 and -9°C. The lowest permafrost temperatures are characteristic of the hilltops with sparse vegetation where snow is blown away. The warmest permafrost temperatures are in areas with tall willows due to retention of snow in depressions.

#### Cryogenic processes

The region has very dynamic erosional processes that are important with respect to the vegetation ecology. Highly erodable sands and the presence of massive ground ice near the surface contributes to the unstable landscapes. Cryogenic processes observed in the area are connected to tabular ground ice found in geological sections at the depths of 1 to 25 m practically

everywhere. The most widespread processes observed in the study area are landslides of various types and thermoerosion of slopes. Aeolian erosion is common on convex hilltops. Thermokarst and frost heave are less common. In August 1989, 400 new landslides occurred within an area of 10 km<sup>2</sup>, where previously there were only three modern landslides (but hundreds of ancient landslides). The age of five of the older landslide events was determined radiocarbon dating to be 300 to 2000 years old. Dendrochronology was used to determine the reaction of willows to land sliding. During the last two warm summers (2006-2007) several new areas of tabular ground ice were exposed by landslide activity (retrogressive thaw slumps).

#### Geoecology



Figure 15. Willow communities (Salix lanata and S. glauca) cover large areas of the landscapes near Vaskiny Dachi. Most of these are on old landslides and in valley bottoms. A more barren recent landslide surface is visible on the upper left side of the photo. Photo no. DSC 0488, 8/21/07, D.A. Walker.

A striking aspect of the regional vegetation is the abundance of willow thickets (Salix lanata and S. glauca) covering many hill slopes and valley bottoms (Figure 15). Studies of the willow communities in relationship to landslides have included: (a) vegetation succession, (b) ash chemistry of each vegetation group, (c) ground water chemistry, and (d) plant and soil chemistry using water extraction and X-rayfluorescent analyses of air-dry homogenized plants (Ukraintseva 1997,

1998; Ukraintseva and Leibman 2000, 2007; Ukraintseva et al. 2000, 2002, 2003). Phytomass was measured in layers: shrubs from a 5 x 5-m area and herb and moss layers from 0.5 x 0.5-m plots.

The study concluded that there is a strong correlation between disturbance age soil fertility, and willow growth. Desalination of old marine sediments after the landslide event leads to active layer enrichment with water-soluble salts, which supply plants with nutrition, provide active revegetation of herbs, and re-formation of soils, followed by willow-shrub expansion. Willows are the main reason for increased biodiversity and biological productivity. They provide more nutrition than typical tundra vegetation due to leaf litter.

Striking differences in soil chemistry were observed between stable undisturbed surfaces and landslide-affected slopes of various ages. The soil of stable hilltops is characterized by relatively low pH (pH 5.5-5.8), very low base saturation (4.5%), low nitrogen content (0.08-0.18%), and rather high organic carbon (1.5-2.3%); whereas recent landslide surfaces have high soil pH (7.5-8.0), much higher base saturation (50-100%), and low organic carbon content (0.2-0.7%).

Tall willow thickets occupy old landslide surfaces due to additional nutrients, especially where there is deep winter snow cover. On 1000-2000 year old landslides, soils show gradual reduction both in pH (down to 6.5) and in base saturation (down to 24.5 %) that indicates continuing desalination of the active layer deposits towards the background conditions. Organic carbon and nitrogen concentration in the older soils was double that of recent landslide surfaces, thus improving soil fertility. In summary, landslides that started more than 2000 years ago result in increased soil fertility and biomass in the modern typical tundra subzone of Yamal Peninsula.

# METHODS AND TYPES OF DATA COLLECTED

#### Study sites

#### Criteria for site selection

Study sites were selected at each location (Nadym, Laborovaya, and Vaskiny Dachi) in large areas of more or less homogeneous vegetation. The objective was to select large areas of zonal vegetation that could be recognized by their homogeneous spectral signatures on aerial photographs and satellite images. At all three locations there were surfaces with different parent materials that affected the character of the vegetation (**Table 2** and **Table 3**).

Table 2. Study locations, site numbers, site names, and geological settings.

Location and site no.	Site name	Microsite	Geological setting, parent material
Nadym-1	Forest site	Uses II.	Fluvial terrace II, Karga-age, (about 20-40 kya), alluvial sands
Nadym-2a	CALM-grid site	Hummocks	Fluvial terrace III, Zyranski-age, (about 60-80 kya), alluvial sands
Nadym-2b		Inter-hummocks	
Laborovaya-I	Clay-site		( ? ), clay
Laborovaya-2	Sand site		( ? ), alluvial sand
Vaskiny Dachi-1	Terrace IV site		Coastal marine plain, Kazantsevskaya-age (Earnian-age 130-117 kya), marine clays
Vaskiny Dachi-2	Terrace III site		Fluvial-marine terrace, ( middle-Wiechselian, 75-25 kya ), mixed alluvial sands and marine clays
Vaskiny Dachi-3	Terrace II site		Fluvial terrace, (late-Wiechsellan, 25-10 kya), alluvial and eolan reworked sands

Table 3. Dominant vegetation at each study site.

Location and site no.	Dominant vegetation			
Nadym-1	Pinus sylvestris-Ledum palustre-Cladonia stellaris lichen-woodland			
Nadym-2a	Ledum palustre-Betula nana-Cladonia stellaris dwarf-shrub, lichen tundra			
Nadym-2b	Cladonia stellaris-Carex glomerata lichen tundra			
Laborovaya-1	Carex bigelowii-Betula nana-Aulacomnium palustre sedge, dwarf-shrub, moss tundra			
Laborovaya-2	Betula nana-Vaccinium vitis-idaea-Sphaerophorus globosus-Polygrichum stirctum dwarf-shrub, lic			
Vaskiny Dachi-1	Carex bigelowii-Vaccinium vitis idaea-Hylocomium splendens sedge, dwarf-shrub, moss tundra			
Vaskiny Dachi-2	Betula nana-Calamagrostis holmii-Aulacomnium turgidu dwarf-shrub, graminoid, moss tundra			
Vaskiny Dachi-3	Vaccinium vitis idaea-Cladonia arbuscula-Racomitrium lanuginosum dwarf-shrub, sedge, lichen, ti			

# Size, arrangement, and marking of transects and study plots

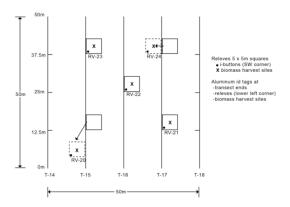


Figure 16. Typical transect and plot layout.

At most study sites the transects and study plots were arranged similarly to the pattern shown in **Figure 16**. Transects were laid out parallel to each other. Most transects were 50 m long and spaced 12.5 m apart. The study plots (relevés) were generally 5 x 5 m and arranged along the transects as shown, with the following exceptions.

Nadym-1: 100-m transects, spaced 25 m apart.

Nadym-2: Transects arranged around perimeter of the CALM grid, and plots were 1 x 1 m to adjust to size of the hummocks.

Vaskiny Dachi-3: 50-m transects arranged to conform to areas of homogeneous vegetation.

The transects were temporarily marked with pin flags spaced at 1-m intervals.

The plots were temporarily marked with pin flags at each corner and one in the middle (the biomass harvest site).

After sampling all flags were removed except for the following which were left so that the transects and plots could be resampled in the future:

1. Transects: pin flags at the ends of each transect and labeled with an aluminum tag that designated the location name, transect number, and distance along the transect,

- e.g. LA\_T15\_00m (Laborovaya, transect 15, 0 m).
- 2. Relevés: pin flags at the southwest corner of each plot labeled with the location name, and relevé number, e.g., LA\_RV21.
- 3. Biomass harvest sites: pin flag in the southwest corner of the harvest site, labeled with location, relevé number, and biomass harvest number, e.g. LA RV21 BM.

Photographs were taken of each transect from both ends of the transect.

#### Sampling along the transects

#### Species cover using the Buckner pointintercept sampling device

Species cover was sampled using the Buckner point-intercept sampling device

**Figure 17**) (Buckner 1985) and the data form in **Appendix B**. Sampling was done at 0.5-m intervals along each transect (100 points per transect, 500 points per study site), except on the Nadym-1 forest site where sampling was done at 1-m intervals along 100-m transects.



Figure 17. Buckner point-intercept sampling device. The box on the end piece of the device contains a mirror that can be pointed down to the ground cover or up to the forest canopy. The tube is a telescope that magnifies the image in the mirror. Cross hairs in the sighting device identify a point that intercepts a plant species which is recorded as a "hit". The percentage cover of an individual species or cover type is the number of hits for that type divided by the total number of hits. Photo no. DSC\_0151, 8/06/07, D.A. Walker.

For the ground cover, at points where there were more than one layer in the plant

canopy, two hits were recorded: the species at the top of the ground canopy, and the species, litter or soil at the base of the canopy. "Foliage" or "wood" was recorded for trees and shrubs, and "live" or "dead" for leaves and stems of herbaceous species. At each sample point at the Nadaym-1 site, the mirror on the device was also flipped to face upward, and the intercepted tree species or "sky" were recorded at each point.

# Normalized Difference Vegetation Index (NDVI) and Leaf area index (LAI)



Figure 18. Howie Epstein sampling NDVI using the PSII Spectrometer. Photo no. DSC 0175, 8/23/07, D.A. Walker.

At each site, five 50-m (100-m at Nadym-1) transects were run parallel to each other. NDVI was measured every meter using a Portable Spectroradiometer from PSII Analytical Spectral Devices. **NDVI** measurements were take 0.5 m off the transect in the direction of the sun to ensure well-lit conditions when available. sensor was held 0.9 m from the ground surface; with a 25° field of view, this produces a circular footprint with an approximate diameter of 0.4 m. White and dark references were taken after every 10 samples and more frequently under cloudy or variable sun conditions. For relevés, NDVI samples were taken in the center of the relevé, and then at the midpoint of the distance between the center and each of the four corners, for a total of five NDVI measurements for each relevé.

LAI measurements were taken every meter along each of the 50-m transects at each site,

using a LICOR LAI-2000 Plant Canopy Analyzer. Measurements of LAI were taken at the same locations as the NDVI measurements, however the person doing the sampling would stand with his/her back to the sun, to keep the sensor shaded. A mask of 270° was placed on the sensor, so that the sensor would only measure the incoming radiation within a 90° angle pointing away from the user (so the user is not included as part of the LAI). At each measurement point, an initial reading was taken either above or outside of the plant canopy. Then four readings were taken below the canopy, each at 20 cm from a central point (0.5 off the transect) in the cardinal directions (N,S,E,W). These five readings were used by the instrument to calculate a single LAI value (with standard error) for each point along the transects. LAI measurements were also taken for each relevé at the center point and then at the midpoint of the distance between the center and each of the four corners, for a total of five LAI measurements for each relevé. Note: LAI and NDVI were also measured at each grid point in the Vaskiny Dachi CALM grid, and at two additional transects at Vaskiny Dachi (a wet transect and a shrubby transect).

#### Active layer depth



Figure 19. Anatoly Gubarkov with active-layer probe used for measuring depth to the permafrost table. Photo no. DSC\_0180, 8/27/07, D.A. Walker.

The active layer summer thaw depth was measured at 1-m intervals along each

transect using a 2-m long steel probe (**Figure 19**).

# Sampling within the study plots (relevés)

#### Site factors and species coverabundance

Each study plot was described using the data forms shown in **Appendix** C. Site factors included estimates of cover for all plant growth forms, bare soil, water, and total dead plant cover. We also recorded vegetation canopy height; thickness of the moss, the organic soil horizon, and the soil horizon; height of microrelief; mean thaw depth; landform, surficial geology/parent material; microsite description; site moisture (scalar estimate); topographic position; estimated snow duration (scalar estimate); disturbance degree (scalar estimate); disturbance type; stability (scalar estimate); and exposure to wind (scalar estimate).

Each vascular plant, moss and lichen species within the plot was noted and a sample taken as a voucher. The cover-abundance of each species was recorded using the Bruan-Blanquet cover-abundance scale (see data form **Appendix C).** The voucher samples were sent to the Komarov Botanical Institute (KBI) for identification.

A small soil pit was dug next to the study plot, and plug of soil was removed. A sample of the soil was collected from the top of the uppermost mineral horizon using a 190 cm<sup>3</sup> soil can. The soils will be analyzed for physiochemical properties at the University of Alaska Palmer Soils Laboratory.

Photographs were taken of each study plot and each soil plug.

# Placement of iButton temperature loggers for determining n-factors

The *n*-factor is an integrator of the total insulative effect of the vegetation, soil organic, and snow layers (Kade, Romanovsky et al. 2006). The *n*-factor is defined here as ratio of the seasonal degree-

day sum at the ground surface to that of the air at standard screen height. To determine the n-factor, temperatures at the surface of the soil are compared to temperatures at the base of the soil organic horizons.

We used small iButton temperature loggers (Maxim Integrated Products, Inc.) to measure the temperatures. Each iButton was wrapped in duct tape and numbered with a consecutive logger number. A purple ribbon was attached to each logger so it could be located at a later date (Figure 20).



Figure 20. An iButton logger wrapped in duct tape with the logger number.

Each logger can record approximately 11 mo of temperature data with 4 daily readings. One iButton was placed just below the surface of the soil, and one was placed at the boundary between the bottom organic soil horizon and the mineral soil horizon (Error! Reference source not found. shows the serial number of the iButtons and corresponding logger number (label on the duct tape). **Table 5** gives the logger numbers for each relevé. The loggers were placed about 1 m from the SW corner of each plot.

We defined two different n-factors, a summer n-factor  $(n_s)$  and a winter n-factor  $(n_w)$ :  $n_s = TDD_m/TDD_a$  and  $n_w = FDD_m/FDD_a$  where  $TDD_m$  is the annual sum of thawing degree-days (TDD or mean daily temperatures above 0 °C) at the top of the mineral horizon, and  $TDD_a$  is the annual sum of the thawing degree-days of the soil surface. Similarly,  $FDD_w$  is annual sum of the freezing degree-days (mean daily temperatures below 0°C) at the top of the mineral soil, and  $FDD_a$  is the freezing degree-days at the soil surface.

Table 4. Logger numbers (on outside of duct tape) and iButton serial numbers.

Logger No.	Serial no.	Logger No.	Serial no.		
1	12350A	35	125050		
2	1252B2	36	123003		
3	122D12	37	125256		
4	122A9E	38	124A0A		
5	1231E8	39	12506D		
6	124E85	40	12516B		
7	123A83	41	125333		
8	124585	42	1250E8		
9	12505D	43	12450E		
10	122ED0	44	1233E3		
11	12339F	45	12534D		
12	124EE3	46	12311D		
13	122EBF	47	125375		
14	123050	48	125389		
15	124235	49	123589		
16	125073	50	124CC7		
17	123163	51	124C87		
18	124C01	52	12514D		
19	123415	53	123389		
20	1236DE	54	1231D8		
21	12312A	55	122B9C		
22	122EE8	56	1237CE		
23	122D44	57	1233BA		
24	1233FE	58	122F28		
25	125305	59	1251C9		
26	1242D8	60	124AA8		
27	12333D	61	122A82		
28	125086	62	1245A5		
29	12379C	63	1230F8		
30	1234EE	64	124C68		
31	122D4F	65	125204		
32	123855	66	124E27		
33	124B9E	67	12320C		
34	122D94	68	124FD3		

Table 5. Locations of iButton loggers in relevés and depths.

Releve No.		sehai (cm)
Nadym-1, For		_
ND-RV-1	41	0
	46	19
ND-RV-2	27	0
	26	10
ND-RV-3	62	0
	54	5
ND-RV-4	60	0
	55	13
ND-RV-5	31	0
	67	12
Nadym-2, CAI		
ND-RV-6	29	60
IND IN O	49	0
ND-RV-7	39	51
ND-KV-/		0
	5	
ND-RV-9	12	30
	56	0
ND-RV-10	18	10
	59	0
Laborovaya-1	, clayey site	•
LA-RV-15	16	0
	25	9
LA-RV-16	19	0
	6	10
LA-RV-17	65	0
	13	9
LA-RV-18	63	ó
PV-IVA-10	34	4
LA-D)(-10		
LA-RV-19	68	0
	17	9
Laborovaya-2		
LA-RV-20	42	0
	44	9
LA-RV-21	30	0
	22	5
LA-RV-22	43	0
	53	4
LA-RV-23	28	0
	37	7
LA-RV-24	32	ó
_ \ 1\0 27	21	8
Vaskiny Dach		
VD-RV-25	1-1, Terrace . 11	0
0D-KV22		_
VP BY C:	14	6
VD-RV-26	61	0
	8	7
VD-RV-27	38	0
	3	5
VD-RV-28	36	0
	10	8
VD-RV-29	35	0
-	9	8
Vaskiny Dach		
VD-RV-30	33	0
-5 KV 50	51	8
1(D-B) (-24		0
VD-RV-31	2	
VP PV 05	1	6
VD-RV-32	4	0
	45	3
VD-RV-33	58	0
	66	7
VD-RV-34	64	0
	40	4
Vaskiny Dach		II
VD-RV-35	47	0
	50	3
VD-RV-36	24	0
0D-1/0-20	15	
VD DV 07		2
VD-RV-37	57	0
	48	1
VD-RV-38	7	0
	20	3
VD-RV-39	23	0

#### Tundra biomass

Aboveground biomass was harvested in a 20 x 50-cm plot, generally located in the center of each relevé. The method of harvest followed the procedures outlined in the tundra biomass procedures guidelines (**Appendix D**).

# Forest structure methods (Nadym-1 site only)

#### Point-centered quarter method

The forest trees at Nadym-1 were sampled using the point—centered quarter method for determining frequency, density, and basal area for each tree species (Cottam and Curtis 1956). The sampling and calculation methods are described in several textbooks (Shimwell 1971; Mueller-Dombois and Ellenberg 1974; Barbour, Burk et al. 1996), and are summarized in **Appendix E**.

Sample points were established at 10-m intervals along the five 100-m transects (10 points per transect, 50 points total for the study site).

At each point four quadrants were defined using the transect line and a meter stick placed at right angles to the transect. In each quadrant, the nearest tree to the sample point was defined in each quadrant, and the species of the tree, diameter at breast height (dbh), the distance from the sample point to the tree, and the height of the tree were recorded. Thus 40 trees were sampled along each transect (200 total trees for the study site). Using these data, the frequency, density and basal area of each tree species were calculated.

The *frequency* was the occurrence of each tree species within a sample of 4 trees at each point along the five 100-m transects. So if a given tree species occurred at half of the points, it had a frequency of 50%. If it occurred at only one point in the total of 50 points, it had a frequency of 2%.

The *density* is the number of trees per hectare. This calculation uses the average distances recorded. The calculation is too

long to describe here, but intuitively, the density of trees increases as the total distances decrease. The average distance squared is the area occupied by a single tree, and the density is the area occupied by one tree divided into one unit of area measurement (i.e. 1 hectare).

The basal area is the area of the tree stems at breast height per hectare. This calculation uses the density of each tree species and areas of the measured stems.

#### Plot-count method:

In each 10 x 10-m plot, the location of each tree was recorded using coordinates in meters. The position of each tree was estimated to nearest 0.25 m by running a 10-m tape along each border of the plot, using the SW corner of the plot as the origin. For each tree the species, diameter at breast height, and the height of the tree was recorded. The number of samplings (dbh < 5 cm) and number of seedlings of each species was also recorded.

Using these data the density and basal area of each tree species within each plot was determined.

#### Tree biomass

Tree biomass was determined for the forest using both the data from the point-centered quarter method and the plot-count method. Aboveground tree biomasses were calculated using following equations (Zianis et al. 2005):

**Betula pubescens** (equation no. 40, Zianis et al. 2005):

Biomass  $[kg] = a * D^b$ , where

a = 0.00029, b = 2.50038, D = diameter at breast height [mm]

*Pinus sylvestris* (equation no. 388, Zianis et al. 2005):

Biomass  $[kg] = a + b*D + c*D^2$ , where

a = 18,779; b = (-4,328); c = 0.506; D = diameter at breast height [cm]

*Larix sibirica* (equation no. 136, Zianis et al. 2005):

Biomass [kg] =  $a * D^b * H^c$ , where a = 0.1081; b = 1.53; c = 0.9482; D = diameter at breast height [cm]; H = height [m].

**Pinus sibirica** (equation no. 733. Muukkonen et al. 2006):

Biomass [kg] =  $a + b*D^2*H + c*D^2$ , where a = (-3.4268); b = 0.010356; c = 0.14144; D = diameter at breast height [cm]; H = height [m].

**Biomass for both** *Pinus sylvestris* and *P. sibirica* saplings (dbh < 5 cm) (equation no. 327 (Zianis et al. 2005). Note: Because there are few equations available for estimating biomass of young trees, the following equation was used.

Biomass [kg] = a \* exp(D\*b), where a = 0.2304; b = 0.6536; D = diameter at breast height [cm].

#### Tree cover, density, and basal area using the plot-count method (Nadym-1 forest site only)

For each of the five 10 x 10 m relevés at the forest site at Nadym, each individual tree was mapped, with diameter at breast height measured and height visually estimated. In addition the number of seedlings for each species was counted for each relevé.

#### Soils

Two types of soils data were collected: (1) A sample of soil was collected from each of the 39 study plots (relevés) as described above. These soil samples are being analyzed at the University of Alaska for physical and chemical properties. (2) One or two soil pits were dug at each site, in a representative site, usually near southwest corner of the site. These pits were described by Dr. Georgy Matyshak according the Russian approach and translated into descriptions corresponding to the US Soil Taxonomy approach of soil description.

#### **R**ESULTS

#### Maps and locations of study sites

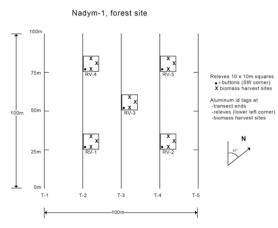


Figure 21. Map of transects and vegetation study plots at Nadym-1.

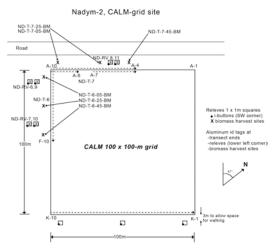


Figure 22. Map of transects and vegetation study plots at Nadym-2.

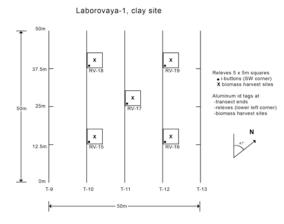


Figure 23. Map of transects and vegetation study plots at Laborovaya-1.

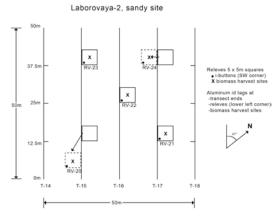


Figure 24. Map of transects and vegetation study plots at Laborovaya-2.

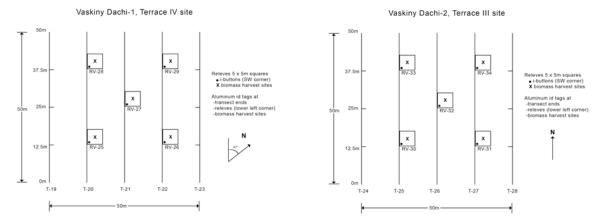


Figure 25. Map of transects and vegetation study plots at Vaskiny Dachi-1.

Figure 26. Map of transects and vegetation study plots at Vaskiny Dachi-2.

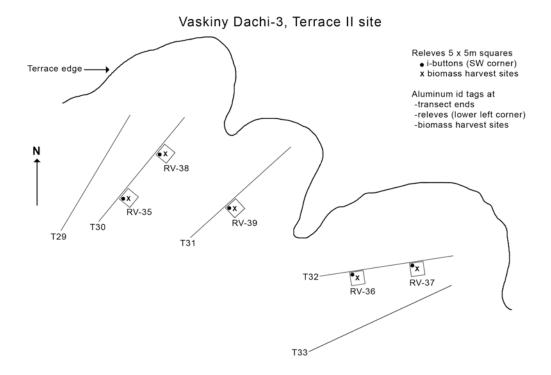


Figure 27. Map of transects and vegetation study plots at Vaskiny Dachi-3.

Table 6. GPS coordinates and elevations of vegetation study plots and transects. LA = Laborovaya, ND = Nadym, VD = Vaskiny Dachi.  $RV = Relev\acute{e}$ , T = Transect. Coordinates are recorded at the southwest corner of each grid, and at both ends of the transects (00 and 50 m).

Description	North	East	Altitude	Site	Description North	East	Altitude	Site
LA Camp	67 42.210	068 01.089	72	NA	ND T05 10 65 18.817	072 53.350	31	1
LARV 15	67 42.397	067 59.946	79	1	ND T06 00 65 18.828	072 51.730	17	2
LARV 16	67 42.387	067 59.970	79	1	ND T07 00 65 18.885	072 51.716	23	2
LARV 17	67 42.396	067 59.971	79	1	ND T08 10 65 18.833	072 51.86	18	2
LARV 18	67 42,406	067 59,969	77	1	VD Camp 70 17.214	068 53.65!	29	NA
LARV 19	67 42 397	067 59.995	78	1	VD RV 25 70 16.540		38	1
LARV 20		068.02.244	63	2	VD RV 26 70 16.528		40	
LARV 21		068 02.283	59	2	VD RV 27 70 16.538		40	-
LARV 22		068 02.270	64	2	VD RV 28 70 16.547		41	1
LARV 23		068 02.277	62	2	VD RV 29 70 16.536		41	1
LARV 24		068 02.301	63	2	VD RV 30 70 17.734		27	2
LA T09 00m		067 59.920	79	1	VD RV 31 70 17.731		29	-
LA T09 50m		067 59.920	79	1	VD RV 32 70 17.739		29	
LA T10 00m		067 59.934	79	1	VD RV 33 70 17.747		30	
LA T10 50m		067 59.984	79	1	VD RV 34 70 17.744		31	2
LA T 11 00m	The second secon	067 59.946	80	1	VD RV 35 70 18.088		15	
			-					
LA T11 50m		067 59.995	79	1	VD RV 36 70 18.031		14	
LA T12 00m		067 59.959	80	1	VD RV 37 70 18.060		13	
LA T12 50m		068 00.008	80	1	VD RV 38 70 18.097		15	
LA T13 00m		067 59.971	81	1	VD RV 39 70 18.031		10	
LA T13 50m		068 00.019	81	1	VD T19 00 70 16.542		45	
LA T14 00m		068 02.230	60	2	VD T19 50 70 16.557		41	1
LAT14 50m		068 02.273	62	2	VD T20 00 70 16.537		46	
LA T15 00m		068 02.243	61	2	VD T20 50 70 16.551		41	1
LA T15 50m		068 02.287	64	2	VD T21 00 70 16.529		42	1
LA T16 00m	67 41.684	068 02.255	61	2	VD T21 50 70 16.545	068 53.50	41	1
LA T16 50m	67 41.705	068 02.301	64	2	VD T22 00 70 16.524	068 53.45	39	1
LA T17 00m	67 41.679	068 02.269	58	2	VD T22 50 70 16.540	068 53.51	40	1
LAT17 50m	67 41.700	068 02.315	61	2	VD T23 00 70 16.519	068 53.46	39	1
LAT18 00m	67 41.675	068 02.286	60	2	VD T23 50 70 16.535	068 53.52	41	1
LA T18 50m	67 41.696	068 02.330	63	2	VD T24 00 70 17.729	068 53.004	30	2
ND Camp	65 18.873	072 52.841	24	NA	VD T24 50 70 17.756	068 53.020	29	2
ND RV 01	65 18.810	072 53.226	32	1	VD T25 00 70 17.728	068 53.024	32	2
ND RV 02	65 18.794	072 53.277	28	1	VD T25 50 70 17.754	068 53.04	28	2
ND RV 03	65 18.811	072 53.274	18	1	VD T26 00 70 17,726	068 53.043	32	2
ND RV 04	65 18.831	072 53.261	27	1	VD T26 50 70 17,752	068 53.06	30	
ND RV 05	65 18.814	072 53.314	26	1	VD T27 00 70 17,725	068 53.063	28	2
ND RV 06		072 51.703	23	2	VD T27 50 70 17,751		28	
ND RV 07		072 51.695	22	2	VD T28 00 70 17.723		28	
ND RV 08		072 51.785	23	2	VD T28 50 70 17.750		32	
ND RV 09		072 51.702	21	2	VD T29 00 70 18.076		4	3
ND RV 10		072 51.703	21	2	VD T29 50 70 18.100		4	
ND RV 11		072 51.785	21	2	VD T30 00 70 18.083		15	-
ND RV 12		072 51.737	22	2	VD T30 50 70 18.099		9	
ND RV 13		072 51,803	16	2	VD T31 00 70 18.047		14	
ND RV 14		072 51.803	23	2	VD T31 50 70 18.072		13	
ND T01 000m			27					
				1	VD T32 00 70 18.031		14	
ND T01 100m			36	1	VD T32 50 70 18.031		11	3
ND T02 000m			18	1	VD T33 00 70 18.019		14	
ND T02 100m			31	1	VD T33 50 70 18.024		12	
ND T03 000m			28	1	VD T34 00 70 17.470		14	
ND T03 100m			28	1	VD T34 50 70 17.488		16	
ND T04 000m			28	1	VD T35 00 70 17.422		13	
ND T04 100m			27	1	VD T35 50 70 17.402	068 51.76	17	5
ND T05 000m	65 18.775	072 53.281	31	1				

#### Factors measured along transects

#### Species cover along transects using the Buckner point sampler.

Table 7. Nadym-1 (forest site) cover along transects. 6 Aug 2007. Skip Walker, Elena Kaerkjärvi, Natalya Moskalenko, Pinus Sylvestris-Cladina stellaris forest. Five 100-m transects, observations at 1-m intervals. Record top species in tree layer, shrub layer, and moss layer at each point. 505 total points.

		TRANSECT 1 (A)			TRANSECT 2 (E	3)	TRANSECT 3 (C) TRANSECT 4 (D)				TRANSECT 5 (E)			Total tally	% Cover	s.d.				
Layer														Dwarf-shrub M					TOTAL (FOL	IAGE + DEAI
Species				i i											寸					
Trees																				
Larix sibirica (foliage)	1			3			1			1			4			10	1.98	0.28	2.98	
Larix sibirica (stem or dead)	_			1			1			1			2			5		0.10		
Pinus sibirica (foliage)				1			1			7			3			12	2.38	0.56	2.58	
Pinus sibirica (stem or dead)				_						1						1	0.20			
Pinus sylvestris (foliage)	14			13			14			12			7			60	11.90	0.58	22,22	
Pinus sylvestris (stem or dead)	11			6			13			7			15			52	10.32	0.76		
Betula toruosa (foliage)	- 5			10			16	1		19			5			56	11.11	1.39		
Betula toruosa (stem or dead)	_												1			1	0.20			
																ō	0.00			
Shrubs																0				
Betula nana (foliage)		3			6			1			2			5		17	3.37	0.41	4.96	
Betula nana (stem or dead)		2			2			2						2		8	1.59	0.00		
Empetrum nigrum (foliage)		3			-			1			5			3		12	2.38	0.32	3,97	
Empetrum nigrum (stem or dead)					7			1								8	1.59	0.84	0.77	
Juniperis sibirica (foliage)								1						2		3	0.60	0.14	0.60	
Ledum palustre (foliage)		14			11			15			10			7		57	11.31	0.64	17.06	
Ledum palustre (stem or dead)		8			8			3			5			5		29	5.75	0.43		
Vaccinium myrtellis		2			1			4			4			4		15	2.98	0.28	2.98	
Vacciinium uliginosum (foliage)		10			5			5			6	_		4		30	5.95	0.47	7,34	
Vacciinium uliginosum (stem or dead)		10			,			3			3			-		7	1.39	0.23		
Vaccinium vitis-idaea (foliage)		6			2			7			11	_		5		31	6.15	0.65	6.35	
Vaccinium vitis-idaea (stem or dead)								1			- 11	_		3		1	0.20	0.63	6,33	
Paccindin Fids Idaca (Stern or dedd)												_				0				
Graminoids, forbs																0				
Carex globularis					2											2			0.40	
Carex groundins												_				0	0.40		0.40	
Mosses and lichens																0				
Cetraria islandica						1									- 5	6	1.19		1.19	
Cladina rangiferina						1			- 1			_			- 3	2	0.40	0.00		
Cladina stellaris			56			35			23			31			42	187	37.10	2.79		
Cladina stygia			- 00	1		5			4			3			72	15	2.98	0.20		
Peltigera aghthosa						,			1			2			1	4	0.79	0.14		
Pleurozium schreberi			12	.1		29			35			20			23	119	23.61	2.00		
Polytrichastrum commune ?			1			2			2			- 20			23	5	0.99	0.11		
roryananestrani commune :			- 1	1												0	0.33	0.11	0,77	
Litter			26			29			39			45			27	166	32.94	1.75	32.94	
accer			20	+		27			37			40			4/	200	32.34	2.75	32.74	
TOTAL	31	. 49	95	34	44	102	46	45	105	48	46	101	37	37	101	921	182.74	5.61	182.74	
TOTAL POINTS	504																			
	504																			
TOTAL TREE COVER (%)	39																			
TOTAL DWARF-SHRUB LAYER COVER	44																			
TOTAL MOSS LAYER COVER	100																			
TO THE HOUSE ENTER GOVER	200			_		_						_								

Table 8. Nadym-2 (CALM-grid site) cover along transect. "Overstory" species are those recorded at the top of the plant canopy at each point; "understory" species are those recorded at the base of the plant canopy; (l) - live green plant part, (d) – dead or senescent plant part. Species use six letter abbreviations. Only two transects were sampled at Nadym-2 because of the limited area available for sampling. Sample points were identified as one of three microsites: hummocks, inter-hummocks, and wet inter-hummocks.

Percent Co											1
	Transect 6		Transect 7				Transect 6		Transect 7		
		Understory	Overstory	Understory		11172		Understory	Overstory	Understory	
Hummocks	:	11			Average	Interhumn	nocks				Average
Andpol	1.9		6.7		4.3	Andpol (I)	0.0		5.3	J.	2.7
Betnan (I)	11.1		13.3		12.2	Betnan (I)	4.9		0.0		2.4
Betnan (s)			0.0		0.9	Betnan (d)			0.0		1.2
Carglo (d)	3.7		6.7		5.2	Carglo (I)	19.5		2.6		11.1
Carglo (I)	5.6		10.0		7.8	Carglo (d)	0.0		13.6		6.8
Empnig (I)	1.9		0.0		0.9	Erivag (I)	2.4		2.6		2.5
Ledpal (I)	29.6		1.7		15.6	Ledpal (I)	2.4		2.6		2.5
Ledpal (s)	0.0		18.3		9.2	None	58.5		68.4		63.5
None	35.2		6.7		20.9	Rubcha (I)	4.9		2.6		3.7
Vacvit (I)	9.3		20.0		14.6	Vaculi (I)	2.4		0.0		1.2
Vacvit (d)	0.0		3.3		1.7	Vacvit (I)	2.4		2.6		2.5
Cetcuc		0.0		11.7	5.8	Cetisl		4.9		0.0	2.4
Cetisl		0.0		1.7	0.8	Claarb		2.4		2.6	2.5
Claama		1.9		1.7	1.8	Claste		53.7		57.9	55.8
Claarb		5.6		1.7	3.6	Clasty		24.4		10.5	17.4
Claste		31.5		5.0	18.2	Flacuc		2.4		0.0	1.2
Clasty		25.9		28.3	27.1	Litter		12.2		23.7	17.9
Flacuc		5.6		23.3	14.4	Polstr		0.0		5.3	2.7
Litter		29.6		26.7	28.1	Total		200.0		200.3	
Polstr		0.0		1.7	0.8						
Sphang		0.0		1.7	0.8						
Sphfus		0.0		5.0	2.5						
Sphwar		0.0		5.0	2.5						
Total		200		200.0							
	Note: total	is the total	of top and bott	tom hits=20	0%						
		Transect 6	Transect 7					Transect 6	Transect 7		
Wet inter	hummocks:					Wet inter	hummocks:				
	Carglo (I)	1		25			Clasty		1	50	
	None	3		75			Litter		1	50	
	Claste		1				none	2		100	
	Sphcom		2				Total	2	2	200	ji.
	Sphmag(?)		1	25							
	Litter	4	4								
	Total	8	8	200							

Table 9. Laborovaya-1 (clayey site) cover along transects. "Overstory" species are those recorded at the top of the plant canopy at each point; "understory" species are those recorded at the base of the plant canopy. Species use six letter abbreviations, sometimes followed by L (live green plant part) or D (dead or senescent plant part).

OVERSTORY Species	T09 count	T09 %	T10 count	T10 %	T11 count	T11 %	T12 count	T12 %	T13 count	T13 %	Total count	Total %
Arclat	1	1.0		0.0	122 000	0.0		0.0		0.0		0.2
BetnanL	24				18							24.2
BetnanS	1				1	1.0		0.0			10	2.0
Calstr	2			0.0		0.0		0.0		0.0		0.4
Calstr D	-	2.0		0.0		0.0		0.0	4			0.8
Calstr L			2	2.0	2	2.0	3	3.0			15	3.0
CarbigD	9	9.1			7							5.7
CarbigL	12		15		17							11.5
Empnig L	- '-			15.1	1	1.0		0.0		0.0		0.2
Eriang L			2	2.0		0.0		0.0		0.0		0.4
Erivag D			-	2.0	3			0.0				1.4
ErivagL	3	3.0	6	6.1	7							4.0
Fesovi L		5.0		0.1	1			3.0		0.0		0.2
Ledpal L			1	1.0	· ·	0.0				0.0		0.2
None	28	28.3			22			34.3	31			28.3
Petfri	20	20.3	20	25.3	2			34.3	31	0.0		0.4
Posalp					1	1.0				0.0		0.4
Rubcha	2	2.0	1	1.0	,	0.0			1			0.2
Salgia S	1			0.0		0.0			1	0.0		0.8
	2			0.0						0.0		
Salphy	2	2.0		0.0	3	0.0		3.0				0.4
Salphy L			1	1.0	3	3.0	3	3.0	2	2.0		1.6
Salphy S	2						3	2.0			1	0.2
Vaculi L					3							2.0
VacvitD					2						10	2.0
VacvitL	11		10		9						47	9.5
(total)	99	100.0	99	100.0	99	100.0	99	100.0	99	100.0	495	100.0
UNDERSTORY												
Species	T09 count	T09 %	T10 count	T10 %	T11 count	T11 %	T12 count	T12 %	T13 count	T13 %	Total count	Total %
Aulpal					12			0.0		0.0		2.4
Aultur	3	3.0	5	5.1	4							5.1
Carbig D	1			J.1		4.0	10	10.1	9	5.0	1	0.2
Cetisl		0.0		2.0		0.0	1	1.0		0.0		0.6
Chaset		0.0			1	1.0		0.0		0.0		0.4
Claarb	1					0.0				0.0		2.0
Claama		1.0	- 1	7.1		0.0		2.0	2			0.4
Cladso		0.0		0.0		0.0	2	2.0		0.0		0.4
Clagra		0.0		0.0		0.0						0.6
Clasty		0.0		0.0		0.0		1.0		0.0		0.0
Dicang	5				5						49	9.9
Dicelo	21				3							8.7
Dicfus	21	0.0				0.0		0.0			43	0.8
Dicrep		0.0				0.0		0.0		0.0		
		0.0				0.0		0.0		0.0		0.2
Dicsco Flacuc	1			0.0		0.0		2.0		0.0		0.6
Hepaticae	1			0.0	7	7.1						1.2
	1											
Hylspl							20	20.2		39.4	173	34.9
Litter	47	47.5	30	30.3	37							
Litter Pelaph	47	10000			37	1.0		0.0		0.0		
Litter Pelaph Pelmal	47	0.0		0.0		1.0	1	1.0		0.0	1	0.2
Litter Pelaph Pelmal Plesch		0.0		0.0	1	1.0 0.0 0.0	1 6	1.0 6.1		0.0	1 6	0.2 1.2
Litter Pelaph Pelmal Plesch Polstr	5	0.0 0.0 5.1	4	0.0 0.0 4.0	12	1.0 0.0 0.0 12.1	1 6 6	1.0 6.1 6.1	. 6	0.0 0.0 6.1	1 6 33	0.2 1.2 6.7
Litter Pelaph Pelmal Plesch Polstr	5	0.0 0.0 5.1 1.0	4 7	0.0 0.0 4.0 7.1	12	1.0 0.0 0.0 12.1 11.1	1 6 6 15	1.0 6.1 6.1 15.2	6	0.0 0.0 6.1 12.1	1 6 33 46	0.2 1.2 6.7 9.3
Litter Pelaph Pelmal Plesch Polstr Pticil Sphang	5	0.0 0.0 5.1 1.0	4 7	0.0 0.0 4.0 7.1	12	1.0 0.0 0.0 12.1	1 1 6 6 . 6 . 15 . 15 3	1.0 6.1 6.1 15.2 3.0	6 12	0.0 0.0 6.1 12.1 0.0	1 6 33 46 17	0.2 1.2 6.7 9.3 3.4
Litter Pelaph Pelmal Plesch Polstr Pticil Sphang Sphfus	5 1 9	0.0 0.0 5.1 1.0 9.1	4 7 4	0.0 0.0 4.0 7.1 4.0	12 11 11	1.0 0.0 0.0 12.1 11.1 1.0	1 1 6 6 6 . 6 15 3 1	1.0 6.1 6.1 15.2 3.0 1.0	6 12	0.0 0.0 6.1 12.1 0.0	1 6 33 46 17 2	0.2 1.2 6.7 9.3 3.4 0.4
Litter Pelaph Pelmal Plesch Polstr Pticil Sphang Sphfus Sphgir	5 1 9	0.0 0.0 5.1 1.0 9.1	4 7 4	0.0 0.0 4.0 7.1 4.0	12 11 11 1	1.0 0.0 0.0 12.1 11.1 1.0	1 6 6 6 . 15 1 3	1.0 6.1 6.1 15.2 3.0 1.0	6 12	0.0 0.0 6.1 12.1 0.0 1.0	1 6 33 46 17 2 6	0.2 0.2 1.2 6.7 9.3 3.4 0.4
Litter Pelaph Pelmal Plesch Polstr Pticil Sphang Sphflus Sphgir Sphwar	5 1 9	0.0 0.0 5.1 1.0 9.1	4 7 4	0.0 0.0 4.0 7.1 4.0 0.0 2.0	12 11 11 1 2 2	1.0 0.0 0.0 12.1 11.1 1.0 2.0 2.0	1 6 6 15 3 1	1.0 6.1 6.1 15.2 3.0 1.0 0.0	. 6 12 1 1 2	0.0 0.0 6.1 12.1 0.0 1.0 2.0	1 6 33 46 17 2 6	0.2 1.2 6.7 9.3 3.4 0.4 1.2 2.4
Litter Pelaph Pelmal Plesch Polstr Pticil Sphang Sphfus Sphgir	5 1 9	0.0 0.0 5.1 1.0 9.1 2.0	4 7 4	0.0 0.0 4.0 7.1 4.0 0.0 2.0	12 11 11 1	1.0 0.0 0.0 12.1 11.1 1.0 2.0 2.0	1 6 6 15 3 1	1.0 6.1 6.1 15.2 3.0 1.0 0.0 2.0	1 12 5 1 1	0.0 0.0 6.1 12.1 0.0 1.0 2.0 5.1	1 6 33 46 17 2 6 12	0.2 1.2 6.7 9.3 3.4 0.4 1.2

Table 10. Laborovaya-2 (sandy site) cover along transects. "Overstory" species are those recorded at the top of the plant canopy at each point; understory" species are those recorded at the base of the plant canopy. Species use six letter abbreviations, sometimes followed by L (live green plant part) or D (dead or senescent plant part).

Species	T14 count	T14.06	T15 count	T1506	T16 count	T16.06	T17 count	T17.06	T18 count	T19 06	Total count	Total %
	114 count	114 90										
AndpolL			3			0		0		0.0		
AndpolD			1	1		0		0		0.0	1	0.2
BetnanD	1			0				0		0.0	2	0.4
BetnanL	10		9	9	10			11		6.9	46	10.2
BetnanS	2	3.0	2	2		0		0		3.4		1.5
Calhol					1	1		1		0.0	2	0.4
CarbigD	2	3.0	4	4	6	6	4	4	. 5	5.7	21	4.6
CarbigL		0.0	4	4	5	5	1	1	3	3.4	13	2.9
CarrotD		0.0	1	1		0		0		0.0	1	0.2
EmpnigD	1	1.5		0		0		0		0.0	1	0.2
EmpnigL	1		2	2	3	3	1	1	1	1.1	8	1.8
EmpnigS	1		1	1		0		0		0.0		0.4
EriangD	2		1	1		0		1		1.1	5	1.1
		3.0			1			0		1.1	2	0.4
EriangL					2			0		0.0		
ErivagL												0.4
LedpalL		0.0	3	3							19	4.2
LedpalS		0.0	1	1		0		0		0.0		0.2
None	39	59.1	53	53	58	58				54.0	263	58.1
Salphy							2			0.0		0.4
VaculiL	1		9	9		0				11.5	22	4.9
VaculiD	1	1.5		0		0		0		0.0	1	0.2
VaculiS		0.0	1	1		0		0	2	2.3	3	0.7
VacvitD	1			0		0		1		0.0		0.4
VacvitL	4		5	5	9	9	2	2	3	3.4	23	5.1
VacvitS									1	1.1	1	0.2
Wet (exclude from total)	35			0		0		0			47	
(total)	101	100.0	100	100	100					100.0		100.0
(tota)	101	100.0	100	100	100	100	100	100		100.0	300	100.0
UNDERSTORY												
Species	T14 count	T14 06	T15 count	T1506	T16 count	T16.06	T17 count	T17 06	T18 count	T19 06	Total count	Total %
	TITCOUNC	114 90										
Asachr			1	1		0		0		1.1	2	0.4
Aultur	1		3	3		0					8	1.8
BlackCrust	2	3.1	12	12				7		0.0	24	5.3
BlkCrstLiver					1	1		0		0.0		0.2
Brydiv							3			3.4		1.3
Cetdel					1	1		0		0.0	1	0.2
Cetisl			1	1	2	2	1	1	1	1.1	5	1.1
Claarb	7	10.8	13	13	9	9	14	14	. 8	9.2	51	11.3
Clabrnholes					2	2		0	1	1.1	3	0.7
Cladsp					2					1.1		1.1
Clagra					2			1		1.1		0.9
Claran	4	6.2	3	3		0				0.0		2.4
		0.2	1	1								4.2
Clasty	2	2.1						7				
Claune		3.1	10	10	5					6.9		6.6
Dialap	-		1	1	_	0				0.0		0.4
Dicelo	5		2	2	7							4.6
Dicfus	1	1.5		0		0		0		0.0		0.2
Drepsp									1	1.1		0.2
Flacuc	1	1.5		0		0	2	2	2	2.3	5	1.1
Flaniv			1	1	1	1		0	3	3.4	5	1.1
												1.1
	1	1.5		ō				1		2.3	5	
Hepaticae			22	0	1	1	1		2			
Hepaticae Litter	1 12		22		1 9	1 9	1 16	16	2	10.3	68	15.0
Hepaticae Litter Ochfri			22	0	1 9 1	1 9 1	1 16 1	16 1	2 9 3	10.3 3.4	68 5	15.0 1.1
Hepaticae Litter Ochfri Okstr?			22	0	1 9 1	1 9 1	1 16 1	16 1 0	2 9 3	10.3 3.4 0.0	68 5 1	15.0 1.1 0.2
Hepaticae Litter Ochfri Okstr? Pelmal			22	0	1 9 1 1	1 9 1 1	1 16 1	16 1 0	9 3	10.3 3.4 0.0 0.0	68 5 1 1	15.0 1.1 0.2 0.2
Hepaticae Litter Ochfri Okstr? Pelmal Pertsp			22	0	1 9 1	1 9 1 1	1 16 1	16 1 0	9	10.3 3.4 0.0 0.0	68 5 1 1	15.0 1.1 0.2 0.2 0.2
Hepaticae Litter Ochfri Okstr? Pelmal Pertsp Plesoh				0 22	1 9 1 1	1 9 1 1 1 1	1 16 1	16 1 0 0	2 9 3	10.3 3.4 0.0 0.0 0.0	68 5 1 1 1 1	15.0 1.1 0.2 0.2 0.2 0.2
Hepaticae Litter Okstr? Pelmal Pertsp Ples oh	12	18.5	22	0 22 1	1 9 1 1 1	1 9 1 1 1 1	1 16 1	16 1 0 0 0	2 9 3	10.3 3.4 0.0 0.0 0.0 1.1	68 5 1 1 1 1 1 3	15.0 1.1 0.2 0.2 0.2 0.2 0.2
Hepaticae Litter Ochtri Okstr? Pelmal Pertsp Plesch Polcom Polkyp	12	3.1	1	1 0	1 9 1 1 1 1	1 9 1 1 1 1 0 6	1 16 1	16 1 0 0 0	2 9 3	10.3 3.4 0.0 0.0 0.0 1.1 0.0	68 5 1 1 1 1 3 11	15.0 1.1 0.2 0.2 0.2 0.2 0.7 2.4
Hepaticae Litter Okstr? Pelmal Pertsp Plesch Poloom Polhyp Polstr	12	3.1		1 0 12	1 9 1 1 1 1	1 9 1 1 1 1 0 6	1 16 1	16 1 0 0 0 0	1 3 3 10	10.3 3.4 0.0 0.0 0.0 1.1	68 5 1 1 1 1 3	15.0 1.1 0.2 0.2 0.2 0.2 0.2
Hepaticae Litter Okstr? Pelmal Pertsp Plesch Poloom Polhyp Polstr	12	3.1	1	1 0	1 9 1 1 1 1	1 9 1 1 1 1 0 6	1 16 1	16 1 0 0 0	1 3 3 10	10.3 3.4 0.0 0.0 0.0 1.1 0.0	68 5 1 1 1 1 3 3 11	15.0 1.1 0.2 0.2 0.2 0.2 0.7 2.4
Hepaticae Litter Ochfri Okstr? Pelmal	12	3.1 16.9	1	1 0 12 0	1 9 1 1 1 1 1 1 8	1 9 1 1 1 1 0 6 14	1 16 1 1	16 1 0 0 0 0	2 9 3 1 1	10.3 3.4 0.0 0.0 0.0 1.1 0.0 3.4	68 5 1 1 1 1 1 3 3 11 50	15.0 1.1 0.2 0.2 0.2 0.2 0.7 2.4
Hepaticae Litter Ochtri Okstr? Pelmal Pertsp Plesch Polcom Polkyr Polstr Potarmigan poop	12 2 11 1	3.1 16.9	1 12	1 0 12 0	1 9 1 1 1 1 1 6 14	1 9 1 1 1 1 0 6 14 0 9	1 16 1 1 2 3	16 1 0 0 0 2 0 3 0 9	2 9 3 1 1 3 10	10.3 3.4 0.0 0.0 0.0 1.1 0.0 3.4 11.5 0.0	68 5 1 1 1 1 3 3 11 50 1	15.0 1.1 0.2 0.2 0.2 0.2 0.7 2.4 11.1
Hepatioae Litter Obstr? Pelmal Pertsp Plesoh Poloom Polhyp Polstr Ptarmigan poop	12 2 11 1	3.1 16.9	1 12 4	1 0 12 0 12 0	1 9 1 1 1 1 1 6 14	1 9 1 1 1 1 0 6 14 0 9	1 16 1 2 2 3 9 9	16 1 0 0 0 2 0 3 0 9	2 9 3 1 1 3 10 2	10.3 3.4 0.0 0.0 0.0 1.1 0.0 3.4 11.5 0.0 11.5	68 5 1 1 1 1 1 3 3 11 50 1 1 36 9	15.0 1.1 0.2 0.2 0.2 0.7 2.4 11.1 0.2
Hepaticae Litter Ochtri Okstr? Pelmal Pertsp Ples ch Poloom Polhyp Polstr Patarmigan poop Pticil Racidan ReindeerPoop	2 11 11 4	3.1 16.9 1.5 6.2	1 12 4 2	1 0 12 0 12 0 4	1 9 1 1 1 1 1 1 8 14	1 9 1 1 1 1 0 6 14 0 9	2 3 9 2 1	16 1 0 0 0 0 2 0 3 0 9 2 1	2 9 3 1 1 3 10 2	10.3 3,4 0.0 0.0 0.0 1.1 0.0 3,4 11.5 0.0 11.5	68 5 1 1 1 1 3 11 50 1 36 9	15.0 1.1 0.2 0.2 0.2 0.7 2.4 11.1 0.2 8.0 0.2
Hepaticae Litter Ochtri Okstr? Pelmal Pertsp Plesch Polcom Polkyr Polstr Prarmigan poop Pticil Racian ReindeerPoop	12 2 11 1	3.1 16.9 1.5 6.2	1 12 4 2	1 0 12 0 4 2	1 9 1 1 1 1 1 1 6 14	1 9 1 1 1 1 0 6 14 4 0 9	1 16 1 2 2 3 9 2 1 1 13	16 1 0 0 0 2 0 3 0 9 2 1 1	2 9 3 1 1 10 2 7	10.3 3,4 0.0 0.0 1.1 0.0 3.4 11.5 0.0 11.5 2.3 0.0	68 5 1 1 1 1 3 11 50 1 36 9 1 1 47	15.0 1.1 0.2 0.2 0.2 0.7 2.4 11.1 0.2 8.0 0.2 0.0
Hepaticae Litter Ochtri Okstr? Pelmal Pertsp Pelsoh Poloom Polhyp Polstr Ptarmigan poop Pticil Racian ReindeerPoop Sphglo	2 11 11 4	3.1 16.9 1.5 6.2	1 12 4 2	1 0 12 0 12 0 4	1 9 1 1 1 1 1 1 6 14	1 9 1 1 1 1 0 6 14 0 9 3	1 16 1 2 3 3 9 2 1 1 13	16 1 0 0 0 2 0 3 3 0 9 2 1 1 13	2 9 9 3 3 10 10 10 2 7 7 1	10.3 3,4 0.0 0.0 0.0 1.1 0.0 3,4 11.5 0.0 11.5	68 5 5 1 1 1 1 1 1 1 1 3 3 1 1 1 1 5 0 0 1 1 3 6 9 1 1 4 7 5 5 6	15.0 1.1 0.2 0.2 0.2 0.7 2.4 11.1 0.2 8.0 0.2
Hepaticae Litter Ochtri Okstr? Pelmal Pertsp Plesch Poloom Polhyp Polstr Plarmigan poop Pticil Racian Racian Racian Racian Racian Racian Spiglo Sphglo Story Vacwit	2 11 11 4	3.1 16.9 1.5 6.2	1 12 4 2 9	1 1 0 12 0 4 2	1 9 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1 9 1 1 1 1 0 6 14 4 0 9	1 16 1 2 2 3 9 2 1 1 13	16 1 0 0 0 2 0 3 0 9 2 1 1	2 9 9 3 3 10 10 10 2 7 7 1	10.3 3,4 0.0 0.0 1.1 0.0 3.4 11.5 0.0 11.5 2.3 0.0	68 5 1 1 1 1 1 1 1 3 3 11 1 1 5 0 0 9 1 1 4 7 5 1 1	15.0 1.1 0.2 0.2 0.2 0.7 2.4 11.1 0.2 8.0 2.00 0.2
Hepaticae Litter Obstr? Pelmal Pertsp Plesoh Poloom Polhyp Polstr Ptarmigan poop Pticil Racian ReindeerPoop Sphglo Stersp Vacvit white crust	2 11 1 4	3.1 16.9 1.5 6.2	1 12 4 2	1 0 12 0 4 2	1 9 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1 9 1 1 1 1 0 6 14 4 0 9	1 16 1 2 3 3 9 2 1 1 13	16 1 0 0 0 2 0 3 3 0 9 2 1 1 13	2 9 3 3 10 10 10 2 7 1	10.3 3,4 0.0 0.0 1.1 0.0 3.4 11.5 0.0 11.5 2.3 0.0	68 5 1 1 1 1 1 1 3 3 11 1 1 3 6 9 1 1 4 7 7 5 1 1 1 1 1 1	15.0 1.1 0.2 0.2 0.2 0.7 2.4 11.1 0.2 8.0 0.2
Hepaticae Litter Ochtri Okstr? Pelmal Pertsp Plesch Poloom Polhyp Polstr Plarmigan poop Pticil Racian Racian Racian Racian Racian Racian Spiglo Sphglo Story Vacwit	2 11 11 4	3.1 16.9 1.5 6.2	1 12 4 2 9	1 1 0 12 0 4 2	1 9 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1 9 1 1 1 1 0 6 4 1 4 0 9 3	1 16 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	16 1 0 0 0 2 0 3 3 0 9 2 1 1 13	2 9 3 1 1 3 10 2 7 1	10.3 3,4 0.0 0.0 1.1 0.0 3.4 11.5 0.0 11.5 2.3 0.0	68 5 1 1 1 1 1 1 1 1 5 0 1 1 1 3 3 6 9 1 1 4 7 5 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	15.0 1.1 0.2 0.2 0.2 0.7 2.4 11.1 0.2 8.0 2.00 0.2

Table 11. Vaskiny Dachi-1 (Terrace-IV) cover along transects. "Overstory" species are those recorded at the top of the plant canopy at each point; "understory" species are those recorded at the base of the plant canopy. Species use six letter abbreviations, sometimes followed by L (live green plant part) or D (dead or senescent plant part).

Species	T19 count	T19 %	T20 count	T20 %	T21 count	T21 %	T22 count	T22 %	T23 count	T23 %	Total count	Total %
Betnan L	5	5.0	5	5.0	4	4.0	4	4.0	3	3.0	21	4.2
Betnan S	1		_	0.0	1		1		_	0.0	3	0.6
Bisviv	_		1	1.0	1		2				4	0.8
Carbig D	8	8.0	12	12.0	6		12		4	4.0	42	8.4
Carbig L	15		22	22.0	21		12		19	19.0	89	17.8
Dryoct L	- 10	2010	1	1.0	3		2			2510	6	1.2
Empnig L				1.0	1		1				2	0.4
Eriang D						1.0		1.0	1	1.0	1	0.2
Eriang L							1	1.0	5	5.0	6	1.2
Fesrub L							1		3	3.0	1	0.2
Festsp							1		1	1.0	2	0.2
None	55	55.0	42	42.0	47	47.0	38		_	45.0	227	45.4
	33	33.0	42	42.0	47	47.0	38	38.0	5	45.0 5.0		
Poaalp	_						_				5	1.0
Salgla L	2	2.0	6	6.0	3	3.0	7	7.0			20	4.0
Salgla S									1	1.0	1	0.2
Sallan L			2		5				1	1.0	8	1.6
Salpol L	8		6	6.0	1		10		8	8.0	33	6.6
Vacvit L	6		3		7						29	5.8
(total)	100	100.0	100	100.0	100	100.0	100	100.0	100	100.0	500	100.0
UNDERSTO	RY											
Species	T19 count	T19 %	T20 count	T20 %	T21 count	T21 %	T22 count	T22 %	T23 count	T23 %	Total count	Total %
Aultur	14		19	19.0							71	14.2
Aultur Trail		14.0	- 17	19.0	10	10.0	17	14.0	1	1.0	1	0.2
Bisviv					1	1.0				1.0	1	0.2
Carbig D			1	1.0		1.0			1	1.0	2	0.2
				1.0					2		2	
Carbig D T	2											0.4
Carbig L				0.0		0.0		0.0		0.0	2	0.4
Cetisl	1.0	1	2.0	2	2.0	2		0		0	5	1.0
Claama							2				2	0.4
Cladsp							1				1	0.2
Clagra					1		1				2	0.4
Dicelo					2		5	5.0	2	2.0	9	1.8
Dicelo = Di					1						1	0.2
Dryoct L	2	2.0	4	4.0		0.0	2	2.0		1.0	9	1.8
Flacuc									1	1.0	1	0.2
Hepatic							1	1.0			1	0.2
Hylspl	37	37.0	43	43.0	22	22.0	22	22.0	13	13.0	137	27.4
Hylspl Trail							3	3.0	2	2.0	5	1.0
Litter	23	23.0	16	16.0	38	38.0	12	12.0	27	27.0	116	23.2
Litter Trail							1	1.0	21	21.0	22	4.4
Ochfri							1	1.0	1	1.0	2	0.4
Pelaph	1	1.0	1	1.0		0.0		0.0		0.0	2	0.4
Pelmal							2		1		3	0.6
Pelmal = P	elareen				1	1.0					1	0.2
Polstr	12	12.0	8	8.0	5		23	23.0	6	6.0	54	10.8
Polstr Trail		22.10		0.0		3.0	2				5	1.0
Pticil			2	2.0			3				7	1.4
Reinpoop				2.0			1			2.0	1	0.2
	1	1.0		0.0		0.0	1			0.0	1	
Salpol L		1.0		0.0		0.0		0.0				0.2
Salpol L Tr									2		2	0.4
Sphglo 	2	2.0		0.0		0.0		0.0		0.0	2	0.4
Thaver			1	1.0			1		1		3	0.6
Tomnit			3	3.0	6		3		5	5.0	17	3.4
Vacvit L	5			0.0	3			0.0	2		10	2.0
(total)	100	100.0	100	100.0	100	100.0	100	100.0	100	100.0	500	100.0

Table 12. Vaskiny Dachi-2 (Terrace-III) cover along transects. "Overstory" species are those recorded at the top of the plant canopy at each point; "understory" species are those recorded at the base of the plant canopy. L - live green plant part; D – dead or senescent plant part. Species use six letter abbreviations.

OVERSTOR												
Species	T24 count	T24 %	T25 count	T25 %	T26 count	T26 %	T27 count		T28 count		Total count	
Arclat L							1	1.1	2	3.9	3	0.9
Betnan D	1							0.0		0.0	1	0.3
Betnan L	7		2	2.5	12	16.0	11	12.5	7	13.7	39	11.2
Betnan S	2	3.8			1	1.3		0.0		0.0	3	0.9
Bisviv											0	0.0
Calhol D	3	5.8	2	2.5	7	9.3	4	4.5	3	5.9	19	5.5
Calhol L					7	9.3	2	2.3	2	3.9	11	3.2
Carbig D	7	13.5	12	14.8	2	2.7	10	11.4	4	7.8	35	10.1
Carbig L	7	13.5	14	17.3	3	4.0	7	8.0	3	5.9	34	9.8
Eriang D			1	1.2				0.0		0.0	1	0.3
Eriang L			1	1.2			2	2.3			3	0.9
Erivag D											0	0.0
None	19	36.5	31	38.3	32	42.7	29	33.0	24	47.1	135	38.9
Pedlap							1	1.1			1	0.3
Rubcha								0.0		0.0	0	0.0
Salgla L			1	1.2			4	4.5	1	2.0	6	1.7
Sallan D								0.0		0.0	0	0.0
Sallan L								0.0		0.0	0	0.0
Salnum L	1	1.9			1	1.3		0.0	1		3	0.9
Salpol L	1		2	2.5			4			0.0	8	2.3
Vacvit L	4		15		9		13		4		45	13.0
(total)	52						88		51		347	100.0
,												
UNDERSTO	RY (Zonal)											
Species	T24 count	T24 %	T25 count	T25 %	T26 count	T26 %	T27 count	T27 %	T28 count	T28 %	Total count	Total %
Aultur	3								2		27	7.8
Betnan S					1			12.0	_	0.5	1	0.3
Black crust	3	5.8	2	2.5							7	2.0
Carbig D		0.0	_		1						1	0.3
Cetisl	1	1.9				1	2	2.3			3	0.9
Claama	_						_		2	3.9	2	0.6
Claarb	2	3.8	2	2.5	3	4.3	4	4.5		0.5	11	3.2
Clasty			3		3						6	1.7
Claunc	1	1.9	1						2	3.9	5	1.4
Dacarc	_			1.2		1	2	2.3	_	0.5	2	0.6
Dicang			3	3.7			_	2.0			3	0.9
Dicang is Dic	c hia		1								1	0.3
Dicelo	7	13.5	3			7.1	2	2.3	3	5.9	20	5.8
Eriang L	,	10.0	3	0.7		7.1	_	2.0	1		1	0.3
Flacuc	1	1.9							-	2.0	1	0.3
Gymcor	-	. 1.0					1	1.1			1	0.3
Hepatic			5	6.2			2		2	3.9	9	2.6
Hylspl	12	23.1	17			11.4			8		58	16.7
Litter	4		5				7		10		39	11.2
Ochfri		7.7	1				2		10	15.0	5	1.4
Pelaph			1			2.5		2.0	1	2.0	2	0.6
Pelmal				1.2	3	4.3	2	2.3	2		7	2.0
Pertsp					3	4.3	1			3.9	1	0.3
	7	13.5	19	23.5	9	12.9	18			01.6	64	
Polstr	/	13.3				12.9	18	20.5	11	21.6		18.4
Poop	-		1 4		11	15.7	17	19.3	-	FO	1 38	0.3
Pticil	3	5.8				15.7				5.9		11.0
Raclan	-		6	7.4			3	3.4			9	2.6
Salnum L	2	3.8									2	0.6
Salpol L	-		_		1		-				1	0.3
Sphglo	2	3.8	1	1.2	4	5.7	1	1.1			8	2.3
Thaver									1	2.0	1	0.3
Tomnit	1				-				_		1	0.3
Vacvit L	3				3				3		9	2.6
(total)	52	100.0	81	100.0	75	106.9	88	100.0	51	100.0	347	100.0

Table 12 (cont') Vaskiny Dachi-2 (Terrace-III) cover along transects. "Overstory" species are those recorded at the top of the plant canopy at each point; "understory" species are those recorded at the base of the plant canopy. Species use six letter abbreviations, sometimes followed by L (live green plant part) or D (dead or senescent plant part).

	Y (Moist)	T24.05	T25	TOE 04	T26	T26.00	T27	T27.04	T20	T20.06	Takal same	4-1 CC
pecies	T24 count		T25 count		T26 count	120 %	T27 count	127 %	T28 count		Total count To	
etnan L	5		5						7	30.4		14.7
etnan S	1		1						2	8.7	4	3.4
alhol L	1		1						1	4.3	3	2.6
arbig D	1		1								2	1.7
Carbig L	2	4.5	2	5.4			2	16.7	1	4.3	7	6.0
riang D	4	9.1	4	10.8			2	16.7			10	8.0
riang L	2	4.5	2	5.4							4	3.4
lone	17	38.6	11	29.7			5	41.7	9	39.1	42	36.2
Rubcha	2		2								4	3.4
algla L	_		_				1	8.3			1	0.9
Sallan D	1	2.3	1	2.7				0.0			2	1.7
Sallan L	1	2.3	-								1	0.9
/acvit L	7		7	10.0			2	16.7		12.0		
		15.9						16.7	3	13.0	19	16.4
total)	44	100.0	37	100.0			12	100.0	23	100.0	116	100.0
INDERSTO	RY (Moist)											
Species	T24 count	T24 %	T25 count	T25 %	T26 count	T26 %	T27 count	T27 %	T28 count	T28 %	Total count To	otal %
ulpal	1	2.3	1	2.7							2	1.7
kultur	1	2.3	1				2	16.7			4	3.4
lack crust	3	6.8	2								5	4.3
Clagra	_		_						2	8.7	2	1.7
	4	9.1	4	10.0				0.2		0.,	9	
Dicang Dicalo							1	8.3				7.8
icelo	1	2.3	1	2.7					-		2	1.7
icfus							-		1	4.3	1	0.9
lylspl	15	34.1	9				3	25.0	4	17.4	31	26.7
itter	8	18.2	8						6	26.1	22	19.0
elmal	1		1								2	1.7
olstr	4	9.1	4	10.8			5	41.7			13	11.2
Pticil	3	6.8	3				1		7	30.4	14	12.1
Salnum L									1	4.3	1	0.9
phglo	1	2.3	1	2.7					_		2	1.7
haver	_	2.0		,					2	8.7	2	1.7
/acvit L	2	4.5	2	5.4						0.7	4	3.4
total)	44	100.0	37				12	100.0	23	100.0	116	100.0
cocar)	44	100.0	37	100.0			12	100.0	23	100.0	110	100.0
VERSTOR	Y (Drv)											
pecies	T24 count	T24 %	T25 count	T25 %	T26 count	T26 %	T27 count	T27 %	T28 count	T28 %	Total count To	otal %
	TETCOUNC	12.4 70	TEO COUNT	120 00	TEO COUNT	120 00	TE / Counc	127 70				
etnan L									3	11.1	3	11.1
alhol D									1	3.7	1	3.7
Carbig D									1	3.7	1	3.7
Carbig L									1	3.7	1	3.7
lone									16	59.3	16	59.3
Salgla L									2	7.4	2	7.4
Salnum L									1	3.7	1	3.7
/acvit L									2	7.4	2	7.4
total	0	0.0	0	0.0	0	0.0	0	0.0	27	100.0	27	100.0
JNDERSTO												
pecies	T24 count	T24 %	T25 count	T25 %	T26 count	T26 %	T27 count	T27 %	T28 count	T28 %	Total count To	otal %
Aultur									2	7.4	2	7.4
Black crust									1	3.7	1	3.7
Claarb									2	7.4	2	7.4
Dicelo									1	3.7	1	3.7
									1	3.7	1	3.7
Hylspl												
itter									10	37.0	10	37.0
Ochfri									3	11.1	3	11.1
Polstr									1	3.7	1	3.7
Pticil									2	7.4	2	7.4
Radan									1	3.7	1	3.7
Sphglo									3	11.1	3	11.1
total)	0	0.0	0	0.0	0	0.0	0	0.0	27	100.0	27	100.0
	w (w . 1)											
OVERSTOR Species	T24 count	T24 0%	T25 count	T25 %	T26 count	T26 %	T27 count	T27 06	T28 count	T28 %	Total count	Total %
Betnan L	. E T COUIT	.ET 70	. 2 5 Count	12.5 70	. z v count	120 90	res count	127 70				
				-	-		-	-	1			4.
Calhol D								-	1			4.
Calhol L									2			8.
Carbig D									1			4.
riang D									4		0 4	16.
riang L									2			8.
lone									9			36
Salgla L												8
Salnum L									1			4.
					-							
/acvit L	0		+	) 00		,	,	,	2			100
total)	0	0.0	0	0.0		0.0	) (	0.0	25	100.0	D 25	100
INDERSTO	RY (Wet)										+	
pecies		T24 04	T25 court	T25 06	T26 court	T26 06	T27 court	T27 06	T28 court	T28 06	Total court	Total 04
	T24 count	124 90	T25 count	123 9/0	T26 count	120 9/0	T27 count	127 9/0	T28 count		Total count	
Aultur									1			4
Dicelo									1	4.0	0 1	4
riang D									1			4
riang L												4
Hepatic									2			8
Hylspl												20
itter									9			36
Pelmal									2			8
									3	12.0	<b>D</b> 3	12
Polstr	0							0.0		12.0	<u> </u>	

Table 13. Vaskiny Dachi-3 (Terrace-II) cover along transects.

Species	Y T29 count	T29 %	T30 count	T30 %	T31 count	T31 %	T32 count	T32 %	T33 count	T33 %	Total count	Total %
Arclat	TE J COUITC	0.0	100 court	0.0		0.0	TOE COUNT	0.0		0.0		0.0
erciat BetnanL		0.0		0.0			1	1.0		0.0	9	1.8
Betnans		0.0		0.0		0.0	3	3.1		0.0	3	0.6
Calhol L	3			0.0	1			0.0		0.0	4	0.8
Califor		0.0		0.0		0.0		0.0		0.0	0	0.0
Calstr D		0.0		0.0		0.0		0.0		0.0	0	0.0
		0.0		0.0		0.0		0.0		0.0	0	
Calstr L												0.0
CarbigD	9		11	11.2			1		1		23	4.7
CarbigL	9	9.2	4	4.1		0.0	1	1.0	3		17	3.5
Empnig					1				1		2	0.4
Empnig L		0.0		0.0		0.0		0.0		0.0	0	0.0
Eriang L		0.0		0.0		0.0		0.0		0.0	0	0.0
Erivag D		0.0		0.0		0.0		0.0		0.0	0	0.0
ErivagL		0.0		0.0		0.0		0.0		0.0	0	0.0
Festuca			1	1.0							1	0.2
Fesovi L		0.0		0.0		0.0		0.0		0.0	0	0.0
Hiealp							1	1.0			1	0.2
Ledpal L		0.0		0.0			12	12.2	2	2.0	21	4.3
Ledpal S					2	2.0	4	4.1	6	6.1	12	2.4
Luzmul					1						1	0.2
Luzmul D					1	1.0					1	0.2
None	67	68.4	63	64.3	61		67	68.4	77	78.6	335	68.4
Petfri		0.0		0.0		0.0		0.0		0.0	0	0.0
Poaalp		0.0		0.0		0.0		0.0		0.0	0	0.0
Rubcha		0.0		0.0		0.0		0.0		0.0	0	0.0
Salgla S		0.0		0.0		0.0		0.0		0.0		0.0
Salnum L		0.0		0.0	4		1				7	1.4
Salphy		0.0		0.0		0.0		0.0		0.0	ó	0.0
Salphy L		0.0		0.0		0.0		0.0		0.0	0	0.0
Vaculi L		0.0		0.0		0.0		0.0		0.0	0	0.0
VacuitD		0.0		0.0		0.0		0.0		0.0	0	0.0
	10		10				-					
VacvitL	10	10.2	19	19.4			7	7.1	6	6.1		10.6
Vacvit S (total)	98	100.0	98	100.0	98	1.0	98	100.0	98	100.0	490	100.0
, ,												
III DEBATA												
Species	RY T29 count	T29 %	T30 count	T30 %	T31 count	T31 %	T32 count		T33 count		Total count	
<b>Species</b> Aleoch		T29 %	T30 count	T30 %			T32 count	T32 %		T33 %	2	0.4
<b>Species</b> Aleoch		T29 %			1	1.0	2			0.0	2 1	0.4 0.2
<b>Species</b> Aleoch Aultur			<b>T30 count</b>		1	1.0				9.2	2 1 26	
<b>Species</b> Aleoch Aultur Black crust	T29 count	1.0			1 7	1.0 7.1	2	2.0 6.1		9.2	2 1 26	0.4 0.2
UNDERSTO Species Aleoch Aultur Black crust Brydiv Carbig L	T29 count	1.0		3.1	1 7 1	1.0 7.1	6 4	2.0 6.1 4.1 0.0	9	9.2	2 1 26 7	0.4 0.2 5.3 1.4 0.2
<b>Species</b> Aleoch Aultur Black crust Brydiv	1 1	1.0		3.1 0.0	1 7 1	1.0 7.1 1.0	2	2.0 6.1 4.1 0.0	9	9.2 1.0 0.0	2 1 26 7	0.4 0.2 5.3 1.4
<b>Species</b> Aleoch Aultur Black crust Brydiv Carbig L	1 1	1.0 1.0 1.0		3.1 0.0	1 7 1	1.0 7.1 1.0 0.0	6 4	2.0 6.1 4.1 0.0 2.0	9 1	9.2 1.0 0.0	2 1 26 7	0.4 0.2 5.3 1.4 0.2
Species Aleoch Aultur Black crust Brydiv Carbig L Cetdel Cetisl	1 1 1	1.0 1.0 1.0	3	3.1 0.0 0.0	1 7 1	1.0 7.1 1.0 0.0	6 4	2.0 6.1 4.1 0.0 2.0 4.1	9 1	9.2 1.0 0.0 1.0	2 1 26 7 1 3	0.4 0.2 5.3 1.4 0.2
Species Aleoch Aultur Black crust Brydiv Carbig L Cetdel Cetisl Claarb	1 1 1 3	1.0 1.0 1.0	3	3.1 0.0 0.0	1 7 1	1.0 7.1 1.0 0.0	2 6 4 2 4	2.0 6.1 4.1 0.0 2.0 4.1 2.0	9 1 1 3	9.2 1.0 0.0 1.0	2 1 26 7 1 3 11	0.4 0.2 5.3 1.4 0.2 0.6
Species Aleoch Aultur Black crust Brydiv Carbig L Cetdel	1 1 1 3	1.0 1.0 1.0 3.1 6.1	3	3.1 0.0 0.0	1 7 1	1.0 7.1 1.0 0.0 2.0 2.0	2 6 4 2 4 2	2.0 6.1 4.1 0.0 2.0 4.1 2.0	9 1 1	9.2 1.0 0.0 1.0	2 1 26 7 1 3 11 21	0.4 0.2 5.3 1.4 0.2 0.6 2.2
Species Aleoch Aultur Black crust Brydiv Carbig L Cetdel Cetisl Claarb Clabel Cladsp	1 1 1 1 3 6 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1.0 1.0 1.0 3.1 6.1	3	3.1 0.0 0.0 2.0 8.2	1 7 1 1	1.0 7.1 1.0 0.0 2.0 2.0	2 6 4 2 4 2 1	2.0 6.1 4.1 0.0 2.0 4.1 2.0 1.0	9 1 1 3	9.2 1.0 0.0 1.0 0.0 3.1	2 1 26 7 1 3 11 21 1	0.4 0.2 5.3 1.4 0.2 0.6 2.2 4.3 0.2
Species Aleoch Aultur Black crust Brydiv Carbig L Cetdel Cetisl Claarb Clabel Cladsp Cladw/brwn	1 1 1 3 6 1 holes	1.0 1.0 1.0 3.1 6.1	3	3.1 0.0 0.0 2.0 8.2	1 7 1 1	1.0 7.1 1.0 0.0 2.0 2.0	2 6 4 2 4 2	2.0 6.1 4.1 0.0 2.0 4.1 2.0	9 1 1 3	9.2 1.0 0.0 1.0 0.0 3.1	2 1 26 7 1 3 11 21	0.4 0.2 5.3 1.4 0.2 0.6 2.2 4.3 0.2
Species Aleoch Aultur Brydiv Carbig L Cetdel Cetisl Claarb Cladsp Cladyprwn( Cladypreenw/)	1 1 1 3 6 1 holes	1.0 1.0 1.0 3.1 6.1	3	3.1 0.0 0.0 2.0 8.2	1 7 1 2 2 2	1.0 7.1 1.0 0.0 2.0 2.0	2 6 4 2 4 2 1	2.0 6.1 4.1 0.0 2.0 4.1 2.0 1.0	9 1 1 1 3 3 1 1	9.2 1.0 0.0 1.0 0.0 3.1	2 1 26 7 1 3 11 21 1 4	0.4 0.2 5.3 1.4 0.2 0.6 2.2 4.3 0.2 0.8
Species Aleoch Aultur Black crust Brydiv Carbig L Cetdel Cetisl Claarb Cladsp Cladw/brwn Clagreenw/ Clasty	11 1 1 3 6 6 1 1 holes brwn 5	1.0 1.0 1.0 3.1 6.1	2 8	3.1 0.0 0.0 2.0 8.2 0.0	1 7 1 2 2 2 2	1.0 7.1 1.0 0.0 2.0 2.0 2.0	2 6 4 2 4 2 1	2.0 6.1 4.1 0.0 2.0 4.1 2.0 0 1.0 0.0	9 1 1 1 3 3 1 1 4 4	9.2 1.0 0.0 1.0 0.0 3.1 1.0	2 1 26 7 1 3 11 21 1 4 1 2 1	0.4 0.2 5.3 1.4 0.2 0.6 2.2 4.3 0.2 0.8 0.2
Species Aleoch Aultur Brydiv Carbig L Cetdel Cetisl Claarb Clabel Cladsp Cladw/brwn Clagreenw/ Clayun	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1.0 1.0 1.0 3.1 6.1 1.0	2 8	3.1 0.0 0.0 2.0 8.2 0.0	1 7 1 2 2 2	1.0 7.1 1.00 0.0 2.0 2.0 2.0 2.0 0.0	2 6 4 2 4 2 1	2.0 6.1 4.1 0.0 2.0 4.1 2.00 1.0 0.0	9 1 1 3	9.2 1.0 0.0 1.0 0.0 3.1 1.0	2 1 26 7 1 3 11 21 1 4 1 2 1 2	0.4 0.2 5.3 1.4 0.2 0.6 2.2 4.3 0.2 0.8 0.2 0.4
Species Aleoch Aultur Black crust Brydiv Carbig L Cetdel Clearb Claarb Cladsp Cladbel Cladybrwn Clagreenw/ Clasty Claurc Claurc	1 1 1 3 6 1 1 holes brwn 5 2 1 1	1.0 1.0 1.0 3.1 6.1 1.0	2 8 5 5	3.1 0.0 0.0 2.0 8.2 0.0	1 7 1 2 2 2 2	1.0 7.1 1.0 0.0 2.0 2.0 2.0 2.0 0.0 0.0	2 6 4 2 4 2 1	2.0 6.1 4.1 0.0 2.0 4.1 1.0 0.0 1.0 0.0 3.1	9 1 1 3 1	9.2 1.0 0.0 1.0 0.0 3.1 1.0	2 1 26 7 1 3 11 21 1 4 1 2 14 1 0	0.4 0.2 5.3 1.4 0.2 0.6 2.2 4.3 0.2 0.8 0.2 0.4 2.9
Species Aleoch Aleoch Aultur Black crust Brydiv Carbig L Cetdel Cetisl Claarb Cladsp Cladsp Cladw/brwn Clagreenw/ Clasty Claunc Dacarc Dicelo	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1.0 1.0 1.0 3.1 6.1 1.0	2 8 5 5 2 4	3.1 0.0 0.0 2.0 8.2 0.0 5.1 5.1 2.00	1 7 1 2 2 2 2 2	1.0 7.1 1.0 0.0 2.0 2.0 2.0 0.0 0.0	2 6 4 2 4 2 1	2.0 6.1 4.1 0.0 2.0 4.1 2.0 1.0 0.0 0.0 3.1 0.0	9 1 1 1 3 3 1 4 4 1 1 1	9.2 1.0 0.0 1.0 0.0 3.1 1.0 4.1 0.0 0.0	2 1 26 7 1 3 11 21 1 4 1 1 2 1 4 1 1 2 1 4	0.4 0.2 5.3 1.4 0.2 0.6 2.2 4.3 0.2 0.8 0.2 0.4 2.9 2.0 0.8
Species Aleoch Aultur Black crust Brydiv Carbig L Cetdel Cetisl Claarb Cladsp Cladw/brwn Clagreenw/ Clasty Claunc Dacarc Dicelo Flacuc	1 1 1 3 6 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1.0 1.0 1.0 3.1 6.1 1.0	2 8 5 5	3.1 0.0 0.0 2.0 8.2 0.0 5.1 5.1 2.0 4.1	1 77 1 1 2 2 2 2 2 1 1 1 3	1.0 7.1 1.0 0.0 2.0 2.0 2.0 0.0 0.0 1.0 1.00	2 6 4 2 4 2 1 1	2.0 6.1 4.1 0.0 2.00 4.1 2.0 1.00 0.0 3.1 0.0 0.0	9 1 1 3 3 1 4 4 1 1	9.2 1.0 0.0 1.00 0.0 3.1 1.0 4.1 0.0 0.0	2 1 26 7 1 3 11 21 1 4 1 2 14 1 2 14 7	0.4 0.2 5.3 1.4 0.2 0.6 2.2 4.3 0.2 0.8 0.2 0.4 2.9 2.0 0.8
Species Aleoch Aultur Black crust Brydiv Carbig L Cetdel Cetisl Claarb Clabel Cladsp Cladybrwni Clagreenw/i Clasty Claunc Dacarc Dicelo Flacuc Flaniv	1 1 1 3 6 1 1 holes brwn 5 2 1 1	1.0 1.0 1.0 3.1 6.1 1.0	2 8 5 5 2 4	3.1 0.0 0.0 2.0 8.2 0.0 5.1 5.1 2.00	1 7 7 1 2 2 2 2 2 2	1.0 7.1 1.0 0.0 2.0 2.0 2.0 0.0 0.0 1.0 3.1 0.0	2 6 4 2 4 2 1	2.0 6.1 4.1 0.0 2.00 1.0 0.0 1.0 0.0 3.1 0.0 0.0	9 1 1 3 1 4	9.2 1.0 0.0 1.0 0.0 3.1 1.0 4.1 0.0 0.0 1.0	2 1 26 7 1 3 11 21 1 4 1 1 2 14 1 0 4 7 7	0.4 0.2 5.3 1.4 0.2 0.6 2.2 4.3 0.8 0.2 0.4 2.9 2.0 0.8
Species Aleoch Aultur Black crust Brydiv Carbig L Cetdel Cetisl Clabel Clabel Cladsp Cladw/brwn Clagreenw/ Clasty Claunc Dacarc Dicelo Flacuc Flaniv Gymcor	1 1 1 3 6 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1.0 1.0 1.0 3.1 6.1 1.0	2 8 5 5 2 4	3.1 0.0 0.0 2.0 8.2 0.0 5.1 5.1 2.0 4.1	1 7 1 2 2 2 2 2 2 1 1 3	1.0 7.1 1.0 0.0 2.0 2.0 2.0 0.0 0.0 1.0 3.1	2 6 4 2 4 2 1 1	2.0 6.1 4.1 0.0 2.00 4.1 2.0 1.00 0.0 3.1 0.0 0.0	9 1 1 3 1 4	9.2 1.0 0.0 1.0 0.0 3.1 1.0 4.1 0.0 0.0 0.0 0.0	2 1 26 7 1 3 11 1 21 1 4 1 2 14 1 0 4 4 10 4 7 7	0.4 0.2 5.3 1.4 0.2 0.6 6.2 2.2 4.3 0.2 0.8 0.2 0.4 2.9 2.0 0.8 1.4 0.8
Species Aleoch Aultur Black crust Brydiv Carbig L Cetdel Claarb Claarb Cladsp Cladybrwn Clagreenw/ Clasty Claunc Dacarc Dicelo Flaniv Gymcor Hylspl	1 1 1 3 6 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1.0 1.0 1.0 3.1 6.1 1.0	2 8 5 5 2 4	3.1 0.0 0.0 2.0 8.2 0.0 5.1 5.1 2.0 4.1	1 7 7 1 2 2 2 2 2 2	1.0 7.1 1.0 0.0 2.0 2.0 2.0 0.0 0.0 1.0 3.1	2 6 4 2 4 2 1 1	2.0 6.1 4.1 0.0 2.00 4.1 2.0 1.00 0.0 3.1 0.0 0.0	9 1 1 3 1 4 4 1 7 7	9.2 1.0 0.0 0.0 3.1 1.0 4.1 0.0 0.0 7.1 7.1	2 1 2 2 3 3 3 3 3 3 3 3 3 3 3 5 6 7 9 9 3 3	0.4 0.2 5.3 1.4 0.2 0.6 6.6 2.2 0.3 0.2 0.2 0.2 0.2 0.8 1.4 0.8 1.4 0.8 1.4 1.4 1.4 1.4 1.4 1.4 1.4 1.4 1.4 1.4
Species Aleoch Aultur Black crust Black crust Brydiv Carbig L Cetisl Claarb Clabel Clabel Cladw/brwn Clagreenw/i Clasty Claunc Dacarc Dicelo Flacuc Filaniv Gymcor Hylspi	1 1 1 3 6 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1.0 1.0 1.0 3.1 6.1 1.0	2 8 5 5 2 4	3.1 0.0 0.0 2.0 8.2 0.0 5.1 5.1 2.0 4.1	1 7 1 2 2 2 2 2 2 1 1 3	1.0 7.1 1.0 0.0 2.0 2.0 2.0 0.0 0.0 1.0 3.1	2 6 4 2 4 2 1 1	2.0 6.1 4.1 0.0 2.00 4.1 2.0 1.00 0.0 3.1 0.0 0.0	9 1 1 3 1 4 4 7 7 7	9.2 1.0 0.0 1.0 0.0 3.1 1.0 4.1 0.0 0.0 7.1 7.1 1.00	2 1 26 7 1 3 11 21 1 4 1 1 2 14 1 10 4 7 7 4 13 9 9	0.4 0.2 5.3.3 1.4 0.2 0.6.6 2.2 4.3 0.2 0.8 0.2 0.4 2.9 2.0 0.8 1.4 2.7 1.8 0.6 0.6 0.4
Species Aleoch Aultur Black crust Brydiv Carbig L Cetdel Clabel Clabel Cladsp Cladw/brwn Clagreenw/ Clasty Claunc Dacarc Dicelo Flacuc Flaniv Gymcor Hylspl Ledpal D Ledpal D Ledpal L	1 1 1 3 6 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1.0 1.0 1.0 3.1 6.1 1.0	2 8 5 5 2 4	3.1 0.0 0.0 2.0 8.2 0.0 5.1 5.1 2.0 4.1	1 7 1 2 2 2 2 2 2 1 1 1 3	1.0 7.1 1.0 0.0 2.0 2.0 2.0 0.0 0.0 1.0 1.0 3.1 0.0 2.0	2 6 4 2 4 2 1 1	2.0 6.1 4.1 0.0 2.00 4.1 2.0 1.00 0.0 3.1 0.0 0.0	9 1 1 3 1 4 4 1 7 7	9.2 1.0 0.0 0.0 3.1 1.0 4.1 0.0 0.0 7.1 7.1	2 1 26 7 1 3 11 21 1 4 1 2 14 10 4 10 4 7 7 4 13 9 9 3 3	0.4 0.2 5.3 1.4 0.2 0.6 6.2 0.6 6.2 0.8 0.2 0.4 2.9 0.4 1.4 0.8 2.7 1.8 0.6 0.4 0.9
Species Aleoch Aultur Black crust Brydiv Carbig L Cetdel Cetisl Claarb Clabel Clabel Clads/brwn Clagreenw/ Clasty Clatur Dacarc Dicaun Flanu Flanu Flanu Flanu Hylspl Ledpal D Ledpal D Ledpal S	1 1 1 3 6 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1.0 1.0 1.0 3.1 6.1 1.0 5.1 2.0 1.0	2 8 5 5 2 4	3.1 0.0 0.0 2.0 8.2 0.0 5.1 5.1 2.0 4.1 1.0	1 77 1 1 2 2 2 2 2 1 1 1 1 2 2 2	1.0 7.1 1.0 0.0 2.0 2.0 2.0 0.0 0.0 1.0 1.0 2.0 2.0	2 6 4 2 4 2 1 1 3	2.0 6.1 4.1 0.0 2.0 4.1 2.0 0.0 1.0 0.0 3.1 0.0 0.0 0.0	9 1 1 3 1 4 4 1 7 7 7 1 1 2	9.2 1.0 0.0 0.0 3.1 1.0 4.1 0.0 0.0 7.1 7.1 1.0	2 1 26 7 1 3 11 1 1 4 1 2 14 4 10 4 7 7 4 13 9 3 3 2 11 10 11 11 11 11 11 11 11 11 11 11 11	0.4 0.2 5.3 1.4 0.2 0.6 6.6 2.2 0.8 0.2 0.8 0.2 0.4 0.8 2.9 1.4 0.8 2.7 1.8 0.6 0.4 0.4 0.9 0.5 0.6 0.4 0.9 0.6 0.6 0.6 0.6 0.7 0.7 0.8 0.8 0.6 0.8 0.6 0.8 0.6 0.8 0.8 0.6 0.8 0.8 0.6 0.8 0.8 0.8 0.8 0.8 0.8 0.8 0.8 0.8 0.8
Species Aleoch Aultur Black crust Black crust Brydiv Carbig L Cetdel Cetisl Claarb Clabel Cladsp Cladw/brwn Clagreenw/i Clasty Claunc Docarc Dicelo Flacuc Flaniv Gymcor Hylspl Ledpal D Ledpal C Ledpal S Litter	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1.0 1.0 1.0 3.1 6.1 1.0 5.1 2.0 1.0	2 8 5 5 5 2 4 1	3.1 0.0 0.0 2.0 8.2 0.0 5.1 5.1 2.0 4.1 1.0	1 7 7 1 2 2 2 2 2 1 1 1 3 2 2	1.0 7.1 1.0 0.0 2.0 2.0 2.0 0.0 0.0 1.0 3.1 1.0 2.0 2.0	2 6 4 2 4 2 1 1 3	2.0 6.1 4.1 0.0 2.0 4.1 2.0 0.0 0.0 3.1 0.0 0.0 4.1	9 1 1 3 3 1 4 4 1 1 7 7 1 1 2 1 1 2 2 7	9.2 1.0 0.0 1.0 0.0 3.1 1.0 4.1 0.0 0.0 7.1 7.1 1.0 2.0	2 1 2 6 7 7 1 3 3 11 21 1 4 4 1 1 2 1 4 4 1 1 3 9 9 3 2 2 1 1 8 5 5	0.4 0.2 5.3.3 1.4 0.2 0.6.6 2.2 4.3 0.2 0.8 0.2 0.4 2.9 2.0 0.8 1.4 0.8 2.7 1.8 0.6 0.4 0.9 2.0 0.4 1.9 1.9 1.9 1.9 1.9 1.9 1.9 1.9 1.9 1.9
Species Aleoch Aultur Black crust Brydiv Carbig L Cetdel Cetisl Claarb Cladsp Cladsp Cladw/brwn Clagreenw/ Clagreenw/ Clasty Claunc Dacarc Dicelo Flacuc Flaniv Gymcor Hylspl Ledpal D Ledpal S Litter Ochfri	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1.0 1.0 1.0 3.1 6.1 1.0 5.1 2.0 1.0 2.0	3 2 8 5 5 2 4 1	3.1 0.0 0.0 2.0 8.2 0.0 5.1 5.1 2.0 4.1 1.0 0.0	1 77 1 2 2 2 2 2 1 1 1 3 2 2 2	1.0 7.1 1.0 0.0 2.0 2.0 2.0 0.0 0.0 1.0 1.0 2.0 2.0 2.0	2 6 4 2 4 2 1 1 3 4	2.0 6.1 4.1 0.0 2.0 4.1 2.0 0.0 1.0 0.0 3.1 0.0 0.0 4.1	9 1 1 3 3 1 1 4 4 1 1 2 2 7 2 2 7 2 2	9.2 1.0 0.0 0.0 3.1 1.0 4.1 0.0 0.0 7.1 7.1 1.0 2.0 1.00	2 1 2 6 7 7 1 3 11 1 1 1 4 4 1 1 2 1 4 4 1 1 3 9 9 3 2 1 1 1 5 5 1 1 0	0.4 0.2 5.3 1.4 0.2 0.6 6.2 2.2 0.6 6.0 0.8 0.2 0.4 2.9 2.0 0.8 1.4 0.8 0.6 2.7 1.8 0.6 0.4 0.2 0.7 1.8 0.6 0.4 0.2 0.2 0.4 0.8 0.8 0.6 0.8 0.7 0.8 0.8 0.7 0.8 0.8 0.8 0.8 0.8 0.8 0.8 0.8 0.8 0.8
Species Aleoch Aleoch Aultur Black crust Brydiv Carbig L Cetdel Cetisl Claarb Clabel Cladsp Cladybrwni Clagreenw/ Clagreenw/ Clagreenw/ Clasty Claunc Dacarc Dicelo Flacuc Flaniv Gymcor Hylspl Ledpal D Ledpal D Ledpal C Ledpal S Litter Ochfri Polstr	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1.0 1.0 1.0 3.1 6.1 1.0 5.1 2.0 1.0 2.0	2 2 8 5 5 5 2 4 1 1 5 5 2 2 19	3.1 0.0 0.0 2.0 8.2 0.0 5.1 5.1 2.0 4.1 1.0 0.0	1 77 1 2 2 2 2 2 2 1 1 1 2 2 2	1.0 7.1 1.0 0.0 2.0 2.0 2.0 0.0 0.0 1.0 3.1 0.0 2.0 2.0 2.0	2 6 4 2 4 2 1 1 3 4 6 6 3 5	2.0 6.1 4.1 0.0 2.0 4.1 2.0 0.0 1.0 0.0 3.1 0.0 0.0 4.1	9 1 1 3 3 1 4 4 1 1 7 7 1 1 2 1 1 2 2 7	9.2 1.0 0.0 0.0 3.1 1.0 4.1 0.0 0.0 7.1 7.1 1.0 2.0 2.0 3.1	2 1 1 26 7 1 3 11 1 1 1 4 4 1 1 0 4 7 7 4 1 1 3 9 3 2 1 1 8 5 5 1 0 0 4 9 9	0.4 0.2 5.3 1.4 0.2 0.6 6.6 2.2 4.3 0.2 0.8 0.2 0.4 2.9 2.0 0.8 1.4 0.8 2.7 1.8 0.6 0.4 0.2 17.3 2.0
Species Aleoch Aultur Black crust Brydiv Carbig L Cetisl Clasip Clastp Cladsp Cladybrwn Clagreenw/ Clayr Clauc Dicelo Flacuc Flacuc Flacuc Flacuc Flacuc Flacuc Dicelo Ledpal L Ledpal L Ledpal S Litter Ochfri Polstr	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1.0 1.0 3.1 6.1 1.0 5.1 2.0 1.0 2.0	2 8 5 5 2 4 1 1	3.1 0.0 0.0 2.0 8.2 0.0 5.1 5.1 1.0 0.0	1 77 1 2 2 2 2 2 2 1 1 3 3 2 2 2 2	1.0 7.1 1.0 0.0 2.0 2.0 2.0 0.0 0.0 0.0 1.0 3.1 0.0 2.0 2.0	2 6 4 2 4 2 1 1 3 4	2.0 6.1 4.1 0.0 2.0 4.1 2.0 1.0 0.0 0.0 0.0 0.0 4.1	9 1 1 3 3 1 1 4 4 7 7 1 1 2 1 1 2 7 2 7 2 3	9.2 1.0 0.0 1.0 0.0 3.1 1.0 4.1 0.0 0.0 7.1 1.0 2.0 3.1 1.0	2 1 26 7 1 3 111 21 1 4 1 2 14 10 4 4 7 7 4 4 13 3 9 3 3 2 11 1 10 4 4 7 10 10 4 10 10 10 10 10 10 10 10 10 10 10 10 10	0.4 0.2 5.3 1.4 0.2 0.6 6.2 0.6 6.2 0.8 0.2 0.8 0.2 0.4 1.4 0.8 2.7 1.8 0.6 0.2 0.4 0.4 0.8 0.7 1.8 0.6 0.6 0.7 0.8 0.7 0.8 0.7 0.8 0.8 0.8 0.8 0.8 0.8 0.8 0.8 0.8 0.8
Species Aleoch Allour Black crust Brydiv Carbig L Cetdel Clastel Clastel Clastel Clasty Clady brwn Clagreenw/	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1.0 1.0 3.1 6.1 1.0 5.1 2.0 1.0 2.0	2 2 8 5 5 5 2 4 1 1 5 5 2 2 19	3.1 0.0 0.0 2.0 8.2 0.0 5.1 5.1 1.0 0.0	1 77 1 2 2 2 2 2 2 1 1 1 3 3 2 2 2 2	1.0 7.1 1.0 0.0 2.0 2.0 2.0 0.0 0.0 1.0 2.0 2.0 2.0 2.0 2.0 1.0 2.0 2.0 6.1 1.0	2 6 4 2 4 2 1 1 3 4 6 6 3 5	2.0 6.1 4.1 0.0 2.0 4.1 2.0 0.0 1.0 0.0 3.1 0.0 0.0 4.1	9 1 1 3 3 1 1 4 4 1 1 2 2 7 2 2 7 2 2	9.2 1.0 0.0 0.0 3.1 1.0 4.1 0.0 0.0 7.1 7.1 1.0 2.0 2.0 3.1	2 1 1 26 7 7 1 3 3 11 1 1 1 4 4 1 1 2 1 4 4 1 1 3 9 3 2 2 1 1 1 8 5 1 1 0 4 9 1 5 8 8 7	0.4 0.2 5.3 1.4 0.2 0.6 6.6 2.2 0.8 0.2 0.4 2.9 2.0 0.8 1.4 0.2 2.7 1.8 0.6 0.4 0.2 0.2 17.3 2.0 10.0
Species Aleoch Altur Black crust Brydiv Carbig L Cetisl Clasig Clasig Cladsp Cladyp Cladyp Cladyp Clagreenw/ Clasty Clayreenw/ Clasty Clauc Dicelo Flacuc Flaniv Gymcor Hylspl Ledpal D Ledpal D Ledpal S Litter Ochfri Polstr Pticil Salnum L	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1.0 1.0 3.1 6.1 1.0 5.1 2.0 1.0 2.0	2 8 5 5 2 4 1 1	3.1 0.0 0.0 2.0 8.2 0.0 5.1 5.1 1.0 0.0	1 77 1 2 2 2 2 2 2 1 1 1 2 6 2 2 6 1 7 7 3	1.0 7.1 1.0 0.0 2.0 2.0 2.0 0.0 0.0 1.0 3.1 1.0 2.0 2.0 2.0 2.0	2 6 4 2 4 2 1 1 3 4	2.0 6.1 4.1 0.0 2.0 4.1 2.0 1.0 0.0 0.0 0.0 0.0 4.1	9 1 1 3 3 1 1 4 4 1 7 7 1 1 2 1 1 2 7 2 7 2 3	9.2 1.0 0.0 1.0 0.0 3.1 1.0 4.1 0.0 0.0 7.1 1.0 2.0 3.1 1.0	2 1 1 26 7 7 1 3 11 1 1 1 2 1 4 4 1 1 0 0 4 7 7 4 1 3 9 9 3 2 1 1 1 8 5 1 0 0 4 9 1 5 8 7 3 3	0.4 0.2 5.3 1.4 0.2 0.6 6.6 2.2 4.3 0.2 0.8 0.2 0.4 2.9 2.0 0.8 2.7 1.8 0.6 0.4 0.2 17.3 2.0 10.0 3.1 17.8
Species Aleoch Aultur Black crust Brydiv Carbig L Cetdel Cetisl Clastp Clabel Clabel Cladsp Cladybrwn Clagreenw/ Claunc Dacarc Dicelo Flacuc F	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1.0 1.0 1.0 3.1 6.1 1.0 5.1 2.0 1.0 2.0 2.1.4 1.0 16.3 7.1 18.4	2 8 5 5 2 4 1 1 5 5 2 4 1 1 2 4 2 4 2 4 2 4 4 2 4 4 4 4 4 4	3.1 0.0 0.0 2.0 8.2 0.0 5.1 5.1 1.0 0.0	1 77 1 2 2 2 2 2 1 1 1 3 3 2 2 2 2 1 1 2 6 6 6 6 7 7 7 7 7 7 8 7 8 7 8 8 7 8 8 7 8 8 7 8 8 7 8 8 8 8 8 7 8	1.0 7.1 1.0 0.0 2.0 2.0 2.0 0.0 0.0 1.0 3.1 0.0 2.0 2.0 2.0 2.0	2 6 4 2 4 2 1 1 3 4 6 6 3 5 3 29	2.0 6.1 4.1 0.0 2.0 4.1 2.0 1.0 0.0 1.0 0.0 4.1 0.0 3.1 0.0 4.1 6.1 3.1 5.1	9 1 1 3 3 1 1 4 4 1 1 1 2 2 7 2 2 3 3 9 9	9.2 1.0 0.0 1.0 0.0 3.1 1.0 4.1 0.0 0.0 7.1 1.0 2.0 1.0 2.7.6 2.0 3.1 0.9 2.0	2 1 2 6 7 7 1 3 3 11 1 1 2 1 1 4 4 1 1 3 3 9 9 3 3 2 1 1 1 8 5 1 1 0 4 9 9 1 5 8 7 8 7 3 2 2	0.4 0.2 5.3 1.4 0.2 0.6 6.2 0.6 6.2 0.8 0.2 0.4 2.9 0.4 1.4 0.8 2.7 1.8 0.6 0.1 1.7 1.8 0.6 0.6 0.6 0.7 1.7 1.8 0.6 0.6 0.6 0.6 0.6 0.6 0.6 0.6 0.6 0.6
Species Aleoch Aultur Black crust Brydiv Carbig L Cetdel Cetisl Claarb Cladsp Cladsy Cladybrwn Cladybrwn Clagreenw/ Clasty Claurc Dacarc Dicelo Flacuc Flaniv Gymcor Hylspl Ledpal D Ledpal D Ledpal D Ledpal D Ledpal D Cohfri Polistr Phicil Sanda	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1.0 1.0 1.0 3.1 6.1 1.0 5.1 2.0 1.0 2.0 2.1.4 1.0 16.3 7.1 18.4	2 8 5 5 2 4 1 1	3.1 0.0 0.0 2.0 8.2 0.0 5.1 5.1 1.0 0.0	1 77 1 2 2 2 2 2 1 1 1 3 3 2 2 2 2 1 1 2 6 6 6 6 7 7 7 7 7 7 8 7 8 7 8 8 7 8 8 7 8 8 7 8 8 7 8 8 8 8 8 7 8	1.0 7.1 1.0 0.0 2.0 2.0 2.0 0.0 0.0 1.0 3.1 1.0 2.0 2.0 2.0 2.0	2 6 4 2 4 2 1 1 3 3 4 6 6 3 3 5 3 29	2.0 6.1 4.1 0.0 2.0 1.0 0.0 1.0 0.0 3.1 0.0 0.0 4.1 5.1 3.1 29.6	9 1 1 3 4 4 1 7 7 1 2 2 1 2 3 3	9.2 1.0 0.0 1.0 0.0 3.1 1.0 4.1 0.0 0.0 7.1 1.0 2.0 3.1 1.0	2 1 1 2 6 7 7 1 3 3 1 1 1 1 2 1 4 4 1 1 0 1 4 7 7 4 1 3 3 2 2 1 1 8 5 5 1 1 0 4 9 1 5 8 7 8 7 9 7 9	0.4 0.2 5.3 1.4 0.2 0.6 6.6 2.2 2.8 0.8 0.2 0.4 2.9 2.0 0.8 1.4 0.8 2.7 1.8 0.6 0.4 0.1 1.9 1.0 1.0 1.0 1.1 1.8 0.6 0.4 1.1 1.8 0.6 0.4 1.4 1.8 1.8 1.4 1.8 1.8 1.8 1.8 1.8 1.8 1.8 1.8 1.8 1.8
Species Aleoch Aleoch Aultur Black crust Black crust Brydiv Cetdel Cetdel Clabel Clabel Cladsp Cladw/brwn Clagreenw/i Clasty Claunc Docarc Dicelo Flacuc Flaniv Gymcor Hylspl Ledpal D Ledpal D Ledpal S Litter Pochfri Polstr Pticil Raclan Salnum L Sand Sphglo Stespp	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1.0 1.0 1.0 3.1 6.1 1.0 5.1 2.0 1.0 2.0 2.1.4 1.0 16.3 7.1 18.4	2 8 5 5 2 4 1 1 5 5 2 4 1 1 2 4 2 4 2 4 2 4 4 2 4 4 4 4 4 4	3.1 0.0 0.0 2.0 8.2 0.0 5.1 5.1 1.0 0.0	1 77 1 2 2 2 2 2 3 3 2 2 6 6 1 7 7 3 2 2 2	1.0 7.1 1.0 0.0 2.0 2.0 0.0 0.0 1.0 3.1 0.0 2.0 2.0 2.0 2.0 2.0 2.1 2.0 2.0 2.0 2.0 2.0 2.0 2.0 2.0 2.0 2.0	2 6 4 2 4 2 1 1 3 3 4 6 3 5 3 29 20 1	2.0 6.1 4.1 0.0 2.0 4.1 2.0 1.0 0.0 1.0 0.0 4.1 0.0 3.1 0.0 4.1 6.1 3.1 5.1	9 1 1 3 4 4 1 7 7 1 2 2 1 2 3 3	9.2 1.0 0.0 1.0 0.0 3.1 1.0 4.1 0.0 0.0 7.1 1.0 2.0 1.0 2.7.6 2.0 3.1 0.9 2.0	2 1 26 7 1 3 111 21 1 4 1 2 14 10 4 7 7 4 13 3 9 3 3 2 2 11 1 1 1 5 7 7 8 7 9 9 1 9 1 9 1 9 1 9 1 9 1 9 1 9 1 9 1	0.4 0.2 5.3 1.4 0.2 0.6 6.2 0.6 6.2 0.2 0.8 0.2 0.4 0.8 0.2 0.4 0.8 0.8 0.6 0.7 1.8 0.6 0.1 1.7 1.8 0.6 0.4 0.6 0.6 0.6 0.6 0.6 0.6 0.6 0.6 0.6 0.6
Species Aleoch Aultur Black crust Brydiv Carbig L Cetdel Cetisl Clabel Clabel Cladsp Cladw/brwn Clagreenw/ Clasty Claunc Dacarc Dicelo Flacuc Flaniv Gymcor Hylspl Ledpal D Ledpal S Littler Ochfri Polstr Pticil Radan Sand Sphglo Sand Sphglo Stapp Thaver	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1.0 1.0 1.0 3.1 6.1 1.0 5.1 2.0 1.0 2.0 21.4 1.0 16.3 7.1	2 8 5 5 2 4 1 1 5 5 2 4 1 1 2 4 2 4 2 4 2 4 4 2 4 4 4 4 4 4	3.1 0.0 0.0 8.2 0.0 5.1 5.1 2.0 4.1 1.0 0.0	1 77 1 2 2 2 2 2 1 1 1 3 3 2 2 2 2 1 1 2 6 6 6 6 7 7 7 7 7 7 8 7 8 7 8 8 7 8 8 7 8 8 7 8 8 7 8 8 8 8 8 7 8	1.0 7.1 1.0 0.0 2.0 2.0 2.0 0.0 0.0 1.0 1.0 2.0 2.0 2.0 2.0 2.1 2.0 2.1 2.0 2.1 2.0 2.1 2.0 2.0 3.1 3.1 3.1 3.1 3.1 3.1 3.1 3.1 3.1 3.1	2 6 4 2 4 2 1 1 3 3 4 6 6 3 3 5 3 29	2.0 6.1 4.1 0.0 2.0 1.0 1.0 0.0 1.0 0.0 0.0 4.1  6.1 3.1 5.1 29.6	9 1 1 3 4 4 1 7 7 7 1 2 2 7 2 2 3 9	9.2 1.0 0.0 0.0 3.1 1.0 4.1 0.0 0.0 7.1 1.0 2.0 1.0 2.7.6 2.0 3.1 0.0 9.2	2 1 2 6 7 7 1 3 3 11 1 1 1 4 4 1 1 2 1 4 4 1 1 3 3 9 3 2 1 1 1 1 8 5 1 1 0 4 9 1 5 8 7 8 7 9 1 1 4 4	0.4 0.2 5.3 1.4 0.2 0.6 6.2 0.6 6.2 0.8 0.2 0.4 0.4 2.9 0.8 1.4 0.8 0.6 0.1 1.7 1.8 0.6 0.1 1.7 1.8 0.6 0.6 0.6 0.6 0.6 0.6 0.6 0.6 0.6 0.6
Species Aleoch Aultur Black crust Brydiv Carbig L Cetdel Cetisl Claarb Cladsp Cladsp Cladw/brwn Clagreenw/ Clasty Claunc Dacarc	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1.0 1.0 1.0 3.1 6.1 1.0 5.1 2.0 1.0 2.0 21.4 1.0 16.3 7.1 18.4	2 8 5 5 2 4 1 1 5 5 2 4 1 1 2 4 2 4 2 4 2 4 4 2 4 4 4 4 4 4	3.1 0.0 0.0 2.0 8.2 0.0 5.1 5.1 1.0 0.0	1 77 1 2 2 2 2 2 3 3 2 2 6 6 1 7 7 3 2 2 2	1.0 7.1 1.0 0.0 2.0 2.0 2.0 0.0 0.0 1.0 1.0 2.0 2.0 2.0 2.0 2.0 2.1 2.0 2.0 2.0 2.0 2.0 2.0 2.0 2.0 2.0 2.0	2 6 4 2 4 2 1 1 3 3 4 6 3 5 3 29 20 1	2.0 6.1 4.1 0.0 2.0 4.1 2.0 0.0 1.0 0.0 3.1 0.0 0.0 4.1 3.1 3.1 29.6	9 1 1 3 4 4 1 7 7 7 1 2 2 7 2 2 3 9	9.2 1.0 0.0 0.0 3.1 1.0 4.1 0.0 0.0 7.1 7.1 1.0 2.0 2.0 3.1 0.0 9.2	2 1 26 7 1 3 111 21 1 4 1 2 14 10 4 7 7 4 13 3 9 3 3 2 2 11 1 1 1 5 7 7 8 7 9 9 1 9 1 9 1 9 1 9 1 9 1 9 1 9 1 9 1	0.4 0.2 5.3.3 1.4 0.2 0.6.6 2.2 4.3 0.2 0.8 0.2 0.4 2.9 2.0 0.8 1.4 0.8 2.7 1.8 0.6 0.4 0.9 2.0 0.4 1.9 1.9 1.9 1.9 1.9 1.9 1.9 1.9 1.9 1.9

# Leaf-area index (LAI)

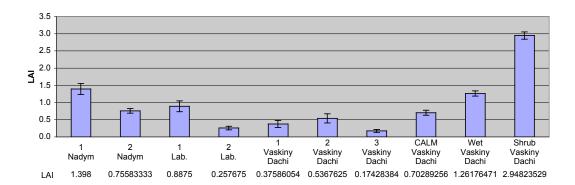


Figure 28. Mean leaf-area index of transects.

# Normalized Difference Vegetation Index (NDVI)

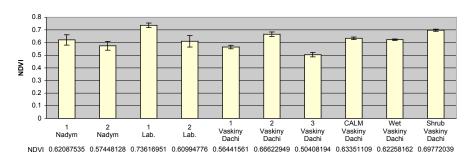


Figure 29. Mean NDVI of sample transects.

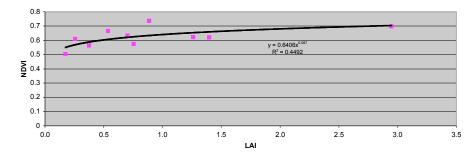


Figure 30. NDVI vs. LAI for all transects.

# Point-centered quarter data for Nadym-1 (tree species density, frequency, basal area, biomass)

Table 14. Point-centered quarter data for Nadym-1 with species arranged alphabetically within each transect. 10 points (40 trees) were sampled along each transect (200 trees total). Abbreviations: Betpub= Betula pubescens, Larsib=Larix sibirica, Pinsib=Pinus cembra ssp. sibirica Pinsyl=Pinus sylvestris. (See Appendix B for explanation of method and data sheets).

				Above-	Above-					Above-	Above-					Above-	Above-					Above- ground							Above-
	Dhh	Basal area	Height	ground biomass	ground biomass		Dhb	Basal	Height	ground biomass	ground		Dbh	Basal area	Height	ground biomass	ground		Dbh	Basal area	Height	biomass /kg/tre			Dbh	Basal area	Height	ground biomass	ground
Species		/cm2	/m		/g/tree	Species				/kg/tree		Species		/cm2	/m	/kg/tree		Species		/cm2	/m	e		Species	/cm	/cm2	/m	/kg/tree	
		Transec	t 1					Tra	nsect 2					Tran	sect 3					Transe	ct 4					Trans	ect 5		
Betpub	7	38.48	6	11.9	11908.1	Betpub	8	50.27	5	16.6	16628.2	Betpub	5	19.63	3	5.1	5134.2	Betpub	7	38.48	3	11.9	11908.1	Betpub	6	28.27	6	8.1	8099.4
Betpub	7	38.48	8	11.9	11908.1	Betpub	10	78.54	8	29.1	29050.8	Betpub	4	12.57	4	2.9	2938.7	Betpub	8	50.27	7	16.6	16628.2	Betpub	7	38.48	6	11.9	11908.1
Betpub	8		9			Betpub		50.27	5	16.6	16628.2	Betpub	5		6	5.1	5134.2	Betpub	8		7			Betpub	6	28.27	6		
Betpub	2		3		519.4	Betpub	9		9	22.3	22322.7	Betpub	4	12.57	5		2938.7	Betpub	6	28.27	5		8099.4	Betpub	9	63.62	6		
Betpub	3		5			· ·	9		7	22.3	22322.7	Betpub	7	38.48	6			Betpub	5		5		5134.2	Betpub	9	63.62	7		
Larsib	2		3			Betpub		38.48	5	11.9	11908.1	Betpub	6		6		8099.4	Betpub	10		9		29050.8	Betpub	7	38.48	7		11908.1
Pinsyl	4	12.57	7		9563.0	Betpub	8	50.27	4	16.6	16628.2	Betpub	17	226.98	1	109.5	109488.3	Betpub	3	7.07	5	1.4	1431.4	Betpub	7	38.48	6	11.9	11908.1
Pinsyl	5	19.63	5		6050.0	Larsib	9	63.62	8	22.4	22393.7	Betpub	5	19.63	3		5134.2	Betpub	7	38.48	9	11.9	11908.1	Larsib	2	3.14	3	0.9	
Pinsyl	6	28.27	7		11027.0	Larsib	3		13	6.6	6607.9	Larsib	9	63.62	8			Betpub	3	7.07	3			Pinsib	4	12.57	5		
Pinsyl	2		3		851.5	Larsib	3		3	1.6	1645.2	Larsib	6	28.27	5	7.7		Pinsyl	15		10	67.7	67709.0	Pinsib	5	19.63	5	6.1	
Pinsyl	2	3.14	2	0.9	851.5	Larsib	6	28.27	6	9.2	9167.3	Larsib	6	28.27	6	9.2	9167.3	Pinsyl	6	28.27	6	11.0	11027.0	Pinsib	11	95.03	5	19.9	19892.3
Pinsyl	3	7.07	4		1637.0	Pinsib	10	78.54	9	19.9	19947.6	Pinsib	5	19.63	7		1904.0	Pinsyl	6	28.27	7			Pinsyl	6	28.27	6	11.0	
Pinsyl	5	19.63	5		6050.0	Pinsib	13	132.73	10	37.8	37809.2	Pinsib	3	7.07	3	1.6	1637.0	Pinsyl	15	176.71	9	67.7	67709.0	Pinsyl	5	19.63	3	6.1	
Pinsyl	4	12.57	5		3147.0	Pinsib	8		8	10.9	10876.4	Pinsib	3	7.07	4	1.0		Pinsyl	11	95.03	7			Pinsyl	5	19.63	6	9.8	
Pinsyl	2	3.14	3	0.9	851.5	Pinsib	2	3.14	2	0.9	851.5	Pinsyl	14	153.94	4	57.4	57363.0	Pinsyl	9	63.62	8	20.8	20813.0	Pinsyl	13	132.73	8	48.0	48029.0
Pinsyl	3	7.07	4	1.6	1637.0	Pinsib	3	7.07	4	1.6	1637.0	Pinsyl	5	19.63	6	9.8	9789.0	Pinsyl	10	78.54	7	26.1	26099.0	Pinsyl	3	7.07	3	1.6	1637.0
Pinsyl	2	3.14	3	0.9	851.5	Pinsib	4	12.57	4	3.1	3147.0	Pinsyl	5	19.63	5	6.1	6050.0	Pinsyl	2	3.14	2	0.9	851.5	Pinsyl	4	12.57	4	3.1	3147.0
Pinsyl	10	78.54	11	26.1	26099.0	Pinsyl	14	153.94	9	57.4	57363.0	Pinsyl	9	63.62	7	20.8	20813.0	Pinsyl	2	3.14	2	0.9	851.5	Pinsyl	2	3.14	2	0.9	851.5
Pinsyl	6	28.27	9	11.0	11027.0	Pinsyl	8	50.27	8	16.5	16539.0	Pinsyl	13	132.73	9	48.0	48029.0	Pinsyl	13	132.73	11	48.0	48029.0	Pinsyl	11	95.03	8	32.4	32397.0
Pinsyl	10	78.54	10	26.1	26099.0	Pinsyl	14	153.94	8	57.4	57363.0	Pinsyl	14	153.94	9	57.4	57363.0	Pinsyl	10	78.54	10	26.1	26099.0	Pinsyl	7	38.48	6	13.3	13277.0
Pinsyl	13	132.73	10	48.0	48029.0	Pinsyl	2	3.14	4	0.9	851.5	Pinsyl	2	3.14	3	0.9	851.5	Pinsyl	5	19.63	5	6.1	6050.0	Pinsyl	10	78.54	8	26.1	26099.0
Pinsyl	11	95.03	7	32.4	32397.0	Pinsyl	7	38.48	6	13.3	13277.0	Pinsyl	6	28.27	3	11.0	11027.0	Pinsyl	8	50.27	7	16.5	16539.0	Pinsyl	13	132.73	9	48.0	48029.0
Pinsyl	6	28.27	5	11.0	11027.0	Pinsyl	11	95.03	8	32.4	32397.0	Pinsyl	5	19.63	5	6.1	6050.0	Pinsyl	15	176.71	15	67.7	67709.0	Pinsyl	4	12.57	5	3.1	3147.0
Pinsyl	5	19.63	7	9.8	9789.0	Pinsyl	14	153.94	9	57.4	57363.0	Pinsyl	2	3.14	3	0.9	851.5	Pinsyl	17	226.98	14	91.4	91437.0	Pinsyl	4	12.57	4	3.1	3147.0
Pinsyl	6	28.27	10	11.0	11027.0	Pinsyl	5	19.63	5	6.1	6050.0	Pinsyl	6	28.27	5	11.0	11027.0	Pinsyl	4	12.57	5	3.1	3147.0	Pinsyl	6	28.27	6	11.0	11027.0
Pinsyl	13	132.73	4	48.0	48029.0	Pinsyl	7	38.48	6	13.3	13277.0	Pinsyl	10	78.54	8	26.1	26099.0	Pinsyl	3	7.07	5	1.6	1637.0	Pinsyl	2	3.14	3	0.9	851.5
Pinsyl	3	7.07	4	1.6	1637.0	Pinsyl	12	113.10	7	39.7	39707.0	Pinsyl	15	176.71	9	67.7	67709.0	Pinsyl	3	7.07	3	1.6	1637.0	Pinsyl	20	314.16	10	134.6	134619.0
Pinsyl	3	7.07	4	1.6	1637.0	Pinsyl	5	19.63	5	6.1	6050.0	Pinsyl	5	19.63	4	6.1	6050.0	Pinsyl	2	3.14	4	0.9	851.5	Pinsyl	6	28.27	5	11.0	11027.0
Pinsyl	3	7.07	4	1.6	1637.0	Pinsyl	11	95.03	8	32.4	32397.0	Pinsyl	16	201.06	9	79.1	79067.0	Pinsyl	5	19.63	8	9.8	9789.0	Pinsyl	11	95.03	7	32.4	32397.0
Pinsyl	7	38.48	8	13.3	13277.0	Pinsyl	12	113.10	10	39.7	39707.0	Pinsyl	4	12.57	4	3.1	3147.0	Pinsyl	14	153.94	8	57.4	57363.0	Pinsyl	7	38.48	6	13.3	13277.0
Pinsyl	5	19.63	5	6.1	6050.0	Pinsyl	17	226.98	8	91.4	91437.0	Pinsyl	7	38.48	6	13.3	13277.0	Pinsyl	13	132.73	13	48.0	48029.0	Pinsyl	2	3.14	2	0.9	851.5
Pinsyl	6	28.27	8	11.0	11027.0	Pinsyl	11	95.03	10	32.4	32397.0	Pinsyl	3	7.07	4	1.6	1637.0	Pinsyl	10	78.54	11	26.1	26099.0	Pinsyl	3	7.07	3	1.6	1637.0
Pinsyl	6	28.27	8	11.0	11027.0	Pinsyl	20	314.16	14	134.6	134619.0	Pinsyl	6	28.27	6	11.0	11027.0	Pinsyl	3	7.07	4	1.6	1637.0	Pinsyl	10	78.54	7	26.1	26099.0
Pinsyl	6	28.27	5	11.0	11027.0	Pinsyl	4	12.57	5	3.1	3147.0	Pinsyl	13	132.73	9	48.0	48029.0	Pinsyl	3	7.07	5	1.6	1637.0	Pinsyl	15	176.71	8	67.7	67709.0
Pinsyl	5	19.63	7	9.8	9789.0	Pinsyl	15	176.71	13	67.7	67709.0	Pinsyl	4	12.57	4	3.1	3147.0	Pinsyl	12	113.10	8	39.7	39707.0	Pinsyl	9	63.62	6	20.8	20813.0
Pinsyl	9	63.62	9	20.8	20813.0	Pinsyl	5	19.63	6	9.8	9789.0	Pinsyl	14	153.94	10	57.4	57363.0	Pinsyl	5	19.63	5	6.1	6050.0	Pinsyl	2	3.14	3	0.9	851.5
Pinsyl	11	95.03	10	32.4	32397.0	Pinsyl	5	19.63	7	9.8	9789.0	Pinsyl	7	38.48	5	13.3	13277.0	Pinsyl	5	19.63	5	6.1	6050.0	Pinsyl	12	113.10	8	39.7	39707.0
Pinsyl	13	132.73	11	48.0	48029.0	Pinsyl	4	12.57	6	9.6	9563.0	Pinsyl	4	12.57	3	3.1	3147.0	Pinsyl	14	153.94	10	57.4	57363.0	Pinsyl	17	226.98	10	91.4	91437.0
Pinsyl	9	63.62	10	20.8	20813.0	Pinsyl	15	176.71	13	67.7	67709.0	Pinsyl	12	113.10	9	39.7	39707.0	Pinsyl	5	19.63	5	6.1	6050.0	Pinsyl	9	63.62	7	20.8	20813.0
Pinsyl	4	12.57	5	3.1	3147.0		5	19.63	5	6.1	6050.0	Pinsyl	12	113.10	9	39.7	39707.0	Pinsyl	2	3.14	4	0.9	851.5	Pinsyl	3	7.07	4	1.6	1637.0

Table 15. Summary of point-centered quarter data: Density, basal area, height, and biomass for each tree species and all tree species for each transect and average for all transects.

Density (trees/ha)								
Transect	1	2	3	4	5	Average	s.d.	s.e.
Species								
Betula pubescens ssp. tortuosa	202.83	183.88	340.80	565.32	534.17	365.40	179.19	80.14
Larix sibirica	40.57	105.07	127.80	0.00	76.31	69.95	50.93	22.78
Pinus cembra ssp. sibirica	0.00	157.61	127.80	0.00	228.93	102.87	100.84	45.10
Pinus sylvestris	1379.24	604.17	1107.61	1947.23	2213.00	1450.25	645.58	288.71
Total	1622.64	1050.73	1704.01	2512.55	3052.41	1988.47	790.69	353.61
Basal area (m²/ <b>ha)</b>								
Transect	1	2	3	4	5	Average	s.d.	s.e.
Species								
Betula pubescens ssp. tortuosa	0.56	1.04	0.37	0.66	2.28	0.98	0.77	0.34
Larix sibirica	0.01	0.28	0.17	0.00	0.02	0.10	0.12	0.06
Pinus cembra ssp. sibirica	0.00	0.86	0.24	0.00	0.97	0.41	0.47	0.21
Pinus sylvestris	5.24	0.21	1.65	2.44	14.07	4.72	5.54	2.48
Total	5.81	2.38	2.44	3.10	17.34	6.22	6.38	2.85
Height (m)								
Transect	1	2	3	4	5	Average	s.d.	s.e.
Species								
Betula pubescens ssp. tortuosa	6.20	6.71	7.50	5.44	7.71	6.71	0.93	0.42
Larix sibirica	12.57	4.50	8.67		5.00	7.68	3.75	1.87
Pinus cembra ssp. sibirica		4.83	8.33		6.33	6.50	1.76	1.01
Pinus sylvestris	5.76	5.78	7.50	6.90	5.76	6.34	0.81	0.36
Average	5.80	5.68	7.65	6.58	6.13	6.37	0.80	0.00
Biomass (g/m²)								
Transect	1	2	3	4	5	Average	s.d.	s.e.
Species	•		-			Average	3.u.	3.6.
Betula pubescens ssp. tortuosa	171.98	355.90	642.31	642.08	736.92	509.84	236.88	105.94
Larix sibirica	3.59	104.58	167.30	0.00	6.75	56.45	75.92	33.95
Pinus cembra ssp. sibirica	0.00	195.09	22.06	0.00	221.98	87.83	110.97	49.63
Pinus sylvestris	1859.33	2113.41	2733.25	5430.03	5199.63	3467.13	1718.33	768.46
Total	2034.90	2768.99	3564.92	6072.11	6165.28	4121.24	1902.29	850.73

# Thaw depth

Table 16. Active layer at Laborovaya and Vaskiny Dachi transects and relevés. Depths are in centimeters.

			١	ladym-1 (i	no permaf	rost)				
				Na	dym-2					
See relevé da	ata Table 1	7. No dat	a from tr	ansects.						
449	17	7		Labo	rovaya-1		4	2	110	
Transect/ Relevé #	T09	T10	T11	T12	T13	RV15	RV16	RV17	RV18	RV19
N	31	8	11	8	8	1	1	1	1	
Max	104	87	95	100	108	8				
Min	56	66	75	70	66					
Aver	80,1	77,4	83,4	80,0	77,0	89	70	91	74	8
St Dev	10,10	8,05	5,66	10,58	13,88	2				
					rovaya-2					
Transect/ Relevé #	T14	T15	T16	T17	T18	RV20	RV21	RV22	RV23	RV24
N	11	5	10	11	5	1	1	1	1	0.
Max	119	136	134	133	136					
Min	83	95	87	104	5				V-	
				115,1					N-	×
Aver	100,6	117,6	113,8	8	73,5	118	114	128	109	10
St Dev	10,21	13,68	14,08	9,35	60,38					
77	W.	y		Vaskin	y Dachi-1		33	31		
Transect/ Relevé #	T19	T20	T21	T22	T23	RV25	RV26	RV27	RV28	RV29
N	11	11	11	11	11	1	1	1	1	
Max	83	80	76	84	95					
Min	57	55	61	63	74					
Aver	66,9	69,1	68,6	72,9	81,5	71	66	76	66	79
St Dev	7.54	7,40	4,34	7,35	6.22	9				V.
		11	1000	Vaskin	y Dachi-2					
Transect/ Relevé #	T24	T25	T26	T27	T28	RV-30	RV-31	RV-32	RV-33	RV-34
N	11	11	11	11	11	1	1	1	1	
Max	93	85	89	91	90	1			-	V
Min	40	60	50	56	57				V	V
Aver	68,5	70,5	74,2	73,2	71,5	80	77	78	57	5
St Dev	17,41	8,26	12,66	11,12	8,19	- 00		10	01	
0.001	,	0,20	12,00		y Dachi-3					
Transect/ Relevé #	T29	T30	T31	T32	T33	RV-35	RV-36	RV-37	RV-38	RV-39
N	11	11	11	11	11	1	1	1	1	
Max	127	115	125	127	127					
Min	91	85	99	104	105	ici				1
Aver	102,6	102,7	117,2	117,1	118,9	104	116	128	107	114
St Dev	11,34	9,34	8,29	5.89	7.27	7 The same	0.1000000	1 1000	7.000	-

# Factors measured in study plots

# Relevé data

Table 17. Relevé descriptions. Characteristic species use six letter abbreviations (first three letters of genus name + first three letters of species name). Observers: PK, Patrick Kuss; NM, Nataliya Moskalenko; EK, Elina Kärlajaarvi, SW, Skip Walker. Photo archives are at UAF.

Relevé #	Location	Study site	Characteristic species	Date	Observer	Plot size (m2)	GPS north	GPS east	Elev.	Slope (°)	Aspect	Photo
01	Nadym	Forest	Pinsyl, Betpub, Betnan, Ledpal, Vacmyr, Claste, Plesch	6-Aug-07	PK	10×10	65 18.810	72 53.226	25	0	0	all photos in folder:
02	Nadym	Forest	Pinsyl, Betpub, Betnan, Ledpal, Vacmyr, Claste, Plesch	6-Aug-07	PK	10×10	65 18.794	72 53.277	25	0	0	/data/ru_yamal/photos/
03	Nadym	Forest	Pinsyl, Ledpal, Vacmyr, Claste	6-Aug-07	PK	10×10	65 18.811	72 53.274	25	0	0	SubzoneN ND Nadym/
04	Nadym	Forest	Pinsyl, Betnan, Ledpal, Claste	6-Aug-07	PK	10×10	65 18.831	72 53.261	25	0	0	ND Site1 ForestSite
05	Nadym	Forest	Betpub, Ledpal, Vacmyr, Claste	6-Aug-07	PK	10×10	65 18.814	72 53.314	25	0	0	Terrasse2
06	Nadym	CALM-grid, hummock	Ledpal, Rubcha, Claste	8-Aug-07	PK,NM	1x1	65 18.883	72 51.703	23	0	0.	all photos in folder:
07	Nadym	CALM-grid, hummock	Ledpal, Rubcha, Sphfus	8-Aug-07	PK,NM	1×1	65 18.863	72 51.695	23	0	0	data/ru yamal/photos/
08	Nadym	CALM-grid, hummock	Betnan, Ledpal, Carglo, Clasty	8-Aug-07	PK,NM	1x1	65 18.888	72 51.785	23	0	0	SubzoneN ND Nadym/
09	Nadym	CALM-grid, inter-hummock	Claste, Clasty	8-Aug-07	PK,NM	1x1	65 18.884	72 51.702	21	0	0	ND Site2 CALMGrid
10	Nadym	CALM-grid, inter-hummock	Carglo, Claste, Clasty	8-Aug-07	PK,NM	1x1	65 18.867	72 51.703	21	0	0	Terrasse3
11	Nadym	CALM-grid, inter-hummock	Carglo, Claste, Clasty	8-Aug-07	PK,NM	1×1	65 18.887	72 51.785	21	0	0	
12	Nadym	CALM-grid, mire	Carcho, Carrot, Shpmaj	8-Aug-07	PK,NM	1x1	65 18.825	72 51,737	18	0	0	
13	Nadym	CALM-grid, mire	Carrot, Sphmaj	8-Aug-07	PK,NM	1x1	65 18.824	72 51.803	18	0	0	
14	Nadym	CALM-grid, mire	Carrot, Sphmaj	8-Aug-07	PK,NM	1x1	65 18.828	72 51.831	18	0	0	
15	Laborovaya	Clay-site	Betnan, Vacvit, Erivag, Dicelo	15-Aug-07	EK,NM,PK	5x5	67 42.397	67 59.946	79	2	SW	all photos in folder:
16	Laborovaya	Clay-site	Betnan, Carbig, Dicelo	15-Aug-07	EK,NM,PK	5x5	67 42.387	67 59.970	80	2	SW	data/ru yamal/photos/
17	Laborovava	Clay-site	Betnan, Vacvit, Carbig, Dicelo	15-Aug-07	EK,NM,PK	5x5	67 42.396	67 59.971	80	2	SW	SubzoneE LA Laborovaya/
18	Laborovaya	Clay-site	Betnan, Carbig, Dicelo	15-Aug-07	EK,NM,PK	5x5	67 42.406	67 59.969	80	2	SW	LA Site1
19	Laborovaya	Clay-site	Betnan, Salphy, Vacvit, Carbig, Dicelo	15-Aug-07	EK,NM,PK	5x5	67 42.397	67 59.995	80	2	SW	ClayeySite
20	Laborovaya	Sand-site	Betnan, Vaculi, Claarb, Sphglo, Dicelo	17-Aug-07	PK,NM,SW,EK	5x5	67 41.691	68.02.244	60	1	S	all photos in folder:
21	Laborovaya	Sand-site	Betnan, Vaculi, Sphglo, Dicelo	17-Aug-07	PK,NM,SW,EK	5x5	67 41.684	68 02.283	60	1	S	data/ru yamal/photos/
22	Laborovaya	Sand-site	Vaculi, Sphglo, Dicelo	17-Aug-07	NM,PK	5x5	67 41.694	68 02.270	60	1	S	SubzoneE LA Laborovaya/
23	Laborovaya	Sand-site	Betnan, Vaculi, Carbig, Claarb, Dicelo, Polstr	17-Aug-07	NM,PK	5x5	67 41.703	68 02.277	60	1	S	LA Site2
24	Laborovaya	Sand-site	Betnan, Empsub, Vaculi, Carbig, Claarb, Dicelo	17-Aug-07	NM,PK	5x5	67 41.696	68 02.301	60	1	S	SandySite
25	Vaskiny Dachi	Terrace IV	Salnum, Carbig, Aultur, Hylspl	23-Aug-07	PK,NM,SW,EK	5x5	70 16.540	68 53.446	40	2	S	all photos in folder:
26	Vaskiny Dachi	Terrace IV	Dryoct, Salpol, Carbig, Aultur, Hylspl, Tomnit	23-Aug-07	PK,NM	5x5	70 16.528	68 53.465	40	2	S	data/ru_yamal/photos/
27	Vaskiny Dachi	Terrace IV	Salnum, Salpol, Carbig, Aultur, Hylspl	23-Aug-07	PK,NM	5x5	70 16.538	68 53.469	40	2	S	SubzoneD VD VaskinyDachi/VD Site1
28	Vaskiny Dachi	Terrace IV	Salnum, Carbig, Aultur, Hylspl	23-Aug-07	PK,NM	5x5	70 16.547	68 53.475	40	2	S	LoamySite Terrasse4
29	Vaskiny Dachi	Terrace IV	Salnum, Carbig, Aultur, Polstr	23-Aug-07	PK,NM	5x5	70 16.536	68 53.498	40	2	S	
30	Vaskiny Dachi	Terrace III	Betnan, Vacvit, Calhol, Aultur, Hylspl, Dicfle	26-Aug-07	PK,NM,SW,EK	5x5	70 17.734	68 53.027	30	2	SW	all photos in folder:
31	Vaskiny Dachi	Terrace III	Betnan, Vacvit, Calhol, Dicfle, Aultur	26-Aug-07	PK,NM	5x5	70 17.731	68 53.065	30	2	SW	data/ru_yamal/photos/
32	Vaskiny Dachi	Terrace III	Betnan, Vacvit, Calhol, Diclae	26-Aug-07	PK,NM	5x5	70 17.739	68 53.052	30	2	SW	SubzoneD_VD_VaskinyDachi
33	Vaskiny Dachi	Terrace III	Vacvit, Calhol, Carbig, Dicacu	26-Aug-07	PK,NM	5x5	70 17.747	68 53.038	30	2	SW	/VD_Site2_
34	Vaskiny Dachi	Terrace III	Betnan, Vacvit, Calhol, Diclae, Dicacu	26-Aug-07	PK,NM	5x5	70 17.744	68 53.077	30	2	SW	ClayeySite_Terrasse3
35	Vaskiny Dachi	Terrace II	Vacvit, Carbig, Sphglo, Raclan	28-Aug-07	PK,NM,SW,EK	5x5	70 18.088	68 50.519	15	1	NW	all photos in folder:
36	Vaskiny Dachi	Terrace II	Ledpal, Vacvit, Carbig, Sphglo, Racian	28-Aug-07	PK,NM	5x5	70 18.031	68 50.587	15	1	NW	data/ru_yamal/photos/
37	Vaskiny Dachi	Terrace II	Ledpal, Salnum, BlackCrust	28-Aug-07	PK,NM	5x5	70 18.060	68 50.580	15	1	NW	SubzoneD_VD_VaskinyDachi
38	Vaskiny Dachi	Terrace II	Vacvit, Carbig, BlackCrust, Raclan	28-Aug-07	PK,NM	5x5	70 18.097	68 50.554	15	1	NW	/VD_Site3_
39	Vaskiny Dachi	Terrace II	Ledpal, Salnum, BlackCrust, Racian	28-Aug-07	PK,NM	5x5	70 18.031	68.50.625	15	1	NW	SandySite Terrasse2

Table 18. Relevé site characteristics. See data forms (Appendix C).

Releve#	Tree height	Shrub height	Herbs height	Moss height	Soil moss horizon thickness	Soil organic horizon thickness	Soil A- horizon thickness	Micro- relief	Mean thaw depth	Landform	Surficial geology, parent material	Surficial geomorphology
					heir	ht/cm		_				1111
01	800	50	10	0	0	4	0	40	NA	fluvial terraces	stabilized alluvium	featureless
02	1000	50	10	0	0	4	0	50	NA	fluvial terraces	stabilized alluvium	featureless
03	900	60	12	0	0	2	0	20	NA	fluvial terraces	stabilized alluvium	featureless
04	1100	50	10	0	0	3	0	20	NA	fluvial terraces	stabilized alluvium	featureless
05	1100	45	10	0	0.5	4	0	30	NA	fluvial terraces	stabilized alluvium	featureless
06	0	15	0	0	1	>40	2	30	40	fluvial terraces	stabilized alluvium	turf hummocks
07	0	15	0	1	27	>40	2	20	36	fluvial terraces	stabilized alluvium	turf hummocks
08	0	15	0	0	1	2	1	30	?	fluvial terraces	stabilized alluvium	turf hummocks
09	0	10	10	0	0	25	1	5	50	fluvial terraces	stabilized alluvium	flat centered polyons
10	0	10	15	0	20	>20	2	10	60	fluvial terraces	stabilized alluvium	flat centered polyons
11	0	10	15	0	0	2	0.5	10	2	fluvial terraces	stabilized alluvium	flat centered polyons
12	0	0	25	0	0	?	?	0	?	fluvial terraces	NA	wetland
13	0	0	25	0	0	?	?	0	2	fluvial terraces	NA	wetland
14	0	0	25	0	0	?	?	0	?	fluvial terraces	NA	wetland
15	0	30	10	5	3	5	6	30	89	fluvial terraces	2	with <20 % frost scars
16	0	20	35	2	2	10	3	15	70	fluvial terraces	2	with <20 % frost scars
17	0	15	25	2	2	6	0.5	30	91	fluvial terraces	2	with <20 % frost scars
18	0	30	35	2	2	4	0.5	20	74	fluvial terraces	2	with <20 % frost scars
19	0	25	30	2	2	3	2	20	82	fluvial terraces	?	with <20 % frost scars
20	0	5	15	2	0	1	3	10	118	fluvial terraces	stabilized alluvium	small hummock
21	0	5	5	1	0	3	2	10	114	fluvial terraces	stabilized alluvium	flat centered polyons, small hummoc
22	0	8	5	1	0	4	1	5	128	fluvial terraces	stabilized alluvium	flat centered polyons, small hummoc
23	0	10	10	1	0	4	2	10	109	fluvial terraces	stabilized alluvium	flat centered polyons, small hummoc
24	0	20	3	2	1	5	3	10	106	fluvial terraces	stabilized alluvium	flat centered polyons, small hummoc
	17. 13							200				
25	0	10	10	1	1	3	1	5	70	hills, marine terrace	marine sands	with <20 % frost scars
26	0	10	15	1	1	4	1	5	66	hills, marine terrace	marine sands	with <20 % frost scars
27	0	В	10	1	4	3.5	1	5	76	hills, marine terrace	marine sands	with <20 % frost scars
28	0	10	10	1	2	4	1	5	66	hills, marine terrace	marine sands	with <20 % frost scars
29	0	2	10	1	3	2	1	5	79	hills, marine terrace	marine sands	with <20 % frost scars
30	0	5	7	1	3.5	2.5	2	5	71	marine terrace	marine glay	with <20 % frost scars
31	0	5	7	1	4	4.5	1	5	71	marine terrace	marine glay	with <20 % frost scars
32	0	5	7	1	2	2	0	5	76	marine terrace	marine glay	with <20 % frost scars
33	0	5	7	1	3	4	9	5	61	marine terrace	marine glay	with <20 % frost scars
34	0	5	7	1	3	3.5	0	5	61	marine terrace	marine glay	with <20 % frost scars
35	0	1	4	0.5	2	3	2	5	0	marine terrace	marine sands	with <20 % frost scars
36	0	3	4	1	1	1	1	5	0	marine terrace	marine sands	with <20 % frost scars
37	0	2	2	1	1	2	2	5	0	marine terrace	marine sands	with <20 % frost scars
38	0	2	2	1	0	0.5	5	5	0	marine terrace	marine sands	with <20 % frost scars
39	0	3	4	1	1	0	1	5	0	marine terrace	marine sands	with <20 % frost scars

Table 18 (cont') Relevé site characteristics.

Releve#	Micro- site	Site moisture	Soil moisture	Topographic position	Snow bank persistance after melt out	Disturbance degree	Disturbance type	Stability	Exposure
01	0	subxeric	damp	flat	1-2 weeks	no sign present	none	stable	protected from winds
02	0	subxeric	damp	flat	1-2 weeks	no sign present	none	stable	protected from winds
03	0	subxeric	damp	flat	1-2 weeks	no sign present	none	stable	protected from winds
04	0	subxeric	damp	flat	1-2 weeks	no sign present	none	stable	protected from winds
05	0	subxeric	damp	flat	1-2 weeks	no sign present	none	stable	protected from winds
06	hummock	mesic	moist	flat	snow free prior to melt out	no sign present	none	subject to solifluction	exposed to winds
07	hummock	mesic	moist	flat	snow free prior to melt out		none	subject to solifluction	exposed to winds
08	hummock	mesic	moist	flat	snow free prior to melt out		none	subject to solifluction	exposed to winds
09	interhummock	mesic	moist	flat	1-2 weeks	no sign present	none	subject to solifluction	exposed to winds
10	interhummock	mesic	moist	flat	1-2 weeks	no sign present	none	subject to solifluction	exposed to winds
11	interhummock	mesic	moist	flat	1-2 weeks	no sign present	none	subject to solifluction	exposed to winds
12	0	hydric	very saturated	flat	1-2 weeks	no sign present	none	stable	exposed to winds
13	0	hydric	very saturated	flat	1-2 weeks	no sign present	none	stable	exposed to winds
14	0	hydric	very saturated	flat	1-2 weeks	no sign present	none	stable	exposed to winds
15	0		moist to wet	flat	0 weeks	228/80 <del>-2</del> 8/8/2016/00/8/2	reindeer tracks & scat	stable	exposed to winds
16	0	subxeric to mesic	moist to wet	flat	0 weeks	minor	reindeer tracks & scat	stable	
				flat	Total Control Control	minor			exposed to winds
17	0	subxeric to mesic	moist to wet	flat	0 weeks 0 weeks	minor	reindeer tracks & scat	stable	exposed to winds
19	0		moist to wet	flat	0 weeks	minor	reindeer tracks & scat	stable stable	exposed to winds
12/12/2	100	subxeric to mesic				minor		100000000000000000000000000000000000000	exposed to winds
20	NA	subxeric to mesic	moist	flat	0 weeks	minor	reindeer scat	stable	exposed to winds
21	NA	subxeric to mesic	moist	flat	0 weeks	minor	reindeer scat	stable	exposed to winds
22	NA	subxeric to mesic	moist	flat	0 weeks	minor	reindeer scat	stable	exposed to winds
23	NA	subxeric to mesic	moist	flat	0 weeks	minor	reindeer scat	stable	exposed to winds
24	NA	subxeric to mesic	moist	flat	0 weeks	minor	reindeer scat	stable	exposed to winds
25	0	mesic	moist to wet	hill crest	snow free prior to melt out	moderate	ptarmigan scat & reindeer tracks	stable	exposed to winds
26	0	mesic	moist to wet	hill crest	snow free prior to melt out	moderate	ptarmigan scat & reindeer tracks	stable	exposed to winds
27	0	mesic	moist to wet	hill crest	snow free prior to melt out	moderate	ptarmigan scat & reindeer tracks	stable	exposed to winds
28	0	mesic	moist to wet	hill crest	snow free prior to melt out	moderate	ptarmigan scat & reindeer tracks	stable	exposed to winds
29	0	mesic	moist to wet	hill crest	snow free prior to melt out	moderate	ptarmigan scat & reindeer tracks	stable	exposed to winds
30	0	subxeric to mesic	moist to wet	hill crest	0 weeks	minor	ptarmigan scat, reindeer tracks&scat	stable	exposed to winds
31	0	subxeric to mesic	moist to wet	hill crest	0 weeks	minor	ptarmigan scat, reindeer tracks&scat	stable	exposed to winds
32	0	subxeric to mesic	moist to wet	hill crest	0 weeks	minor	ptarmigan scat, reindeer tracks&scat	stable	exposed to winds
33	0	subxeric to mesic	moist to wet	hill crest	0 weeks	minor	ptarmigan scat, reindeer tracks&scat	stable	exposed to winds
34	0	subxeric to mesic	moist to wet	hill crest	0 weeks	minor	ptarmigan scat, reindeer tracks&scat	stable	exposed to winds
35	0	xeric	dry	flat	snow free prior to melt out	minor	ptarmigan scat, reindeer tracks&scat	stable	exposed to winds
36	0	xeric	dry	flat	snow free prior to melt out	minor	ptarmigan scat, reindeer tracks&scat	stable	exposed to winds
37	0	xeric	dry	flat	snow free prior to melt out	minor	ptarmigan scat, reindeer tracks&scat ptarmigan scat, reindeer tracks&scat	stable	exposed to winds
38	0	xeric	dry	flat	snow free prior to melt out	minor	ptarmigan scat, reindeer tracks&scat ptarmigan scat, reindeer tracks&scat	stable	exposed to winds
39	0	xeric	dry	flat	snow free prior to melt out	minor	ptarmigan scat, reindeer tracks&scat ptarmigan scat, reindeer tracks&scat	stable	exposed to winds

Table 19. Species percentage cover in vegetation study plots (relevés).

	5	_02	_03	-04	-05	90-	-07	-08	-09	10	=	_12	_13	14	15	16	11	18	19	20	-21	-22	23	24	_25	-26	_27	_28	_29	30	5	32	-33	34	35	36	_37	38	39
	ND_RV_01	ND_RV_02	ND_RV_03	ND_RV_04	ND_RV_05	ND_RV_06	ND_RV_07	ND_RV_08	ND_RV_09	ND_RV_10	ND_RV_11	ND_RV_12	ND_RV_13	ND_RV_14	LA_RV_15	LA_RV_16	LA_RV_17	LA_RV_18	LA_RV_19	LA_RV_20	LA_RV_21	LA_RV_22	LA_RV_23	LA_RV_24	VD_RV_25	VD_RV_26	VD_RV_27	VD_RV_28	VD_RV_29	VD_RV_30	VD_RV_31	VD_RV_32	VD_RV_33	VD_RV_34	VD_RV_35	VD_RV_36	VD_RV_37	VD_RV_38	VD_RV_39
Species	Z	Z	Z	z	Z	z	z	z	Z	Z	Z	Z	Z	Z	7	7	_	_	7	1	_			1	>	>	>	-	>	_	>		>	>	>	>	>	>	>
Alopecurus alpinus	8.1	- 33	202	86	83	/8	100	- 36	83	.03	100	36	83	(8)	103	-36	83	38	100	-36	83	.98	100	36	1	1	1	0.1	2	0.1	100	0.1	83		100	- 36	-83	38	188
Andromeda polifolia						1	0.5		0.01	0.01	4	0.01	0.1	0.1								0.1																	
Arctagrostis latifolia		1 87	100	1.55		80	18.	- 53	- 1		100	138		80	0.1	0.01		80	100	- 53	- 2	- 50	100	- 53	0.01	0.01	0.01	0.1	0.1	0.1	3	2	0.1	2	0.5	1.33		1 8	100
Arctous alpina																					0.1	0.1	0.1															-	
Betula nana	10	10	7	10	1	100	S	20	- 33	- 20	0.1		- 33	- 100	25	45	40	50	25	10	15	7	10	25	S	S	10	10	- 33	20	30	30	2	15	100	1 38	1	100	1
Betula pubescens	8	10	2	1	9	100	100	-					200	555		-	-500	-				-			.000	100	100				100	-	- 20	-			100	-	500
	· ·	10		I KSIVE	· ·	185	100	- 5%	- *	185	100	- 5%	*	185	0.01	-5%	× 1	100	200	-5%	*	-00	202	-5%	0.1	0.1	0.1	0.1	0.1	0.1	200	- 5%	- 81	0.50	255.	- 5%	- 81	100	200
Bistorta vivipara	- 35	- 6	- 500	1	35	100	13	• 0	- 10	-			1	:	1	-	1	- 1				- 6		-		0.1							-	- :			-		100
Calamagrostis neglecta agg.	20	32	Res	- 28	20	33	8.6	-28	20	- 32	8.6	- 28	20	32	100	0.1	2	2	2	0.1	0.1	- 8-1	0.1	0.1	0.1	- 3	0.1	0.1	0.1	20	40	20	20	20	0.1	0.1	0.1	0.1	8/4
Carex bigelowii subsp. arctisibirica		- 36	200	1.00	8.1	-39	100	- 86		- 36	100	- 86	* 1	38	15	25	20	20	20	7	S	7	35	20	80	30	40	30	20	10	S	S	10	10	15	10	0.1	15	2
Carex chordorhiza			100			- 2				- 2	101	30	1	2		-95		2				2	1.0	25			1/2			- 2	1.2				100				100
Carex globularis	× 3	56	100		×3	0.2	0.1	10	0.1	8	S	.68	*			-63	× 1	- 56		-63	× 1	56		-63	×	86		• 65	× 1	5	100	- 63	×3	- 55	100	- 63	× .	- 86	100
Carex limosa	- X	34	10	-00	×.	35	100	-00		99	10	1	1	1	100	-00	×.	99		-00	×.		10	-00	×.	35	10	-00		- 00	100			39	10	-00		9.0	160
Carex rotundata	- 23	- 35	630	1.32	- 20	- 25	100	1.50	- 23	- 25	100	30	30	30	100	36	33	36	100	. 55	- 20	- 34	100	- 52	20	25	100	. 52	- 88	- 35	100	1 52	- 20	- 35	130	0.5	- 23	136	6.00
Chamaedaphne calyculata	- 23	100	500	200	- 20	100	1000	20	- 20	100	1000	201	98	0.01	504	200	93	58	500	201	900	- 12	500	201	- 20	100	500	201	- 200	58	500	20	900	- 2	500	200	- 20	1.0	500
Diapensia lapponica	1	0.00	100			000	100	500		100	556	- 60	-		550	- 50		107		- 20	0.1	0.1	-00	- 22	- 1	105	100	50		- 000	100	100		100	100	100		-	100
	1 10	1 3	0.1	1 8		- 10	100			- 10				- 1							***		100		- 10	- 3	100			- 3	100	100		-:-	183				183
Diphasiastrum aplinum	20	- 22	0.1	.83	20	333	Nº	.00	20	- 30	1000	-63	**	3.6	500	•8	201	- 04	5.04	.00	200		500	-63	201	- 36	1004	.88	200	- 565	10.00	- 25	20	- 50	10.54	-68	20	- 00	10.00
Drosera rotundifolia	- 80		10.0	96	8	(8)	(2)	- 86	8.1	.00	100	- 86	80	.99	100	- 66	8.1	(8)	10.5	- 86	81	.8	100	- 86	8.1	.00	100	36	31	.08	100	- 86	8.1	- 33	100	- 56	8.1	- 38	100
Dryas octopetala subsp. subincisa	2.0	- 4	100	25	- 50	- 1		25		- 1	10.	25			105	-95						- 2	100	25	10	10	S	S	5	- 21	12.	. 25			100	25			100
Empetrum nigrum	S	S	3	S	S	56		1		100	100	-53	*	52	1.0	-63	*	87				- 54	1.0		×	50			× .	- 55	100	. 58	× .	- 55	100	- 63		. 8	100
Empetrum subholarcticum	×	30	10	- 92	188	26	10	•00	1.0	94	10	-22	×.	90	S	- 22	1	S	1	0.1	S	3	1	10		200	100	0.5	- 23		10	1	1		100	-00	0.5	0.1	0.1
Eriophorum angustifolium	- 33	186	125	1.33	- 20	74	100	1.55	- 23	74	132	3	0.1	36	2	. 33	28	74	100	0.1	0.1	35	100	0.1	201	24	100	0.01	- 23	0.1	0.1	1.33	1	1	100	1.50	- 23	- 75	133
Eriophorum russeolum	933	132	198	201	93	52	500	201	93	52	500	1	0.1	0.1	500	-28	23	32	500	-23	23	52	500	20	123	52	500	- 20	939	52	500	201	93	52	500	201	93	532	500
Eriophorum vaginatum		0.00	0.00			0.1	1000					1000			25	0.1	2	0.1	2	0.1	0.1	0.1	0.1	0.1		0.1	0.1	0.1			200		2	1	200		0.1	0.1	0.1
Festuca cf. ovina		10	123	1	1				- 30	- 10				- 8	0.01	200	-781		155	***	-	0.01	0.01	0.1			100				100	- 8	1 70			1	-	-	100
			8.0		0.01		5.0		-		100		-		0.01		-		5.64	.0		0.01	0.01	0.1	0.4	0.04	0.01	0.1	0.1		5.0				5.04				5.4
Festuca sp.	- 80	- 36	200	- 66	0.01	- 39	105	- 56		36	100	- 56	*	38	100	196	8.	38	203	- 59		. 39	100	- 66	0.1	0.01		0.1		- 38	100	196	- 80	- 38	100	- 56	- 53	.38	100
Hierochloe alpina		- 2	100	20		- 2	1.25			- 2	10.5	20		2	1.2	20		2	1.			0.1	0.1	20	0.01	0.01	0.01	20	0.01	- 2	105				1.2		2	- 2	2
Huperzia selago	- 33	9	100	1.00	1 8	86	100	- 60	- 23	- 56	100	- 60	- 23	86	100	-65	×	66	100	-68	- 33	0.01	100	-60	- 83	66		-68	- ×3	- 86	100	- 68	- 83	- 5%	100	0.01	- ×	66	100
Juniperus communis	× .	2	4	1	1	25	100	•01		9.5	10	.00	×	200		•22	× .	20		•	X	- 20	10	.00	×.	2.5		• 0		25	100			2.5	10			2.5	100
Larix sibirica	1	S	S	3	3	- 35	184	1.33			198	1.85	- 63	36	100	. 52	28	36	100	. 56	- 28	- 35	100	. 52	- 23	- 25	100	1.55	- 20	- 25	1000	1 80	. 23	- 26	130	1 52	23	136	6.05
Ledum palustre	15	15	10	20	15	65	40	60	0.1	0.01	0.01	266	23	52	504	285	93	38	506	28	20	- 52	500	28	23	120	508	288	- 23	32	500	28	933	120	506	28	425	52	502
Ledum palustre subsp. decumbens															1				2	0.1	2	3	1	2												15	15	3	10
Luzula cf. confusa		1 0	100	1	1	10									100				155			-8-1	635	25	0.1	0.01					1235	1	1 30	<u> </u>		12.47	1	18	1000
Luzula cf. comusa Luzula cf. wahlenbergii	_								-				-							-	-	0.1			•	0.01			-				-				-		
	*	35	200	- 56	- 80	38	1005	- 59	- 80	38	100	- 56	- 50	38	100	-50	8	38	202	- 59	- 80	0.5	100	- 50	80	38	2005	- 50		.33	100	- 55	- 80	38	0.01	- 55	0.5	0.1	0.1
Luzula sp.		- 4	100	2.5		- 1				- 1	- 1	2.5			100	25			1.			- 2	1.	2.5		- 1	1.5			- 4	1			- 1	0,01		0.5	0.1	0.1
cf. Minuartia arctica	× .	- 56	100	- 6%	1 8	56	1.0	-63		- 56	100		*	96	0.01	-63	×3	0.01	100	-58	×	- 56	100	-52	×	- 50	100	-53		- 50	100	- 63		- 56	100	- 68		56	100
Oxycoccus microcarpus	1.50		10		1.5	95	S	•		- 20	10	0.01				-00	8	25		•	× .		9		×.		100	•00	× .		100				100			26	100
Pedicularis hirsuta	200	- 25	100	. 50	. 30	- 35	1005	. 50,	- 20	256	100	. 5%	200	36				36	13	0.01		25	100	. 5%	93	0.1	100	. 50,	- 33	26	0.1	0.1	0.1	. 35	100	1 50	- 20	- 36	100
Pedicularis labradorica	23	1 38	599	- 20	23	133	500	20	- 23	- 12	500	33.	23	130	0.1	0.1	0.1	0.1	0.1	0.1	0.1	- 38	0.1	20.	23	- 12	500	233	23	- 53	500	23	23	- 12	500	23	- 23	138	500
Pedicularis cf. lapponica													-				0.01				0.01	0.1	0.1															-	
Petasites frigidus	1 2	1 2	155	1 37	30	12	133	100	- 30	2	183	100	30	2	102	0.01	0.5	0.5	1	28	3	***************************************	6.	100	- 30	- 2	183	100	- 30		153	1 35	30		133	1 3	30		153
Pinus sibirica	10	2			2											-																							
	25	10	10	10	5	38	205	. 59	- 50	35	208	59	-50	35	205	199	-52	38	205	59	-50	38	205	196	-5%	35	205	199	- 50	38	200	199	- 50	35	205	.59	- 50	38	805
Pinus sylvestris	23	10	10	10	a	- 20	100			- 6	-		• 6	- 6	14	25		- 60		20		- 20		20						- 40	100	- 25		1	100	20		- 35	1
Poa arctica	X3	99	250	-000	- X3	- 39	100		- 83	- 39	100	-00	X3	90	19	-65	X	8	0.01	-05	X3.	540	200	-000	XS	0.01	0.1	-00	0.1	- 50	100	-00	X3.	- 99	- 1	-95	×3	660	250
Rubus chamaemorus	×.				1.5	10	15	3	2	1		.0			0.1		× .			•	X				<u> </u>			•	×.		100		1.5				1.5		
Salix glauca	- 33	- 25	100	1. 5%	- 24	26	100	1 50,	- 24	29	100	36,	20	26	198	50,	20	36	1000	0.1	0.1	35	0.1	30,	S	5	S	7	1	3	2	1	2	2	100	1 50	- 24	- 39	100
Salix hastata	21	18	100	100	23	18	100	- 88	23	(8)	100	38	23		0.01	-98	23	18	506	-88	23	18	500	38	S	1	1	1	27	100	500	38	27	18	100	- 88	23	18	100
Salix lanata																							1				1	1											
Salix myrtilloides	30	1 2	153	1 25	30	12	152	1 25	- 30	- 2	102	255	- 33	2	102	28	- 20	2	132	0.1	- 30	2	632	35	- 33	2	103	.00	- 20	- 2	102	100	- 30	100	133		- 31	18	153
Salix nummularia	8.1	701	100	1 25	2.1	.00							2.1	.00		26		700	100		2.1	807	500	25			10	15			6.0	7.0	190	857		7 20	585	277	6.0
Salix polaris		35	205	1 50	- 20	35	105	59	- 60				-00	35	105	59	-000	35	205	59	- 60	2	205	59	30	15	10	5	20	8	5	3	1	- 1	105	0.1	5	- 00	7
		- 35	100	20	- 50	- 60	- 100	2.5	- 1	- 6		20	- 0.0	- 60	2	5	2		15	2	0.5	0.1	4	20		0.1	10	4	20	0.1	- 4	u	1		- 1	0.1	-	- 35	100
Salix phylicifolia	× .	- 34	100	- 00	X3.	000	10.	- 95	X3	- 30	100	-00	XS	- 00	2	a	2	12.	la	- 2	0.0	0.0		20.00	XS	0.1	100	-00	X3.	0.1	100	- 90	XS.	- 30	100	- 95	XS	- 2	100
cf. Senecio	1.5				- 33	9.5		• 00	1.5			- 22			10		- 63	- 1		•	- 1	2	9		- 83				× .	- 2	100		1.5		100		1.5	0.1	
Stellaria sp.		. (2)		1 50,	. 33	- 25	1000	1 30,	- 23	- 29	100	330	- 28	35	100	50,	23	39	100	. 50,	- 60	35	100	33	20	- 25	100	0.01	- 33	25	0.05	33	- 20	. 3	1004	1 250	- 20	- 39	535
Vaccinium myrtillus	20	15	15	4	15	133	500	28	93	- 32	500	- 88	23	33	100	- 28	23	33	593	- 28	23	33	596	- 88	23	138	500	- 28	23	- 533	500	- 20	23	1.0	500	- 23	93	138	500
Vaccinium uliginosum	6	10	8	S	8			1			1																												
Vaccinium uliginosum subsp. microphyllum		1.5	100			100	1.	1.33	- 01	- 22	100	- 33		2	0.1	2	7	3	5	15	20	10	10	10	5	- 83	1	0.1		-8	100	1.00	100		100	.39		12	100
Vaccinium vitis-ideae	S	S	S	S	S	5	2	2	1	0.1	S				10	7	15	S	10	0.1	0.5		0.5		2	1	S	S	7	30	15	15	20	10	35	15	2	20	2
Valeriana capitata			183	1	30	100	183	1 85	30	-	183	100	30	- 10	10000	100	30	0.1	53.7	250001 (2)	30		155.00	100	0.1	0.1	183	100	0.1		188	1 55	30		188	1775	- 80	100	153
	_		5.0			0.0	200		-					0.0			***	45.5		0.1	0.1				0.1	0.7	0.1	.0	0.1	0.1	200	0.1	-	0.1	0.1	0.1	0.1	0.1	5.0
Alectoria nigricans	- 80	.39	10.5	1.55	- 8	38	1005	- 56	- 8	.39	100	- 55		35	203	-59	8.	38	2015			0.1	0.0	56	0.1	38	0.1	- 56	0.1		100	0.1		0.1					
Alectoria ochroleuca		- 2	100	20	1.0	- 2				- 2	13			2				4	1.5		0.1	0.1	0.1	25		- 2				0.1				0.1	0.1	0.1	0.5	0.1	0.1
Arctocetraria andrejewii	×	56	100	- 65	× .	- 55		- 63	× .	- 56	100	- 52		50		- 63		8			× .	. %			×3	- 55	100	- 63	× .	50	100	- 63		5.0	0.1		× .	- 56	100
Asahinea chrysantha	- ×	399	10		1.0	99		•07	×.	20		•00	×	90		.00	×.	1		0.1	1	0.5	0.1	0.1		9.5	100	•00	X.	- 0.	10	.00	×.	2.0	100	.07	×.	- 20	
Baeomyces rufus	1.00	- 35	100	1.85	- 22	26	100	1.55	- 28	26	100	1.55	28	36	100	. 52	33		100			- 35	100	. 53		26		1.52		- 26	. 100			. 36	100			0.1	100
Bryocaulon divergens	- 20	524	500	100	400	524	500	20	400	520	504	20	93	520	0.1	200	90	0.01	500	0.1	0.1	0.1	0.1	0.1	0.1	524	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.5	0.5	0.1	0.1	0.1
		100	1000	1 22	1 01	- 00				-00			-	1000	0.1	95		artero Art	200	0.000		0.1	200	0.1					0.1		2.00	0.0000	0.0000	Acres 20	0.1	1	00000	-	0.1

Table 19 (cont'). Species percentage cover in vegetation study plots (relevés).

	5	05	03	0.	0.5	90	07	80	60	10	F.	12	5	4	15	16	11	18	19	20	21	22	23	24	67	26	28	29	30	55	32	33	34	35	36	37	38	
	ND_RV_01	ND_RV_02	ND_RV_03	ND_RV_04	ND_RV_05	ND_RV_06	ND_RV_07	ND_RV_08	ND_RV_09	ND_RV_10	ND_RV_11	ND_RV_12	ND_RV_13	ND_RV_14	LA_RV_15	LA_RV_16	LA_RV_17	LA_RV_18	LA_RV_19	LA_RV_20	LA_RV_21	LA_RV_22	LA_RV_23	LA_RV_24	VD_KV_ZS	VD_RV_26	ND BV 28	VD_RV_29	VD_RV_30	VD_RV_31	VD_RV_32	VD_RV_33	VD_RV_34	VD_RV_35	VD_RV_36	VD_RV_37	VD_RV_38	
Species	Z	Z	Z	ž	Z	Z	Z	Z	Z	Z	Z	ž	Z	Z	5	5	5	5	3	5	5	3	3	5	>	> >	5	3	>	>	>	>	>	>	>	>	>	18
Cetraria delisei	100	90	1/X	36	100	20	la.	39	100	85	18	36	950	881	ix.	3.9	900	20	t/k	0.1	100	925	tik .	3.6	<b>1</b> 00	98 (8	135	- 50	- 83	1.8	3.9	100	90	0.1	0.1	100	92	T
Cetraria islandica	2	1	1	1	1			0.1	2			- 11			0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1 0	0.1	0.1 0.1	0.	1 0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.5	
Cetraria laevigata					- 11	1	0.01			1	2	12.	2.0		2				- 12				0.1	0.1 0	1.1	. 0.1								0.1				
Cetraria nigricans	- 0.0			20.															- X					See			100											
etrariella fastigiata		7	170	188	200	- 2	100	154	- 95	78	19	18%	96	2		18%	2		10.	186	- 90		0.1	88			18			100	184	- 20		0.1	186	- 1	7	t
Cladonia amaurocraea	200	- 60	700	194	200	0.1	S	0.01	0.1	0.01	0.01	164	9001	8 0	0.01	0.01	0.1	0.1	0.1	3	0.1	0.1	259		1.1	0.1	0.	1 0.1	0.1	0.1	0.1	0.1	0.1	0.1	164	0.1	0.1	t
ladonia arbuscula subsp. arbuscula		4	10	4	S			5								0.01		0.01	0.1	20	10	7	20	15			100		0.5	0.5	0.1	0.1	0.1	S		1	2	+
ladonia arbuscula subsp. mitis		-	100	154	100		100		- 100	-3	100	183	100	- 3		5.	- 100			100				3000		3 10				1	100				5			+
ladonia bellidiflora						-					0.01									0.1	0.1	0.1	0.1	0.1			0.	1 0.1			0.1			0.1	0.1		0.1	t
Cladonia cenotea	- 10			110	- 20	1	10			- 3		188	- 20	1877		0.01	- 20		0.01	18.			- 12	i.	201					12	100	- 80			183	- 0		т
ladonia cf. cenotea		50	1.0	100	200	- 00	1.0		200	100	1.0	0.0	200	100	1.0	0.6	200	100	1.0	0.6		100	100	3.5	200	90 10		100	100	100		0.1	100	1.0	0.6	100	190	
ladonia cf. decortiata	- 100	80	556	100								100	801	80	556	100						80	556		800	80 58	100	100	0.1	100			0.1	53.00	100	100		+
Madonia cf. decordata	-1-5			189			-	100				188		3		95				100		0.1					188	10	0.1		100	- 33		0.1	0.1		0.1	Ħ
ladonia ct. grayi ladonia cf. scabriuscula			- 2.8	1,530	***	- *	536	50	100	**	5.X	124.	***	**		50.			::X	50.	***	9.1	:×	24.	100	763 2.8	1,530	-		0.1	150	***	**	0.,	0.1	- 10	- 9.1	÷
	- 0	100	-	18.	900		- 100	8.	- 00	25		186	900				900			10.	- 60				1.1	. 0.1		-		0.1	0.1	900	0.1		155	0.1	-	+
Cladonia chlorophaea	-	0.01	7.0		100	-	2797			~	774		***	~	7.4				274		***	- 1	77			. 0.	0		-	0.1	0.1	***	0.1	276				+
iladonia chlorophaea s. l.	399	0.01	138	39	*35		0.4	29	0.1	0.01	DK.	129	233	87	0.01	0.01	0.01	0.01	0.01	0.1	0.1	0.1	0.1	0.1	· (1)	0.1 0.1			0.1	0.1	0.1	100	0.4	0.1	0.1	100	0.1	H
ladonia coccifera	- 50	-	15				0.1		0.1	0.01	15			2 1			0.01	0,01	0.01			0.1	0.1	0.1		0.1 0.1			0.1	0.1	0.1		0.1	0.1	0.1		10000	4
ladonia cornuta subsp. cornuta	200	- 881	100	0.01	26.6		- 2	0.01	86	181	150	336	25.6	100		0.01	26.5	100	152	0.01	0.1	0.1	182	S 6	855	100	0.	30 E		150	336	0.1	0.1	150	376	. 80	- 2	4
Cladonia cornuta subsp. groenlandica	- 8				• •	0.04	- 2	13.5	- 10	- 0		150	•	- 6	0.01		•	- *	- 3			- 6				× - ×	130	- 1	0.1	- 2		0.1	- 4	- 2	13.0	- 1		+
Cladonia crispata	- 82	860	852	155	3.6	0.01	100		45.5	160	100	18%	352	320	100	S-4	8.6	160	100	554	10.0	167	100	S14	152	100	188	1.00	100	250	S.	9.2	160	1141	1814	950	100	1
Cladonia cyanipes	- 50	(8)	1.8	39		8	1.8	36	100	85	18	39	200	80		0.01	300	20	5.8	3.6	500	90	138	16	100	. 0.1	100	100	- 20	1.8	3.9	100		138	3.6	100	9	4
Cladonia deformis				100		1		100			0.1	100				0.01				0.0			2.5	20 1		0/1 20	- 65	0.1	0.1	0.1	100		0.1	2.5	100			4
Cladonia furcata	- 2	- 6	- 3%	2.0		- 2	×	20	- 60		- 50	20				Ç.	0.01		0.01				- 52			0.1 0.1			0.1	1.	10			- 2				
Cladonia gracilis	0.01		- 18				- 1		- 6		× .		- 0		0.01				0.01	1	0.1	0.1	× .	0.1 0	0.1	0.1 0.1	1 30	0.1	0.5	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	
Cladonia grayi	20	4	3%	15%	200		576	. 56	. 20	42.	34	56	200	223	56	5%	200	0.01	50	F6.	200	7	376	6	200	20 10	1,5%	. 20		. 5%	16	200	4	34	94	, 20	720	
Cladonia macrophylla	200	- 87	79	59	\$93	0.01	79	59	366	87	79:	59	893	80	792	56	393	8	79	56	266	87	79	0.1	293	87 79	155	100	0.1	79	56	200	80	79	169	100	- 80	
Cladonia pleurota			1.5				1.5				1.5	0.							1.5				1.5				100		0.1			0.1		1.5				
Cladonia pyxidata	- 10		18		- 83	- 8	- 10	188	- 80	- 6	12	188	- 66	- 5	100	150.			12	0.1			0.1		82	. 0.1		0.1	0.1	0.1	35.	100		18	188	0.01	- 50	
Cladonia rangiferina	5	50.	7	1	100	521	190	8.5	0.1	520	192	186	100	527	ix I	1	0.1	0.1	100	S	0.5	2	2	1	F06	50 1.8	0.	1 0.1	0.1	1.8	3.5	*50	50	190	3.6	1	520	
Cladonia sp.																													0.1									
Cladonia sgamosa					- 2				- 20			12.	2	- 1		2.				0.01	0.1	0.1	0.01				18		0.1		0.1	0.1			12.			t
Cladonia stellaris	50	45	80	85	30	30	0.1		90	40	75							0.5					0.1							-				0.01				
Cladonia stricta			172	182	26		172	88				182	95	28	10.	102	95		100			7	0.1	82.	201	7	189	0.01	1 2	100		200	0.1	0.1	0.1		72	t
Cladonia stroia	96	1	1	1160	4	25	10	15	10	50	20	100	960	60	0.1	0.1	0.1	0.01	0.01	10	1	1	1	1	960	6.7 70		0.1	0.5	0.5	0.1	0.1	0.1	S	2		1	÷
Cladonia stygia Cladonia subfurcata	- 100	251	- 55	132	23.76		4.50		7.10			lige.	-500	201	***		****	0.01		0.1	0.1	0.1	0.1	0.1	•35	201 178	100	/***	0.1	0.1		2.6	0.1	0.1	0.1		0.1	٠
Cladonia subturcata Cladonia sulphurina	- 6	- 6	100	125		- 6	100	100	0.01	- 6	0.1	125	- 20		0.01	10.	-	0.01	- 16	0.1	0.1	0.1	0.1	0.1			- 125	- 10		0.1	18.	0.1	٠.,	0.1	0.1	- 20	-	Ŧ
Diadonia sulphurma Cladonia uncialis	87	-		1100	*000				0.01	- 00	0.1	//05-	100		0.01	100-	0.01	0.01	0.01	2	10	10	5	10	•500	. 0.1	0	1 0.1	0.1	0.1	0.1	1	0.1	10	5	- 000	1	+
	58	- 20	1.8	100	50	- 20	125	100	588	- 80	1.8	26	50			0.01	0.01	0.01	0.01	0.1	0.1	0.1	0.1		0.1	0.1 0.1			0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	+
Dactylina arctica	- 1	-	2.5	100		- 1	0.1	2	-		- 14	100				0.1	0.5		0.1	0.1	7	0.1 S	1			0.1 0.1			0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	
lavocetraria cucullata	- 0	100	230	180	100	1	0.1	2	700	100	- 100	186	201			0.1	0.5	0.1		301	7			200	1.1	0.1 0.1	1 0	1 0.1	.0.1	0.1	0.1	0.1	.0.1					I
Flavocetraria nivalis	- 0		1.0	- 30-			- 1		- 64		- 2	39.	-		0.01	0.1	0.1		0.01	0.1	7	7	3	1	0	* X	139				8.			1	2	0.5	1	1
lypogymnia physodes	100	40	5%	24	. 200	40	574	96	. 20	48	576	, 9a .	200	40	500	94	200	40	576	96	201	0.1	576	0.1	200	40 . 54	1,97	. 20	4	574	94	200	40	100	94	0.1	- 60	4
cmadophila ericetorum	260	- 80	78	56	\$00	- 80	78	156	300	-87	79	59	393	80	38	56	300	8	79	56	2(6)	87	78	56	200	81 78	156	100	. 8	78	56	200	- 87	1	56	0.5	1	
ichenomphalia hudsoniana			10				1.0				10	20	.73		10				100				10			0 0	2.0		0.1	1.5	20			10				
/lycoblastus sp.	- 50		- 64	186.	- 53		- 64	35.	- 60		18	186	- 52		100	35.	-5.2		- 25	186	- 63	0.1	- 12	5 L	53	2 2	135			- 84	35.	- 82		186	186			
Ochrolechia androgyna	100	92	18	354	100	- 20	131	39	100	93	18	36	200	92	18	35	500	20	18	36	100	90	18	36	100	20 La	188	100	- 20	1.8	35	100	90	18	36	0.1	50	
Ochrolechia frigida												a.			1	0.1	0.01	1	1	0.01	0.1	0.1	0.1	0.1				0.1						1	2	2	1	
Ochrolechia inequatula	- 1		100	12%	- 1	- 3	- 0	2.	200	- 2		12%	201	53	0					12.			10	0.1	20	. 0.1	0	1 .	1	1	1	0.5	2	0.1	100		123	
Peltigera canina	-																								.01													t
Peltigera cf. frippii	- 10	12	100	18%	25	20	100	18%	95	20	192	18%	95	7.0	100	88.	90		- 10	188	0.1	7	100	5%	95	18	189	- 20	100	100	0.1	0.1		192	184	26	7.0	t
Peltigera cf. neckeri	960	1	70	160	900	6.7	70	66	960	67	70	160	960	60 10	0.01	66	0.1	67	0.01	66	960	0.1	70	56	960	60 70		900	-	70	100	900	0.1	76	66	960	60	٠
Peltigera leucophiebia	1	1	1	1	2			2.5				184			0.01	2.5	0.01					.,	100		0.1	0.1 0.1	0	1 0.1	0.1	17.6	0.1	0.1	0.1	100			200	
Peltigera malacea		1	-	188	1		- 100		- 10	- 6	- 10	188	- 201		-	100				100	2/1	- 6							12.50	100	10000		25.0	100				H
	_	-							•00								• • • • •						0.1		• 02							• 100				•02	-	÷
eltigera polydactylon-group	- 100	- 80	5.8	0.1	100		525	100	100	- 80	5.8	28.	500	87	5.25	0.01	0.01	0.01	5.8	0.1	500	30		0.1	565	2 2		1 01	0.4	0.4	100	100	30	5.8	25.	100	- 20	+
Peltigera scabrosa	- 1		13.	0.1			2.5	100	-		2.5	100	1			0.01	0.01	0.01		0.1				0.1	1	. 0.	0	1 0.1	0.1	0.1	100	1		2.5	100	- 1		4
eltigera sp.	- 20		- EX	20		*	200	20	190	- 10	200	E.	*20	163	×.	Ç.		160	- 22	Re.			0.1	£(•	120	90 EX	1,60	- 20		230	(4	100			K.O.	- 70		4
ertusaria dactylina			1.0					30	- 00		- 3	39	*04		*		0.01			0.1	0.1	0.1	0.1				139		100	1.0	3.0	***		0.5	30	- 0		
ertusaria geminipara	- 20	40	5%	94	200	4	576	96	. 10	40	576	196	200	78	576	94	20	40	576	96	0.1	S	574	98	260	40 39	1,5%	. 20	0.1	5%	94	200	4	10 m	96	. 26	0.5	
Pertusaria panyrga	200	- 87	79	56	200	8	79	199	300	87	79:	156	888	87	78	56	900	8	78	156	2(6)	8	79:	56	200	8/ 78	150	- 200	8	79	194	100	8	0.1	159	300	0.5	
Protopannaria pezizoides			1.5				1.5				1.5	2.		2	10				1.5				1.0			20	0.0			1.0			3	1.5				
Protothelenella leucothelia	- 50	100	100	135	8.0		100	35.	0.01	183	34	188	53	183	100	38	- 80		38	188	5.0		186	38	£2[]					- 50	350	82	-	18	188		- 8	
soroma hypnorum	100	90	18	39		20	ljæ.	36	100	90	18	39.1	200	80	ta T	39	.00	92	18	39	100	90	ta I	36	100	. 0.	0.	1 .	90	1,80	3.9	100	90	18	36 1	0.1	90	
Rhexophiale rhexoblephara							514																				100		1									Ì
phaerophorus globosus		- 2	100		- 1	- 2			- 33	- 2		1	200	23	0.1	0.1	0.1	0.1	- 10	15	40	50	15	10 0	0.1	0.1 0.1	0	1 0.1	1	1	1	1	2	10	15	10	15	1
tereocaulon alpinum			10	100	- 0		100	1	- 1		100	1,0	- 1			100		201	100	1		0.1	0.5	1				1 1			100	100		100	0.1			1
tereocaulon paschale			- 2.0	185		.00	- 3/3	187	- 33	- 55	-3.0	187	100	100	40	27.			- 3.6	s	0.1	185	5.07.5	25	300	35 30	183	100	100	2.0	1835	500		3.0	127014		- 63	A

Table 19 (cont'). Species percentage cover in vegetation study plots (relevés).

	10	7_02	/_03	104	7_05	0-7	107	90-	60-/	5	14	1-12	13	7	13	1.16	1-17	1.18	119	7.20	-23	73	24	1_25	1_26	1_21	1-2	12	13	2	13	E.	134	1.35	/36	1_37	/ 38
	ND_RV_01	ND_RV_02	ND_RV_03	ND_RV_04	ND_RV_05	ND_RV_06	ND_RV_07	ND_RV_08	ND_RV_09	ND_RV_10	ND_RV_11	ND_RV_12	ND_RV_13	ND_RV_14	LA_RV_15	LA_RV_16	LA_RV_17	LA_RV_18	LA_RV_19	LA_RV_20	LA_RV_21	LA_RV_22	LA_RV_24	VD_RV_25	VD_RV_26	VD_RV_27	VD_RV_28	VD_RV_29	VD_RV_30	VD_RV_31	VD_RV_32	VD_RV_33	VD_RV_34	VD_RV_35	VD_RV_36	VD_RV_37	VD_RV_38
pecies	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	ATT/S		7	_	7	7		٠ ـ	7	7	1500				>	>	_	>		>	>	>	>	>
hamnolia vermicularis var. subuliformis				50.	- 0	- 00	- 2	35.	- 6		- 22	50.	-0	16/	0.1	50.	•		- 2		450	. 0.1		0.1	0.1	0.1	0.1			0.1		0.5		100	50.	- 0	
hamnolia vermicularis var. vermicularis	200	40	5%	1,5%	, 20	20	374	15%	. PS	220	56	56	20	20	376	0.1	0.01	0.01	0.01	1	0.1	0.1	0.1	0.1	20	0.1	0.1	0.1	0.1	0.1	0.1	200	0.1	0.1	0.1	0.1	0.1
aricellaria rhodocarpa	260	- 87	78	156	399	8	38	199	3(6)	90	78	59	260	80	79:	59	360	87	38.	56	200	s) 19	156	200	87	78	56	303	8	78	196	200	87	0.1	156	399	- 87
ulacomnium palustre				0.0			1.5	0.0			1.5				S	0.0	0.5		0.01					- 00											0.0		
ulacomnium turgidum	1 30	- 3	100	1188	- 80	1.0	100	0.1	- 80	- 5	100	188	- 80	- 2	S	S	3	2	S	0.01	1 (	0.1 0.5	2	50	40	90	40	40	20	15	10	10	S	0.01	135	0.1	- 81
lepharostoma trichophyllum	100	527	14	185	100	520	197	86	100	520	100	86	200	520	1.0	8.5	200	520	1.0	8.5	400	50 10	186	100	0.01	18	35	100	50.	19	186	100	500	100	35	100	520
alypogeia sphagnicola				100			0.01			60		100	- 200	90	2.00	100				100	300	200	1100	200							100	2001					
ephaloziella sp.				100	1			195		3				- 31		100				100	100		100	1 2					0.01		188		0.01				
	_	- *	::X	18.0		- 000	:X	184	100	10.	:×	E		**	×	20.	***	- *	5.X	10.		X	150		*	::X	183.		0.01	5.X	15.0	**	0.01	- 200	5.0	201	1
eratodon purpureus		- 4	- 2	189	- 00	- 33	- 2	189	- 100	- 5		89.	- 00	162	*	\$3°	.00		- 2	8.	0.01 0	.01 0.1	189	- 30	100		180			- 2	189	- 30	- 5	0.01	33.		
onostomum tetragonum	100	40	2.0	P/G	. 10	-	2.0	Pa I	100	- m	2.0	94	200	40	2.00	Pa .	***	40	24	PG   2			100	200	40	2.0	N/G	200	40	2/4	194	200	- 0	0.01	196	200	(0)
nodontium strumiferum	200		78	55	300	- 87	18	139	300	87	138	59.	200	8/	8	59	300	- 86	138	59	38 00	0.1	39	200	- 80	138	35	100	- 80	138	35	300	- 8	138	50.	100	90
cranum acutifolium	20	0.5	100	2.5			14	0.01		2	10				S	S			1.5			21 14	200	- 22		1	1	1		0.1	25	20	15	100	200	2	
icranum elongatum	. 50			188	. 52	- 3	-26	0.1	- 52	100	0.1	186	- 52	- 1	20	20	15	15	15	20		15 15	30	2	1	1	1	S	0.1	0.1	0.1	0.1	- 1	3	355	- 52	2
cranum flexicaule	100	383	0.01	186		- 32	18c	36	100	32	18	36	100	92	18	36	:00	0.1	18	0.01	0.1	8) tx	186	0.1	- 80	18	3.5		20	30	3.9	100	92	18	3.6	100	923
cranum fuscescens					0.5	0.1										- 1																					
cranum groenlandicum		- 2							100	- 2			- 2	- 2	2			- 2				0.1	0.1		- 2	- 2		- 1	- 2			- 2	- 1		20.	- 2	
cranum laevidens															15	15	15	15	15												40	0.1	15				
cranum majus	96	120	100	182	98	100	100	18%	95	12		88	95	78	100	52.63	95	1911	100	88	90		188	2	72	100	182	96	130		102	99	100	100	182	96	72
cranum majus cranum spadiceum	900	-	707				70	100	962		70			-	70			-	700			60 79	1156	90	-	707	1	907	-	70				6	4		-
	1000	-8/	1.8	3.5	.00	3/	138	13.5	100	287	1.3	53.	500	2831	15.	3.5	.00	20/	13.	2.5		100	1500	100	1	1.8	1/22	833	-8/	198	32	100	257		1529	100	100
trichum flexicaule		-	16			- 6	16			-	16			-	3		•	- 1	16					1 2		16				18	2.	- 50		16			-
ymnocolea inflata	82	- 83	892	35	100	860	- 20	3%	10.5	163	-52	3%	352	150	:30	3%	100	160	89	3%	100	. 0.1	33.	- 80	150	88	3%	100	860	89	3%	100	150	- 20	0.1	200	. 1
ymnomitrion corallioides	100	90	18	36	- 5%	90	18	36	***	20	18	38	200	89	18	39	98	923	1.8	36	200	20 32	36	100	93	18	139		- 89	18	35	100	20	18	0.01	0.01	0.01
locomnium splendens			2.5	- 0.0			2.0					0.	100		0.5	2	2	1	S	0.	0.01 0	.01	100	40	40	30	30	10	20	10	10	10	10	2.0	- 0	0.1	0.1
aeria cf. blyttii		- 2	- 2	126		0.01	×	126		- 2		2.	2.0	- 2	× 1	K.		- 2					l Pa	- 2		- 32	2.0			- 2	180			- 50	26		
phozia ventricosa s.l.			5×	30	100		5×		- 6		5.X		101		×		-0.		5×		0.1	0.1	0.1	- 0	0.01	0.1	30	0.1	0.1	0.1			0.1	- 1			0.1
dia anomala	200	12	1%	18%	95	0.01	1	188	95	72	1%	5%	95	28		88	200		172	188	200	7 7	15%	200	72	39	5%	25	12	176	15%	200	120	100	15%	20	72
ncophorus wahlenbergii	900		70	100	900	-		66			770	60	960	60	2754	60	960	6		0.5	900	. 0.01	66	900	0.1	7/3/					100	200		75	100	100	60
rthocaulis binsteadii		- 20/	1.6	100		- 20	1.5	100		301		1946		201	3	5.5	.00	-201				120	0.1	1.00		1.6	100		0.1	0.1	100	0.1	0.1	136.	2.0		250
	- 5	-	10	10.		- 6	16	10.	-	-	- 10		-	-	•	2.	-	-	0.1		0.1	. 0.1	0.1	- 50		- 15	10.	-	· · ·	0.1	13.	0.1	0.1	- 16	0.1		-
rthocaulis kunzeanus	92	3.0	000		100	- 00	850	S%	10.0	100	050	8.	800	300	5%:	S-	9.2	3.0	0.1	S	0.1	. 0.1	15%	100		100	S.	200		850	85.	952	140	200		- 60	- 10
lagiomnium ellipticum	100	- 90	18	135		- 90	18	139	100	(2)	3.8	159	38	88	18	26	.00	- 20	18	16	Y 10	8 3	36	0.1	0.1	18	100		- 89	18	159	700	(8)	18	3.6	100	- 89
leurozium schreberi	30	30	15	15	15		12	0.5			2.5	0.0	100		0.01	0.5	2		0.01	00	0.1	0.1	0.1			2.5	100			2.5	100	0.1		2.5	100		
ogonatum dentatum	- 20		- 10	126		- 2	- 52	100	-	- 2	- 0		201	- 2	× 1	100			- 1			× ×	186	24		- 52		200		- 52	2.0	-		- 52			0.01
ogonatum urnigerum		100	58	100		- 0	-58	50	- 6		58	Se-		10	×	(e-	•	- 0	58		100	w x	50	- 0	- 0		50		100	- 28	50			- ×	30	0.01	100
ohlia cruoides	200	12	3%	196	26		32	196	200	120	. 16	196	26	20	3% L	56	26	12	37	15%		7	15%	200	220		164	26		56	1.56		120	0.01	196		. 22
ohlia nutans	260	60	732	196	900	0.01	79	164	960	40	0.01	56	960	60	75	164	9001	40	759	56	0.01 0	0.01	166	960	60	0.01	0.01	900	0.1	250	0.1	0.01	50	239	156	0.01	0.01
ohlia sp.																							1							0.01							
olytrichastrum alpinum	100			100		100				100				101	10.						221		118	1 20	0.1				10	10	10			12		- 80	
olytrichastrum longisetum		-			0.1	-			-					-		-	•	-							0								-	-			-
	0.01	- 20		100		- 8	525	25.	38	20	1.8	22.	28	- 20	5.25	22.	:00	- 20	525	20.	188		2	- 38	- 20	5.8	225	500	- 8	525	255	100	20	528	25.	100	9
olytrichum commune	0.01		0.01	- 00	0.5		1.5			- 1	2.5		100		2.5		100		- 1		S	. 2	2	100	-	- 15	0.0	- 1		2.5	100	S	-	2.5	0.0	100	- 5
olytrichum hyperboreum	- 01		- 5%	20	-	- 0	- 34	100	100		×	20	201	- 2	2	26	- 60	140	- 50		400	× ×	186	- 20	- 40	- 52	20	-		- 52	20	- 20	100	S	3	1	2
olytrichum jensenii			- 1.4	30-			0.1				1.8				×	Se-					400		39		10		50.				39			S	2		
olytrichum piliferum	200	40	500	15%		- 20	376	198		. 7		56	200	20	16	. Sa			· 100	183		F	186.	100	- 6	100	186			100	186	. 200	100	100	198	0.01	40
olytrichum strictum	299	50	792	56	0.1	50	792	199	0.01	0.01	0.01	56	200	50	0.1	0.1	0.1	0.1	0.1	10	0.1	1 15	10	1	1	1	10	30	10	1	10	S	10	1	156	299	- 60
tilidium ciliare		0.01						0.01							1	S	3	2	S	S	2 1	0.1 S	S	0.1	0.1	0.1	0.1	0.1	S	S	S	3	S	S	3	0.1	2
tilidium crista-cristensis	- 37		12	186		1.0	100	0.01	- 50	- 5	12	186	8.7	200	0.01	18.			12	18.			188.	- 50	100	- 1	188			12	188	- 60	- 1	100	18.		- 5
acomitrium lanuginosum	-	50	14	2.5		- 2	19	186		- 20	10	35	700	50		2.5		0.01	1.0	1	1 1	0.1 0.1	0.1	100	500	0.1	2.5		0.1	1	1	0.1	1	10	10	2	5
anionia uncinata	300			1166		- 60				- 60			500	80	0.00	166	1	10000	1	0.01	0.1	. 0.1	5011	0.1	0.1	Refere		0.01	0.1	-55	1225	3533		18,87.5	23.50	10.70	100
	100		- 1	100	- 1	-	- 15	- 25	-	-	2.5	30	100	- 1	0.1	93	0.1	-		0.01	0.1	. 0.1		0.1	0.1	- 15	100	0.01	0.1	- 1	100	-		2.5	00		
phagnum balticum	- 22	- 90	- 23	180	- 60	90	- 22	180	100	90	×		100	90	0.1	Re-	0.1	- 90	2.00	Re-	V20	90 EX	180	200	- 90	- 33	( ·	100	- 90	- EX	Ke.	100	(80)	- X	Ke.	- 60	190
phagnum compactum												30											1														
phagnum fuscum	200	40	500	94	200	0.01	75	94	200	40	500	94	200	40		94	. 20	40	500	94	200	W W	94	200	420	576	94	200	40	574	94	200	(45)	574	96	200	(45)
phagnum girgensohnii	200	- 87	78	56	398	- 80	78	25	200	80	190	56	200	88	S	59	991	8	79	59	2(6)	87 78	159	293	8	78	56	393	- 87	78	25	200	80	78:	56	39	- 87
phagnum lenense			1.5				1.5				10						0.1						0.1			1.5				1.5				1.0			
phagnum lindbergii													80										11.														
hagnum majus		50	1-X	86	100	50	100	36	100	321	tion 1	30	20	100	ix I	35	2	90	t is	3.9	100	20 14	185	100	321	tik.	35	100	501	18	35	100	30	18x	36	100	501
hagnum rubellum																	1		0.5																		
hagnum squarrosum		- 10	100		1 80		100	100	837			100	- 22				0.1				100	10	193		128			833		100	100	- 60	151		100	- 83	19
	_		::X	150	***	90	: ×	188	100		:X	3.9*	*20	385		33.	V.1		0.5	330	***	** X	1,530	170		5.8	1,53*			:X	184	100	100	::X:	5.0	100	183
hagnum teres								13.5						150			•		0.4				150	1	- 50		150	- 1	- 5		39	-			3.		
hagnum warnstorfii	120	40	5.0	94	200	40	5/4	194	200	(20)	270	MG .	200	400	2	May -	0.38		18	FG		(A) 18.	186	- 100	40	5.0	84.0		- 4	1800	86.0	1000	(0)	10	86.		420
phenolobus minutus	100	8	79:	150	399	8	79	199	200	9	79	56	399	9	19	0.01	0.1	0.1	0.01	56	1	1 0.5	0.1	39	- 87	79	0.01	0.01	0.1	0.01	0.01		87	2	0.1	0.01	8
olacnum sphaericum			115				5.5				100				10.				1.5			2 12				100				1.5		0.1		115			
ereodon holmenii			12.	186	- 50		- 12	136	100		32	186	- 60	20	1	155	- 200		0.01	188	-		188	- 80		12	0.01	- 50		- 12	135	- 50	- 1	- 100	35.	- 50	- 8
ereodon subimponens	0.0	520.	1.0	86	100	500	1.4	3.5	*100	9	13	34	100	30	i k	3.6	200	30	1.0	3.9	V. 1	20 LX	3.9	100	0.01	19	3.5	100	500	1.4	3.5	100	90	19	3.6	100	500
traminergon stramineum	100	- 60	330	100	80	-	330	186	800	60	200	100	8001	-	0.01	100	8001	- 60	330	1623	800		100	100	0.02075	XO.	1000	800	-	330	100	300	- 60	XO	100		
				100			-	195	-			00.	-			0.0	-			100				-			100	-		-	100				0.01		
		1963	2.8	100	100	1967	2.36		4.00	193	230	1049	V 2		2 X	100	• 22		276	100	990		10	- 20	1963	2.00	156					1 200	0.00	- 22	0.01	- 6	- 6
etralophozia setiformis omentypnum nitens	- 6							1,555					-	140			0.01		0.5	100	_			1	10	1	1				1755	-				0.	

## Plot-count data for tree cover, density, and basal area (at Nadym only)

Table 20. Raw plot-count data from the Nadym-1 relevés. All trees in each  $10 \times 10$ -m plot were recorded, including diameter at breast height (dbh), basal area of the stem at breast height, height of the tree, and above-ground mass of the tree. Mass was determined using the equations presented in the methods (from Zianis et al. 2005). The location of the tree is given by the x and y coordinates measured in meters from the southwest corner of the plot.

n		dbh (cm)	dbh (mm)	basal area (cm^2)	ht (m)	x.coor	y.coor	mass (kg)	mass (g)		dbh (cm)	dbh (mm)	basal area (cm^2)	ht (m)	x.coor	y.coor i	mass (kg)	mass (g)
ND_RV_										ND_RV_03								
	Bet.pub Bet.pub	1 6				5.7 5.3	2.2	0.1 8.1		1 Bet.pub 2 Bet.pub	0.3		0.1	1.5 1.8	0.2	0.2 1.2	0.0	4.5 1.6
	Bet.pub	9				8.2	4.2			3 Bet.pub	1			2.3	0.3	2.3	0.1	91.8
17	Lar.sib	1				4.8	1.5			6 Bet.pub	0.2			1	1	2	0.0	1.6
21	Lar.sib	4	40	12.6	6	5.8	0.7	4.9	4929.7	4 Lar.sib	5	50	19.6	4.5	0.3	2.7	5.3	5279.9
	Pin.syl	16				0.9	8.3			8 Lar.sib	5		19.6	6	2.9	6.7	6.9	6935.7
	Pin.syl	16 3.5		201.1 9.6	9	0.5 2.8	9.8 1.3			13 Lar.sib 5 Pin.syl	7		38.5 227.0	6.5	5.8	9.2 9.7	12.5 91.4	12520.7 91437.0
	Pin.syl Pin.syl	3.0	30	7.1	4	1.8	3.3			7 Pin.syl	6		28.3	9 7	0.1	6.5	11.0	11027.0
	Pin.syl	14		153.9	9	1.8	3.8			9 Pin.syl	11		95.0	9	4	9.7	32.4	32397.0
	Pin.syl	12		113.1	8	1.2	1.2			10 Pin.syl	8		50.3	6	4.5	6.7	16.5	16539.0
	Pin.syl	3		7.1	2	1.8	4.5			11 Pin.syl	9		63.6	6.5	4.5 6	0.1	20.8	20813.0
	Pin.syl Pin.syl	12	70 120	38.5 113.1	8	1.2 1.8	5.6 6.3			12 Pin.syl 14 Pin.syl	2		12.6	2.3 1.7	6.2	2.4 5.8	3.1 0.9	3147.0 851.5
		3.5		9.6			7.5				12		113.1	7	6.7	0.2	39.7	
	Pin.syl Pin.syl	12				1.8 2.8	4.8			15 Pin.syl 16 Pin.syl	8		50.3	7	7.4	7.4	16.5	39707.0 16539.0
	Pin.syl	6.5				2.5	2.8			17 Pin.syl	16		201.1	9	8.5	2.5	79.1	79067.0
13	Pin.syl	0.5	5	0.2	1.5	2.8	1.8	0.3	319.5	18 Pin.syl	9	90	63.6	7	8	0.8	20.8	20813.0
	Pin.syl	6		28.3		3.6	7.7	11.0		19 Pin.syl	8		50.3	6	9.8	1.6	16.5	16539.0
	Pin.syl	14		153.9 132.7	9	3.2 4.5	8.5 5.8			20 Pin.syl	13	130	132.7	8.5	9.3	6.3	48.0	48029.0
	Pin.syl Pin.syl	11		95.0		4.5	0.8			ND_RV_04								
	Pin.syl	4		12.6		5.5	1	32.4		8 Bet.pub	1	10	0.8	2.5	4.1	2.3	0.1	91.8
	Pin.syl	5	50	19.6	7.5	5.2	0.7	9.8	9789.0	21 Bet.pub	11		95.0	8	9.7	1	36.9	36868.5
22	Pin.syl	7	70	38.5		5.7	0.6			5 Lar.sib	6		28.3	4.5	3.5	3.5	7.0	6978.7
25	Pin.syl	20	200	314.2	11	7.2	2.8	134.6	134619.0	14 Lar.sib	1.5		1.8	2.2	8.5	1.6	0.4	424.6
										1 Pin.syl	11		95.0	8	0.2	4.2	32.4	
ND_RV_										2 Pin.syl	5		19.6	2.2	1.2	6.7	6.1	6050.0
	Bet.pub Bet.pub	0.6		28.3 0.3		4.6 7.2	9.2	8.1 0.0		3 Pin.syl 4 Pin.syl	21		346.4 3.1	9.5 2.5	1.5 2.5	6.2 8.7	151.0 0.9	151037.0 851.5
	Bet.pub	1				7.5	6.5			6 Pin.syl	2		3.1	3	3.6	3.4	0.9	851.5
	Bet.pub	7.5		44.2		7.6	5.8		14150.2	7 Pin.syl	15		176.7	8.5	4.5	0.4	67.7	67709.0
37	Lar.sib	20		314.2		7.5	3.6	111.6		9 Pin.syl	4		12.6	4	4.5	2.5	3.1	3147.0
46	Lar.sib	21		346.4		9	8.2		129736.5	10 Pin.syl	0.5		0.2	1.2	4.6	2.4	0.3	319.5
	Pin.sib Pin.svl	4		12.6 7.1	5 3.5	8.2 0.2	7.6	3.1 1.6		11 Pin.syl 12 Pin.syl	5 15		19.6 176.7	4.5 9	4.5 6.5	3.1 5.7	6.1 67.7	6050.0 67709.0
	Pin.svl	0.5				0.4	3.4			13 Pin.svl	1.5			2.2		6.8	0.6	614.1
	Pin.syl	16				1.7	3.2			15 Pin.syl	7	70		6	8.5	2.6	13.3	13277.0
- 4	Pin.syl	10	100	78.5	8.5	1.2	3	26.1	26099.0	16 Pin.syl	0.5	5	0.2	1	8	8.8	0.3	319.5
	Pin.syl	3		7.1	1.5	1.2	1.8			17 Pin.syl	4		12.6	4.5	9.7	8.6	3.1	3147.0
	Pin.syl	2.5		4.9	3.5 2.2	2.3 2.5	0.5			18 Pin.syl	0.4		0.1	9	9	3.5	0.3	299.2
	Pin.syl Pin.syl	5		19.6		3.3	0.5			19 Pin.syl 20 Pin.syl	16		201.1 50.3	6.5	9.5	3.1 1.5	79.1 16.5	79067.0 16539.0
	Pin.syl	10		78.5		2.5	8.8			20 1 111.591			00.0	0.0	0.0	1.0	10.0	10000.0
	Pin.syl	0.7	7	0.4	2	2.5	9.2	0.4	364.1	ND_RV_05								
11	Pin.syl	4.5	45	15.9	6.5	2.2	10	4.4	4363.4	1 Bet.pub	0.7	7	0.4	2.5	0.4	0.5	0.0	37.6
	Pin.syl	2				3.6	9.5			5 Bet.pub	1			3	0.7	9.7	0.1	91.8
	Pin.syl	0.5				3.7	9.2			8 Bet.pub	11			7	1.8	4	36.9	36868.5
	Pin.syl Pin.syl	0.4		0.1 7.1	4.5	3.3 4.3	8.3 9.5	0.3 1.6		24 Bet.pub 25 Bet.pub	0.8 7.5		0.5 44.2	7.5	9.7	4.7 4.2	0.1 14.2	52.5 14150.2
	Pin.syl	2				4.7	9.6			4 Lar.sib	7.5		38.5	7.5	0.7	9.2	11.6	11605.6
	Pin.syl	0.5				4.3	9.7	0.3	319.5	11 Lar.sib	2		3.1	2.5	3.5	3.5	0.7	744.3
	Pin.syl	0.6		0.3		5.5	9.8	0.3		13 Lar.sib	12		113.1	8	4	7	34.8	34776.3
	Pin.syl Pin.syl	7	70 60	38.5 28.3		5.5 5.7	9.5 9.2			6 Pin.sib 9 Pin.sib	0.7		0.4 50.3	2.5 6	0.7 1.5	10 3.5	0.4 9.6	364.1 9563.7
	Pin.syi	2		28.3		5.5	9.2	0.9		9 Pin.sib 26 Pin.sib	0.7		0.4	1	9.5	3.5	9.6	9003.7 364.1
23	Pin.syl	2	20	3.1	3	6.3	0	0.9	851.5	2 Pin.syl	2.5	25	4.9	3.2	0.8	1.8	1.2	1180.6
24	Pin.syl	10		78.5		6.2	2.5			3 Pin.syl	6	60	28.3	7	1	7.8	11.0	
	Pin.syl	3.5		9.6		6.5	3.5			7 Pin.syl	4.8		18.1	6	2	5	5.3	5308.7
25	Pin.syl Pin.syl	4	40 70	12.6 38.5		6.7 6.9	4.5		3147.0 13277.0	10 Pin.syl 12 Pin.syl	18 15		254.5 176.7	8.5 8.5	3.8	3.4 6	104.8 67.7	104819.0 67709.0
	Pin.syl	1				6.9	4.7	0.4		14 Pin.syl	14		153.9	8	5.0	0.2	57.4	57363.0
	Pin.syl	3.5				6.2	5.5			15 Pin.syl	14		153.9	8	6	6.9	57.4	57363.0
	Pin.syl	3		7.1		7.5	9.5			16 Pin.syl	2		3.1	3	7.5	6.2	0.9	851.5
	Pin.syl	1 0.5	10			7.6 7.6	9.2			17 Pin.syl	7		38.5	6.5	8.7 8.5	5.3 5.5	13.3	13277.0 3147.0
	Pin.syl Pin.syl	0.5 3.5				7.6	4.2			18 Pin.syl 19 Pin.syl	0.4		12.6 0.1	1.5		5.5 6.5	0.3	299.2
	Pin.syl	3.5		7.1		7.4	2.7			20 Pin.syl	0.4		0.1	1.2		7	0.3	299.2
39	Pin.syl	8	80	50.3	7	8	1.5	16.5	16539.0	21 Pin.syl	3.5	35	9.6	6.5	8.7	7.2	2.3	2269.7
	Pin.syl	2		3.1		7.5	1.2			22 Pin.syl	6.5		33.2	7.5	9.1	8.1	12.0	12025.5
	Pin.syl	1.5	15 70	1.8		4.8 9	0.8			23 Pin.syl	7		38.5 0.1	7.5	9.2	5.8	13.3 0.3	13277.0 280.3
42	Pin.syl Pin.syl	3		38.5 7.1	6.5	8.2	1.6			27 Pin.syl	0.3	3	0.1	0.8	9.5	1.8	0.3	280.3
46	Pin.syl	7				8.2	9.7	13.3										
47	Pin.syl	2	20	3.1	3	10	9.7	0.9	851.5									
	Pin.syl	5		19.6		9.2	9.5											
	Pin.syl Pin.syl	2 45		3.1 15.9		10 9.2	9.4											
				10.9	3.5	9.2		4.4	9005.4									

Table 21. Summary of tree data from the plot-count method (biomass, basal area, density, and tree height) at Nadym-1.

Transect	s (g/m2)	2	3	4	5	Average	s.d.	s.e
Species	- 1		- 3			Average	s.u.	3.E
Bettor	305.14	222.67	1.00	369.60	512.01	282.28	100.20	04.70
	51.38	223.67 2413.41	1.00 247.36					84.70
Larsib <b>Pinsib</b>				74.03	471.26			446.86
Pinsyl	0.00	31.47	0.00	0.00	102.92			19.96
Total	6777.01	3144.35	3969.06	4493.84	3504.97	4377.85		
I Otal	7133.54	5812.90	4217.42	4937.48	4591.16	5338.50	1164.41	520.74
Biomas	s (g/tree	)						
Transect	1	2	3	4	5	Average	s.d.	s.e
Species		_					1	
Bettor	10171.29	5591.75	24.90	18480.14	10240.14	8901.64	6798.96	3040.59
Larsib	2569.14	120670.46	8245.46	3701.62	15708.72			22740.42
Pinsib	0.00	3147.04	0.00	0.00	3430.60			1275.73
Pinsyl	32271.50	7146.25	30531.20	26434.38	21906.06			
Total	45011.93	136555.50	38801.56	48616.14	51285.51			
Total	43011.93	130333.50	30001.30	400 10.14	3 1263.3 1	04034.13	407 90.04	10243.71
Basal a	rea (m²/ŀ	na)						
Transect	1	2	3	4	5	Average	s.d.	s.e
Species								
Bettor	0.93	0.74	0.01	0.96	1.41	0.81	0.51	0.23
Larsib	0.13	6.61	0.78	0.30	1.55		2.70	1.21
Pinsib	0.00	0.13	0.00	0.00	0.51	0.13	0.22	0.10
Pinsyl	17.95	9.09	10.91	0.83	9.26	9.61	6.10	2.73
Total	19.01	16.56	11.70	2.08	12.73	12.42	6.48	2.90
Height	(m)							
Transect	1	2	3	4	5	Average	s.d.	s.e
Species	<u> </u>	_	-			A. C. ugo	J	5.0
Bettor	6.00	5.13	1.65	5.25	4.40	4.49	1.68	0.75
Larsib	4.00	12.50	5.67	3.35	5.50			
Pinsib	1.55	5.00	0.07	0.00	3.17	4.08		
Pinsyl	6.95	4.71	6.62	4.86	5.54			0.45
Average	5.65	6.83	4.64	4.49	4.65			0.45
	(trees/h				-	A		
Transect	1	2	3	4	5	Average	s.d.	s.e
Species	00000	/22.2-	400.00	000.00	F22.55		,,,,,	
Bet.pub	300.00	400.00	400.00	200.00	500.00			50.99
Lar.sib	200.00	200.00	300.00	200.00	0.00			
Pin.sib	0.00	100.00	0.00	0.00	0.00			
Pin.syl	2100.00	4400.00	1300.00	1700.00	0.00			
Total	2600.00	5100.00	2000.00	2100.00	500.00	2460.00	1671.23	747.40

Table 22. Summary of number of trees and seedlings from each relevé at Nadym-1.

SPECIES	Bet.pub	Lar.sib	Pin.sib	Pin.syl
Releve 1				
Number				
Individuals	3	2		21
Mean dbh				
(cm)	5.3	2.5		9.0
Mean height				
(m)	6.0	4.0		7.0
Number	1			_
Seedlings	ļ			5
Releve 2				
Number				
Individuals	4	2	1	44
Mean dbh				
(cm)	3.8	20.5	4.0	3.9
Mean height				
(m)	5.1	12.5	5.0	4.7
Number				_
Seedlings	2			2
Releve 3				
Number				
Individuals	4	3		13
Mean dbh				
(cm)	0.4	5.7		9.5
Mean height				
(m)	1.7	5.7		6.6
Number				
Seedlings	1			14
Releve 4				
Number				
Individuals	2	2		17
Mean dbh				
(cm)	6.0	3.8		6.9
Mean height		<b>.</b> .		
(m)	5.3	3.4		4.9
Number Seedlings				10
Seedings				10
Releve 5				
Number				
Individuals	5	3	3	16
Mean dbh				
(cm)	4.2	7.0	3.1	6.6
Mean height	4.4		0.0	
(m) Number	4.4	5.5	3.2	5.5
			1	1
Seedlings			1	4

Table 23. Comparison of tree biomass as determined by the plot-count method and the point-centered quarter method.

10 x 10-m plot count method, b	oiomass (	g/m²)						
Relevé	1	2	3	4	5	Average	s.d.	s.e.
Species								
Betula pubescens ssp. tortuosa	305.14	223.67	1.00	369.60	512.01	282.28	189.39	84.70
Larix sibirica	51.38	2413.41	247.36	74.03	471.26	651.49	999.22	446.86
Pinus cembra ssp. sibirica	0.00	31.47	0.00	0.00	102.92	26.88	44.64	19.96
Pinus sylvestris	6777.01	3144.35	3969.06	4493.84	3504.97	4377.85	1433.53	641.09
Total	7133.54	5812.90	4217.42	4937.48	4591.16	5338.50	1164.41	520.74
Point-centered quadrat method	d, biomas	s (g/m²)						
Transect	1	2	3	4	5	Average	s.d.	s.e.
Species								
Betula pubescens ssp. tortuosa	171.98	355.90	642.31	642.08	736.92	509.84	236.88	105.94
Larix sibirica	3.59	104.58	167.30	0.00	6.75	56.45	75.92	33.95
Pinus cembra ssp. sibirica	0.00	195.09	22.06	0.00	221.98	87.83	110.97	49.63
Pinus sylvestris	1859.33	2113.41	2733.25	5430.03	5199.63	3467.13	1718.33	768.46
Total	2034.90	2768.99	3564.92	6072.11	6165.28	4121.24	1902.29	850.73

#### Plant biomass

Table 24. Summary of above-ground plant biomass for the vegetation study plots (relevés). Tree biomass for each plot was determined from the plot-count method. See Appendix D for biomass sampling and sorting methods for the non-tree species. For the trees, biomass was determined from the plot-count method and expressed in g  $m^2$ .

R Comment	D	eciduous	Shrubs		E	vergreen	Shrub	5	Gram	inoid									8	Trees	3
Site& sample number	Stem	Live foliar	Att. dead foliar	Repro- ductiv e	Stem	Live foliar	Att. dead foliar	Repro- ductiv e	Live foliar	Att. dead foliar	Forb	Live lichen	Live bryophyte	Total excluding dead moss & lichen & litter	Dead moss	Dead lichen	Litter	Total including dead moss & lichen & litter, excluding trees	Broadleaf deciduous trees	Needleleaf deciduous trees	Ever- green trees
Nadym-1*																					
ND_RV_01_BM_01	46.88	11.08	0.00	1.48	76.88	49.28	1.68	1.16	0.10	2.18	0.00	0.00	161.32	352.00	1123.00	22.08	333.02	1830.09	305.14	51.38	6777.01
ND_RV_02_BM_01	141.83	22.36	0.50	1.40	98.63	70.78	2.96	0.10	0.00	0.00	0.20	150.73	251.83	741.29	773.00	75.58	413.53	2003.39	223.67	2413.41	3175.82
ND_RV_03_BM_01 ND_RV_04_BM_01	9.46	14.36	0.00	0.50	16.66 7.36	20.86	1.90	0.00	0.00	0.00	0.00	1720.20	2.56 0.50	1859.66 1477.83	1.86	341.83 559.92		2866.17 2641.18	1.00	247.36 74.03	3969.06 4493.84
ND RV 05 BM 01	46.08	4.06	0.00	0.10	109.03	68.06	7.46	0.10	0.00	0.00	0.00	702.60	34.38	971.85	21.88		844.30	2307.25	512.01	471.26	3607.89
Average	65.37	11.04	0.12	0.74	61.71	42.75	3.14	0.27	0.02	0.44	0.04	804.79	90.12	1080.53	383.95	293.72	571.42	2329.62	282.28	651.49	4404.72
s.d. s.e.	49.96 22.34	7.86	0.22	0.66	46.94	29.12 13.02	1.11	0.50	0.04	0.97	0.09	764.97 342.11	111.83 50.01	596.35 266.70	529.64 236.86	237.36 106.15	203.48 91.00	430.52 192.54	189.39 84.70	999.22 446.86	1411.62 631.29
Nadym-2	22.54	3.51	0.10	0.20	20.55	15.02	1,11	0.22	0.02	0.44	0.04	342.11	30.01	200.70	230.00	100.15	31.00	152.54	04.70	440.00	031.23
Hummocks																					
ND_RV_06 ND_RV_07	0.00	1.08	0.00	0.00		196.63 67.28	3.46	0.86	0.00	11.58	18.46	342.58 2.78	16.78	1274.52 1114.21	97.13 883.00	142.38	681.98 5.78	2195.99 1826.38			
ND RV 08	74.36	30.76	0.00	0.76		182.06	11.16	4.36	8.58	56.43	9.56	340.03	20.96	1158.72	36.46	169.73	264.66	1629.56			
Average	29.14	10.61	0.00	0.25		148.65	4.91	1.77	3.72	23.12	18.83	228.46	383.41	1182.48	338.86	104.03	317.47	1883.98			
s.d.	39.70	17.46	0.00	0.44	286.15		5.67	2.27	4.40	29.29	9.46	195.45	631.41	82.75	472.21	91.13	341.18	287.58			
s.e.	22.92	10.08	0.00	0.25	165.21	40.91	3.27	1.31	2.54	16.91	5.46	112.84	364.55	47.78	272.63	52.61	196.98	166.03			
Inter-hummocks ND RV 09	0.18	0.18	0.00	0.00	3.46	2.76	0.00	0.00	0.00	0.00	2.78	1007.90	1.26	1018.50	0.00	877.03	50.96	1946.48			
ND_RV_10	22.06	1.36	0.00	0.00	11.66	0.56	0.00	0.00	2.66	7.46	4.06	1029.80	0.00	1079.61	0.00	594.42	47.26	1721.28			
ND_RV_11	8.56	0.96	0.00	0.00	422.82	96.38	2.26	2.16	39.28	132.03	1.36	753.60	1.56	1460.94	3.66	0.00	548.33	2012.93			
Average s.d.	10.26	0.83	0.00	0.00	145.98 239.78	33.23 54.70	1.30	1.25	13.98	74.17	1.35	930.43 153.53	0.94	1186.35 239.76	1.22 2.11		215.51 288.23	1893.56 152.85			
s.e.	6.37	0.35	0.00	0.00	138.44	31.58	0.75	0.72	12.67	42.82	0.78	88.64	0.48	138.42	1.22	258.45		88.25			
Laborovaya-1 LA_RV_15	259.43	42.66	0.00	2.00	44.40	25 40	3.36	0.00	36.48	83.46	3.76	59.68	271.32	832.42	612.52	0.00	182.53	1627.46			
LA_RV_16	248.43	52.78	0.00	0.00	44.18 37.96	25.16 44.36	6.16	0.00	35.48	47.68	1.36	102.78	395.02	971.98	312.53	0.00	336.53	1621.03			
LA_RV_17	302.98	27.28	0.00	5.08	10.58	20.68	4.68	0.38	42.68	119.96	6.36	42.36	202.66	785.63	1059.80	10 P. O. S. S. K.	169.68	2015.11			
LA_RV_18	299.42	86.08	0.00	1.46	17.26	24.96	0.00	0.00	15.28	82.88	4.56	31.48	264.82	828.17	595.50	0.00	72.78	1496.44			
LA_RV_19	77.93 237.63	24.16 46.59	0.00	1.90	19.98	33.06 29.64	3.66	0.00	6.86 27.35	71.49	3.30	92.38	375.13 301.79	657.07 815.05	683.52 652.77	0.00	103.58	1640.84			
Average s.d.	92.45	24.95	0.00	2.16	14.35	9.36	2.28	0.17	15.41	37.07	2.39	30.98	80.92	112.83	268.00	0.00	102.11	223.71			
s.e.	41.34	11.16	0.00	0.96	6.42	4.19	1.02	0.08	6.89	16.58	1.07	13.85	36.19	50.46	119.85	0.00	45.67	100.05			
Laborovaya-2 LA_RV_20	123.73	12.96	0.00	0.00	21.06	29.36	0.00	0.00	13.36	62.38	0.00	285.43	110.36	658.62	315.93	0.00	595.53	1570.07			
LA_RV_21	285.33	112.98	0.00	3.06	9.26	16.76	0.00	0.00	8.78	18.88	0.00	201.13	77.78	733.93	280.53	0.00	532.03	1546.48			
LA_RV_22	13.76	2.86	0.00	0.00	10.86	18.56	0.86	0.00	2.66	17.56	0.00	232.58	8.56	308.24	28.66	0.00	502.33	839.23			
LA_RV_23 LA_RV_24	99.86 81.08	5.56	0.00	0.00	1.40 4.76	4.56 15.56	0.00	0.00	32.48 9.58	82.83 32.78	0.00	342.53 243.68	94.73 119.28	663.93 514.11	506.52 466.83	9.96	301.43	1481.83			
Average	120.75	28.20	0.00	0.61	9.47	16.96	0.32	0.00	13.37	42.88	0.00	261.07	82.14	575.76	319.69	1.99	452.81	1350.25			
s.d.	100.69	47.53	0.00	1.37	7.48	8.83	0.44	0.00	11.35	28.70	0.00	54.63	44.07	169.57	188.94	4.45	128.87	302.75			
s.e. Vaskiny Dachi-1	45.03	21.26	0.00	0.61	3.34	3.95	0.20	0.00	5.08	12.84	0.00	24.43	19.71	75.84	84.50	1.99	57.63	135.39			
VD_RV_25	32.16	42.96	0.00	0.46	2.66	5.46	2.06	0.00	23.78	69.38	2.56	27.18	169.23	377.86	687.80	0.00	167.23	1232.88			
VD_RV_26	32.18	19.56	0.00	0.00	47.48	56.48	21.46	0.56	44.88	71.38	13.88	32.98	286.83	627.63	586.90	0.00	234.63	1449.15			
VD_RV_27 VD_RV_28	171.88 9.86	43.56	0.00	0.00	12.96 7.16	40.36 22.86	0.00	1.26 0.56	23.56 38.28	72.86 64.08	2.06	21.18	150.93 268.33	538.53 449.96	449.62 516.10	0.00	318.02 149.93	1306.16 1115.98			
VD_RV_29	24.66	32.26	0.00	1.16	0.00	0.00	0.00	0.00	9.36	24.78	1.36	53.68	317.33	464.57	834.10	0.00	91.68	1390.34			
Average	54.15 66.44	29.78	0.00	0.59	14.05	25.03	4.70	0.47	27.97	60.49 20.24	3.97	31.98	238.53	491.71	614.90	0.00	192.29	1298.90			
s.d. s.e.	29.71	14.52 6.49	0.00	0.64	19.32 8.64	23.65 10.58	9.41	0.52	13.92 6.23	9.05	5.62 2.51	12.86 5.75	74.00 33.10	95.01 42.49	151.02 67.54	0.00	86.81 38.82	131.15 58.65			
Vaskiny Dachi-2								100000000000000000000000000000000000000			N. 18473.0			1000000000	200000000000000000000000000000000000000						
VD_RV_30	7.26	5.56	0.00	0.00	14.76	28.86	2.06	0.10	17.48	33.48	0.00	72.78	210.73	393.04	514.02	0.00	112.28	1019.33			
VD_RV_31 VD_RV_32	113.73 39.88	36.58 8.06	0.00	0.00	11.46 15.56	32.66 45.56	1.66	0.00	19.18 6.38	29.28	0.00	89.28 53.88	210.33 253.73	544.13 453.10	456.02 602.62	0.00	171.38 146.58	1171.52 1202.29			
VD_RV_33	13.06	5.16	0.00	0.00	18.36	49.56	3.06	1.86	19.36	63.58	0.00	68.38	278.23	520.58	666.70	0.00	90.48	1277.76			
VD_RV_34	120.13 58.81	21.36	0.00	1.06	9.16	31.46	0.00	0.56	15.28	26.78	0.00	59.68 68.80	366.93	652.37	1258.30	0.00	132.48	2043.14			
Average s.d.	54.51	15.34	0.00	0.21	13.86	37.62 9.29	1.62	0.52	15.53 5.38	36.36 15.41	0.00	13.61	263.99 64.46	512.64 98.01	699.53 322.65	0.00	130.64 31.09	1342.81 402.62			
s.e.	24.38	6.08	0.00	0.21	1.61	4.15	0.50	0.35	2.40	6.89	0.00	6.09	28.83	43.83	144.29	0.00	13.91	180.06			
Vaskiny Dachi-3	0.00	0.00	0.00	0.00	15.86	42.56	0.00	0.10	7.88	27.28	0.00	174.33	115.18	383.17	399.53	0.00	238.58	1021.27			
VD_RV_35 VD_RV_36	0.00	0.00	0.00	0.00	7.06	11.06	0.00	0.00	3.36	15.06	0.00	183.43	230.53	450.48	460.43	0.00	104.66	1021.27			
VD_RV_37	3.86	5.16	0.00	0.86	9.26	6.46	0.00	0.66	0.76	2.26	0.00	191.23	43.28	263.77	164.38	0.00	278.08	706.22			
VD_RV_38	0.00	0.00	0.00	0.00	9.06	20.66	1.66	1.86	7.58	25.78	0.00	256.73	116.33	439.63	284.13	0.00	134.98	858.73			
VD_RV_39 Average	0.00	1.03	0.00	0.00	93.03	33.56 22.86	0.00	1.02	0.66 4.05	2.16	0.00	255.93	402.73 181.61	790.51 485.51	165.68	0.00	398.23	1354.41 991.24			
s.d.	1.73	2.31	0.00	0.38	37.14	15.13	0.74	1.09	3.53	12.17	0.00	40.61	140.62	196.21	134.35	0.00	117.71	240.93			
S.O.	0.77	1.03	0.00	0.17	16.61	6.77	0.33	0.49	1.58	5.44	0.00	18.16	62.89	87.75	80.08	0.00	52.64	107.75			

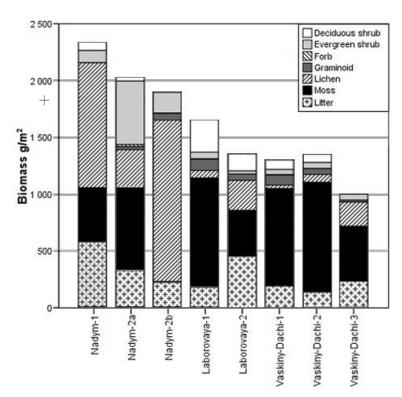


Figure 31. Average total biomass for each of the study sites excluding tree biomass at Nadym-1 and including dead moss and dead lichen components.

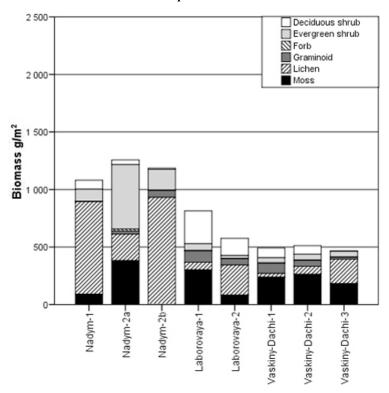


Figure 32. Average live biomass for each of the study sites excluding tree biomass, litter, dead moss, and dead lichen.

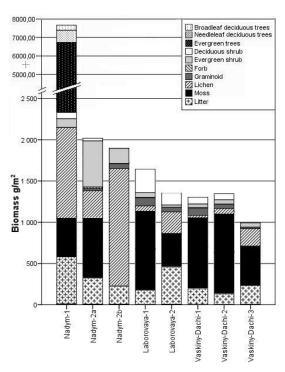


Figure 33. Average total biomass for each of the study sites including tree biomass at Nadym-1.

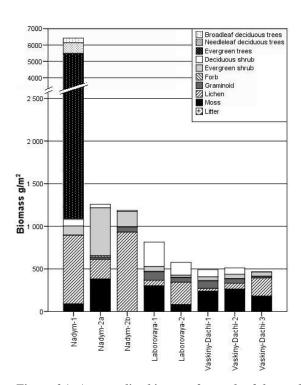


Figure 34. Average live biomass for each of the study sites including tree biomass at Nadym-1.

## Soil Descriptions of Study Sites: G. Matyshak

## Nadym - 1

Location:

GPS position: 65°18'48.2"N, 72 °53'16.6"E

Elevation: 49 m

Parent material: alluvial-lacustrine sediments

Classification: Typic Haplocryods, (Podzols in Russia)

(a)



(b)



Figure 35. (a) Soil pit at Nadym – 1 (pit N21), higher microsite. (b) Close up of pit wall.

0-2cm; Oi; fibric material, loose, (slightly decomposed lichen and moss, a few slightly decomposed twigs, needles and leaves).

2-6 cm; Oa; dark reddish brown (2.5YR2.5/4) sapric material (lichen), (H8, F0, R1,V3), very friable, 20% fine coal in horizon; moderately few medium roots; abrupt wavy boundary.

6-14 cm; E; gray (10YR6/1) sandy with slightly and moderately decomposed organics (10YR3/2); structureless; loose, non-sticky, non-plastic, common medium roots; abrupt irregular boundary.

14-20 cm; EB; yellowish brown (5YR5/6) sandy loam; moderate fine angular structure; friable, non-sticky, non-plastic, clear wavy boundary, common medium roots.

20-44 cm; Bw; grayish brown (10YR3/2) sandy clay loam with moderately decomposed organics (10YR2/2); weak medium subangular blocky structure; firm, non-sticky, slightly plastic; many medium roots, abrupt wavy boundary.

- 44-75 cm; BC; yellowish gray (7.5YR8/3) loamy sand; structureless; very friable, non-sticky, non-plastic, common dark brown (7.5YR3/2) streaks of 5-10 mm thickness of Fe-Mn concentrations; 5% medium pebbles in horizon; very few fine roots; gradual wavy boundary.
- 75-140 cm; C; gray (10YR7/1) sandy; structureless; loose, non-sticky, non-plastic, many dark brown (7.5YR3/2) streaks of 5-10 mm thickness of Fe-Mn concentrations; water below 140 cm.



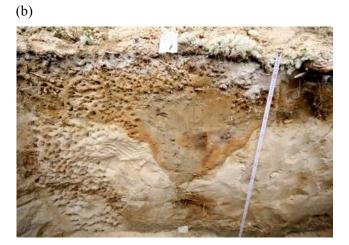


Figure 36. (a) Soil pit at Nadym – 1 (pit N2), lower microsite. (b) Close up of pit wall.

- 0-2 cm; Oi; 10YR5/2; fibric material, loose (slightly decomposed lichen and moss, a few slightly decomposed twigs, needles and leaves).
- 2-11 cm; Oe; dark brown (7.5YR3/2) hemic material (lichen and moss), (H6, F3, R1, V2), very friable, moderately decomposed lichen, twigs and leaves, few coarse roots; abrupt wavy boundary.
- 11-12 cm; Oa; black (10YR2/1) sapric material (H8, F1, R2, V0), loose; 40% fine coal in horizon; common medium roots; abrupt wavy boundary.
- 12-64 cm; E; light gray (10YR7/1) sandy, structureless; loose, non-sticky, non-plastic, very few coarse roots; 3% medium pebbles in horizon; clear irregular boundary.
- 64-90 cm; Btjj; yellowish-brown (5YR5/6) loamy sand; non-sticky, non-plastic, weak medium subangular structure; very friable, 10% medium pebbles; common dark brown (7.5YR3/2) streaks of 5-10mm. thickness of Fe-Mn concentrations; few medium roots; clear irregular boundary.
- 90-140 cm; BC; gray (10YR7/1) sandy; structureless; friable, non-sticky, non-plastic, many yellowish-brown (10YR4/6) streaks of 5-10mm. thickness of Fe-Mn concentrations; water below 140cm; very few fine roots.

## Nadym - 2

Location: CALM Grid

GPS position: 65 ° 18'51.9"N, 072 ° 51'42.8"E

Elevation: 35 m

Parent material: alluvial-lacustrine sediments

Classification: Typic Histoturbels, (Peat Cryozems in Russia)

(a) (b)





Figure 37. (a) Soil pit at Nadym - 2 (pit No3), higher hummock microsite. (b) Close up of pit wall.

0-2 cm; Oi; fibric material, loose, slightly decomposed lichen, a few slightly decomposed twigs and leafs of shrubs.

2-26 cm; Oi; dark reddish brown (2.5YR2.5/4) fibric material (moss), (H4, F3, R2, V0); friable, common medium roots; abrupt wavy boundary.

26-33 cm; Oa; black (10YR2/1) sapric material (H8, F0, R2, V1); very friable, abrupt irregular boundary.

33-37 cm; Bhjjf; light gray (10YR8/1, 40%) and grayish brown (10YR3/2, 60%) loamy sand; structureless; loose, non-sticky, non-plastic, common vertical frozen cracks with dark brown (7.5YR3/2) of mucky peat of 10 mm to 50 mm; moderately few medium roots (inside of frozen cracks); 5% coarse pebbles in horizon; frozen below 37 cm.

(a)



Figure 38. (a) Soil pit at Nadym – 2 (pit  $N_24$ ), lower inter-hummock microsite.

- 0-5 cm; Oi; fibric material, loose, slightly decomposed lichen, a few slightly decomposed twigs and leaves of shrubs.
- 5-15 cm; Oi; reddish brown (5YR3/4), fibric material (moss), (H3, F3, R2, V1); very friable, common medium roots; abrupt wavy boundary.
- 15-28 cm; Oa; dark brown (7.5YR3/2) sapric material, (H8, F1, R1, V0); friable, moderately few fine roots; abrupt wavy boundary.
- 28-38 cm; Bhjj; yellowish gray (7.5YR8/3) loamy sand; structureless; very friable, non-sticky, non-plastic, few fine roots; abrupt wavy boundary.
- 38-40 cm; Cf; (Gley 2, 7/5BG) silty clay; weak very coarse platy structure; friable, slightly sticky, moderately plastic, water below 40 cm; frozen below 42 cm; many Fe concentrations around root channels, cracks.

#### Laborovaya-1

Location:

GPS position: 67°42'22.8"N, 067°59'57.7"E

Elevation: 84 m

Parent material: Pleistocene saline clays

Classification: Typic Historthels, (Peat Gleyzems in Russia)

(a)







Figure 39. (a) Soil pit at Laborovaya-1 (pit №5). (b) Close up of pit wall.

0-2 cm; Oi; fibric material, loose, slightly decomposed moss.

- 2-7 cm; Oe; brown (7.5YR4/4) hemic material, (H6, F3, R2, V0); very friable, common medium roots, gradual wavy boundary.
- 7-10 cm; Oa; dark brown (7.5YR3/3) sapric material (moss), (H8, F2, R2, V0); very friable, common medium roots, abrupt wavy boundary.
- 10-11 cm; Bw1; dark brown (7.5YR3/2) loam; moderate fine granular structure; friable, moderately sticky, moderately plastic, many fine and medium roots, gradual wavy boundary.
- 11-75 cm; Bw2; grayish brown (10YR5/2, 70%) and (Gley 1, 5/5GY, 20%) and yellowish red (5YR5/8, 10%) clay; weak very coarse platy structure; friable, moderately sticky, moderately plastic; common medium roots (inside of frozen cracks); common vertical and horizontal frozen cracks with dark brown (7.5YR3/2) of mucky peat of 10-100 mm; 10% coarse gravel and medium pebbles in horizon; clear wavy boundary.
- 75-78 cm; Cgf; (Gley 2, 6/10G); Clay with cryoturbated organics (10YR3/2); moderate very coarse platy structure; firm, moderately sticky, very plastic, frozen below 78 cm; 10% coarse gravel and medium pebbles in horizon; 20-30% ice by volume, ice lenses and ice veins of 3-5 mm thickness.

#### Laborovaya-2

Location:

GPS position: 67 ° 41'41.1"N, 068 ° 02'15.3"E

Elevation: 55 m

Parent material: alluvial sands underlain by pleistocene saline clays?

Classification: Typic Haploturbels, (Podburs in Russia)





Figure 40. (a) Soil pit at Laborovaya-2 (pit №6), higher polygon microsite. (b) Close up of pit wall.

- 0-1 cm; Oi; fibric material, loose, slightly decomposed lichen and moss.
- 1-3 cm; Oa; dark brown (7.5YR3/3) sapric material, (H7, F1, R3, V0); friable, abrupt irregular boundary; common fine and medium roots.
- 3-12 cm; Bw; reddish brown (5YR4/4) and dark brown (7.5YR3/3) on top of horizon loamy sand, moderate medium subangular blocky structure; friable, non-sticky, non-plastic, few fine roots; 5% medium pebbles in horizon; gradual irregular boundary.
- 12-60 cm; BC light gray (5YR6/1) reddish brown (5YR4/4) on bottom of horizon loamy sand; weak medium subangular blocky structure; very friable, non-sticky, non-plastic; common 5-20 mm of organic streaks (10YR 4/1), few fine roots; abrupt wavy boundary.
- 60-62 cm; Cf; gray (5YR5/1) sand; structureless; loose, non-sticky, non-plastic; water below 62 cm; frozen below 100 cm.



Figure 41. (a) Close up of soil pit wall at Laborovaya-2b (pit №7).

- 0-1 cm; Oi; fibric material, loose, slightly decomposed lichen and moss.
- 1-7 cm; Oa; dark brown (7.5YR3/3) sapric material, (H7, F2, R2, V1); very friable, clear wavy boundary; common fine and medium roots.
- 7-19 cm; Oa; yellowish-brown (10YR4/6) sapric material, (H8, F1, R2, V0); friable, abrupt wavy boundary; common fine and medium roots.
- 19-50 cm; Bhjj; grayish brown (10YR5/2) sandy loam; moderate medium subangular blocky structure; very friable, non-sticky, non-plastic; few vertical frozen cracks with dark brown (7.5YR3/2) of mucky peat of 10-50 mm; many fine and medium roots (inside of frozen cracks); gradual irregular boundary.
- 54-50 cm; BCf; gray (5YR5/1) sand; structureless; loose, non-sticky, non-plastic, water below 50 cm; frozen below 90 cm.

# Vaskiny Dachi-1

Location:

GPS position: 70 ° 16'32.4"N, 068 ° 53'24.8"E

Elevation: 30 m

Parent material: marine sediments

Classification: Typic Histoturbels, (Peat Gleyzems in Russia)

(a) (b)





Figure 42. (a) Soil pit at Vaskiny Dachi-1 (pit №8), higher microsite. (b) Close up of pit wall.

0-1 cm; Oi; fibric material, loose, slightly decomposed moss, twigs and leafs of shrubs and sedge.

- 1-2 cm; Oi; brown (7.5YR4/4) fibric material, (H4, F3, R2, V0); friable, common fine roots; gradual wavy boundary.
- 2-5 cm; Ah; reddish brown (2.5YR4/6) sandy loam; moderate fine subangular blocky structure; friable, slightly sticky, slightly plastic, many fine roots; abrupt wavy boundary.
- 5-28 cm; Bgjj; (Gley 1, 6/10GY) loam; moderate coarse angular structure; firm, slightly sticky, slightly plastic, many Fe concentrations around root channels, cracks and on top of horizon (2.5YR5/8); many 5-10 mm of organic streaks and lenses (10YR 4/1); common medium roots; gradual irregular boundary.
- 28-70 cm; BCjj; grayish brown (10YR5/2) clay loam; moderate coarse platy structure; firm, moderately sticky, moderately plastic, few 10-30 mm of organic streaks (10YR 4/1) (Ab?), with oxidized zone around boundary (5YR6/8); few medium roots;
- 70-72 cm; Cf; gray (5YR5/1) clay loam; massive, frozen; extremely firm; sticky, plastic; 10-20% ice by volume, ice lenses and ice veins of 1-3 mm. thickness.

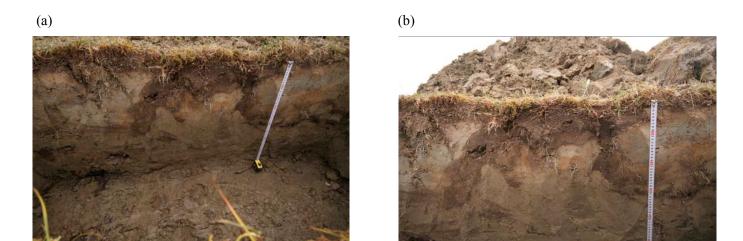


Figure 43. (a) Soil pit at Vaskiny Dachi-1 (pit №9), lower microsite. (b) Close up of pit wall.

- 0-3 cm; Oi; fibric material, loose, slightly decomposed moss and sedge.
- 3-8 cm; Oe; dark reddish brown (2.5YR2.5/4) hemic material, (H5, F2, R2, V0); friable, common fine and medium roots; gradual wavy boundary.
- 8-21 cm; Ah; brown (7.5YR4/3) clay loam; moderate fine subangular blocky structure; firm, non-sticky, slightly plastic; common fine roots; clear irregular boundary.
- 21-34 cm; Bwjj1; grayish brown (10YR5/2) clay loam with oxidized zone around boundary (5YR6/8), moderate medium subangular blocky structure; firm, slightly sticky, slightly plastic, few 5-10 mm of organic streaks (Ab?) and lenses (10YR 4/1); strongly cryoturbated, common medium roots; gradual irregular boundary.
- 34-62 cm; 2Cjjf; gray (7.5YR5/1) silty clay loam; strong coarse platy structure; firm, moderately sticky, moderately plastic, many 5-10 mm of organic streaks and lenses (10YR 4/1); strongly cryoturbated; few fine roots; frozen below 62 cm, 10-20% ice by volume, ice lenses and ice veins of 1-3 mm thickness.

#### Vaskiny Dachi-2

Location:

GPS position: 70 ° 17'43.7"N, 068 ° 53'00.8"E

Elevation: 36 m

Parent material: Aeolian sand over marine clays

Classification: Glacic Haploturbels (Cryozems in Russia)





Figure 44. (a) Soil pit at Vaskiny Dachi-2 (pit No 10), lower microsite. (b) Close up of pit wall.

- 0-2 cm; Oi; fibric material, loose, slightly decomposed moss, twigs and leaves of shrubs and sedge.
- 2-11 cm; Oe; brown (7.5YR4/4) hemic material (moss), (H5, F2, R2, V0); friable, common fine and medium roots; abrupt wavy boundary.
- 11-20 cm; Bwjj; reddish brown (5YR4/4, 70%) and (5YR6/8, 30%) sandy loam, moderate fine subangular blocky structure; friable, non-sticky, slightly plastic, strongly cryoturbated, many vertical frozen cracks with brown (7.5YR4/3) of mucky peat of 10-20 mm; few fine roots; gradual irregular boundary.
- 20-60 cm; Bw; gray (7.5YR5/1, 80%) and (2.5YR4/6, 20%) silty clay loam; weak coarse platy structure; very friable, slightly sticky, slightly plastic; few fine roots; abrupt wavy boundary.
- 60-62 cm; 2Cgzf; dark gray (7.5YR4/1) silty clay; moderate coarse platy structure; firm, moderately sticky, very plastic, many fine vesicular pores; frozen below 62 cm, 30% ice by volume, ice lenses of 5-10 mm thickness.





Figure 45. (a) Soil pit at Vaskiny Dachi-2 (pit №11), higher microsite. (b) Close up of pit wall.

- 0-1 cm; Oi; fibric material, loose, slightly decomposed moss, twigs and leaves of shrubs, sedge.
- 1-3 cm; Oi; brown (7.5YR4/4) fibric material (moss), (H4, F3, R2, V0); loose; common fine roots; abrupt wavy boundary.
- 3-4 cm; Ah; light brown (7.5YR6/4) clay loam; moderate fine subangular blocky structure; friable, slightly sticky, moderately plastic; common fine and medium roots; clear irregular boundary.
- 4-21 cm; Bwgjj; (Gley 1, 6/10GY) silty loam; weak medium angular structure; firm, slightly sticky, slightly plastic, common Fe concentrations (2.5YR5/8); few fine roots; clear wavy boundary.
- 21-26 cm; Ab; brown (7.5YR4/4) clay loam; moderate fine subangular blocky structure; friable, slightly sticky, slightly plastic, few fine roots; clear wavy boundary.
- 26-62 cm; Bw; gray (7.5YR5/1, 80%) and yellowish red (5YR5/8, 20%) silty clay loam, weak coarse platy structure; friable, slightly sticky, slightly plastic, few medium roots; abrupt wavy boundary.
- 62-67 cm; 2Cgzf; dark gray (7.5YR4/1) silty clay; moderate coarse platy structure; firm, moderately sticky, very plastic, many fine vesicular pores; frozen below 67cm, 30% ice by volume, ice lenses of 5-10 mm thickness.

#### Vaskiny Dachi-3

Location:

GPS position: 70 ° 18'01.7"N, 068 ° 50'33.5"E

Elevation: 18 m

Parent material: Aeolian sand over marine sediments? Classification: Typic Haploturbels, (Podburs in Russia)

(a) (b)





Figure 46. (a) Soil pit at Vaskiny Dachi-3 (pit №12). (b) Closeup of pit wall.

0-0.5 cm; Oi; fibric material (black crast), firm; very abrupt smooth boundary.

- 0.5-1.5 cm; Ah; dark brown (7.5YR3/3) silty loam, moderate fine subangular blocky structure; very friable, slightly sticky, slightly plastic, common fine and medium roots; abrupt irregular boundary.
- 1.5-5 cm; Bw; light brown (7.5YR6/4) sand; weak medium subangular blocky structure; loose, non-sticky, non-plastic, few vertical frozen cracks with brown (7.5YR4/3) of mucky peat of 10-20 mm few medium roots; gradual irregular boundary.
- 5-24 cm; Bwjj; reddish brown (2.5YR4/6, 80%) and light brown (7.5YR6/3, 20%) sand; structureless; very friable, non-sticky, non-plastic, few lenses gray (7.5YR5/1) silty loam; few medium roots; gradual irregular boundary.
- 24-71 cm; BC; light gray (5YR7/1, 60%) and reddish yellow (5YR7/8, 40%) loamy sand; structureless; loose, non-sticky, non-plastic, water below 71 cm; frozen below 124 cm;





Figure 47. (a) Soil pit at Vaskiny Dachi-3 (pit № 13), inter-polygon lower microsite. (b) Close up of pit wall.

- 0-2 cm; Oi; fibric material, loose, slightly decomposed moss and sedge.
- 2-5 cm; Oe; dark brown (7.5YR3/3) hemic material (moss), (H6, F1, R2, V0); very friable, common fine roots; abrupt irregular boundary.
- 5-30 cm; Bwjj1; reddish brown (2.5YR4/6) sand; weak medium subangular blocky structure; friable, non-sticky, non-plastic, many vertical frozen cracks with black (10YR2/1) of mucky peat of 10 mm to 20 mm; common fine and medium roots (inside of frozen cracks); gradual broken boundary.
- 30-40 cm; Bwjj2; grayish brown (10YR5/2) sand with cryoturbated organics (10YR3/2); structureless; friable, non-sticky, non-plastic, common medium roots; clear broken boundary.
- 40-50 cm; Oajj; dark brown (7.5YR3/3) mucky peat; very friable, common fine and medium roots; clear broken boundary.
- 50-75 cm; Bw; gray (5YR6/1, 50%) and reddish yellow (5YR7/8, 50%) loamy sand; structureless; very friable, non-sticky, non-plastic; common Fe concentrations around frozen cracks, few medium roots; clear broken boundary.
- 75-77 cm; Cf; gray (5YR6/1) clay loam; moderate coarse platy structure; firm, moderately sticky, moderately plastic, water below 75 cm; frozen below 130 cm.

Table 25. Summary of mean chemical properties for the Nadym-2 Histoturbels. Smallest N for any variable is 66.

Horizon			
	pH 1:2.5	TC (%)	TN (%)
Oi	4.26	40.2	0.05
Oe	4.63	43.1	0.5
Oa	4.48	41.8	0.9
B1	5.75	0.8	-

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# APPENDIX A: LIST OF PARTICIPANTS

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# APPENDIX B: DATA FORM FOR SAMPLING SPECIES COVER ALONG TRANSECTS USING THE BUCKNER SAMPLE

# Yamal Expedition 2007

Method: 50m transect - 0.5m spacing - 1 point at each 0.5 met	er - 100 points total - Species at top and bottom of plant canopy
Location:	Date:
Vegetation Type:	Observers:

	Trans	sect	Trans	sect	Trans	sect	Trans	ect	Trans	ect	N	lean
Species								Bottom	Тор	Bottom	Тор	Bottom
0.5												
1.5												
2.5												
3												
3.5												
4.5 5												
5.5												
6 6.5												
7												
7.5 8												
8.5												
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23.5												
24 24.5												
25												

# APPENDIX C: DATA FORMS FOR RELEVÉ DATA (SITE DESCRIPTION AND SPECIES COVER/ABUNDANCE)

Relevé data form: Site description, and growth form cover values

Yam	al Expedition 2007	Location:					Grid Number:			
Grid	d Releves	GPS Location of SW corner of Grid:								
		Grid photo from N:								
Obse	rver:	_Slope:			Grid photo	o from E:				
Date:		Aspect:				Grid photo				
Comm	nunity:	Elevation:				Grid photo	o from S:			
				Releve nu	mber		Notes			
	(grid point at SW corner)									
	Low shrubs									
	Erect dwarf shrubs									
	Prostrate dwarf shrubs									
	Evergeen shrubs						1			
,	Deciduous shrubs									
Live & standing dead cover %	Erect forbs									
8	Mat & cushion forbs		···········							
pad	Non-tussock graminoids						Section 1989			
g de	Tussock graminoids									
din	Foliose lichen									
stan	Fruticose lichen									
જ	Crustose lichen									
Live	Pleurocarpous bryophytes									
~	Acrocarpous bryo./Liverworts			,						
	Horsetails/Algae									
	Rocks		,							
%	Bare soil/Salt crust	1.								
Cover	Water									
ರ	Total dead									
	Vegetation canopy height									
5	Moss/Organic/A horizon									
(cm)	Microrelief									
	Mean thaw depth									
	Landform									
	Surficial geol./parent material									
	Surficial geomorphology									
	Microsite									
	Site moisture									
	Soil moisture		·							
١ ـ	Glacial geology									
ţį	Topographic position									
information	Estimated snow duration									
	Disturbance degree									
Site	Disturbance type									
Ι ຶ	Stability									
	Exposure									
	Soil grab sample taken									
Photo	Plot (from south side)						,			
Ӗ	Soil	7 .								

species cover data on back side

## **Site Description Codes**

ar	dforms		ITE DESCRIPTION CODES crosites	So	il Units
	Hills (including kames and morain			1	Pergelic Cryorthent, acid
	Talus slope	2	Inter-frost scar element	2	Pergelic Cryopsamment
	Colluvial basin	3	Strang or hummock	3	Pergelic Cryohemist, euic
	Glaciofluvial and other fluvial terr	4	Flark, interstrang, or interhummock area	4	Pergelic Cryosaprist, euic
	Marine terrace	5	Polygon center	5	Lithic Pergelic Cryosaprist
	Floodplains	6	Polygon trough	6	Pergelic Cryofibrist, euic
	Drained lakes and flat lake margin		Polygon rim	7	Histic Pergelic Cryaquept, acid
	Abandoned point bars and sloughs		Stripe element	8	Histic Pergelic Cryaquept, nonacid (Aquiturbo
	Estuary	9	Inter-stripe element	9	
	Lake or pond		Point bar (raised element)	10	Pergelic Cryaquept, nonacid
	Stream		Slough (wet element)		Pergelic Cryochrept
	Sea bluff		Ring		Pergelic Cryumbrept
	Lake bluff	13			Ruptic-Lithic Cryumbrept
	Stream bluff	14			Pergelic Cryaquoll
	Sand dunes	15			Histic Pergelic Cryaquoll
	Beach				Pergelic Cryoboroll (Mollitrubel)
	Disturbed			17	
	Alluvial plain/abandoned	Sit	e Moisture (modified from Komárková 1983)	18	
	sland	1	Extremely xeric - almost no moisture; no plant growth		
	Plain - residual surface	2	Very xeric - very little moisture; dry sand dunes	.,	
l	Fiam - residual surface	3	Xeric - little moisture; stabilized sand dunes, dry ridge	to	ne .
•		4	Subxeric - noticeable moisture; well-drained slopes, ric		
		5	Subxeric to mesic - very noticeable moisture; flat to		
	Goial Caalagy (Bayant Matarial)	3	gently sloping		Snow free anyear Snow free most of winter; some snow cover
	ficial Geology (Parent Material)	6	Mesic-moderate moisture; flat or shallow depressions	2	persistsafter storm but is blown free soon
	Glacial tills				afterward
	Glaciofluvial deposits	7	Mesic to subhygric - considerable moisture; depression		
	Active alluvial sands	8	Subhygric - very considerable moisture; saturated but	3	
	Active alluvial gravels	_	< 5% standing water < 10 cm deep		most of winter
	Stabilized alluvium (sands & grav		Hygric - much moisture; up to 100% of surface under		Snow free immediately after melt out
	Undifferentiated hill slope colluvi		10 to 50 cm deep; lake margins, shallow ponds, stream		Snow bank persists 1-2 weeks after melt out
			Hydric - very much moisture; 100% of surface under v		Snow bank persists 3-4 weeks after melt out
	Drained lake or lacustrine organic		50 to 150 cm deep; lakes, streams	7	Snow bank persists 4-8 weeks after melt out
	deposits				Snow bank persists 8-12 weeks after melt out
	Lake or pond organic, sand, or silt	i		9	Very short snow free period
0	Undifferentiated sands	So	il Moisture (from Komárková 1983)	10	Deep snow all year
1	Undifferentiated clay	1	Very dry - very little moisture; soil does not stick toget	the	r
2	Roads and gravel pads	2	Dry - little moisture; soil somewhat sticks together	Aı	nimal and Human Disturbance (degree)
3	Loess	3	Damp - noticeable moisture; soil sticks together but cr	. 0	No sign present
4	Fine sand	4	Damp to moist - very noticeable moisture; soil clumps		Some sign present; no disturbance
5	Marine sands	5	Moist - moderate moisture; soil binds but can be	2	Minor disturbance or extensive sign
	Marine clay		broken apart	3	Moderate disturbance; small dens or light
•		6	Moist to wet - considerable moisture; soil binds and st	-	grazing
		٠	to fingers	4	Major disturbance; multiple dens or
	ficial Geomorphology	7	Wet - very considerable moisture; water drops can be	7	noticeable trampling
	Frost scars	′	squeezed out of soil	5	Very major disturbance; very extensive
	Wetland hummocks	8		,	tunneling or large pit
			Very wet - much moisture can be squeezed out of soil		tuilleling of large pit
	Turf hummocks	9	,		rivel and Homen Disturbance (tree)
	Gelifluction features		Very saturated - extreme moisture; soil is more liquid		
	Strangmoor or aligned hummocks		than solid	1	Ptarmigan scat
	High- or flat-centered polygons				Caribou tracks
	Mixed high- and low-centered pol			_	Caribout scat
	Sorted and non-sorted stripes		lacial Geology		Goose tracks & scat
_	Palsas		Till 4		Squirrel mounds
	Thermokarst pits			_	Vole tracks & scat
	Featureless or with less 20% frost				Vehicle tracks
2	Well-developed hillslope water tra	icks	7	-	ability
	and small streams > 50 cm deep			1	
3	Poorly developed hillslope water t	rac	ks,	2	Subject to occasional disturbance
	< 50 cm deep T	op	ographic Position	3	Subject to prolonged but slow
4	Gently rolling or irregular microre				disturbance such as solifluction
	Stoney surface		Side slope	4	Annually disturbed
	Lakes and ponds		Footslope or toeslope	5	Disturbed more than once annually
•	Disturbed		Flat	_	
7	Hill hummock		Drainage channel	E	xposure Scale
		_,	Diamage channel	-	apooni e Denie
8			Denreccion	1	Protected from winds
18 19	Wetland	6	Depression Lake or pand		Protected from winds Moderate exposure to winds
8 9 20		6		2	Protected from winds Moderate exposure to winds Exposed to winds

## Species cover/abundance:

ascular plant						
species						
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r = rare; + = common, but < 1%; 1 = 1-5%; = 6-25%; 3 = 26-50%; 4 = 51-75%; 5 = 76-100%

# APPENDIX D: BIOMASS SAMPLING PROCEDURES FOR TUNDRA VEGETATION

## Skip Walker, Martha Raynolds, Elina Kaarlejärvi August 2007

#### **PURPOSE**

The goal of biomass sampling of vegetation is to quantify the amount of plant material in a given vegetation type, thus we sample all phytomass from a specified amount of surface area, so the values can be extrapolated over larger areas.

Phytomass is sorted into categories that were relevant to the research questions. Phytomass included above-ground live phytomass, above-ground dead phytomass. Below-ground phytomass was not determined. Phytomass was sorted by plant functional type (trees, deciduous shrub, evergreen shrub, graminoid, forb, horsetail, lichen, moss). Finally, plant functional types were sorted into plant parts, such as live leaves, dead leaves, stems, and reproductive parts.

Most of the difficulties in obtaining good phytomass data come from inconsistencies in the clip harvest methods and the sorting methods. This document is intended to make these methods as consistent as possible. Please read through the whole document, so as to understand and be able to minimize problems associated with getting consistent biomass data. The methods are based primarily with some modification on the methods used to collect biomass along the North American Arctic Transect (Walker et al. 2007 submitted; Epstein et al. 2007 submitted).

#### COLLECTING ABOVEGROUND BIOMASS

**Equipment needed:** Metal frame(s), pegs, serrated knife, clippers, scissors, gallon zip-lock plastic bags, indelible "Sharpie" markers, "write-in-the-rain" paper or Post-its

- 1. **Establish sample strategy.** At each location biomass sample sites should be chosen randomly within areas of homogeneous vegetation. For the 2007 Yamal Expedition, the biomass harvest locations are shown in Figures 16 to 22 in the main body of this data report.
- 2. **Discuss clipping strategy.** Before beginning the harvest, the group of samplers should sample one plot as a team and define just how this particular vegetation type will be treated. One topic that should be discussed is the definition of the distinction between the aboveground and belowground portions of the plant canopy. This transition will be at the bottom of the dead moss layer, and at the top of the soil. Usually, the dead moss will extend down to a dark compressed layer of moss that is no longer loose. For our purposes, the light colored loose moss is part of the aboveground material, and the dark compressed layer is the top of the soil layer. See discussion of live vs. dead mosses on page 7 below. Our harvest will be a slice of tundra that extends 2 cm down into the dark belowground portion. Take notes regarding the sampling strategy.
- 3. **The clip harvest frame.** Tundra biomass is collected using a 20 x 50-cm frame (0.1 m<sup>2</sup>). 25 of these 0.1 m<sup>2</sup> frames provide an adequate sample of a tundra vegetation type (Walker et al. 2003). If the shrubs are over 50 cm tall, it becomes difficult to determine if

the shrubs are within the frame or not. In that case, a  $1 \times 1$  m frame on 1.5 m legs is used to sample the shrubs, and the  $20 \times 50$  cm frame is used to sample the understory.

- 4. **Anchor the frame** to the tundra, using metal pegs or pins in the corners.
- 5. **Trim the margins of the frame.** Cut all plants than hang over the frame. Anything above the inside of the frame is included in the sample, everything above the outside is excluded. Be sure the pieces you cut end up on the right side. Throwing the excluded pieces far away from the frame helps prevent future confusion.
- 6. **Remove slices of tundra.** Use a serrated knife to cut down along the inside edge of the frame. You will want to cut deep enough that you are below the dead moss layer and into the belowground layer. Cut the sample in half, creating two 20 x 25-cm pieces of tundra. If the sample is very thick, it may need to be divided into thirds. Cut horizontally across the bottom of each piece with the knife, below the dead moss layer, 1-2 cm into the belowground layer. Remove each slice of tundra so that the entire plant mat and top layer of soil comes out in 2-3 slices of turf about 5-10 cm thick.
- 7. **Bag each sample.** Put each slice of tundra into a gallon zip-lock bag. Label the bag with the date, location, plot number, and which bag this is out of the total for this plot, and your initials (e.g. "5 Aug 2007, Nadym, Plot 2, 1 of 2, SW"). Also place a paper label inside the bag with the same information in case the label on the outside of the bag rubs off. Large garbage bags will be needed for 1 m<sup>2</sup> shrub samples.
- 8. **Put the samples into cardboard boxes.** Keep the samples from each location in separate boxes. Each box should hold about 8-10 sample bags (4-5 plots). Label each box with "Aboveground Biomass" Date, Location, which box this is out of the total for that location, and the plot numbers included in the box. (e.g. "Aboveground biomass, 5 Aug 2007, Nadym, 1 of 5 boxes, Plots 1-5"). The samples should be kept cool in the field, and frozen as soon as possible. They should remain frozen until they are sorted.

#### SAMPLING ISSUES FOR PARTICULAR TYPES OF SITES

**Barren areas**, **such as frost boil centers** - Bare soil should be sampled, even if it has nothing growing on it. That way there is a record that it was sampled, and any tiny crumbs of vegetation can be sorted and dried in the lab.

Crustose lichen areas – These should be sampled, though sorting is difficult

**Very wet areas** - It is difficult to extract a good sample from very wet areas. You need to disturb the site as little as possible and keep the knife vertical in order to get a deep, straight cut along the sides. Extracting the sample without collapsing the sides or washing away much of the sample takes a lot of care.

**Tussocks** – Tussocks should be included in the sample, cutting below them into the belowground (usually mineral) layer.

#### **SORTING ABOVEGROUND BIOMASS**

**Equipment needed:** scissors, tweezers, aluminum pans, bags, scale, drying oven, markers.

- 1. Log the samples through each step of the sorting process. Use the attached log (Table 1) to keep track of the samples from each location by filling in the appropriate box for each step with your name and date each step is completed.
- 2. Remove the sample from the freezer and allow it to thaw in the bag.
- 3. **Define above vs. belowground biomass in your sample.** Dead unattached organic matter is considered aboveground litter if the plant parts are loose, easily separated,

distinct and identifiable. Litter that has decomposed beyond this point is considered belowground biomass. Consult any field notes regarding the distinction between above and below ground biomass at this particular location. Remove the belowground biomass from your sample. It should be dried, labeled as "soil and roots" and saved along with the rest of the sample, but there is no need to weigh it.

4. **Sorting categories**. The sample will be sorted into the following categories:

```
evergreen shrub
        stem
        live foliar
        attached dead foliar
        reproductive
deciduous shrub
        stem
        live foliar
        attached dead foliar
        reproductive
graminoid
       live
        attached dead
forb
eauisetum
bryophyte (mosses & liverworts):
        live
        dead
lichen
        live
        dead
algae
litter (all unattached dead plant parts)
soil and roots (belowground)
```

- 5. Put labels in the sorting tins with the plot number and the above plant categories.
- 6. Clip with scissors and sort the vascular plants into their specific categories. Cut off vascular plants above the roots or base of green stems in herbaceous species. This is generally the same location as the above/belowground definition as above, but some plants may have roots in the dead moss layer. Include all attached dead. See below for issues associated with particular species.
- 7. **Sort the lichens, equisetum and algae into their categories.** These are usually loose and can be immediately separated. Keep your sample moist or the plants will crumble. If it has dried out, you can always wet it again. If you have a relatively intact moss mat, you may be able to separate litter from moss by turning it upside-down and brushing it gently.
- 8. Separate the live moss from the dead moss and sort into subcategories if needed. Be aware that many mosses are brown, so the live/dead distinction cannot be done solely on color (see details below)!
- 9. **Sort the crumbs.** At this stage, you will be left with a mix of plant pieces and litter. Remove the recognizable pieces of moss and lichen to their proper containers. There may be some live vascular leaves that were missed in the first sorting that should go in their respective containers. All the rest the dead leaves and the crumbs go into the litter category. If there is noticeable soil in your sample, you may need to sieve it or wash it to remove the soil.

- 10. **Clayey samples.** Samples from clayey soils, or prostrate shrub samples, may need to be washed after sorting to remove soil.
- 11. **Dry the sorted samples.** Once you have completely sorted a sample, put the containers into the drying oven until they are dry (1 day for small samples, 2 days for larger, wetter samples).
- 12. **Weigh the samples**. Once the samples are dry, weigh them and record the weights (Table 2).
- 13. **Store the samples**. Put the weighed material in bags labeled with the location, plot number, growth-form category, and the weight. Store all the individual sorted samples from a plot into the original large plastic sample bag for that plot. Place all the sorted aboveground biomass samples for each location in a single box for storage. Label the box "Aboveground biomass, Yamal expedition 2007, Nadym." If more than one box is needed, label each box with the number of the box and the total number of the boxes (for example "Box 1 of 3").
- 14. **Time estimate:** For a well-trained sorter, the average is 4-5 hours/sample though some samples can take twice that time.

#### Sorting considerations for each growth form:

**Evergreen Shrubs:** Separating *Dryas* leaves into live, dead, and litter is difficult. You will probably end up with some live leaves in the dead pile and vice-versa. Try to minimize this, but the differences will probably balance out. Many of the dead leaves fall off when the plants are handled. These should go into dead leaves, not litter, as they were on the plants when sampled. The *Dryas* leaves that are part of the litter are often hidden in the moss and lichen layer. Turning samples upside-down and brushing them can remove a lot of this litter. *Dryas* leaf stipules (leaf stems) go along with their leaves. Dead *Dryas* plants that have no live leaves go into litter.

Vaccinium vitis-idaea leaves lose their color when they freeze, so even the live leaves will look brownish; the leaves that are lighter brown and brittle go in the dead pile

Cassiope tetragona has leaves that are very hard to get off the stem when wet. Separate this species, dry the plants, and then take off the dead and live leaves.

*Ledum* - be sure to put the flower buds into the reproductive category.

**Deciduous Shrubs:** Deciduous leaves often lose their green color from being frozen and thawed. Most attached leaves on deciduous shrubs are live. There may be a few dead ones, especially on *Salix pulchra* or *Salix phlebophylla*.

Rubus chamaemorus is very low growing, but it is a deciduous shrub.

**Graminoids:** Any blade that has any green on it goes in the live pile. Make sure you dissect the ramets that look completely dead, because there are often live blades hidden in the center. Any blade that has no green on it goes in the dead pile. Graminoid reproductive parts go in with the "live graminoid"; there is no special reproductive category.

Differentiating between dead graminoid (still attached to the plant), and litter (unattached, but not decomposed) from very wet areas is difficult because leaves get separated from the plants as you scoop them up from the water.

*Eriophorum vaginatum* tussocks are formed from an assemblage of shoots growing off to all sides. The aboveground portion is the shoot, with its live and attached dead leaves. The belowground portion is composed of roots below the base of the shoot. In some

tussocks, old shoots may have decomposed to the point where they are no longer recognizable and distinct, in which case they are part of the underground peat category.

Forbs: All forb stems, leaves, flowers, etc. go into the "forb" pile.

Saxifraga oppositifolia – this forb often has large quantities of dead stem below the live. This issue is rare enough that the dead stem is just included in the single "forb" category. If there is no live part to the stem, it goes into the "litter" pile.

**Lichens:** Foliose lichens that are growing on mineral soil need to carefully cleaned of soil, either by brushing them off or washing them, otherwise the soil will outweigh the lichen.

It is not possible to separate crustose lichens from rhizinae (the little root-like hairs under the lichen), mycelium and mineral soil. Separate any plants that you can. All the rest of the crustose lichen should go in the belowground pile, as the non-lichen parts of the crumbs far outweigh the actual lichen. Compared to well vegetated areas, their weight is minimal.

Bryophytes: The most important sorting decision for mosses and liverworts is the distinction between live mosses, dead mosses and peat (belowground biomass). Live mosses are greenish, pliable when moist, the leaves are translucent and distinct. There are many brown mosses, but even these have leaves that look greenish under magnification. Dead mosses are darker, the stems more brittle, and the leaves no longer distinct and entire. For example, the live portions of the common feather-moss, Hylocomium splendens, can range from bright lime green to golden brown. Its branches often grow horizontally in the moss layer, with a live upper portion growing from a dead lower portion. The peat portion of mosses consists of densely packed dead stem bases. For unbranching (acrocarpous) mosses that form tight cushions, this may be everything below the green, live moss (i.e. there may be only live moss and peat, with no dead moss portion). For Sphagnum, there is a greenish live portion on top, then a loose dead portion, and often a packed peat portion at the base. Thin moss layers on soil sometimes cannot be separated from the soil, and have to be left with the belowground portion of the sample. When they can be separated, thin moss layers may need to be sifted or washed to remove clinging mineral soil.

#### References

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- Walker, D. A., H. E. Epstein, W. A. Gould, C. L. Ping, V. E. Romanovsky, Y. Shur, C. T. Tarnocai, R. P. Daanen, G. Gonzalez, A. N. Kade, A. M. Kelley, W. B. Drantz, P. Kuss, N. V. Matveyeva, G. J. Miochaelson, C. A. Munger, D. J. Nickolsky, R. A. Peterson, M. K. Raynolds, and C. M. Vonlanthen. 2007 submitted. Biocomplexity of small patterned-ground features along the North American Arctic Transect. *Journal of Geophysical Research Biogeosciences*.

Table 1. Data sheet for recording aboveground biomass sample sorting procedures.

#### Yamal Expedition 2007

# ABOVE GROUND BIOMASS SORTING

write date and your initials when each step is done

write date and y	your initials wi	len each ste	o is done	I vanconosa I	
Location & number	Thawed	Sorted	Into drier	Out of drier, weighed, recorded	Boxed
			Į.		
	j				
				1	
				1	
	5			1 - 1	
	ĺ				
	Ī				
				1	
	7	7	ķ.		
			9		
	5				

Table 2 (page 1 of 2). Data sheet for recording aboveground biomass weights.

#### Yamal Expedition 2007

#### **ABOVEGROUND BIOMASS weights**

20x50cm = 0.1 m2			Decidu	ious			Everg	reen			Gram	inoid	
Location & number		Stem	Live leaves	Dead leaves	Flowers/ berries	Stem	Live leaves	Dead leaves	Flowers/ berries		Live	Dead	Forb
										500			
	- 12		3			-							
	-33									200			
										1.00			
										333			
													360
										200			
										1000			

Table 2 (page 2 of 2). Data sheet for recording aboveground biomass weights.

Equisetum	Lichen	Bryo- phyte	Algae	Total above- ground biomass (excluding dead moss & litter)	dead moss	litter	Total above- ground biomass (INCLUDING dead moss & litter)	Notes
					- U			
				-				
-				-				
				-			-	
				4	4			10
			-	-			-	
							1	0.
								X
			+ +	+	-		2	

# APPENDIX E: POINT-CENTERED QUARTER METHOD: CALCULATION OF FREQUENCY, DENSITY, AND BASAL AREA IN FORESTS

100-m tape	Meter stick	Pencil
Biltmore stick or diameter tape	Data sheets (this handout)	Hand calculato

**Methods**: Stretch the 100-m tape the length of a transect. Sample points at 10-m intervals along the tape (10 points total). At each sample point, lay a meter stick perpendicular to the transect and make an imaginary "X" that defines four quadrants. Record the following for the nearest tree to the sample point in each quadrant: (1) tree species, (2) distance from the sample point to the tree, and (3) diameter at breast height of the tree. Sample a total of 10 points (40 trees). Count dead trees greater than breast height. Note next to species code if the tree is dead.

#### **Table 1. Field Data Sheets:**

1. Transect No.
-----------------

(1) Sample Point	(2) Quadrant No.	(3) Species code	(4) Distance (m)	(5) dbh (cm)	(6) Basal area (cm <sup>2</sup> )	(7) Height (m)
1	1					
	2					
	3					
	4					
2	1					
	2					
	3					
	4					
3	1					
	2					
	3					
	4					
4	1					
	2					
	3					
	4					
5	1					
	2					
	3					
	4					
6	1					
	2					
	3					
	4					
7	1					
	2					
	3					
	4					
8	1					
	2					
	3					
	4					
9	1					
	2					
	3					
	4					
10	1					
	2					
	3					
	4					

m=10	n=40	$d_t=$		

Table 2. Summary data sheet, Transect No.

A. Species code	B. Absolute frequency (Fa <sub>j</sub> )	C. Relative Frequency (Frj)	D. Absolute Density (Daj)	E. Relative density (Drj)	F. Absolute Dominance (Baj)	G. Relative Dominance (Brj)	H. Importance Value (IVj)

Fill in the above table using the calculations described below.

Calculate the absolute density of <u>all</u> trees (Da):

Step 1. Calculate the **total distance**,  $d_t$ :

$$d_t = \sum_{i=1}^n d_i = \underline{\qquad} \text{ meters}$$

where  $d_t$  is the total distance,  $d_i$  is the distance to tree number i, and n is the total number of trees.

Step 2. Calculate the average distance between trees, d:

$$\overline{d} = d_t \div n =$$
 meters

Step 3. Calculate the average area occupied per tree, A:

$$A = d^2 = \frac{-}{\text{meters}^2}$$

Step 4. Calculate the **absolute density for all trees, Da**, in trees per hectare (ha):

$$Da = (10^4 \text{ m}^2) \div A = ____ \text{trees/ha}$$

Note: One hectar is 100 x 100 meters, or 10<sup>4</sup> meters<sup>2</sup>.

- Step 5. Fill in Table 2 (note that capital letters match column headings and in certain cases are not in order they are calculated!):
  - **A. Species code.** Record the names of all species encountered. Use a six letter code for each species (first three letters of the genus name and first three letters of the species name). Then calculate each of the following values for *each species*.
  - B. Absolute frequency of species j, Faj:

$$Fa_j = M_j \div m$$

where  $M_j$  is the number of points where species j occurs, and m is the total number of points (10 for each transect).

**C.** Relative frequency of species j, Frj, is the absolute frequency of species j divided by the sum of the absolute frequencies for all species:

$$Fr_{j} = Fa_{j} \div \sum Fa_{k} \cdot 100\%$$

$$k = \frac{100\%}{100\%}$$

where the denominator is the sum of the absolute frequencies (i.e., the sum of column B in Table 3) for all species, k is the species number, and p is the total number of species.

**E.** Relative density of species j, Drj, is the number of occurrences of species j divided by the total number of trees:

$$Dr_1 = N_1 \div n \cdot 100\%$$

where  $N_j$  is the number of occurrences of species j and n is the total number of trees.

**D.** Absolute density of species j, Daj, is the relative density of species j times the absolute density of all trees:

$$Da_j = Dr_j \cdot Da$$

where Da is the absolute density for all trees (calculated in Step 4).

**F.** Absolute dominance for species j, Baj, is the mean basal area for species j times the absolute density of species j:

$$Ba_j = Ba_j \cdot Da_j$$

where k is an individual of species j, and t is the number of occurrences of species j.

**G.** Relative dominance of species j, Brj, is the absolute dominance of species j divided by the sum of dominance for all species:

$$Br_{j} = \frac{Ba_{j}}{\sum_{i=1}^{p} Ba_{i}} \cdot 100\%$$

where the denominator is the sum of the absolute dominance (i.e., the sum of column F in Table 3) for all species, and p is the total number of species.

**H.** Importance value for species j, IV<sub>j</sub>, is the sum of the relative frequency, relative density, and relative dominance for the species:

$$IV_j = Fr_j + Dr_j + Br_j$$

# APPENDIX F: LISTS OF VASCULAR PLANTS, LICHENS, AND BRYOPHYTES RECORDED IN THE YAMAL-REGION STUDY PLOTS

#### Vascular plants

Nomenclature followed Elven et al. 2007: Checklist of the Panarctic Flora (PAF). Vascular plants. -Draft. University of Oslo.

Alopecurus alpinus Ledum palustre

Andromeda polifolia Ledum palustre subsp. decumbens

Arctagrostis latifolia Luzula cf. confusa

Arctous alpina Luzula cf. wahlenbergii

Betula nana Luzula sp.

Betula pubescenscf. Minuartia arcticaBistorta viviparaOxycoccus microcarpusCalamagrostis neglecta agg.Pedicularis hirsuta

Carex bigelowii subsp. arctisibirica Pedicularis labradorica
Carex chordorhiza Pedicularis cf. lapponica

Carex globularis Petasites frigidus
Carex limosa Pinus sibirica
Carex rotundata Pinus sylvestris
Chamaedaphne calyculata Poa arctica

Diapensia lapponica Rubus chamaemorus

Diphasiastrum aplinumSalix glaucaDrosera rotundifoliaSalix hastataDryas octopetala subsp. subincisaSalix lanata

Empetrum nigrumSalix myrtilloidesEmpetrum subholarcticumSalix nummulariaEriophorum angustifoliumSalix polarisEriophorum russeolumSalix phylicifolia

Eriophorum vaginatumcf. SenecioFestuca cf. ovinaStellaria sp.

Festuca sp. Vaccinium myrtillus Hierochloe alpina Vaccinium uliginosum

Huperzia selago Vaccinium uliginosum subsp. microphyllum

Juniperus communis Vaccinium vitis-ideae
Larix sibirica Valeriana capitata

#### Lichens

Nomenclature followed H. Kristinsson & M. Zhurbenko 2006: Panarctic lichen checklist

(http://archive.arcticportal.org/276/01/Panarctic\_lichen\_checklist.pdf)

Alectoria nigricans

Alectoria ochroleuca

Arctocetraria andrejewii

Asahinea chrysantha

Cladonia pleurota

Cladonia pyxidata

Cladonia rangiferina

Cladonia cf. scabriuscula

Baeomyces rufusCladonia sqamosaBryocaulon divergensCladonia stellarisBryoria nitidulaCladonia strictaCetraria deliseiCladonia stygia

Cetraria islandica Cladonia subfurcata
Cetraria laevigata Cladonia sulphurina
Cetraria nigricans Cladonia uncialis

Cetrariella fastigiata Cladonia sp.

Cladonia arbuscula ssp. arbuscula Dactylina arctica

Cladonia arbuscula ssp. mitis Flavocetraria cucullata
Cladonia amaurocraea Flavocetraria nivalis
Cladonia bellidiflora Hypogymnia physodes
Cladonia cenotea Icmadophila ericetorum

Cladonia chlorophaea Lichenomphalia hudsoniana

Cladonia chlorophaea s. 1. Mycoblastus sp.

Cladonia coccifera Nephroma arcticum, found outside of

Cladonia cornuta ssp. cornuta relevés in Nadym Forest site

Cladonia cornuta ssp. groenlandica Ochrolechia androgyna

Cladonia crispata

Cladonia cyanipes

Ochrolechia frigida

Ochrolechia inequatula

Cladonia cf. decortiata

Cladonia deformis

Cladonia furcata

Peltigera canina

Peltigera cf. frippii

Peltigera malacea

Cladonia gracilis Peltigera polydactylon-group

Cladonia grayi

Cladonia macrophylla

Peltigera leucophlebia

Peltigera cf. neckeri

Peltigera scabrosa

Peltigera sp. Rhexophiale rhexoblephara
Pertusaria dactylina Sphaerophorus globosus
Pertusaria geminipara Stereocaulon alpinum
Pertusaria panyrga Stereocaulon paschale

Protopannaria pezizoides Thamnolia vermicularis var. subuliformis
Protothelenella leucothelia Thamnolia vermicularis var. vermicularis

Psoroma hypnorum Varicellaria rhodocarpa

#### **Bryophytes**

Nomenclature for mosses followed M.S. Ignatov, O.M. Afonina & E.A. Ignatova 2006: Checklist of mosses of East Europe and North Asia. *Arctoa* 15: 1-130 and for liverworts N.A. Konstantinova & A.D. Potemkin 1996: Liverworts of Russian Arctic: an annotated check-list and bibliography. *Arctoa* 6: 125-150.

Aulacomnium palustre Mylia anomala

Aulacomnium turgidum
Oncophorus wahlenbergii
Blepharostoma trichophyllum
Orthocaulis binsteadii
Calypogeia sphagnicola
Orthocaulis kunzeanus
Cephaloziella sp.
Plagiomnium ellipticum
Ceratodon purpureus
Pleurozium schreberi
Conostomum tetragonum
Pogonatum dentatum
Cynodontium strumiferum
Pogonatum urnigerum

Dicranum acutifolium Pohlia cruoides
Dicranum elongatum Pohlia nutans

Dicranum flexicaulePolytrichastrum alpinumDicranum fuscescensPolytrichastrum longisetum

Dicranum groenlandicumPolytrichum communeDicranum laevidensPolytrichum hyperboreum

Dicranum majusPolytrichum jenseniiDicranum spadiceumPolytrichum piliferumDitrichum flexicaulePolytrichum strictumGymnocolea inflataPtilidium ciliare

Gymnomitrion corallioides Ptilidium crista-cristensis
Hylocomnium splendens Racomitrium lanuginosum

Kiaeria cf. blyttii Sanionia uncinata Lophozia ventricosa s.l. Sphagnum balticum Sphagnum capillifolium, found outside of relevés in Nadym CALM site

Sphagnum compactum

Sphagnum fuscum

Sphagnum girgensohnii

Sphagnum lenense

Sphagnum lindbergii

Sphagnum majus

Sphagnum rubellum

Sphagnum squarrosum

Sphagnum teres

Sphagnum warnstorfii

Sphenolobus minutus

Splacnum sphaericum

Stereodon holmenii

Stereodon subimponens

Straminergon stramineum

Tetralophozia setiformis

Tomentypnum nitens

Tritomaria quinquedentata

# **APPENDIX G: PLOT PHOTOS**

Key:

ND Nadym

LA Laboravaya

VD Vaskiny Dachi

RV Relevé

# Soils - Nadym 1





ND RV 02



ND RV 03



ND RV 04



ND RV 05

## Soils - Nadym 2



ND RV 06



ND RV 07



ND RV 08



**ND RV 09** 



ND RV 11 - no photo available ND RV 12 - no photo available ND RV 13 - no photo available ND RV 14 - no photo available

# Soils - Laborovaya 1





LARV 16





LA RV 18



# Soils - Laborovaya 2



LARV 20



LA RV 21



LA RV 22



LA RV 23



LA RV 24

# Soils - Vaskiny Dachi 1



VD RV 25



VD RV 26



**VD RV 27** 





# Soils - Vaskiny Dachi 2



VD RV 30



VD RV 31



VD RV 32



**VD RV 33** 



VD RV 34

# Soils - Vaskiny Dachi 3







VD RV 36



VD RV 37



VD RV 38



VD RV 39

# Vegetation - Nadym 1



ND RV 01



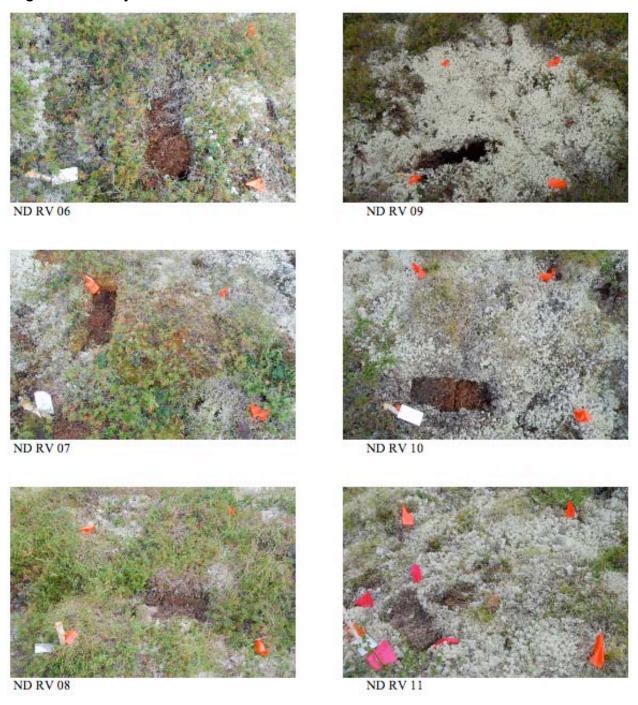
ND RV 02



ND RV 04



# Vegetation - Nadym 2







ND RV 14



# Vegetation – Laborovaya 1



LARV 15



LA RV 16



LARV 17





LA RV 19

# Vegetation – Laborovaya 2



LA RV 20



LA RV 23



LA RV 21



LA RV 24



LA RV 22

# Vegetation – Vaskiny Dachi 1



VD RV 25



VD RV 28



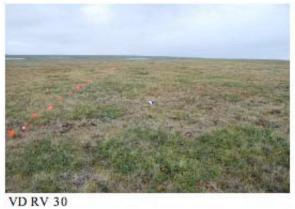


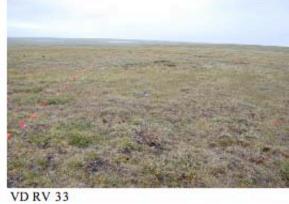
VD RV 29



VD RV 27

# Vegetation - Vaskiny Dachi 2







VD RV 31



VD RV 34



VD RV 32

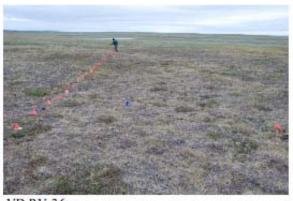
# Vegetation - Vaskiny Dachi 3



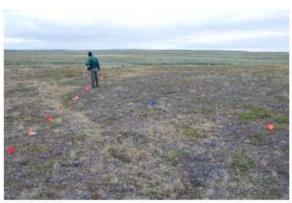
VD RV 35



VD RV 38



VD RV 36



VD RV 39



VD RV 37