# 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**).

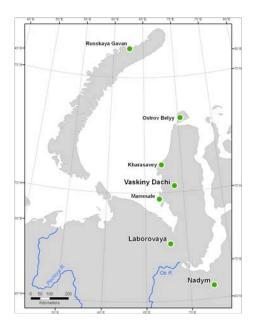


Figure 2. The 2007 study locations at Nadym, Laborovaya, and Vaskiny Dachi, and other proposed study locations.

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

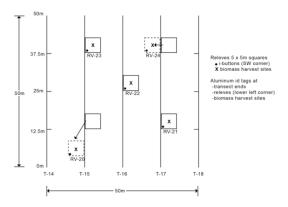


Figure 16. Typical transect and plot layout.

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.

Nadym-1, Forest Site:   ND-RV-1	Releve No.	Logger No.	Depth (cm)
ND-RV-1			
MD-RV-2			
ND-RV-2	UD-MA-T		
ND-RV-3			
ND-RV-3 62 0	ND-RV-2		
S4		26	10
ND-RV-4 60 55 13 ND-RV-5 31 00 ND-RV-5 67 12  Nadym-2, CALM Grid: ND-RV-6 29 60 ND-RV-7 39 51 ND-RV-9 12 30 ND-RV-10 18 10 ND-RV-10 18 10 ND-RV-15 16 0 ND-RV-16 19 0 Laborovaya-1, clayey site LA-RV-16 19 0 LA-RV-17 65 09 LA-RV-18 63 00 LA-RV-19 68 00 LA-RV-19 68 00 LA-RV-20 42 00 LA-RV-21 30 00 LA-RV-21 30 00 LA-RV-21 30 00 LA-RV-22 43 00 LA-RV-23 28 00 LA-RV-24 32 00 LA-RV-25 11 00 VD-RV-25 11 00 VD-RV-26 61 00 ND-RV-29 35 00 VD-RV-29 35 00 VD-RV-29 35 00 VD-RV-29 35 00 VD-RV-31 29 00 VAskiny Dachi-1, Terrace IV VD-RV-29 35 00 VD-RV-29 35 00 VD-RV-31 9 00 VAskiny Dachi-2, Terrace III VD-RV-31 9 00 VD-RV-33 56 00 VD-RV-34 64 00 VD-RV-35 10 00 VD-RV-35 10 00 VD-RV-36 10 00 VD-RV-37 57 00 VD-RV-38 56 70 VD-RV-39 00 VD-RV-3	ND-RV-3	62	0
ND-RV-5		54	5
ND-RV-5	ND-RV-4	60	0
ND-RV-5			_
67	ND DV E		
Nadym-2, CALM Grid:   ND-RV-6	ND-KV-5		
ND-RV-6	_		12
MD-RV-7   39   51			
ND-RV-7	ND-RV-6	29	60
S		49	0
S	ND-RV-7	39	51
ND-RV-9	110 1117		
Section   Sect	ND-D)(-0		
ND-RV-10	ND-KV-9		
59			
Laborovaya 1, clayey site  LA-RV-15	ND-RV-10	18	10
LA-RV-15		59	0
LA-RV-15	Laborovava-	1. clavey site	
LA-RV-16			
LA-RV-16	D(110 10		
6	10 00/46		
LA-RV-17	LA-KV-16		
13			
LA-RV-18	LA-RV-17	65	0
34		13	9
34	LA-RV-18	63	0
LA-RV-19 68 0 17 9  Laborovaya-2, sandy site  LA-RV-20 42 0 44 99  LA-RV-21 30 0 22 5  LA-RV-22 43 0  LA-RV-23 28 0  LA-RV-24 32 0  LA-RV-24 32 0  Vaskiny Dachi-1, Terrace IV  VD-RV-25 11 0 VD-RV-26 61 0 VD-RV-27 38 0 VD-RV-28 36 0 VD-RV-29 35 0 VD-RV-29 35 0 VD-RV-30 33 0 VD-RV-30 33 0 VD-RV-31 2 0 VD-RV-30 33 0 VD-RV-30 33 0 VD-RV-31 2 0 VD-RV-30 40 0 VD-RV-32 4 0 VD-RV-34 66 7 VD-RV-35 47 0 VD-RV-34 64 0 VD-RV-35 47 0 VD-RV-35 47 0 VD-RV-36 24 00 VD-RV-36 24 00 VD-RV-37 57 0 VD-RV-38 7 00 VD-RV-39 23 0 VD-RV-39 23 0 VD-RV-39 23 0 VD-RV-39 20 33 0 VD-RV-30 33 00 0 VD-RV-31 2 00 0 VD-RV-32 4 00 0 VD-RV-34 64 00 0 VD-RV-35 47 00 0 VD-RV-36 24 00 0 VD-RV-37 57 00 0 VD-RV-38 7 00 0 VD-RV-39 0 33 70 00 00 00 00 00 00 00 00 00 00 00 00			
17	I A-D)(-19		
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		2, sandy site	
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22		44	9
22	LA-RV-21	30	0
LA-RV-22			
53	LA-D1(-22		
LA-RV-23	DR-KV-ZZ		
37			
LA-RV-24 32 0 0 21 8 8	LA-RV-23		
21		37	7
Vaskiny Dachi-1, Terrace IV   VD-RV-25	LA-RV-24	32	0
VD-RV-25         11         0           VD-RV-26         61         0           VD-RV-27         38         0           VD-RV-28         36         0           VD-RV-29         35         0           VD-RV-29         35         0           VD-RV-30         33         0           VD-RV-31         2         0           VD-RV-32         4         0           VD-RV-33         58         0           VD-RV-34         66         7           VD-RV-35         58         0           VD-RV-36         66         7           VD-RV-37         50         3           VD-RV-36         24         0           VD-RV-37         57         0           VD-RV-38         7         0           VD-RV-39         23         0		21	8
VD-RV-25         11         0           VD-RV-26         61         0           VD-RV-27         38         0           VD-RV-28         36         0           VD-RV-29         35         0           VD-RV-29         35         0           VD-RV-30         33         0           VD-RV-31         2         0           VD-RV-32         4         0           VD-RV-33         58         0           VD-RV-34         66         7           VD-RV-35         58         0           VD-RV-36         66         7           VD-RV-37         50         3           VD-RV-36         24         0           VD-RV-37         57         0           VD-RV-38         7         0           VD-RV-39         23         0	Vaskiny Dacl	hi-1. Terrace I	[ V
14			
VD-RV-26         61         0           VD-RV-27         38         0           VD-RV-28         36         0           VD-RV-29         35         0           VD-RV-29         35         0           VD-RV-30         9         8           VD-RV-31         2         0           VD-RV-31         2         0           VD-RV-32         4         0           VD-RV-33         58         0           VD-RV-34         64         0           VD-RV-35         46         7           VD-RV-36         40         4           VD-RV-37         50         3           VD-RV-36         24         0           VD-RV-37         57         0           VD-RV-38         7         0           VD-RV-39         23         0	00 100 20		
8	VB BV 64		
VD-RV-27         38         0           VD-RV-28         36         0           VD-RV-29         35         0           VB-RV-29         35         0           VB-RV-30         33         0           51         8           VD-RV-31         2         0           VD-RV-32         4         0           VD-RV-33         58         0           VD-RV-34         64         0         4           VD-RV-34         64         0         4           VD-RV-35         47         0         4           VD-RV-35         47         0         3           VD-RV-36         24         0         3           VD-RV-37         57         0         0           VD-RV-38         7         0         3           VD-RV-39         23         0         0	VD-RV-26		
3   5   5   VD-RV-28   36   0   0   8   VD-RV-29   35   0   9   8   8   VD-RV-29   35   0   9   8   Waskiny Dachi-2, Terrace III   VD-RV-31   2   0   0   0   0   0   0   0   0   0			7
VD-RV-28         36         0           VD-RV-29         35         0           9         8           Vaskiny Dachi-2, Terrace III         VD-RV-30         33         0           VD-RV-31         2         0         0           VD-RV-32         4         0         0           VD-RV-33         58         0         0           VD-RV-34         64         0         4           VD-RV-34         64         0         4           VD-RV-35         47         0         0           VD-RV-35         47         0         0           VD-RV-36         24         0         0           VD-RV-37         57         0         0           VD-RV-38         7         0         0           VD-RV-39         23         0         0	VD-RV-27	38	0
VD-RV-28         36         0           VD-RV-29         35         0           9         8           Vaskiny Dachi-2, Terrace III         VD-RV-30         33         0           VD-RV-31         2         0         0           VD-RV-32         4         0         0           VD-RV-33         58         0         0           VD-RV-34         64         0         4           VD-RV-34         64         0         4           VD-RV-35         47         0         0           VD-RV-35         47         0         0           VD-RV-36         24         0         0           VD-RV-37         57         0         0           VD-RV-38         7         0         0           VD-RV-39         23         0         0		3	5
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VD-RV-29         35         0           Vaskiny Dachi-2, Terrace III         VD-RV-30         33         0           51         8           VD-RV-31         2         0           1         6         0           VD-RV-32         4         0           45         3         0           VD-RV-33         58         0           66         7         0           VD-RV-34         64         0         4           VD-RV-35         47         0         4           VD-RV-35         47         0         3           VD-RV-36         24         0         0           VD-RV-37         57         0           48         1         1           VD-RV-38         7         0           20         3         0           VD-RV-39         23         0	. 2 . 1 4 20		
9   8   Waskiny Dachi-2, Terrace III	1/D-P1/ 00		
Vaskiny Dachi-2, Terrace III           VD-RV-30         33         0           51         8           VD-RV-31         2         0           1         6           VD-RV-32         4         0           45         3           VD-RV-33         58         0           VD-RV-34         64         0           40         4         40           VD-RV-34         40         4           VD-RV-35         47         0           VD-RV-35         47         0           VD-RV-36         24         0           VD-RV-37         57         0           VD-RV-38         7         0           VD-RV-39         23         0	VD-KV-29		
VD-RV-30         33         0           VD-RV-31         2         0           VD-RV-32         4         0           VD-RV-33         58         0           VD-RV-34         64         0           VD-RV-34         64         0           VD-RV-35         47         0           VD-RV-35         47         0           VD-RV-36         24         0           VD-RV-37         57         0           VD-RV-38         7         0           VD-RV-39         23         0	_		
S1	Vaskiny Dack	hi-2, Terrace I	III
S1	VD-RV-30	33	0
VD-RV-31         2         0           VD-RV-32         4         0           VD-RV-33         58         0           VD-RV-34         64         0           VD-RV-34         64         0           VD-RV-35         47         0           VD-RV-35         50         3           VD-RV-36         24         0           VD-RV-37         57         0           VD-RV-38         7         0           VD-RV-39         23         0			8
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45   3   VD-RV-33   58   0   66   7   VD-RV-34   64   0   40   4   Vaskiny Dachi-3, Terrace II   VD-RV-35   47   0   VD-RV-36   24   0   15   2   VD-RV-37   57   0   48   1   VD-RV-38   7   0   VD-RV-39   23   0	1/D-D1/ 00		
VD-RV-33         58         0           66         7           VD-RV-34         64         0           40         4           Vaskiny Dachi-3, Terrace II           VD-RV-35         47         0           50         3           VD-RV-36         24         0           15         2           VD-RV-37         57         0           48         1           VD-RV-38         7         0           20         3           VD-RV-39         23         0	VD-KV-32		
66   7   7   7   7   7   7   7   7   7			
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VD-RV-34 64 0 40 4 4 40 4 4 4 4 4 4 4 4 4 4 4 4		66	7
40   4   4   4   4   4   4   4   4   4	VD-RV-34	64	0
Vaskiny Dachi-3, Terrace II           VD-RV-35         47         0           50         3           VD-RV-36         24         0           15         2           VD-RV-37         57         0           48         1           VD-RV-38         7         0           20         3           VD-RV-39         23         0			
VD-RV-35         47         0           50         3         0           VD-RV-36         24         0           15         2         0           VD-RV-37         57         0           48         1         1           VD-RV-38         7         0           20         3         0           VD-RV-39         23         0	Vacking Dack		
50         3           VD-RV-36         24         0           15         2           VD-RV-37         57         0           48         1           VD-RV-38         7         0           20         3           VD-RV-39         23         0			
VD-RV-36         24         0           15         2           VD-RV-37         57         0           VD-RV-38         7         0           20         3           VD-RV-39         23         0	VD-KV-35		
15   2   2   2   2   2   2   2   2   2			
VD-RV-37 57 0 48 1 VD-RV-38 7 0 20 3 VD-RV-39 23 0	VD-RV-36	24	0
VD-RV-37 57 0 48 1 VD-RV-38 7 0 20 3 VD-RV-39 23 0		15	2
48   1   VD-RV-38   7   0   20   3   VD-RV-39   23   0	VD-RV-37		
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VD-RV-39 23 0	VD-KV-38		
52 2	VD-RV-39		
		52	2

#### 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

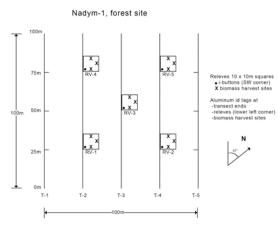


Figure 21. Map of transects and vegetation study plots at Nadym-1.

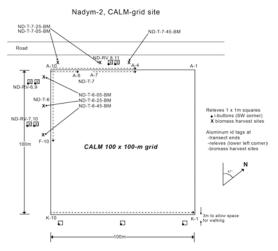


Figure 22. Map of transects and vegetation study plots at Nadym-2.

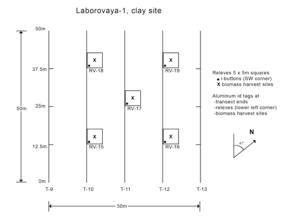


Figure 23. Map of transects and vegetation study plots at Laborovaya-1.

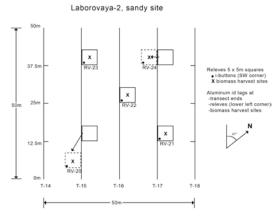


Figure 24. Map of transects and vegetation study plots at Laborovaya-2.

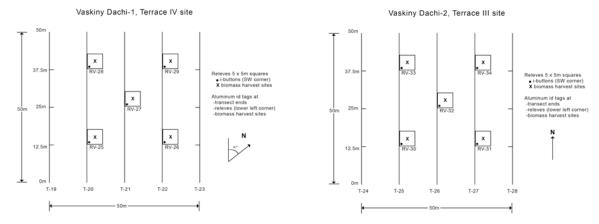


Figure 25. Map of transects and vegetation study plots at Vaskiny Dachi-1.

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

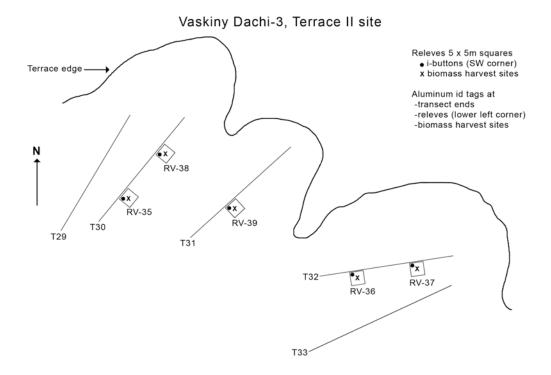


Figure 27. Map of transects and vegetation study plots at Vaskiny Dachi-3.

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).

LA Camp 67 42,210 088 01.089 72 NA ND T05 10 65 18.817 072 53.351 31 1  LARV 16 67 42,397 067 50.946 79 1 1 ND T06 00 65 18.826 072 51.711 23 2  LARV 17 67 67 42,396 067 50.970 79 1 ND T07 00 65 18.885 072 51.711 23 2  LARV 18 67 42,080 067 50.969 77 1 VD Camp 70 17.214 086 53.651 29 NA  LARV 18 67 42,080 067 50.969 77 1 VD Camp 70 17.214 086 53.651 29 NA  LARV 20 67 41.691 068.02.244 63 2 VD RV 26 70 16.528 086 53.461 40 1  LARV 20 67 41.691 068.02.244 63 2 VD RV 26 70 16.528 086 53.461 40 1  LARV 21 67 41.694 068 02.283 59 2 VD RV 26 70 16.528 086 53.461 40 1  LARV 22 67 41.694 088 02.270 64 2 VD RV 28 70 16.528 086 53.461 40 1  LARV 24 67 41.696 088 02.293 69 2 VD RV 28 70 16.528 086 53.471 41 1  LARV 24 67 41.696 088 02.293 69 2 VD RV 28 70 16.536 088 53.471 41 1  LARV 24 67 41.696 087 50.900 79 1 VD RV 30 70 17.734 088 53.021 27 22  LAT 109 50m 67 42.391 697 50.900 79 1 VD RV 30 70 17.734 088 53.021 27 22  LAT 109 50m 67 42.391 697 50.904 79 1 VD RV 32 70 17.734 088 53.021 29 2  LAT 10 50m 67 42.391 697 50.904 79 1 VD RV 32 70 17.734 088 53.051 29 2  LAT 110 50m 67 42.391 697 50.904 79 1 VD RV 32 70 17.734 088 53.051 29 2  LAT 110 50m 67 42.391 697 50.904 79 1 VD RV 32 70 17.734 088 53.051 29 2  LAT 110 50m 67 42.391 697 50.908 79 1 VD RV 32 70 17.734 088 53.051 29 2  LAT 110 50m 67 42.391 697 50.908 80 1 VD RV 36 70 18.037 088 50.051 29 2  LAT 110 50m 67 42.391 697 50.908 80 1 VD RV 36 70 18.037 088 50.651 29 2 2  LAT 110 50m 67 42.391 697 50.908 80 1 VD RV 36 70 18.037 088 50.551 15 3 3 4 141 11 50m 67 42.398 698 50.908 80 1 VD RV 36 70 18.037 088 50.551 15 3 3 4 141 11 50m 67 42.398 698 50.908 80 1 VD RV 36 70 18.037 088 50.551 15 3 3 4 141 11 50m 67 42.398 698 50.008 80 1 VD RV 36 70 18.037 088 50.551 15 3 3 4 141 11 50m 67 42.398 698 50.008 80 1 VD RV 36 70 18.037 088 50.551 15 3 3 4 141 11 11 11 11 11 11 11 11 11 11 11	Description	North	East	Altitude	Site	Description North	East	Altitude	Site
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LARV 17 67 42.396 087 59.997 79 1 VD CAMP 77 11 VD CAMP 70 17.744 086 53.655 29 NA LARV 19 67 42.397 087 59.995 78 1 VD CAMP 70 16.540 088 53.444 38 1 LARV 21 67 41.884 088 02.293 59 2 VD RV 26 77 016.528 088 53.444 38 1 LARV 22 67 41.894 088 02.297 64 2 VD RV 28 77 016.528 088 53.444 41 1 LARV 23 67 41.894 088 02.277 62 2 VD RV 28 77 016.528 088 53.444 41 1 LARV 23 67 41.895 088 02.277 62 2 VD RV 28 77 016.528 088 53.444 41 1 LARV 24 67 41.896 088 02.277 62 2 VD RV 28 77 016.528 088 53.494 41 1 LARV 24 67 41.896 088 02.277 62 2 VD RV 28 77 016.528 088 53.494 41 1 LARV 24 67 41.996 088 02.301 63 2 VD RV 28 77 016.528 088 53.494 41 1 LARV 24 67 42.415 087 59.970 79 1 VD RV 37 70 17.734 088 53.084 29 2 LAT 109 50m 67 42.298 087 59.920 79 1 VD RV 37 70 17.734 088 53.084 29 2 LAT 109 50m 67 42.298 087 59.995 79 1 VD RV 38 77 017.734 088 53.091 29 2 LAT 109 50m 67 42.298 087 59.995 79 1 VD RV 38 77 017.734 088 53.091 30 2 LAT 110 50m 67 42.298 087 59.995 80 1 VD RV 38 77 017.744 088 53.091 30 2 LAT 110 50m 67 42.298 087 59.995 80 1 VD RV 38 77 018.098 088 55.511 15 3 LAT 114 50m 67 42.400 087 59.995 79 1 VD RV 38 77 018.098 088 55.511 15 3 LAT 114 50m 67 42.298 087 59.995 80 1 VD RV 38 77 018.090 088 55.581 14 3 3 LAT 112 50m 67 42.298 088 0.008 80 1 VD RV 38 77 018.090 088 55.581 14 3 3 LAT 113 50m 67 42.298 088 0.019 81 1 VD RV 38 77 018.090 088 55.581 14 3 3 LAT 114 50m 67 42.400 088 0.008 80 1 VD RV 38 77 018.090 088 55.581 15 3 3 LAT 115 50m 67 41.712 088 02.273 62 2 VD TT 10 07 07 016.542 088 53.411 45 1 1 LAT 14 50m 67 41.712 088 02.273 62 2 VD TT 10 07 07 016.542 088 53.411 45 1 1 LAT 14 50m 67 41.712 088 02.273 62 2 VD TT 10 07 07 016.542 088 53.411 45 1 1 LAT 14 50m 67 41.712 088 02.273 62 2 VD TT 10 07 07 016.542 088 53.411 45 1 1 LAT 14 50m 67 41.712 088 02.273 62 2 VD TT 20 07 07 016.540 088 53.411 45 1 1 LAT 14 50m 67 41.712 088 02.275 68 12 VD TT 10 07 07 016.540 088 53.411 41 1 1 LAT 14 50m 67 41.712 088 02.275 68 12 VD TT 10 07 07 016.540 088 53.411 41 1 1 LAT 14 50m 67 41.712 088 02.276 68 07 017.7	LARV 15	67 42.397	067 59.946	79	1	ND T06 00 65 18.828	072 51.730	17	2
LARV 18	LARV 16	67 42.387	067 59.970	79	1	ND T07 00 65 18.885	072 51.716	23	2
LARY 19 67 42.397 (087 59.995 78 1 VD RV 26 77 016.540 (088 53.444 38 1 LARY 21 67 41.884 (088 02.293 59 2 VD RV 26 77 016.528 (088 53.446 40 1 1 LARY 21 67 41.884 (088 02.270 64 2 VD RV 28 77 016.528 (088 53.474 41 1 1 LARY 22 67 41.894 (088 02.270 64 2 VD RV 28 77 016.528 (088 53.474 41 1 1 LARY 23 67 41.093 (088 02.277 62 2 VD RV 29 77 016.536 (088 53.474 41 1 1 LARY 24 67 41.996 (088 02.207 62 2 VD RV 29 77 016.536 (088 53.494 41 1 1 LARY 24 67 41.996 (088 02.207 7 91 VD RV 39 77 017.734 (088 53.002 27 2 LA T09 00m 67 42.396 (087 59.920 7 91 VD RV 30 77 017.734 (088 53.002 27 2 LA T09 50m 67 42.346 (087 59.970 7 91 VD RV 31 77 017.734 (088 53.003 29 2 LA T09 50m 67 42.341 (087 59.994 7 91 VD RV 33 77 017.734 (088 53.003 30 2 LA T10 50m 67 42.341 (087 59.994 7 91 VD RV 33 77 017.734 (088 53.003 30 2 LA T10 50m 67 42.341 (087 59.995 7 91 VD RV 33 77 017.734 (088 53.003 30 2 LA T10 50m 67 42.341 (087 59.995 7 91 VD RV 33 77 017.734 (088 53.005 29 2 LA T10 50m 67 42.341 (087 59.995 7 91 VD RV 33 77 017.734 (088 53.007 31 2 LA T11 50m 67 42.340 (087 59.995 80 1 VD RV 34 77 017.734 (088 53.007 31 2 LA T11 50m 67 42.340 (087 59.995 80 1 VD RV 36 77 018.031 (088 50.591 14 3 LA T11 50m 67 42.340 (087 59.995 80 1 VD RV 36 77 018.031 (088 50.591 14 3 LA T11 50m 67 42.340 (088 02.200 60 0.008 80 1 VD RV 38 77 018.031 (088 50.591 14 3 LA T11 50m 67 42.378 (087 59.9971 81 1 VD RV 38 77 018.037 (088 50.591 13 2 LA T11 50m 67 42.389 (088 00.200 88 00 1 VD RV 38 77 018.031 (088 50.591 14 1 LA T11 50m 67 41.890 (088 02.200 60 2 VD T11 9 007 016.542 (088 53.441 45 1 LA T11 50m 67 41.890 (088 02.200 60 2 VD T11 9 007 016.542 (088 53.441 45 1 LA T11 50m 67 41.890 (088 02.200 60 2 VD T11 9 007 016.542 (088 53.441 45 1 LA T11 50m 67 41.890 (088 02.200 60 2 VD T11 9 007 016.542 (088 53.441 45 1 LA T11 50m 67 41.890 (088 02.200 60 2 VD T11 9 007 016.542 (088 53.441 45 1 LA T11 50m 67 41.890 (088 02.200 60 2 VD T11 9 007 016.542 (088 53.441 45 1 LA T11 50m 67 41.890 (088 02.200 60 2 VD T11 9 007 016.545 (088 53.441 41 1 LA T11 50m 6	LARV 17	67 42.396	067 59.971	79	1	ND T08 10 65 18.833	072 51.86	18	2
LARY 19 67 42.397 (087 59.995 78 1 VD RV 26 77 016.540 (088 53.444 38 1 LARY 21 67 41.884 (088 02.293 59 2 VD RV 26 77 016.528 (088 53.446 40 1 1 LARY 21 67 41.884 (088 02.270 64 2 VD RV 28 77 016.528 (088 53.474 41 1 1 LARY 22 67 41.894 (088 02.270 64 2 VD RV 28 77 016.528 (088 53.474 41 1 1 LARY 23 67 41.093 (088 02.277 62 2 VD RV 29 77 016.536 (088 53.474 41 1 1 LARY 24 67 41.996 (088 02.207 62 2 VD RV 29 77 016.536 (088 53.494 41 1 1 LARY 24 67 41.996 (088 02.207 7 91 VD RV 39 77 017.734 (088 53.002 27 2 LA T09 00m 67 42.396 (087 59.920 7 91 VD RV 30 77 017.734 (088 53.002 27 2 LA T09 50m 67 42.346 (087 59.970 7 91 VD RV 31 77 017.734 (088 53.003 29 2 LA T09 50m 67 42.341 (087 59.994 7 91 VD RV 33 77 017.734 (088 53.003 30 2 LA T10 50m 67 42.341 (087 59.994 7 91 VD RV 33 77 017.734 (088 53.003 30 2 LA T10 50m 67 42.341 (087 59.995 7 91 VD RV 33 77 017.734 (088 53.003 30 2 LA T10 50m 67 42.341 (087 59.995 7 91 VD RV 33 77 017.734 (088 53.005 29 2 LA T10 50m 67 42.341 (087 59.995 7 91 VD RV 33 77 017.734 (088 53.007 31 2 LA T11 50m 67 42.340 (087 59.995 80 1 VD RV 34 77 017.734 (088 53.007 31 2 LA T11 50m 67 42.340 (087 59.995 80 1 VD RV 36 77 018.031 (088 50.591 14 3 LA T11 50m 67 42.340 (087 59.995 80 1 VD RV 36 77 018.031 (088 50.591 14 3 LA T11 50m 67 42.340 (088 02.200 60 0.008 80 1 VD RV 38 77 018.031 (088 50.591 14 3 LA T11 50m 67 42.378 (087 59.9971 81 1 VD RV 38 77 018.037 (088 50.591 13 2 LA T11 50m 67 42.389 (088 00.200 88 00 1 VD RV 38 77 018.031 (088 50.591 14 1 LA T11 50m 67 41.890 (088 02.200 60 2 VD T11 9 007 016.542 (088 53.441 45 1 LA T11 50m 67 41.890 (088 02.200 60 2 VD T11 9 007 016.542 (088 53.441 45 1 LA T11 50m 67 41.890 (088 02.200 60 2 VD T11 9 007 016.542 (088 53.441 45 1 LA T11 50m 67 41.890 (088 02.200 60 2 VD T11 9 007 016.542 (088 53.441 45 1 LA T11 50m 67 41.890 (088 02.200 60 2 VD T11 9 007 016.542 (088 53.441 45 1 LA T11 50m 67 41.890 (088 02.200 60 2 VD T11 9 007 016.542 (088 53.441 45 1 LA T11 50m 67 41.890 (088 02.200 60 2 VD T11 9 007 016.545 (088 53.441 41 1 LA T11 50m 6	LARV 18	67 42,406	067 59.969	77	1	VD Camp 70 17,214	068 53.65!	29	NA
LARY 20 67 41.891 088 02.244 63 2 VD RY 26 70 16.528 088 53.481 40 1 LARY 22 67 41.894 088 02.270 64 2 VD RY 27 70 16.538 088 53.481 40 1 LARY 22 67 41.894 088 02.277 62 2 VD RY 28 70 16.547 088 53.491 41 1 LARY 24 67 41.896 088 02.277 62 2 VD RY 29 70 16.547 088 53.491 41 1 LARY 24 67 41.896 088 02.277 62 2 VD RY 29 70 16.547 088 53.491 41 1 LARY 24 67 41.896 088 02.207 62 2 VD RY 29 70 16.556 088 53.491 41 1 LARY 24 67 41.896 088 02.207 79 1 VD RY 31 70 17.731 088 53.081 29 2 LAT 109 00m 67 42.396 087 59.920 79 1 VD RY 32 70 17.731 088 53.081 29 2 LAT 100 00m 67 42.391 087 59.934 79 1 VD RY 32 70 17.731 088 53.081 29 2 LAT 10 00m 67 42.391 087 59.934 79 1 VD RY 32 70 17.747 088 53.031 30 2 LAT 110 00m 67 42.391 087 59.946 80 1 VD RY 37 70 18.080 088 50.591 15 3 3 LAT 13 00m 67 42.408 087 59.959 79 1 VD RY 36 70 18.088 088 50.591 14 3 LAT 145 00m 67 42.283 087 59.959 80 1 VD RY 36 70 18.093 088 50.551 14 3 3 LAT 12 00m 67 42.238 087 59.959 80 1 VD RY 37 70 18.080 088 50.581 14 3 3 LAT 13 00m 67 42.240 088 00.208 80 1 VD RY 38 70 18.090 088 50.556 15 3 3 LAT 13 00m 67 42.378 088 00.019 81 1 VD RY 38 70 18.090 088 50.556 15 3 3 LAT 13 00m 67 42.378 088 00.019 81 1 VD RY 38 70 18.090 088 50.564 14 3 1 LAT 14 50m 67 41.892 088 02.203 60 2 VD T19 00 70 16.557 088 53.491 41 1 LAT 14 00m 67 41.892 088 02.203 60 2 VD T19 00 70 16.557 088 53.491 41 1 LAT 14 50m 67 41.892 088 02.203 60 2 VD T19 00 70 16.557 088 53.491 41 1 LAT 15 50m 67 41.700 088 02.287 64 2 VD T20 00 70 16.557 088 53.491 41 1 LAT 15 50m 67 41.700 088 02.287 64 2 VD T20 00 70 16.557 088 53.491 41 1 LAT 15 50m 67 41.890 088 02.295 61 2 VD T20 00 70 16.557 088 53.491 41 1 LAT 15 50m 67 41.890 088 02.295 61 2 VD T20 00 70 16.557 088 53.491 41 1 LAT 15 50m 67 41.890 088 02.285 61 2 VD T20 00 70 16.557 088 53.491 41 1 LAT 15 50m 67 41.890 088 02.285 61 2 VD T20 00 70 16.557 088 53.491 41 1 LAT 15 50m 67 41.890 088 02.285 61 2 VD T20 00 70 16.557 088 53.491 41 1 LAT 15 50m 67 41.890 088 02.285 61 2 VD T20 00 70 16.557 088 53.491 41 1 LAT 15 50m 67 41.890 088		67 42 397	067 59.995	78				38	1
LARY 21 67 41.684 088 02.283 59 2 VD RV 27 70 16.538 088 53.461 40 LARY 22 67 41.694 088 02.270 64 2 VD RV 28 70 16.536 088 53.471 41 1 LARY 23 67 41.703 088 02.277 62 2 VD RV 29 70 16.536 088 53.471 41 1 LARY 24 67 41.696 088 02.301 63 2 VD RV 30 70 17.734 088 53.02 27 2 LAT 09 00m 67 42.396 087 59.920 79 1 VD RV 30 70 17.734 088 53.02 27 2 LAT 09 50m 67 42.416 087 59.970 79 1 VD RV 30 70 17.734 088 53.06 29 2 LAT 09 50m 67 42.396 087 59.920 79 1 VD RV 30 70 17.734 088 53.06 29 2 LAT 09 50m 67 42.391 087 59.994 79 1 VD RV 32 70 17.734 088 53.06 29 2 LAT 09 50m 67 42.391 087 59.994 79 1 VD RV 32 70 17.747 088 53.07 30 30 2 LAT 10 50m 67 42.391 087 59.994 80 1 VD RV 33 70 17.747 088 59.07 31 2 LAT 110 50m 67 42.391 087 59.994 80 1 VD RV 35 70 18.088 088 50.51 15 3 1 LAT 11 50m 67 42.492 087 59.995 80 1 VD RV 35 70 18.088 088 50.51 15 3 1 LAT 12 50m 67 42.402 087 69.995 80 1 VD RV 37 70 18.080 088 50.581 13 3 1 LAT 12 50m 67 42.402 088 09.098 80 1 VD RV 37 70 18.080 088 50.581 13 3 1 LAT 13 50m 67 42.398 088 00.019 81 1 VD RV 39 70 18.091 088 50.551 15 3 1 LAT 13 50m 67 42.398 088 00.019 81 1 VD RV 39 70 18.091 088 50.551 15 3 1 LAT 13 50m 67 42.798 088 09.71 81 1 VD RV 39 70 18.091 088 50.551 15 3 1 LAT 14 50m 67 42.402 088 02.230 60 2 VD T19 507 016.542 088 53.41 45 1 LAT 14 50m 67 41.692 088 02.233 60 2 VD T19 507 016.557 088 53.48 41 1 LAT 14 50m 67 41.692 088 02.233 60 2 VD T19 507 016.557 088 53.48 41 1 LAT 14 50m 67 41.690 088 02.243 61 2 VD T20 507 016.557 088 53.48 41 1 LAT 15 50m 67 41.709 088 02.287 64 2 VD T20 507 016.551 088 53.49 41 1 LAT 15 00m 67 41.690 088 02.243 61 2 VD T20 507 016.551 088 53.49 41 1 LAT 15 00m 67 41.690 088 02.287 64 2 VD T20 507 016.551 088 53.49 41 1 LAT 15 00m 67 41.690 088 02.287 64 2 VD T20 507 016.551 088 53.49 41 1 LAT 15 00m 67 41.690 088 02.287 64 2 VD T20 507 016.551 088 53.40 42 1 LAT 15 00m 67 41.690 088 02.287 64 2 VD T20 507 016.551 088 53.40 42 1 LAT 15 00m 67 41.690 088 02.287 64 2 VD T20 507 016.550 088 53.60 30 1 LAT 14 00m 67 41.690 088 02.287 64 2 VD T20 507									
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LAT15 50m 67 41.709 068 02.287 64 2 VD T21 00 70 16.529 068 53.44 42 1  LAT16 00m 67 41.684 068 02.255 61 2 VD T21 50 70 16.545 088 53.501 41 1  LAT16 50m 67 41.705 068 02.301 64 2 VD T22 50 70 16.545 088 53.501 41 1  LAT17 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 16.540 068 53.51 40 1  LAT18 00m 67 41.696 068 02.286 60 2 VD T23 00 70 16.540 068 53.51 40 1  LAT18 50m 67 41.696 068 02.303 63 2 VD T24 00 70 17.729 068 53.60 39 1  LAT18 50m 67 41.696 068 02.330 63 2 VD T24 00 70 17.729 068 53.00 30 2  ND Camp 65 18.873 072 52.841 24 NA VD T24 50 70 17.756 068 53.00 30 2  ND RV 01 65 18.810 072 53.277 28 1 VD T25 50 70 17.756 068 53.00 32 2  ND RV 02 65 18.794 072 53.277 28 1 VD T25 50 70 17.756 068 53.00 32 2  ND RV 03 65 18.811 072 53.274 18 1 VD T25 50 70 17.756 068 53.00 32 2  ND RV 04 65 18.831 072 53.261 27 1 VD T26 50 70 17.752 068 53.00 30 2  ND RV 05 65 18.814 072 53.314 26 1 VD T27 50 70 17.752 068 53.06 30 2  ND RV 06 65 18.883 072 51.703 23 2 VD T28 50 70 17.751 068 53.08 28 2  ND RV 07 66 18.863 072 51.703 23 2 VD T27 50 70 17.751 068 53.08 28 2  ND RV 09 65 18.884 072 51.703 23 2 VD T27 50 70 17.751 068 53.08 28 2  ND RV 09 65 18.885 072 51.703 23 2 VD T27 50 70 17.751 068 53.08 28 2  ND RV 09 65 18.886 072 51.703 21 2 VD T29 00 70 17.750 088 53.08 28 2  ND RV 09 65 18.887 072 51.703 21 2 VD T29 00 70 18.076 068 50.51 4 3  ND RV 11 65 18.887 072 51.703 21 2 VD T29 50 70 18.09 068 50.50 15 3  ND RV 12 66 18.825 072 51.703 21 2 VD T29 50 70 18.09 068 50.50 15 3  ND RV 13 66 18.826 072 51.703 21 2 VD T29 50 70 18.09 068 50.50 15 3  ND RV 14 65 18.827 072 51.703 21 2 VD T29 50 70 18.09 068 50.50 14 3  ND RV 10 66 18.827 072 51.703 21 2 VD T29 50 70 18.09 068 50.50 14 3  ND RV 10 66 18.826 072 51.703 21 2 VD T29 50 70 18.09 068 50.50 14 3  ND RV 10 66 18.826 072 51.703 21 2 VD T29 50 70 18.09 068 50.50 14 3  ND RV 10 66 18.826 072 51.803 16 2 VD T31 50 70 18.09 068 50.50 14 3  ND RV 10 66 18.826 072 51.803 16 2 VD T31 50 70 18.09 068	LAT14 50m	67 41.712	068 02.273	62	2	VD T20 00 70 16.537	068 53.427	46	1
LA T16 00m 67 41.684 068 02.255 61 2 VD T21 50 70 16.545 068 53.506 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 41.705 068 02.269 58 2 VD T22 50 70 16.540 068 53.45 39 1 LA T17 00m 67 41.700 068 02.269 68 2 VD T22 50 70 16.540 068 53.45 39 1 LA T18 00m 67 41.675 068 02.266 60 2 VD T23 50 70 16.545 068 53.62 41 1 LA T18 00m 67 41.675 068 02.286 60 2 VD T23 50 70 16.545 068 53.62 41 1 LA T18 50m 67 41.696 068 02.330 63 2 VD T24 00 70 17.729 068 53.02 29 2 ND Camp 65 18.873 072 52.841 24 NA VD T24 50 70 17.759 068 53.02 29 2 ND RV 01 65 18.810 072 53.226 32 1 VD T25 00 70 17.759 068 53.02 29 2 ND RV 02 65 18.794 072 53.277 28 1 VD T25 00 70 17.754 068 53.04 28 2 ND RV 03 65 18.811 072 53.274 18 1 VD T26 00 70 17.752 068 53.04 32 2 ND RV 04 65 18.831 072 53.274 18 1 VD T26 00 70 17.752 068 53.04 32 2 ND RV 04 65 18.831 072 53.274 18 1 VD T26 00 70 17.752 068 53.04 32 2 ND RV 05 65 18.884 072 51.703 23 2 VD T27 00 70 17.725 068 53.06 30 2 ND RV 06 65 18.883 072 51.703 23 2 VD T27 00 70 17.725 068 53.06 28 2 ND RV 07 65 18.686 072 51.703 23 2 VD T27 50 70 17.750 068 53.08 28 2 ND RV 08 65 18.884 072 51.703 23 2 VD T28 50 70 17.750 068 53.08 28 2 ND RV 09 65 18.884 072 51.703 23 2 VD T28 50 70 17.750 068 53.09 32 2 ND RV 09 65 18.884 072 51.703 21 2 VD T28 50 70 17.750 068 53.09 32 2 ND RV 09 65 18.884 072 51.703 21 2 VD T29 00 70 18.076 068 50.47 4 3 ND RV 10 65 18.887 072 51.703 21 2 VD T29 50 70 18.000 068 50.54 4 3 ND RV 11 65 18.887 072 51.703 21 2 VD T30 50 70 18.000 068 50.54 4 3 ND RV 12 65 18.884 072 51.737 22 2 VD T30 50 70 18.000 068 50.54 14 3 ND RV 14 65 18.887 072 51.881 23 2 VD T30 50 70 18.000 068 50.54 14 3 ND T01 100m 65 18.880 072 53.288 31 1 VD T33 50 70 18.001 068 50.64 11 3 ND T01 100m 65 18.880 072 53.288 31 1 VD T33 50 70 18.001 068 50.64 11 3 ND T01 100m 65 18.863 072 53.288 31 1 VD T33 50 70 18.001 068 50.64 11 3 ND T03 000m 65 18.793 072 53.232 28 1 VD T34 50 70 17.402 068 51.76 11 5 ND T04 100m 65 18.824 072 53.331 27 1 VD T35 50 70 17.402 068	LAT15 00m	67 41.689	068 02.243	61	2	VD T20 50 70 16.551	068 53.49!	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 02.2059 58 2 VD T22 50 70 16.540 068 53.45 40 1  LA T17 50m 67 41.700 068 02.315 61 2 VD T23 00 70 16.540 068 53.46 39 1  LA T18 50m 67 41.675 068 02.286 60 2 VD T23 00 70 16.519 068 53.46 39 1  LA T18 50m 67 41.695 068 02.286 60 2 VD T23 00 70 16.535 068 53.62 41 1  LA T18 50m 67 41.696 068 02.330 63 2 VD T24 00 70 17.729 068 53.00 30 2  ND Camp 65 18.873 072 52.841 24 NA VD T24 50 70 17.756 068 53.02 29 2  ND RV 01 65 18.810 072 53.226 32 1 VD T25 00 70 17.756 068 53.02 32 2  ND RV 02 65 18.794 072 53.277 28 1 VD T25 00 70 17.756 068 53.02 32 2  ND RV 03 65 18.811 072 53.274 18 1 VD T25 00 70 17.726 068 53.04 28 2  ND RV 04 65 18.831 072 53.274 18 1 VD T26 00 70 17.726 068 53.04 32 2  ND RV 04 65 18.831 072 53.274 18 1 VD T26 00 70 17.726 068 53.04 28 2  ND RV 04 65 18.883 072 51.703 23 2 VD T27 50 70 17.751 068 53.06 30 2  ND RV 05 65 18.883 072 51.703 23 2 VD T27 50 70 17.751 068 53.06 30 2  ND RV 06 65 18.883 072 51.703 23 2 VD T27 50 70 17.751 068 53.08 28 2  ND RV 07 65 18.863 072 51.695 22 2 VD T28 00 70 17.725 068 53.08 28 2  ND RV 08 65 18.884 072 51.702 21 2 VD T28 00 70 17.750 068 53.09 32 2  ND RV 09 65 18.884 072 51.702 21 2 VD T29 00 70 18.076 068 50.47 4 3  ND RV 10 65 18.887 072 51.703 21 2 VD T29 50 70 18.076 068 50.47 4 3  ND RV 11 65 18.887 072 51.703 21 2 VD T30 50 70 18.009 068 50.56 14 3  ND RV 11 65 18.887 072 51.85 21 2 VD T30 50 70 18.009 068 50.56 14 3  ND RV 14 65 18.882 072 51.831 23 2 VD T31 50 70 18.009 068 50.56 14 3  ND RV 14 65 18.885 072 51.831 23 2 VD T32 50 70 18.009 068 50.56 14 3  ND RV 14 65 18.885 072 51.831 23 2 VD T33 50 70 18.009 068 50.56 14 3  ND T01 100m 65 18.864 072 51.803 16 2 VD T33 50 70 18.009 068 50.56 14 3  ND T01 100m 65 18.865 072 53.208 18 1 VD T33 50 70 18.001 068 50.56 14 3  ND T01 100m 65 18.864 072 53.208 18 1 VD T33 50 70 18.001 068 50.64 11 3  ND T03 000m 65 18.793 072 53.232 28 1 VD T34 50 70 17.402 068 50.54 14 4  ND T04 000m 65 18.894 072 53.331 27	LAT15 50m	67 41.709	068 02.287	64	2	VD T21 00 70 16.529	068 53.44	42	1
LA T17 00m 67 41.679 068 02.269 58 2 VD T22 50 70 16.540 068 53.51 40 1 LA T17 50m 67 41.700 068 02.315 61 2 VD T23 007 0 16.519 068 53.66 39 1 LA T18 00m 67 41.695 068 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 53.00 30 2 ND Camp 65 18.873 072 52.841 24 NA VD T24 50 70 17.756 068 53.00 30 2 ND RV 01 65 18.810 072 53.226 32 1 VD T25 00 70 17.728 068 53.00 32 2 ND RV 02 65 18.794 072 53.277 28 1 VD T25 00 70 17.728 068 53.00 32 2 ND RV 03 65 18.811 072 53.274 18 1 VD T25 00 70 17.726 068 53.04 28 2 ND RV 03 65 18.811 072 53.261 27 1 VD T26 00 70 17.726 068 53.04 32 2 ND RV 04 65 18.831 072 53.261 27 1 VD T26 00 70 17.725 068 53.06 30 2 ND RV 05 65 18.884 072 53.314 26 1 VD T26 50 70 17.755 068 53.06 30 2 ND RV 06 65 18.883 072 51.703 23 2 VD T27 50 70 17.755 068 53.08 28 2 ND RV 07 65 18.883 072 51.703 23 2 VD T27 50 70 17.755 068 53.08 28 2 ND RV 08 65 18.888 072 51.765 22 2 VD T27 50 70 17.755 068 53.08 28 2 ND RV 09 65 18.886 072 51.705 21 2 VD T28 00 70 17.750 068 53.08 28 2 ND RV 09 65 18.886 072 51.705 21 2 VD T29 00 70 18.100 068 50.51 4 3 ND RV 10 65 18.887 072 51.703 21 2 VD T29 00 70 18.080 068 50.51 4 3 ND RV 11 65 18.887 072 51.785 21 2 VD T30 00 70 18.080 068 50.51 4 3 ND RV 11 65 18.886 072 51.785 21 2 VD T30 00 70 18.080 068 50.50 15 3 ND RV 13 65 18.882 072 51.785 21 2 VD T30 00 70 18.080 068 50.50 15 3 ND RV 14 65 18.882 072 51.831 23 2 VD T31 00 70 18.090 068 50.50 15 3 ND RV 14 65 18.882 072 51.831 23 2 VD T31 50 70 18.090 068 50.50 14 3 ND RV 14 65 18.882 072 51.831 23 2 VD T31 50 70 18.091 068 50.50 14 3 ND T01 000m 65 18.893 072 53.288 31 1 VD T33 50 70 18.010 068 50.56 14 3 ND T01 000m 65 18.893 072 53.288 31 1 VD T33 50 70 18.010 068 50.56 14 3 ND T01 000m 65 18.894 072 53.288 31 1 VD T33 50 70 18.010 068 50.56 14 3 ND T03 000m 65 18.893 072 53.288 31 1 VD T35 50 70 17.402 068 50.62 12 3 ND T03 000m 65 18.893 072 53.288 31 1 VD T35 50 70 17.402 068 50.62 12 3 ND T04 000m 65 18.894 072 53.231 28 1 VD T35 50 70 17.402 068 50.6	LAT16 00m	67 41.684	068 02.255	61	2	VD T21 50 70 16.545	068 53.500	41	1
LA T17 00m 67 41.679 068 02.269 58 2 VD T22 50 70 16.540 068 53.51 40 1 LA T17 50m 67 41.700 068 02.315 61 2 VD T23 007 0 16.519 068 53.66 39 1 LA T18 00m 67 41.695 068 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 53.00 30 2 ND Camp 65 18.873 072 52.841 24 NA VD T24 50 70 17.756 068 53.00 30 2 ND RV 01 65 18.810 072 53.226 32 1 VD T25 00 70 17.728 068 53.00 32 2 ND RV 02 65 18.794 072 53.277 28 1 VD T25 00 70 17.728 068 53.00 32 2 ND RV 03 65 18.811 072 53.274 18 1 VD T25 00 70 17.726 068 53.04 28 2 ND RV 03 65 18.811 072 53.261 27 1 VD T26 00 70 17.726 068 53.04 32 2 ND RV 04 65 18.831 072 53.261 27 1 VD T26 00 70 17.725 068 53.06 30 2 ND RV 05 65 18.884 072 53.314 26 1 VD T26 50 70 17.755 068 53.06 30 2 ND RV 06 65 18.883 072 51.703 23 2 VD T27 50 70 17.755 068 53.08 28 2 ND RV 07 65 18.883 072 51.703 23 2 VD T27 50 70 17.755 068 53.08 28 2 ND RV 08 65 18.888 072 51.765 22 2 VD T27 50 70 17.755 068 53.08 28 2 ND RV 09 65 18.886 072 51.705 21 2 VD T28 00 70 17.750 068 53.08 28 2 ND RV 09 65 18.886 072 51.705 21 2 VD T29 00 70 18.100 068 50.51 4 3 ND RV 10 65 18.887 072 51.703 21 2 VD T29 00 70 18.080 068 50.51 4 3 ND RV 11 65 18.887 072 51.785 21 2 VD T30 00 70 18.080 068 50.51 4 3 ND RV 11 65 18.886 072 51.785 21 2 VD T30 00 70 18.080 068 50.50 15 3 ND RV 13 65 18.882 072 51.785 21 2 VD T30 00 70 18.080 068 50.50 15 3 ND RV 14 65 18.882 072 51.831 23 2 VD T31 00 70 18.090 068 50.50 15 3 ND RV 14 65 18.882 072 51.831 23 2 VD T31 50 70 18.090 068 50.50 14 3 ND RV 14 65 18.882 072 51.831 23 2 VD T31 50 70 18.091 068 50.50 14 3 ND T01 000m 65 18.893 072 53.288 31 1 VD T33 50 70 18.010 068 50.56 14 3 ND T01 000m 65 18.893 072 53.288 31 1 VD T33 50 70 18.010 068 50.56 14 3 ND T01 000m 65 18.894 072 53.288 31 1 VD T33 50 70 18.010 068 50.56 14 3 ND T03 000m 65 18.893 072 53.288 31 1 VD T35 50 70 17.402 068 50.62 12 3 ND T03 000m 65 18.893 072 53.288 31 1 VD T35 50 70 17.402 068 50.62 12 3 ND T04 000m 65 18.894 072 53.231 28 1 VD T35 50 70 17.402 068 50.6	LAT16 50m	67 41.705	068 02.301	64	2	VD T22 00 70 16.524	068 53.45	39	1
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				31	1		211.01		-

#### 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	1		TRANSECT 2 (B)			TRANSECT 3 (C )			TRANSEC	T 4 (D)	Т	- 1	TRANSECT 5 (E		Total tally	% Cover	s.d.		
Layer										s Tn	ee Dwarf-s	hrub Mo:	ss T		Dwarf-shrub					TOTAL (FO	LIAGE + DEAL
Species		Diract Sings	11033		Diract Sings	11033	-	Ditail Siliab	1103	-	ee Diidii b		-		Billari Siliab	1033				101112 (10	LINGE   DEM
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		0.20		
Pinus sibirica (foliage)				1			1				7		-	3			12	2.38	0.56		
Pinus sibirica (stem or dead)				-			-				1		-	,			12		0.30	2.30	
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)	11			10			16				19		-	5			56	11.11	1.39		
Betula toruosa (stem or dead)	-	,		10			1.0		-	_	17		-	1			1		2.33	11.31	
become coroosar (scenii or dead)				-									-				6				
Shrubs				-									-				ő				
Setula nana (foliage)		3		-								2	-		5		17	2.22	0.44	4.96	
Betula nana (stem or dead)					6			1		-		- 2	-				8	3.37 1.59	0.41		
Empetrum nigrum (foliage)		2		-	2			2		-			-		2		12				
Empetrum nigrum (tollage) Empetrum nigrum (stem or dead)		3			-			1		-		5	-		3			2.38	0.32		
Juniperis sibirica (foliage)				1	7			1		+			-				8				
Ledum palustre (foliage)								1					-		2 7		3		0.14		
		14			11			15				10	-				57	11.31	0.64		
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		
Vacciinium uliginosum (foliage)		10			5			5				6	-		4		30	5.95	0.47		
Vacciinium uliginosum (stem or dead)		1						3				3	_				7	1.39	0.23		
Vaccinium vitis-idaea (foliage)		6			2			7				11	_		5		31		0.65	6.35	
Vaccinium vitis-idaea (stem or dead)								1					_				1				
													_				0				
Graminoids, forbs													_				0				
Carex globularis					2								_				2	0.40		0.40	
													_				0				
Mosses and lichens																	0				
Cetraria islandica						1							_			5	6	1.19		1.19	
Cladina rangiferina						1				1							2	0.40	0.00		
Cladina stellaris			56			35			2	3			31			42	187	37.10	2.79		
Cladina stygia						5				4			3			3	15	2.98	0.20		
Peltigera aphthosa										1			2			1	4	0.79	0.14	0.79	
Pleurozium schreberi			12			29			3	5			20			23	119	23.61	2.00		
Polytrichastrum commune ?			1			2				2							5	0.99	0.11	0.99	
																	0				
Litter			26			29			3	19			45			27	166	32.94	1.75	32.94	
																	0				
TOTAL	31	. 49	95	34	44	102	46	45	10	15	48	46 1	01	37	37	101	921	182.74	5.61	182.74	
TOTAL POINTS	504																				
TOTAL TREE COVER (%)	39																				
TOTAL DWARF-SHRUB LAYER COVER	44																				
TOTAL MOSS LAYER COVER	100	)																			

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		
	Overstory	Understory	Overstory	Understory		1110		Understory	Overstory	Understory	
Hummocks	:				Average	Interhumn	nocks				Average
Andpol	1.9		6.7		4.3	Andpol (I)	0.0		5.3	Į,	2.7
Betnan (I)	11.1		13.3		12.2	Betnan (I)	4.9		0.0		2.4
Betnan (s)	1.9		0.0		0.9	Betnan (d)	2.4		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	
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	
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		
	Claste		1	25			none	2		100	
	Sphcom		2				Total	2			
	Sphmag(?)		1								
	Litter	4	4								
	Total	8									

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		0.0		0.0		0.0	1	0.2
BetnanL	24	24.2	28	28.3	18	18.2	26	26.3	24	24.2	120	24.2
BetnanS	1	1.0	2	2.0	1	1.0		0.0	6	6.1	10	2.0
Calstr	2	2.0		0.0		0.0		0.0		0.0	2	0.4
Calstr D									4	4.0	4	0.8
Calstr L			2	2.0	2	2.0	3	3.0			15	3.0
CarbigD	9	9.1	4	4.0	7	7.1	5		3		28	5.7
CarbigL	12		15		17	17.2	10	10.1	3		57	11.5
Empnig L				20.2	1	1.0		0.0		0.0	1	0.2
Eriang L			2	2.0		0.0		0.0		0.0	2	0.4
Erivag D			- 4	2.0	3	3.0		0.0	4		7	1.4
	3	3.0	6	6.1	7	7.1	3		1	1.0	20	4.0
ErivagL	3	3.0	ь	0.1	1		3	3.0	1	0.0		0.2
Fesovi L					,	1.0					1	
Ledpal L			1	1.0		0.0	100		1000	0.0	1	0.2
None	28	28.3	25	25.3	22	22.2	34	34.3	31	31.3	140	28.3
Petfri					2	2.0				0.0	2	0.4
Poaalp					1	1.0				0.0	1	0.2
Rubcha	2	2.0	1	1.0		0.0			1	1.0	4	0.8
Salgla S	1			0.0		0.0				0.0	1	0.2
Salphy	2	2.0		0.0		0.0				0.0	2	0.4
Salphy L					3	3.0	3	3.0	2	2.0	8	1.6
Salphy S			1	1.0							1	0.2
Vaculi L	2	2.0	1	1.0	3	3.0	3	3.0	1	1.0	10	2.0
VacvitD	1	1.0	1	1.0	2	2.0	1	1.0	5	5.1	10	2.0
VacvitL	11		10		9	9.1	11	11.1	6		47	9.5
(total)	99		99		99	100.0	99	100.0	99		495	100.0
(total)		100.0		100.0		100.0		100.0	33	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	12.1		0.0		0.0	12	2.4
Aultur	3	3.0	5	5.1	4	4.0	10	10.1				
Carbig D									2	3.0	25	5.1
				5.1		4.0	10	10.1	3	3.0	25	5.1
	1	1.0							3		1	0.2
Cetisl		1.0 0.0	2	2.0		0.0	1	1.0		0.0	1 3	0.2 0.6
Cetisl Chaset	1	1.0 0.0 0.0	2	2.0 1.0	1	0.0	1	1.0		0.0	1 3 2	0.2 0.6 0.4
Cetisl Chaset Claarb		1.0 0.0 0.0	2	2.0 1.0		0.0		1.0		0.0 0.0 0.0	1 3 2 10	0.2 0.6 0.4 2.0
Cetisl Chaset Claarb Claama	1	1.0 0.0 0.0 1.0	2	2.0 1.0 7.1		0.0 1.0 0.0	1 2	1.0 0.0 2.0	2	0.0 0.0 0.0 2.0	1 3 2 10 2	0.2 0.6 0.4 2.0 0.4
Cetisl Chaset Claarb Claama Cladsp	1	1.0 0.0 0.0 1.0	2	2.0 1.0 7.1		0.0 1.0 0.0	1 2 2	1.0 0.0 2.0	2	0.0 0.0 0.0 2.0 0.0	1 3 2 10 2	0.2 0.6 0.4 2.0 0.4 0.4
Cetisl Chaset Claarb Claarb Cladsp Cladsp Clagra	1	1.0 0.0 0.0 1.0	2	2.0 1.0 7.1 0.0		0.0 1.0 0.0	1 2 2	1.0 0.0 2.0 2.0	2	0.0 0.0 0.0 2.0 0.0	1 3 2 10 2 2 2 3	0.2 0.6 0.4 2.0 0.4 0.4
Cetisl Chaset Claarb Claama Cladsp Clagra Clasty	1	1.0 0.0 0.0 1.0 0.0 0.0 0.0	2 1 7	2.0 1.0 7.1 0.0 0.0 0.0	1	0.0 1.0 0.0 0.0 0.0 0.0	1 2 2 1 1	1.0 0.0 2.0 2.0 1.0 1.0	2	0.0 0.0 0.0 2.0 0.0 2.0	1 3 2 10 2 2 2 3	0.2 0.6 0.4 2.0 0.4 0.4 0.6
Cetisl Chaset Claarb Claarb Cladsp Cladsp Clagra Cladsy Dicang	1 1	1.0 0.0 0.0 1.0 0.0 0.0 0.0 5.1	2 1 7	2.0 1.0 7.1 0.0 0.0 0.0 18.2	1	0.0 1.0 0.0 0.0 0.0 0.0 5.1	1 2 2 1 1 1 13	1.0 0.0 2.0 2.0 1.0 1.0	2 2 8	0.0 0.0 0.0 2.0 0.0 2.0 0.0 8.1	1 3 2 10 2 2 2 3 1	0.2 0.6 0.4 2.0 0.4 0.4 0.6 0.2
Cetisi Chaset Claarb Claama Cladsp Clagra Clasty Dicang Dicelo	1	1.0 0.0 0.0 1.0 0.0 0.0 0.0 5.1 21.2	2 1 7	2.0 1.0 7.1 0.0 0.0 0.0 18.2 2.0	1	0.0 1.0 0.0 0.0 0.0 0.0 5.1 3.0	1 2 2 1 1	1.0 0.0 2.0 2.0 1.0 1.0 13.1 5.1	2 2 8 12	0.0 0.0 0.0 2.0 0.0 2.0 0.0 8.1	1 3 2 10 2 2 2 3 1 49	0.2 0.6 0.4 2.0 0.4 0.4 0.6 0.2 9.9
Cetisi Chaset Claarb Claarb Cladsp Cladsp Clagra Cladsy Dicang Dicelo Dicfus	1 1	1.0 0.0 0.0 1.0 0.0 0.0 0.0 5.1 21.2	18 2 1 18 2	2.0 1.0 7.1 0.0 0.0 0.0 18.2 2.0	1	0.0 1.0 0.0 0.0 0.0 0.0 0.0 5.1 3.0	1 2 2 1 1 1 13	1.0 0.0 2.0 2.0 1.0 1.0 13.1 5.1	2 2 8 12 3	0.0 0.0 0.0 2.0 0.0 2.0 0.0 8.1 12.1	1 3 2 10 2 2 2 3 1 49 43	0.2 0.6 0.4 2.0 0.4 0.6 0.2 9.9 8.7
Cetis Chaset Claarb Claama Cladsp Cladga Cladsp Clagra Clasty Dicang Dicelo Dicfus Dicrsp	1 1	1.0 0.0 0.0 1.0 0.0 0.0 0.0 5.1 21.2 0.0	2 1 7 18 2 1	2.0 1.0 7.1 0.0 0.0 0.0 18.2 2.00 1.0	1	0.0 1.0 0.0 0.0 0.0 0.0 5.1 3.0 0.0	1 2 2 1 1 1 13	1.0 0.0 2.0 2.0 1.0 1.0 13.1 5.1 0.0	2 2 8 12 3	0.0 0.0 2.0 0.0 2.0 0.0 8.1 12.1 3.0	1 3 2 10 2 2 2 3 1 1 49 43 4	0.2 0.6 0.4 2.0 0.4 0.6 0.2 9.9 8.7 0.8
Cetisi Chaset Claarb Claarb Cladsp Cladsp Clagra Cladsy Dicang Dicelo Dicfus	1 1	1.0 0.0 0.0 1.0 0.0 0.0 0.0 5.1 21.2	18 2 1 18 2	2.0 1.0 7.1 0.0 0.0 0.0 18.2 2.0 1.0 6.1	1	0.0 1.0 0.0 0.0 0.0 0.0 0.0 5.1 3.0	2 2 1 1 13 5	1.0 0.0 2.0 2.0 1.0 13.1 5.1 0.0 0.0	2 2 8 12 3	0.0 0.0 0.0 2.0 0.0 2.0 0.0 8.1 12.1	1 3 2 10 2 2 2 3 1 1 49 43 4 1 1 6	0.2 0.6 0.4 2.0 0.4 0.6 0.2 9.9 8.7
Cetis Chaset Claarb Claama Cladsp Cladga Cladsp Clagra Clasty Dicang Dicelo Dicfus Dicrsp	1 1	1.0 0.0 0.0 1.0 0.0 0.0 0.0 5.1 21.2 0.0 0.0	2 1 7 18 2 1	2.0 1.0 7.1 0.0 0.0 0.0 18.2 2.0 1.0	1	0.0 1.0 0.0 0.0 0.0 0.0 5.1 3.0 0.0	1 2 2 1 1 1 13	1.0 0.0 2.0 2.0 1.0 13.1 5.1 0.0 0.0	2 2 8 12 3	0.0 0.0 2.0 0.0 2.0 0.0 8.1 12.1 3.0	1 3 2 10 2 2 2 3 1 1 49 43 4	0.2 0.6 0.4 2.0 0.4 0.6 0.2 9.9 8.7 0.8
Cetis Chaset Claarb Claama Cladsp Clasty Dicang Dicelo Dicfus Dicrsp Dicsco	1 1 5 5 21	1.0 0.0 0.0 1.0 0.0 0.0 0.0 5.1 21.2 0.0 0.0 0.0	18 2 1 1 1 1 6	2.0 1.0 7.1 0.0 0.0 0.0 18.2 2.0 1.0 6.1	5 3	0.0 1.0 0.0 0.0 0.0 0.0 5.1 3.0 0.0 0.0 0.0	1 2 2 1 1 1 13 5	1.0 0.0 2.0 1.0 1.0 13.1 5.1 0.0 0.0 2.0 4.0	2 2 8 12 3	0.0 0.0 0.0 2.0 0.0 0.0 8.1 12.1 3.0 0.0 0.0	1 3 2 10 2 2 2 3 3 1 49 43 4 4 1 6	0.2 0.6 0.4 2.0 0.4 0.6 0.2 9.9 8.7 0.8 0.2 1.2 0.6
Cetis Chaset Claarb Claama Cladsp Cladga Clady Dicang Dicelo Dicfus Dicrsp Dicsoo Flacuc	1 1 5 21	1.0 0.0 0.0 1.0 0.0 0.0 0.0 5.1 21.2 0.0 0.0 0.0 1.0	2 1 7 18 2 1	2.0 1.0 7.1 0.0 0.0 0.0 18.2 2.0 1.0 6.1	1	0.0 1.0 0.0 0.0 0.0 0.0 5.1 3.0 0.0 0.0	2 2 1 1 13 5	1.0 0.0 2.0 1.0 1.0 13.1 5.1 0.0 0.0 2.0 4.0	2 2 8 12 3	0.0 0.0 0.0 2.0 0.0 0.0 8.1 12.1 3.0 0.0 0.0	1 3 2 2 10 10 2 2 2 3 3 1 1 49 43 4 4 1 1 6 6 3 3	0.2 0.6 0.4 2.0 0.4 0.6 0.2 9.9 8.7 0.8 0.2 1.2
Cetis Chaset Claarb Claama Cladsp Clagra Clagra Clasty Dicang Dicelo Dicfus Dicrsp Dicsoo Flacuc Hepaticae	5 21	1.0 0.0 0.0 1.0 0.0 0.0 0.0 5.1 21.2 0.0 0.0 0.0 1.0	18 2 1 1 1 1 6	2.0 1.0 7.1 0.0 0.0 0.0 18.2 2.0 1.0 6.1 0.0 0.0	5 3	0.0 1.0 0.0 0.0 0.0 0.0 5.1 3.0 0.0 0.0 0.0	1 2 2 1 1 1 13 5	1.0 0.0 2.0 1.0 1.0 13.1 5.1 0.0 0.0 2.0 4.0	2 2 8 12 3	0.0 0.0 0.0 0.0 2.0 0.0 0.0 8.1 12.1 3.0 0.0 0.0 0.0	1 3 2 10 2 2 2 3 3 1 49 43 4 4 1 6	0.2 0.6 0.4 2.0 0.4 0.6 0.2 9.9 8.7 0.8 0.2 1.2 0.6
Cetis Chaset Claarb Claama Cladsp Cladga Clasty Dicang Dicelo Dicfus Dicrsp Dicsco Flacuc Hepaticae Hylspi Litter	1 1 5 5 21 1 1 1	1.0 0.0 0.0 1.0 0.0 0.0 5.1 21.2 0.0 0.0 0.0 1.0	2 1 1 7 18 2 1 1 1 6	2.0 1.0 7.1 0.0 0.0 0.0 18.2 2.0 1.0 6.1 0.0 0.0	5 5 3	0.0 1.0 0.0 0.0 0.0 5.1 3.0 0.0 0.0 0.0 0.0	1 2 2 1 1 1 1 3 5 5 2 2 4 4 4 4	1.0 0.0 2.0 1.0 1.0 13.1 5.1 0.0 0.0 0.0 4.0	2 2 8 12 3	0.0 0.0 0.0 0.0 2.0 0.0 0.0 8.1 12.1 3.0 0.0 0.0 0.0	1 3 2 2 10 2 2 3 3 1 1 49 43 4 4 1 1 6 3 6 6 22 2 173	0.2 0.6 0.4 2.0 0.4 0.6 0.2 9.9 8.7 0.8 0.2 1.2 4.4 4.4 34.9
Cetis Chaset Claarb Claama Cladsp Clagra Clasty Dicang Dicelo Dicfus Dicrsp Dicrso Flacuc Hepaticae Hylspl Litter Pelaph	1 1 5 5 21 1 1 1	1.0 0.0 0.0 1.0 0.0 0.0 5.1 21.2 0.0 0.0 0.0 1.0 47.5	2 1 1 7 18 2 1 1 1 6	2.0 1.0 7.1 0.0 0.0 18.2 2.0 1.0 6.1 0.0 0.0 8.1	1 5 3 7 7	0.0 1.0 0.0 0.0 0.0 5.1 3.0 0.0 0.0 0.0 0.0 7.1 37.4	1 2 2 1 1 1 1 3 5 5 2 2 4 4 4 4	1.0 0.0 2.0 1.0 1.0 1.3.1 5.1 0.0 0.0 2.0 2.0 20.2 20.2	2 2 8 12 3	0.0 0.0 0.0 0.0 0.0 0.0 0.0 8.1 12.1 3.0 0.0 0.0 0.0 0.0 39.4 0.0	1 1 3 2 2 10 10 2 2 3 3 1 1 49 43 4 4 1 1 6 6 3 6 6 22 173 1 1	0.2 0.6 0.4 2.0 0.4 0.6 0.2 9.9 8.7 0.8 0.2 1.2 0.6 1.2 4.4 34.9 0.2
Cetis Chaset Claarb Claama Cladsp Cladsp Clagra Clasty Dicang Dicelo Dicris Dicris Dicris Dicris Litter Pelaph Pelmal	1 1 5 5 21 1 1 1	1.0 0.0 0.0 1.0 0.0 0.0 5.1 21.2 0.0 0.0 0.0 1.0 47.5	2 1 1 7 18 2 1 1 1 6	2.0 1.0 7.1 0.0 0.0 0.0 18.2 2.0 1.0 6.1 1.0 0.0 0.0 8.1	1 5 3 7 7	0.0 1.0 0.0 0.0 0.0 5.1 3.0 0.0 0.0 0.0 0.0 7.1 37.4	1 2 2 1 1 1 1 3 5 5 2 4 4 2 0 1 1	1.0 0.0 2.0 1.0 1.0 13.1 5.1 0.0 0.0 2.0 4.0 20.2	2 2 8 12 3	0.0 0.0 0.0 2.0 0.0 8.1 12.1 3.0 0.0 0.0 0.0 39.4	1 1 3 2 2 10 10 2 2 3 3 1 1 49 49 43 4 4 1 6 3 3 6 22 173 1 1 1 1 1	0.2 0.6 0.4 2.0 0.4 0.6 0.2 9.9 8.7 0.8 0.2 1.2 0.6 1.2 4.4 34.9 0.2
Cetis Chaset Chaset Claarb Claama Cladsp Cladsp Clagra Clasty Dicang Dicelo Dicfus Dicres Dic	1 5 21 1 1 1 47	1.0 0.0 0.0 1.0 0.0 0.0 0.0 5.1 21.2 0.0 0.0 0.0 1.0 47.5 0.0	2 1 1 7 7 18 2 2 1 1 1 6 6 8 8 30	2.0 1.0 7.1 0.0 0.0 18.2 2.0 1.0 0.0 0.0 8.1 30.3	5 3 7 7 37 1	0.0 1.0 0.0 0.0 0.0 5.1 3.0 0.0 0.0 0.0 0.0 7.1 1.0 0.0	2 2 1 1 13 5 5 2 4 4 4 20	1.0 0.0 2.0 1.0 1.0 13.1 5.1 0.0 0.0 4.0 4.0 20.2 20.2 1.0 1.0	2 8 12 3 1 1 2 39	0.0 0.0 0.0 2.0 0.0 0.0 8.1 12.1: 3.0 0.0 0.0 0.0 1.0 0.0 0.0 0.0 0.0 0.0 0	1 1 3 2 2 10 0 2 2 2 3 3 4 4 4 1 1 6 3 3 6 2 2 2 173 3 1 1 6 6	0.2 0.6 0.4 0.4 0.6 0.2 9.9 8.7 0.8 8.0 0.2 1.2 4.4 3.9 0.2 0.6 0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.3
Cetis Chaset Chaset Claarb Claama Cladsp Clagra Clasty Dicang Dicelo Dicfus Dicrsp Dicrso Flacuc Hepaticae Hylspi Litter Pelaph Pelmal Plesch Polstr	1 5 21 1 1 1 47	1.0 0.0 0.0 0.0 0.0 0.0 0.0 5.1 21.2 2.0 0.0 0.0 1.0 47.5	2 1 1 7 7 18 18 2 1 1 1 6 8 8 30	2.0 1.0 7.1 0.0 0.0 18.2 2.0 1.0 6.1.1 0.0 0.0 8.1.3 0.0 0.0	1 5 5 3 3 7 7 37 1 1 12	0.0 1.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0	1 2 2 1 1 1 1 3 3 5 5 2 4 4 2 2 0 1 1 6 6 6 6	1.0 0.0 2.0 1.0 1.0 13.1 5.1 0.0 0.0 2.0 4.0 20.2 0.0 6.1	2 2 8 12 12 3 3	0.0 0.0 0.0 0.0 0.0 0.0 0.0 8.1 12.1 13.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0	1 1 3 3 2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	0.2 0.6 0.4 2.0 0.4 0.6 0.2 9.9 8.7 0.8 0.2 1.2 0.6 1.2 4.4 3.4,9 0.2 1.2 1.2 1.2 1.2 1.2 1.4 1.6 1.6 1.6 1.6 1.6 1.6 1.6 1.6
Cetis Chaset Chaset Claarb Claama Cladsp Clagra Clasty Dicang Dicelo Dicfus Dicrsp Dicrsp Dicrso Flacuc Hepaticae Hylspl Litter Pelaph Pelmal Plesch Polstr	1 5 21 1 1 1 47	1.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0	2 1 1 7 7 18 2 1 1 1 1 6 8 8 30 4 4 7 7 7	2.0 1.0 7.1 0.0 0.0 0.0 18.2 2.0 1.0 6.1 0.0 0.0 0.0 8.1 30.3	7 7 37 1 12 111	0.0 1.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0	2 2 1 1 1 1 3 5 5 2 2 4 4 4 20 6 6 6 1 5	1.0 0.0 2.0 1.0 1.0 1.0 0.0 0.0 0.0 4.0 2.2 2.2 0.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0	2 2 8 8 122 3 3 3 4 1 2 2 3 9 9 6 6 12 1	0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0	1 1 3 3 2 2 10 10 10 10 10 10 10 10 10 10 10 10 10	0.2 0.6 0.4 2.0 0.4 0.4 0.6 0.2 9.9 8.7 0.8 0.2 1.2 4.4 4.4 3.9 0.2 1.2 6.6 1.2 6.6 1.2 6.6 6.6 6.6 6.6 6.6 6.6 6.6 6
Cetis Chaset Claarb Claama Claama Clagra Clagra Clasty Dicang Dicelo Dicfus Dicrsp Dicrsp Dicsco Flacuc Hepaticae Hylspi Litter Pelaph Pelmal Plesch Polstr Pticil	1 5 21 1 1 1 47	1.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0	2 1 1 7 7 18 18 2 1 1 1 6 8 8 30	2.0 1.0 7.1 0.0 0.0 0.0 18.2 2.0 1.0 6.1 0.0 0.0 0.0 8.1 30.3	1 5 5 3 3 7 7 37 1 1 12	0.0 1.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0	1 2 2 4 1 13 5 5 2 2 4 4 20 1 1 6 6 6 6 5 3 3	1.0 0.0 2.0 1.0 1.0 1.3.1 5.1.1 0.0 0.0 2.0 4.0 4.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1	2 8 8 122 3 3 1 1 2 2 39	0.0 0.0 0.0 0.0 0.0 0.0 0.0 8.1 12.1 3.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0	1 1 3 3 2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	0.2 0.6 0.4 2.0 0.4 0.2 9.9 8.7 0.8 0.2 0.6 1.2 2.4 4.4 3.4 9 0.2 1.2 6.6 1.2 1.2 1.2 1.2 1.3 1.3 1.3 1.3 1.3 1.3 1.3 1.3
Cetis Chaset Chaset Claama Cladsp Cladsp Cladgra Cladsy Dicang Dicelo Dicfus Dicrsp Dicrsp Dicrsp Dicso Flacuc Hepaticae Hylspl Litter Pelaph Pelmal Plesch Polstr Pticil Sphang Sphfus	1 5 21 1 1 1 1 47 5 5	1.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0	2 1 1 7 7 18 2 1 1 1 1 6 8 8 30 4 4 7 7 7	2.0 1.0 7.1 0.0 0.0 0.0 18.2 2.0 1.0 6.1 0.0 0.0 0.0 0.0 0.0 0.0 0.0 1.0 0.0 0	7 7 37 1 12 111 1	0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0	2 2 1 1 1 1 3 5 5 2 2 4 4 4 20 6 6 6 1 5	1.0 0.0 2.0 1.0 1.0 1.0 0.0 0.0 2.0 4.0 20.2 0.0 6.1 15.2	2 2 8 12 3 3 1 1 2 39	0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0	1 1 3 3 2 2 10 10 10 10 10 10 10 10 10 10 10 10 10	0.2 0.6 0.4 2.0 0.4 0.4 0.6 0.2 9.9 9.9 1.2 1.2 4.4 4.4 4.9 0.2 1.2 1.2 4.4 4.5 6.6 6.6 6.7 7.7 9.8 7.8 9.9 9.9 9.9 9.9 9.9 9.9 9.9 9
Cetis Chaset Chaset Claama Claama Cladsp Clagra Clasty Dicang Dicelo Diorfus Diorsp Dicrsc Dicrsc Flacuc Hepaticae Hylspl Litter Pelaph Pelmal Plesch Polstr Polstr Polstr Sphang Sphflus Sphglir	1 1 5 21 1 1 1 47 5 1 1 9 2 2	1.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0	2 1 1 7 7 18 18 8 2 1 1 1 1 6 8 8 30 4 4 7 7 4 4	2.0 1.0 7.1 0.0 0.0 0.0 18.2 2.0 1.0 6.1 0.0 0.0 8.1 30.3	5 5 3 7 7 37 1 1 1 1 1 1 1 2	0.0 1.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0	1 2 2 1 1 1 3 5 5 2 2 4 4 4 2 2 0 1 1 5 5 3 1 1	1.0 0.0 2.0 1.0 1.0 1.0 0.0 0.0 2.0 4.0 4.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1	2 2 8 8 122 3 3 9 6 6 12 12 1 1 2 2	0.0 0.0 0.0 0.0 0.0 0.0 0.0 8.1 12.1: 3.0 0.0 0.0 0.0 1.0 0.0 0.0 0.0 0.0 0.0 0	1 1 3 2 2 10 10 10 10 10 10 10 10 10 10 10 10 10	0.2 0.6 0.4 2.0 0.4 0.6 0.2 9.9 8.7 0.8 0.2 1.2 4.4 34.9 0.2 1.2 6.7 9.3 3.4 0.4
Cetis Chaset Chaset Claama Claama Cladsp Clagra Clasty Dicang Dicelo Dicfus Dicrsp Dicfus Dicrsp Dicsoo Flacuc Hepaticae Hylspi Litter Pelaph Pelmal Plesch Polstr Pticil Sphang Sphfus Sphfus Sphfus Sphfus	1 5 21 1 1 1 1 47 5 5	1.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0	2 1 1 7 7 18 18 2 1 1 1 6 8 3 3 0 4 7 7 4 2 2 2	2.0 1.0 7.1 0.0 0.0 18.2 2.0 1.0 6.1.1 0.0 0.0 8.1.3 0.0 0.0 0.0 0.0 1.0 0.0 0.0 0.0 0.0 0.0	5 5 3 7 37 1 1 12 11 1 1	0.0 1.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0	1 2 2 4 1 13 5 5 2 2 4 4 20 1 1 6 6 6 6 5 3 3	1.0 0.0 2.0 1.0 1.0 1.0 0.0 0.0 2.0 4.0 4.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1	2 2 8 12 3 3 1 1 2 39 6 12 12 12 12 12 12 12 12 12 12 12 12 12	0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0	1 1 3 3 2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	0.2 0.6 0.4 2.0 0.4 0.2 9.9 8.7 0.8 0.2 1.2 0.6 1.2 4.4 4.4 3.4.9 0.2 1.2 0.3 1.2 1.2 1.2 1.2 1.2 1.4 1.6 1.6 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7
Cetis Chaset Chaset Claarb Claama Cladsp Clagra Clagra Closty Dicang Dicelo Dicfus Dicrsp Dicsco Flacuc Hepaticae Hylspl Litter Pelaph Pelmal Plesch Polstr Polstr Polstr Sphang Sphflus Sphglir	1 1 5 21 1 1 1 47 5 1 1 9 2 2	1.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0	2 1 1 7 7 18 18 8 2 1 1 1 1 6 8 8 30 4 4 7 7 4 4	2.0 1.0 7.1 0.0 0.0 0.0 18.2 2.0 1.0 6.1 0.0 0.0 8.1 30.3 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	5 5 3 7 7 37 1 1 1 1 1 1 1 2	0.0 1.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0	1 2 2 1 1 1 3 5 5 2 2 4 4 4 2 2 0 1 1 5 5 3 1 1	1.0 0.0 2.0 1.0 1.0 1.0 1.0 0.0 0.0 2.0 4.0 4.0 1.0 6.1 6.1 15.2 3.0 0.0 0.0	2 2 8 8 122 3 3 3 4 1 2 2 3 3 9 6 6 12 2 1 1 2 2 5 5 1 1 1	0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0	1 1 3 2 2 10 10 10 10 10 10 10 10 10 10 10 10 10	0.2 0.6 0.4 2.0 0.4 0.6 0.2 9.9 8.7 0.8 0.2 1.2 4.4 34.9 0.2 1.2 6.7 9.3 3.4 0.4

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 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 4	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	1 16 16 1 1 2 2 3 3 9 2 2 1 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 1 3 3 1 1 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 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	T27 %	T28 count	T28 %	Total count	Total %
Arclat L							1	1.1	2	3.9	3	0.9
Betnan D	1	1.9						0.0		0.0	1	0.3
Betnan L	7	13.5	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							35	10.1
Carbig L	7										34	9.8
Eriang D			1					0.0		0.0	1	
Eriang L			1				2				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		55.5		55.5	02	12.7	1			17.12	1	
Rubcha							-	0.0		0.0	0	0.0
Salgla L			1	1.2			4				6	1.7
Sallan D			-	1.2			1	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			3	0.0
Salpol L	1		2	2.5						0.0	8	2.3
Vacvit L	4		15								45	
	52										347	
(total)	52	100.0	81	100.0	/5	100.0	- 00	100.0	51	100.0	34/	100.0
UNDERGTO	DV (71)											
UNDERSTO		TD 4.0/-	TOE	TOE 0/-	TO6t	TO 6 0/-	T07	TO 7.0/-	T00	TOO 0/-	Takal assumb	T-4-1-0/-
Species	T24 count	T24 %		T25 %	T26 count		T27 count			T28 %	Total count	
Aultur	3	5.8	6	7.4				12.5	2	3.9	27	7.8
Betnan S					1						1	
Black crust	3	5.8	2	2.5							7	
Carbig D					1	1.4					1	
Cetisl	1	1.9					2	2.3			3	0.9
Claama									2	3.9	2	0.6
Claarb	2	3.8						4.5			11	3.2
Clasty			3	3.7	3	4.3					6	1.7
Claunc	1	1.9	1	1.2	1	1.4			2	3.9	5	1.4
Dacarc							2	2.3			2	0.6
Dicang			3	3.7							3	0.9
Dicang is Dic	c big		1	1.2							1	0.3
Dicelo	7	13.5	3	3.7	5	7.1	2	2.3	3	5.9	20	5.8
Eriang L									1	2.0	1	0.3
Flacuc	1	1.9									1	0.3
Gymcor							1	1.1			1	0.3
Hepatic			5	6.2			2			3.9	9	2.6
Hylspl	12	23.1				11.4					58	16.7
Litter	4										39	11.2
Ochfri			1								5	
Pelaph			1			2.3	-	2.0	1	2.0	2	
Pelmal				1.2	3	4.3	2	2.3			7	
Pertsp					3	T.0	1			0.9	1	
Polstr	7	13.5	19	23.5	9	12.9				21.6	64	
Poop	,	10.0	1			12.9	10	20.3	11	21.0	1	0.3
	3	5.8			11	15.7	17	19.3	3	5.9	38	11.0
Pticil	3	5.8				15.7	3			3.9		
Raclan	2		6	7.4			3	3.4			9	2.6
Salnum L	2	3.8										
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 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 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 3 1 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 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 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 1.8 0.6 0.4 0.4 0.8 0.6 0.4 0.4 0.8 0.6 0.6 0.4 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 1.8 1.1 1.8 1.8 1.8 1.9 1.8 1.8 1.9 1.8 1.8 1.9 1.8 1.8 1.8 1.8 1.8 1.8 1.8 1.8 1.8 1.8
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 Clearb Claarb Cladsp Clady Clady Clagrenw/ 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 1.8 1.1 1.8 1.8 1.8 1.9 1.8 1.8 1.9 1.8 1.8 1.9 1.8 1.8 1.8 1.8 1.8 1.8 1.8 1.8 1.8 1.8

# Leaf-area index (LAI)

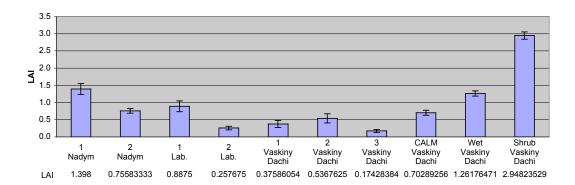


Figure 28. Mean leaf-area index of transects.

# Normalized Difference Vegetation Index (NDVI)

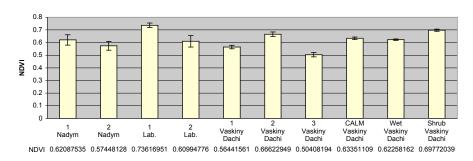


Figure 29. Mean NDVI of sample transects.

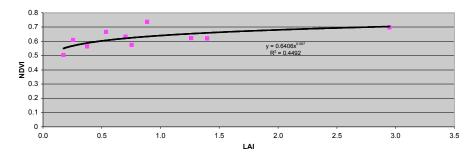


Figure 30. NDVI vs. LAI for all transects.

# 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)				
					dym-2					
See relevé da	ata Table 1	7. No da	ta from tr	ansects.						
111	7	,		Labo	rovaya-1	51				
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	9		0		į.
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				
				Labor	rovaya-2					
Transect/ Relevé #	T14	T15	T16	T17	T18	RV20	RV21	RV22	RV23	RV24
N	11	5	10	11	5	1	1	1	1	7.
Max	119	136	134	133	136					
Min	83	95	87	104	5	(-			\ <u></u>	V.
7111				115,1		0			V-	
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					
777	W.			Vaskin	y Dachi-1		31	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					0.
		14	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					V-
Min	40	60	50	56	57					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	50			31	•
	8	2,23			y Dachi-3		0			
Transect/ Relevé#	T29	T30	T31	T32	T33	RV-35	RV-36	RV-37	RV-38	RV-3
N	11	11	11	11	11	1	1	1	1	
Max	127	115	125	127	127					
Min	91	85	99	104	105					
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	X = 005 × 4 p	0.00000000	10000	2. 00050	V -0.000

# 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.

	é descriptions	tf management in	737. 50x1.0x004 (b)	C Ampletonia	The same	September 17	contest one	thousand and	10000	1/10	S1 75	10° 59276 50
Relevé #	Location	Study site	Characteristic species	Date	Observer	Plot size (m2)	GPS north	GPS east	Elev. (m)	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	1x1	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	1x1	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	Laborovaya	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 Site
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, Raclan	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
			<del>}                                    </del>	-	heic	ht/cm		_				
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	2	2	0	2	fluvial terraces	NA NA	wetland
13	0	0	25	0	0	2	2	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	?	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	?	with <20 % frost scars
19	0	25	30	2	2	3	2	20	82	fluvial terraces	2	with <20 % frost scars
1,727	0	5	15	2	0	1	3	10	118			
20	0		15 5			3	2		118	fluvial terraces	stabilized alluvium	small hummock
21	0	5 8	5	1	0	4	1	10 5	128	fluvial terraces	stabilized alluvium	flat centered polyons, small hummoc
22	0	10000	10	1	0	4	2	10	109	fluvial terraces	stabilized alluvium	flat centered polyons, small hummoci
24	0	10 20	3	2	0	5	3	10	109	fluvial terraces fluvial terraces	stabilized alluvium	flat centered polyons, small hummool
	7. 1							200	10000		stabilized alluvium	flat centered polyons, small hummocl
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	8	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
				4000					
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	no sign present	none	subject to solifluction	exposed to winds
08	hummock	mesic	moist	flat	snow free prior to melt out	no sign present	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	subxeric to mesic	moist to wet	flat	0 weeks	minor	reindeer tracks & scat	stable	exposed to winds
16	0	subxeric to mesic	moist to wet	flat	0 weeks	minor	reindeer tracks & scat	stable	exposed to winds
17	0	subxeric to mesic	moist to wet	flat	0 weeks	minor	reindeer tracks & scat	stable	exposed to winds
18	0	subxeric to mesic	moist to wet	flat	0 weeks	minor	reindeer tracks & scat	stable	exposed to winds
19	0	subxeric to mesic	moist to wet	flat	0 weeks	minor	reindeer tracks & scat	stable	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		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	stable	exposed to winds
38	0	xeric	dry	flat	snow free prior to melt out	minor	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	stable	exposed to winds

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

	5	_02	_03	0.4	-05	90-	-07	-08	-09	10	=	_12	13	4 4		17	18	13	20	21	-22	_23	24	_25	-26	_27	_28	_29	30	5	32	133	3	35	_36	_37	38	39
24 500	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	1 8	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 _		ר ר			7	7	_1		7	>	>	>	_	>	_	>		>	>	>	>	>	>	>
Alopecurus alpinus	8.1	(8)	100	36	8.1	38	100	36	- 83	38	100	36	83	98 B		36 83	- 38	100	- 86	83	-38	100	36	1	1	1	0.1	2	0.1	100	0.1	8.1	/8	1888	- 86	8.1	.08	188
Andromeda polifolia						1	0.5		0.01	0.01	4	0.01	0.1	0.1							0.1				-,													
Arctagrostis latifolia		180	100	1.5		1 80	18.	- 53	- 1		120	133	XIII	. 0	1 0	.01	1 8	100	1.55		- 50	100	- 53	0.01	0.01	0.01	0.1	0.1	0.1	3	2	0.1	2	0.5	- 53		188	100
Arctous alpina																		100	-01	0.1	0.1	0.1																
Betula nana	10		7	10	1	- 6	S	20			0.1	- 10		. 2		45 40	50	25	10	15	7	10	25	S	S	10	10		20	30	30	2	15			1	-	1
	8	10		1	,		u	20	-		0.1			. 2		~ ~	30	20	10	Id		10	2.1		-	10	10		20	30	30	-	10			-		
Betula pubescens	a	10	- 2	230	a	- 38	102	-85	- 30	- 38	10.5	-85	×1	8 18		65 80	- 38	100	- 85	30	- 38	100	- 85	- 83		105	-35	×1	- 35	100	- 85	- 80	18	105	- 65	- 33	- 38	100
Bistorta vivipara	1.5	35	- 12		100			• 6	- 1	15		• •	36	. 0,		10 1	10	- 00	• •	- 56	35	100		0.1	0.1	0.1	0.1	0.1	0.1	100	10	34			• • •	100	100	110
Calamagrostis neglecta agg.	- 25	1 3	633	1 28	- 26	100	103	188	-20	- 3	6.3	28	26	2 18	- 0	0.1 2	2	2	0.1	0.1		0.1	0.1	0.1		0.1	0.1	0.1	20	40	20	20	20	0.1	0.1	0.1	0.1	1833
Carex bigelowii subsp. arctisibirica	- 8	- 60	100	1.00	1 80	480	100	1.66	8.1	-00	100	86	8.1	. 1	5 3	25 20	20	20	7	S	7	35	20	60	30	40	30	20	10	S	S	10	10	15	10	0.1	15	2
Carex chordorhiza												30	1																									
Carex globularis		1 8	113	1 18	1 8	0.2	0.1	10	0.1	8	S		887	ğ-18			1 8	103	1 8		1	100	18			100	- 33	-37			1 13				18		10	1133
Carex globularis Carex limosa	_		20,4				· · · ·				-					· .	100	100			1,00			. A.S.	1,00	20,4	•22	- 43		27.		-	1,00	20.4			1.00	22.4
	- 1		100		- 8		100		- 66		100		~	30		-	- 2	100		- 60		100		- 60		1555	•	-	-2	105		- 66		105		- 60		
Carex rotundata	- 20	- 20	1000		. 24	- 20	1000	200	20	- 20	100	30				26 30	- 00	1000	200	200	- 20	100		200	120		200	•	- 10	100		20	- 20	100	0.5	7.0	- 22	200
Chamaedaphne calyculata	- 27	- 38	100	- 88	20	188	100	-88	23	- 38	100	- 88	2 1	0.01		P. 20	100	100	- 88	21	. 38	100	- 88	27	- 38	99	-88	27	18	500	- 8%	27	- 18	998	-00	20	38	100
Diapensia lapponica					1												100			0.1	0.1						•							· .				
Diphasiastrum aplinum	- 30	1 8	0.1	1 .8	- 55		183	.88	- 30		53	.00	35	# T9		S 3		1632	1 28	25	119	1638	- 58	- 88	- 13	100	.88	20	18	188		- 25	18	183	. 38	35	18	153
Drosera rotundifolia	- 20	100	500	7 24	-	100	1	200	20	.00	100	25	24			25	192	100	7 24	- 2	.00	100	2.5	20	.00	500	1.0	20	790	100	3.5	2.0	.02	500	2.5	2.0	192	500
	- 50	35	205	159	- 60	35	100	59	-63	35	105	50	900	25 20		01 63	35	1005	59	-80	35	(05	50	10	10	5	5	5	355	105	- 59	- 60	35	105	59	- 60	35	105
Dryas octopetala subsp. subincisa	1 20	1		1	1	1		25	- 1			- 20		<b>3</b> 18		20 10	- 30	100	20		- 1		20	10	10	,	4	4	- 30	100	20		3	18	20	- 10	-	100
Empetrum nigrum	S	S	3	S	S	- 86	100	216	- 83	56	165	-58	83	96 B		60 X	1 8	189	1.3	- 83	- 2	100	1.00	- 83	56	100	1.5%	X3.	59	100	1.55	- X3	55	100	- 68	83	. 2	100
Empetrum subholarcticum			19		1.5	- 81	100	• • • • • • • • • • • • • • • • • • • •	- 8	2	19		X	. 3		. 1	S	1	0.1	S	3	1	10		2		0.5	*		10	1			10	.00	0.5	0.1	0.1
Eriophorum angustifolium	- 20		1000	1 5%	- 20	- 36	100	1.50	- 20	- 26	100	3	0.1	35 3		30, 30		1000	0.1	0.1	- 35	100	0.1	- 60	- 25	135	0.01	200	0.1	0.1	1 83	1	- 1		1 50	20	- 76	100
Eriophorum russeolum	20	1 32	596	- 23	93	138	500	28	- 23	- 32	596	1	0.1	0.1		23 23	12	500	20	23	- 32	599	- 28	23	- 12	506	-23	23	120	596	- 20	23	120	999	288	93	138	500
Eriophorum vaginatum						0.1								. 2	5 0	0.1 2	0.1	2	0.1	0.1	0.1	0.1	0.1		0.1	0.1	0.1					2	1			0.1	0.1	0.1
Festuca cf. ovina	1 3	1 8	1000	1 1	1 30	1	100		- 30		183		30	. 0		7	1	188	2000		0.01	0.01	0.1				10000				1	1 70			1	100		163
	_		0.0		0.01		5.00											100			0.01	0.01	0.,	0.4	0.04	0.01	0.1	0.1						5.00				5.0
Festuca sp.		- 39	100	. 100	0.01	38	105	- 59		- 39	10.5	- 86	83	39 18		56 8	- 39	100	- 56	- 80	. 39	100	-96	0.1	0.01		0.1		.00	100	196	- 80		100	199	- 51	- 38	100
Hierochloe alpina			100	20			105	. 20		- 2	10.5	20		2 10		20 0		100			0.1	0.1	25	0.01	0.01	0.01	25	0.01	- 2	105	28		- 2	102	25	2	- 2	2
Huperzia selago	× .		100			5.6		- 63	× .	- 56	100	-63	× 1	S. 18		· ×	86	100	- 63	× 1	0.01	100	- 63	×	5.0		-68	× .		100	- 63	×3	- 55		0.01	× 1	56	
Juniperus communis	- X	2	4	1	1	- 0.0	100		×.	- 0.0	100	-0.	x.	. 10		es x		100		×.		100	-00	×		100		×	- 00	100		×		10	.00	×.	- 00	100
Larix sibirica	1	S	S	3	3	- 24	100	- 52	- 20	- 20	100	- 55	23	X 10		32 33	1 1	100	- 32	- 33	- 10	100	32	- 23	- %	100	- 53	- 23	75	100	133	- 30	- 10	100	- 52	- 20	- 30	682
Ledum palustre	15			20	15	65	40	80	0.1	0.01	0.01		1000	100		200	1	1000	200		550	100	100	1200		1000		1000				1000					100	100
	19	19	10	20	14	95		•	0.1	0.01	0.01	-5%	*1			60 80	100	2	0.1	2	a	1	2	- 6	100	200.5	•55	*	1.5	855	- 5%		1050	200	40	40	a	10
Ledum palustre subsp. decumbens	35	- 5	100	100	1.5	15	23.	• 6	1	- 10	200		25			10 1	100	- 2	0.1	- 4	3		- 4	- 1			• •	25	- 10	200		25	15		15	15	- 3	10
Luzula cf. confusa	20	- 22	10.00	28	26	- 33	8.3	28	20	- 33	8.6	28.	26	38 10		28 20	- 30	0.32	28	20		8.3	28	0.1	0.01	8.6	-88	20	- 33	8.8	28	20	32	132	28	20	- 33	5.32
Luzula cf. wahlenbergii	3.1	- 38	100	36	8.1	-38	100	36	8.1	- 39	100	36	8.1	9 B		56 83	38	103	36	8.1	0.1	100	36	8.1	.99	100	36		18	100	36	83	- (%)	100	35	8.1	38	100
Luzula sp.																											.,.							0.01	.,.	0.5	0.1	0.1
cf. Minuartia arctica			100	1 33		1 8	100	- 33		- 0	100	- 33	331	. 0.	01		0.01		1 33	- 00	- 2	100	133	- 33	- 80	100	- 33	0.0	- 87	100	188		180	100	- 50	1100		100
Oxycoccus microcarpus	_	-	100	-	1		S				100	0.01	A			100		100	- 10				- 1		- 12													-
	- 1		100	12	1	- 22		- 2	- 6		100					100	-	100	0.04	- 6	- 2	100	- 2	- 6		100	• 2	- 6	- 2				2.0	100		-		135
Pedicularis hirsuta	90	729	1000	200	. 20	7.00	1000	1 200	20	729	200	36,	20			25		100	0.01	0.00	729	127	200	200	0.1	100	7 56	20	- 1	0.1	0.1	0.1	220	100	7 56	20	1000	1000
Pedicularis labradorica	27	18	199	98	20	18	100	-86	- 23	- 38	100	- 88	23	. 0	1 0	0.1		0.1	0.1	0.1	. 38	0.1	98	27	- 18	503	-38	23	18	100	- 88	23	18	509	- 88	23	- 38	100
Pedicularis cf. lapponica			- 1			100										. 0.01		- 15		0.01	0.1	0.1						- 54										
Petasites frigidus	- 20		1838	1 33	- 30	100	153	1.00	-20	13.	1838	- 28	-90	2 10	0	0.5	0.5	1	- 28	30		103	25	- 33	- 3	100	- 33	-30	- 2	183	1 28	-30	2	103	.00	- 30	18	1838
Pinus sibirica		2	509	7 00	2	792	1000	7 20		.00	509	0.0	4.0			20° 10	100	100	7	-	.00	100	0.0	447	.020	200	7 20		700	100	7 00		700	100	1 00		100	1000
Pinus sylvestris	25		10	10	5	35					1005	59	50	35   10		59 60	38	205	59		38		59					-50			59	- 50				-52	35	205
	20		10	10	9	- 20	100			- 30		- 20				20 .	-				- 20	- 10	20	•			20		-	100	.75		- 20	102			- 30	- 10
Poa arctica	X3	390	200	-00	X3	30	100		- 83	- 20	200	-05	X	96 12		60 X	100	0.01	- 65	- X3	56	200	-95	×	0.01	0.1	-95	0.1	- 99	200	-00	X3.	36	100	-65	X	590	200
Rubus chamaemorus	1.0		10		1.5	10	15	3	2	1		•	X3	. 0	1	2 X	20	100					.00	× .	20			× .		100				100	.00	X.	29	
Salix glauca	. 33	- 35	0.00	1 53	- 24	- 35	100	1 25	- 63	36	100	33	\$3 <sub>1</sub>	36		25	38	0.00	0.1	0.1	- 35	0.1	1.55	S	S	S	7	1	3	2	1	2	2	100	1 52	- 24	- 35	100
Salix hastata	- 20	38	500	- 20	120	138	500	- 200	23	- 38	500	- 88	23	. 0.	01	20 20	100	500	200	23	- 38	500	200	S	1	1	1	23	- 32	596	- 88	23	138	508	- 200	923	38	500
Salix lanata																						1				1	1											
Salix myrtilloides	1 2	10	1839	1	30						183		327	9 18				189	0.1		- 3	8.3						33			1	30				30		183
	_		5.0		-						N							1000	0.1			5.0				10	15							5.04				5.0
Salix nummularia	8.1	- 33	100	- 66	- 80	- 39	100	- 55	- 8	- 33	100	-86	83	S 18		56 83	- 38	100	- 56	83	2	100	- 56	¥3.	.00				- 5	188		- 83	- 55	100	53	- 23	55	7
Salix polaris			1.0					25		- 2		25		2 10		20 0		10.5	20				25	30	15	10	S	20	8	S	3	1	1		0.1	S		7
Salix phylicifolia		56	100	- 69	× 1	86		- 63		- 50	144	- 53		S 3	1 5	5 2	1	15	2	0.5	0.1	4	1	- X3	0.1		- 53	× 1	0.1	100	- 55	1	5.5		- 63	1	. 8	
cf. Senecio			100				5.7	-51			5.0		×	on W		-01 V		100	00	- X		5.7		- 1		1.74	-50		130	100	11			100	-00		0.1	100
Stellaria sp.	1 80	1 20	100	1 33	187	100	100	138	331	20	100	33	201	\$ TE		33 33	1 100	100	1 33	331	- 20	100	38	201	20	100	0.01	201	70	100	1 32	100	100	100	32	- 33	100	100
	20	15	15	4	15	-			-			-					-	-		-			-									-				-	-	-
Vaccinium myrtillus						100	200	- 55	- 41	- 00	100.	-5%	*1	0.0		55 80	180	200	- 5%	- 81	- 00	200	- 5%	- 80	- 000	200	-5%	*	100	200	- 5%	- 40	180	200	-5%		185	100.0
Vaccinium uliginosum	6	10	8	S	8	12		1	- 5		1		20	2 1 2		25 30	10	25	• •	- 1	100	100	100	20		100	- 8	30			10	20	1.5			1		100
Vaccinium uliginosum subsp. microphyllum		1 8	18	1.00	1 8	- 8		. 63	- 23	. 3	16	-60	× .	. 0		2 7	3	5	15	20	10	10	10	S	- 55	1	0.1	*	- 8	18		X.	- %	100	- 53	1.8	- 8	100
Vaccinium vitis-ideae	S	S	S	S	S	S	2	2	1	0.1	S		20	. 1	0	7 15	S	10	0.1	0.5		0.5	- 10	2	1	S	S	7	30	15	15	20	10	35	15	2	20	2
Valeriana capitata	- 2	1.0	183	1 .8	20	1.3	103	- 58	- 30	1.0	63	- 55	30	# IS			0.1	183	1.8	2	18	153	- 58	0.1	0.1	633	.8	0.1		188	1 .88	36		103	. 8	. 2	1.8	1838
Alectoria nigricans		100	100	7 24	100	700	100	1.00	2.0	-70	500	25	247	000 E00		20 20	100	100	0.1	0.1	.00	100	2.5	0.1	780	0.1	7 .5	0.1	0.1	100	0.1	1	0.1	0.1	0.1	0.1	0.1	100
Alectoria ochroleuca		35	295	159	- 60	35	1205	59	-00	.55	205	59	-000	20		201 (5)	19	205		0.1	0.1	0.1	59	0.500	35		59	0.500	0.1	205	(35.54)	- 00	0.1	0.1	0.1	0.5	0.1	0.1
		1	100			- 86				- 35		20	00.	20 10		20 .0	1 3	100	1	0.1	0.1	0.1	20		- 1		20		0.1				0.1		0.1	0.4	0.1	0.1
Arctocetraria andrejewii		- 86	100	- 65	X3	- 66	100	-65	X3.	36	189	-05	X	96 18		60 X	1 20	100	1.00	- X3	-25-	19	1,2%	X3.	99)	100		X	390	199	- 65	X3	- 50	0.1	- 6%	- 83	(9)	100
Asahinea chrysantha	×		10		1.0	95		•			10	•	X	. N		0 X	1	100	0.1	1	0.5	0.1	0.1	×.			•	× .	9.	10		×	9.	100		X.	- 25	
Baeomyces rufus		- 25	0.00	1 83	- 24	36	100	1 85	- 88	36	000	35	20	3 J		25		682	1.00		- 36	100			35		1.5%			. 35			- 36	. 188			0.1	100
Bryocaulon divergens	- 20	52	500	120	420	328	500	120	- 20	38	506	200	29	. 0	1	20 90	0.01	5 500	0.1	0.1	0.1	0.1	0.1	0.1	52	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
Bryoria nitidula		957												. 0			1				0.1	1	0.1					0.1			1	-		0.1			-	0.1

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

	5	02	03	0.4	0.5	90	07	8	60	5	=	12	13	4	5	16	17	18	19	20	57	22	23	24	25	26	27	28	29	30	.33	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 DV 30
Species	물	물	물	물	문	문	문	문	모	문	문	물	물	물	3	5	3	3	3	5	5	3	3	5	5	5	5	5	5	5	5	5	2	5	2	5	5	2	5
Cetraria delisei	1	5974	14	36	100	30.	to:	8.6	¥500	50.1		8.6	Vis.	587.1	14	86	100	501	1.0	0.1	100	501	tik.	3.6	¥500	587.1	i k	35	¥33	520.1	1.00	3.5	100	501	0.1	0.1	100	5274	1 6
Cetraria islandica	2	1	1	1	1			0.1	2		200				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	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.5	0
Cetraria laevigata						1	0.01			1	2				100								0.1	0.1	0.1		0.1								0.1				T
Cetraria nigricans		-	-	100				100				100									- 1												-						0.
Detrariella fastigiata		12		182	95	28	- 100	182	95	22	100	182	95	22		82	951	23	- 100	100			0.1	88	95	323		82	900	20		182	951		0.1	182		1	1
Cladonia amaurocraea	100		200	100		0.1	5	0.01	0.1	0.01	0.01				0.01	0.01	0.1	0.1	0.1	3	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	73
Cladonia amaurocraea Cladonia arbuscula subsp. arbuscula		4	18.	-	5	0.1	98	5	V.1	0.01	0.01	13.5	100	- 20	0.1	0.01	V.1	0.01	0.1	20	10	7	20	15	0.1	0.1	3.	0.1	V.1	0.5	0.5	0.1	0.1	0.1	S	335	1	2	
Cladonia arbuscula subsp. arbuscula Cladonia arbuscula subsp. mitis		-	100	_	4				-	- 3		25	-	-	0.1	0,01	-	0.01	0.1	20	10	-	20	Id	2	-			-	0.0	0.4	0.1	0.1	0.1	-	5			
Cladonia arbuscula subsp. mius Cladonia bellidiflora	- 200	- 20	18	1300	.00	26/	18	13.5	*200	3/	0.01	13.6	100	- 20	18	3.5	.000	- 20	198	0.1	0.1	0.1	0.1	0.1	•33	201	18	0.1	0.1		18	0.1	100	3/	0.1	0.1	*33	0.1	0.
Cladonia cenotea			100	186	-	- 6	- 15	13:	- 27		0.01	10.		-	- 1	0.01		-:-	0.01	0.1	0.1	0.1	0.1	20001	-				0.1	-	- 1	٠.,			0.1	0.1	-:-		
	200	-	850	1884	\$5.2	***	100		952	100	050		852	100	882	0.01	8.2	- 100	0.01	534	952	100	032	35.	852		0%:	5%	852	100	: SE:	.554		100	888	15%	- 80		-
Cladonia cf. cenotea	- 50	90	18	354	100	20	1.8	-	100	9	1.00	39	500	9	18	39		9	1.8	3.9	500	90	18	39	100	(8)	×.	39	100		1.8	39	0.1	8	1.8	38	100	- 80	12
Cladonia cf. decortiata	- 1			100								100			2.5	0.0				0.0				0.0				0.		0.1				0.1	1.5	100			
Cladonia cf. grayi	- 6		- 3%	2.0	- 60	- 2	- 100	20	- 60		- EX	20	- 20		- 50	ķ.			- 8%	(i)	100	0.1	2		100	-	×	Ž.		0.1		20			0.1	0.1	100	0.1	0.
Cladonia cf. scabriuscula			- 18	50			- 1	50	- 00		- 10	30			- ×			- 0	- ×	30	10.	- 6	28	50	13	10	×	30	•		0.1				- ×	30			
Cladonia chlorophaea	200	- 7	3.6	26	. 200	40	5.0	. 64	. 20	720	100	198	200	42	376	94	. 20	4	57E	,94	. 20	40	100	På   3	0.1	20	0.1	84	200	42	0.1	0.1	. 20	0.1	56	J96 .	0.1	20	. 5%
Cladonia chlorophaea s. l.	- 200	0.01	79	56	200	9	79	26	200	8	79	199	200	9	79.	59	200	9	79	59	200	9	19	56	200		79	0.1	200		79	56	200	9	79	56	100	. 8	73
Cladonia coccifera			10				0.1		0.1	0.01	100				0.01	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	0.
Cladonia cornuta subsp. cornuta	- 37		12	0.01	- 20	- 8		0.01	- 60		100	186	- 80			0.01	- 63		- 1	0.01	0.1	0.1	120	· .	83	1.0	32	0.1			- 1	188	0.1	0.1	- 22	188.	- 60	100	- 83
Cladonia cornuta subsp. groenlandica	- 00		- 1		100	- 0	5×	130	400	- 60		30-			0.01									30.	100		×			0.1		100	0.1		- 128		- 60	- 80	30
Cladonia crispata			1	136		0.01	-	35.		- 10	- 100	186	- 52			188			- 12	8.	- 50		100	· .	53		š!	S				35.	- 52		- 12	188.		- 100	133
Cladonia cyanipes	100	589	tik.	35	100	90	18	3.6	933	92	ta:	39	938	92	ta:	39	100	321	1.8	3.9	978	90	1.8	36	100	50)	0.1	39	938	91	t/R	3.5	100	90	tik.	36	100	323	1,9
Cladonia deformis						1					0.1				0.01	0.01													0.1	0.1	0.1			0.1					
Cladonia furcata				10.					- 10							12.	0.01		0.01					0.1	0.1	0.1	0.1	0.1		0.1								100	13
Cladonia gracilis	0.01		100	100				1				1			0.01				0.01	1	0.1	0.1	10		0.1		0.1	100	0.1	0.5	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	
Cladonia gravi	- 100	22	100	188	95	201		182	951	72	- 102	183	95	72	100	82	30	0.01	100	82	9	22		62	90	721		82		2017	100	182	35	12	- 500 A	182	96	72	10
Cladonia grayi Cladonia macrophylla			775			0.01	775				775				770			0.01	700				70	0.1			770		400	0.1	700				700				-
	38	- 20	18.	133		0.01	138	12.	.000	- 20	13.	13.5	500		18.	324	100	- 20	138	33.	100	- 20	79:	0.1	200	- 20	18.	320	.000	0.1	136		0.4	- 20	138	330	100	301	73
Cladonia pleurota	- 1		135	100	•	- 60	13	9.	- 27		15				15				15		.00			3.									0.1	-	- 15			- 6	13
Cladonia pyxidata	- 1	- 100	18	188	35.5	80	152	335	. 17	180	852	33.	36	100	333				- 15	0.1		- 8	0.1	33	352		0.1	· .	0.1	0.1	0.1	3%	36	80	889	3%	0.01	- 10	- 85
Cladonia rangiferina	5	- 89	7	1	300	320	18	139	0.1	8	18	86	38	- 89	18	1	0.1	0.1	18	s	0.5	2	2	1	100	90	8	0.1	0.1	0.1	18	150	100	90	18	36	1	(2)	1.8
Cladonia sp.			2.5						100		2.5	- 2	100		2.5				2.5	- 10			2.5	00	100			0.	100	0.1	2.5		100		2.5	0.0			- 29
Cladonia sqamosa	- 2		× .	18.				186			- 2				- 1		- 20		- %	0.01	0.1	0.1	0.01	(A)	201		×			0.1		0.1	0.1	- 2		26			15
Cladonia stellaris	30	45	80	85	30	30	0.1	30	90	40	75	30-			- ×			0.5	- 58	30-			0.1	Se		10	×	(e-	•54		- 18			- 0	0.01	30	- 0	100	- 52
Cladonia stricta	20	2	100	15%	. 20					4		194	. 25	4	·	. 56				. Ká	. 10	4	0.1	196 L	200	28	100	5%	0.01		·	. a		0.1	0.1	0.1	. 20	38	. 8
Cladonia stvaia	260	1	1	199	4	25	10	15	10	50	20	164	260	50	0.1	0.1	0.1	0.01	0.01	10	1	1	1	1	260	50	752	56	0.1	0.5	0.5	0.1	0.1	0.1	S	2	200	1	1
Cladonia subfurcata																		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.
Cladonia sulphurina			12	188	- 20		12	183	0.01		0.1				0.01		- 30		12	162	- 20	33.0	12.	0.1	20	191	12		20				0.1		120	158	- 20	100	133
Cladonia uncialis		- 500		100				0.0	000		1.00				0.01		0.01	0.01	0.01	2	10	10	S	10	900	400	0.1	0.1	0.1	0.1	0.1	0.1	1	0.1	10	S		1	1
Dactylina arctica	- 500	- 80	5.0	100	500		50	10.	\$00	- 80	500	155	500		0.1	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	0.1	0.1	0.1	0.1	0.1	0.1	0.
	- 1		1	100	100	1	0.1	2	- 100		-	100	- 1		0.1	0.1	0.5	0.1	0.1	4	7	S.	1		0.1		0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.5	0.1	0.1	0.
Flavocetraria cucullata	- 60	- *	3X	150	***	- 50	0.1	- 4	100	- 10	500	1500	100	*	0.01	0.1	0.1	. 9.1	0.01	0.1	7	7	à	1	0.1	9.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	1	2	0.5	1	0.
Flavocetraria nivalis	- 10		- 33	13.			- 1		- 00	- 5	- 23	3:			0.01	0.1	0.1		0.01	0.1	-		a		**		×	30.											0,
Hypogymnia physodes	100	4	5.0	184	200	40	7/2	24	100	40	110	.94	200	4	70	94	200	40	70	94	100	0.1	170	0.1	200	40	7.0	94	200	4	7.0	914	. 100	90	- 19	9%	0.1	- 6	139
Icmadophila ericetorum	- 30	8	78	56	300	- 80	78	255	399	- 87	732	199	393	- 87	78	56	300	- 87	79	166	200	- 87	79	56	300	87	79	56	398		78	196	300	87	1	196	0.5	1	0;
Lichenomphalia hudsoniana			100				100				100		- 27		100				10				12	20	22		10	200		0.1	1.0	2.	- 22		10				100
Mycoblastus sp.	- 50		186	36	-53	100	14	188	- 53	*	100	186	- 50		32	38.	- 53		100	188	- 53	0.1	100	35.	-53		38	156	50		- 25	188	- 53	100	-26	355		100	- 68
Ochrolechia androgyna	100	527	18	35	300	20	18	36	200	82	tax.	38	38	92	18	35	100	32)	18	36	378	80	18	35	38	32)	18	35	38	20	18	35	100	82	18	36	0.1	-82	13
Ochrolechia frigida			100	100							2.5				1	0.1	0.01	1	1	0.01	0.1	0.1	0.1	0.1				- v	0.1		2.0				1	2	2	1	0.0
Ochrolechia inequatula	- 1	- 2	100	100	- 10	- 2	-		- 2	- 2	100		- 2	- 2					- 12	12.			10	0.1		2	0.1	0.1		1	1	1	0.5	2	0.1			- 2	138
Peltigera canina				10.																					0.01		×												
Peltigera cf. frippii	1 10	12	100	18%	- 36	12	- 12	188	95	72	122	18%	- 30	12		188	26	12	100	15%	0.1	120	100	52	100	72	: I	88	200	7.	100	0.1	0.1	12	100	18%	- 10	72	18
Peltigera cf. neckeri	900	1	70	160	900	60	20	65	960	50	700	60	960	90	0.01	160	0.1	50	0.01	66	960	0.1	750		907	60	200	64	900	97	200	66	900	0.1	70	60	100	68	73
Peltigera ct. necken Peltigera leucophlebia	1	1	1	100	2	- 201	100	1975	.000	207	10.50	1975	A200	- 25	0.01	200	0.01	- 20		225	100		17.0	26	0.1	0.1	0.1	0.1	0.1	0.1	11.5	0.1	0.1	0.1	100	3.5	100	1837	100
	-	1	1	123	1	-6	16	10.	- 20	-6-	16	10.	- 5	-6-1	5.51	10.	5.01	- 6	16		- 10		100			v.,		v.1	w.1	V.1	16	v.,	V.1	w.1	- 16	185	- 1	-	
Peltigera malacea	- 83	- 10	3.	55.	E	- 00	200	.55	*52		536	55.	*52		1000	.55			200	55	100		0.1	35.	45.2		esc.	S5.	•52		200	35.	100		656	554	152	- 8	- 03
Peltigera polydactylon-group	- 10	- 86	18	100	500	8	3.8	36	100	- 80	1.8	100	38	90	18		001		1.8	0.1	300	30	0.1	0.4	100	80		0.4				100	3.0	80	1.8	100	- 500	- 85	1.0
Peltigera scabrosa	- 1		1.	0.1							2.5	100	- 1		2.5	0.01	0.01	0.01		0.1			2.5	0.1			0.1	0.1	0.1	0.1	0.1				2.5	100			2.5
Peltigera sp.	- 6	- 2	- 5%	E.			82	86	20	- 2	200	ķ.	200	- 63	- 3%	Ķě.		- 6	22	Ke.	. 20		0.1	£6.	200	- 6	×	ķ.		- 2	- 8X	20	100		×	80		- 20	
Pertusaria dactylina											- 1		- 0		- ×		0.01			0.1	0.1	0.1	0.1	30	100		×							- 0	0.5				1
Pertusaria geminipara	200	120	3%	5%	. 26	28	576	56	20	720	100	56	200	78	376	56	200	120	376	, Fig. 1	0.1	S	120	56	200	720	100	5%	200	0.1	36	96	200	12	· 100	56	. 20	0.5	5%
Pertusaria panyrga	200	8	797	56	89	8	79	59	300	87	79:	59	200	87	79:	59	888	8	797	59	3(6)	82	79:	56	200	80	79:	56	899	8	781	59	888	80	0.1	56	200	0.5	73
Protopannaria pezizoides			10.5				1.5																											3					
Protothelenella leucothelia	- 0		12	188	- 10	- 1	12	18.	0.01	- 8	100	186	- 50		12	188	- 33		22	18.	- 53		32		33		12		307		12	1	- 10		12	186		1	
Psoroma hypnorum	7	190	1.0	200		- 1	1.4	2.0	-	190	1.4	0.0	700	100	1.0	200		100	1.4	200		120				50	0.1	0.1	200	100	1.4	200			1.4	200	0.1	100	0
Rhexophiale rhexoblephara	100	80	558	100	800	80	556	100	500	80	50.51	1166	800	80	57.65	186	800	80	57.5	165	500	867	10.51	100	500	60	DOM:	5.00 E	\$001	1	574	100	800	80	5561	1000	-0.500	80	-5
	-	- 5	-	100	-	- 1	-	100	-	- 3		100	- 50	-33	0.1	0.1	0.1	0.1	-	15	40	50	15	10	0.1	0.1	0.1	0.1	0.1	1	1	4	1	2	10	15	10	15	1
Sphaerophorus globosus Stereocaulon alpinum	- 20	180	:X	1,50	920	- 90	: ×	180	970	- 90	100	150	200	163	0.1	0.1	0.1	- 9.1	230	10		0.1	0.5	1	9.1	9.1	J.1	0.1	0.1	.00	::1:	100	100	-2	10	0.1			
		1	1.00	1000	100							100	10.0																							0.1	100		0.

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

	5	02	03	2	0.5	90	-07	8	60	₽,	F	12	13	4 4	4	1 7	80	19	20	2.	22	23	24	75	26	2	2	2	60	60	67	m	6	33	36	37	38	20
	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	8	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 DV 30
pecies	Z	ž	Z	Z	Z	Z	Z	Z	Z	ž	Z	ž	Z	Z 3	1 5	5 5	3	3	5	3	5	5	5	>	>	>	>	>	>	>	>	>	>	>	>	>	>	5
hamnolia vermicularis var. subuliformis	1	1 .	M	100	1	100	- 00		- 0.0	- 20/11		. T		. 0	1			71 - sv	500		-w/3	0.1	se 18	0.1	0.1	0.1	0.1			0.1		0.5	/1					
hamnolia vermicularis var. vermicularis	- 25	100	1 1%	15%	28	120	3%	188	\$65	20	3%	5%	\$55	20 3	. 0	0.0	1 0.0	1 0.01	1	0.1	0.1	0.1	0.1	0.1	220	0.1	0.1	0.1	0.1	0.1	0.1	196	0.1	0.1	0.1	0.1	0.1	0
/aricellaria rhodocarpa	100	50	79	156	900	- 60	239	164	900	- 60	75	56	968	60 8	1 15		6 6	189	166	900	60	75	56	900	60	100	56	963	50	739	56	96	60	0.1	160	993	60	0
ulacomnium palustre		-		100	-		1.5		-	-00						. 0.3		0.01			-00							-		1.5			- 00			-		
ulacomnium turgidum	- 10			18	1 1		100	0.1			100		- 22			5 3			0.01	1	0.1	0.5	2	50	40	90	40	40	20	15	10	10	S	0.01		0.1		0
Nepharostoma trichophyllum	-	-	1		1 000	-											-	-	-			-	-		0.01				-	1.74						-	-	H
	- 500	- 80	1.25	1985	- 500	- 20	0.01	100	100	80	525	285	500	50 0	. 12	8 8		1 52	156	100	80	125	585	500 100	0.01	23	100	\$00		125	100	500	80	525	255	300	80	- 2
Calypogeia sphagnicola	- 8	1		100	- 100	-	0.01	100	-		25	200	100		- 8			-	100	100		25	00					- 80	0.01	35	0.0	- 10	0.01		25	100	-	-
Cephaloziella sp.	- 00	- 100	- 2X	100	- 420	- 90	:×	150	191	- 00	:×	E4.	100	* 0	< 18	G 8		1 2×	186	100	100	:X	26-	100	100	×	()•	K20	0.01	×	100	193	0.01	230	86	- 20	1	8
Ceratodon purpureus	- 2		1 .	189			- 2			- 1		38.	***						13.				39	-			. ·	*		- 2	89		- 5		33.	100	- 1	
Conostomum tetragonum	200	- 40	7.0		200	40	74	Pa .	200	40	79	84	200	40	1,87	a , i	9 9	100	194	0.01	0.01	0.1	96	200	40		96	200	40	7.0	94	. 200	- 40	0.01	94	. 20	40	1
Cynodontium strumiferum	200	1.8	78	35	399	- 87	138	156	39	97	78	59	300	87 3		8 8	8	1 13	56	36	0.1	138	56	300	9	3	36	300	- 80	13	39	100	97	78	56	100	- 87	1
Dicranum acutifolium	- 2	0.5	100	2.5	- 20		1.5	0.01			12					S.		100	2.5	- 10		10				1	1	1		0.1	20	20	15	100	2.	2	-	
Dicranum elongatum	- 52			186	. 50	- 60	- 25	0.1	. 82	- 10	0.1	334	82	. 2	0 2	20 18				20	15	15		2	1	1	1	S	0.1	0.1	0.1	0.1	- 100	3	331	- 63	2	
Dicranum flexicaule	500	- 80	0.01	8	100	- 20	38	199	100	32	18	88	500	80 3	i lis	a 🗀 s	0.	138	0.01	0.1	(8)	18	86   3	0.1	287	8		100	20	30	3.6	100	90	18	3.9	300	30	
Dicranum fuscescens	100				0.5	0.1					2.0		100					100	100			20						100		2.0				- 10				
Dicranum groenlandicum	- 20	1	100	186		- 2	- 0			12	2		-					1 3			0.1	2	0.1			2	(·		12	3,	26		- 2	100	186	- 201		
Dicranum laevidens	100		- ×	50.	0		- 28		- 0		x I	Se		. 1	S 1	15 15	13	15		- 0		×	Se				. ·				40	0.1	15		30.	100		
Dicranum majus	- 10	12	1 172	15%	26	120	176	156	\$60	120	100	5%	26	28 3	1 15	2 3	1 2	18	15%	. 20	120	100	56. 3	2	28		S	26	72	12	176	200	12	100	176	200	78	П
Dicranum spadiceum	100	- 60	79	56	200	- 60	79		366	90	792	56	202	40 X	1 10		6 6	79	56	100	80	792	56	202	50		1	200	50	79	156	200	50	6	4	200	60	
Ditrichum flexicaule			1															1							1													
Symnocolea inflata	1 8	10	12	188	1 2		38	100	- 10		100		10					1 12	100	-67		0.1		10		1		101			13	- 201			0.1	100		П
Symnomitrion corallioides	200	200	1 12	0.00			1.00	0.0	400		100		200							• 000			35	700				900		1.2	5.0	• 000		100	0.01	0.01	0.01	0
		- 80	5.78	284	\$88	- 20	525	200	- 500	20	5.25	284	500		S :	2 2	-	5	288	0.01	0.01	525		40	40	30	30	10	20	10	10	10	10	525	0.01	0.1	0.1	0
lylocomnium splendens	- 1	-		- 00	100	0.01		100	-	-	2.	200	100			2 2			100	0.01	0.01			۳,	ш,	30	30	10	20	10	10	10	10				0.1	-
laeria cf. blyttii	- 20		- :X	5.0		0.01	- 23	I Ke	100	- 90	:×	200	¥20	<b>16</b> 3		G 8		1 :X	1,800	-				**			( ·				5.0	- 92		:×	200	- 60		
ophozia ventricosa s.l.				189					- 0				100							0.1	0.1	0.1	0.1		0.01	0.1	. ·	0.1	0.1	0.1	30		0.1	_ :		- 0	0.1	1
fylia anomala	200	- 40	5.0		. 20	0.01	- 11	194	. 10	40	5.0	94	200	40	. J.Pr	a	- 4	5.0	189.0	. 20	20	100	94	200	- 1933 and		- a	200	40	7.0	94	. 10	90	200	94	200	40	L
ncophorus wahlenbergii	399	- 8	79:	39	300	- 87	79	194	398	97	79:	59	300	87 3		9 9	8	79	0.5	3(6)	97 3	0.01	59	300	0.1	9		\$99		79	59	200	90	79.	199	100	- 87	
Orthocaulis binsteadii			1.0				1.5				10			. 3	)			1.0					0.1						0.1	0.1		0.1	0.1					
Orthocaulis kunzeanus	- 80		186	33.	- 80		- 14	354	- 82	- 1	- 1	33.	86	20 0	. 15		1 8	0.1	S	0.1	- 83	0.1	88.				٠.	-80		- 1	35.	. 83	- 8	35	0.1	- 82		
Nagiomnium ellipticum	100	90	1.8	36	100	- 30	138	3.6	200	92	18	35	500	90	138	e   s		1.8	3.9	300	92	18	3e   3	0.1	0.1		35	100	90	18	3.6	100	92	18	36	50	82	
Pleurozium schreberi	30	30	15	15	15			0.5				00	100	. 0	01 0	0.5 2		0.01	0.00	0.1	0.1		0.1					100		1.0		0.1						
Pogonatum dentatum			1 2	18.		- 2	- 0		- 2	- 23		2.							12.			2			-2	2			- 2	- 0	26		- 23	- 0	12.		0.01	0.
Pogonatum urnigerum	100			100			- 50		- 0		5×	50.		10 3				- ×	50.	100		ex.					(e			5.0		- 10			100	0.01		
Pohlia cruoides	96	100	13%	15%	200	100	3%	188	95	7	100	88	26	28 3	1 15		1 2	1 100	188	196	- 28	100	88.	95	28		%	266		3%	164	. 26	100	0.01	15%	100	7	Т
Pohlia nutans	100		70	163	900	0.01	70	64	960		0.01	66	967	40 0				70	66	0.01	0.01	0.01	66	960	. 1	0.01	0.01	9601	0.1	70	0.1	0.01		75	100	0.01	0.01	0
Pohlia sp.	- 500	-	1.0	1000	1.00	7.817.7				201 10		2.6	500	30 1			-	100	1996		1197	200,1	2.6	-	2001 1000		****	500		0.01							8.57	1
Polytrichastrum alpinum		1 6		100	1 6	1 3	100				100		201						100			122	8 1	201	0.1	2		20	10	10	10	27				- 10		Н
		-			0.1	-		1000	•00				10.0						1100					•0.2	0.1			•00			10	• • • •					-	н
olytrichastrum longisetum	0.01	- 80		100	0.5	- 20	525	100	- 50	- 85	1.8	28	500	80 0	. 8	8 8		58	156	S	30	2	2	500	80		25.	500	- 20	3.8	100	56	30	5.8	25.	58	- 80	H
Polytrichum commune	0.01	- 1	0.01		0.5		- 1	25	- 1	- 1	2.5	20 1	1						- 20	3		2	2	1			0.	100			50	s	- 1	2.5		1	- 1	H
Polytrichum hyperboreum	- 61	- 10	- 8%	20	- 20	- 40	- 38	180	200	100	200	86	400	* 0			1 1	1 20	186	200	100	×	86	201	143	×	(0	420	(4)	- 200	80	200	(40)	S	3	15	2	
Polytrichum jensenii	- 0		- ×	- 39-			0.1		- 0		2	30	0		. 3				3.	- 00		2				× .	(e				30	- 60	- 1	S	2	- 6	100	
Polytrichum piliferum	20	- 25	. 5%	96	-	40	374	98			10	98	201	40	. B	So od	1,00	100	86.		(8)	900	86.0	100	(A)	8		. 3	1	14	86.0	. 10.	18	199	94	0.01	40	
Polytrichum strictum	200	. 8	78	56	0.1	50	78	194	0.01	0.01	0.01	56	393	. 0		0.1 0.1			10	0.1	1	15	10	1	1	1	10	30	10	1	10	S	10	1	199	393	80	
Ptilidium ciliare		0.01	1 .	2.			1.5	0.01			10			. 3	1 3	5 3	2	S	S	2	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	- 60		- 88	33.	- 50	- 2	- 64	0.01	- 82		100	15E	-53	. 0	01			1 12	18.	- 50		3 L	S	62			· .	-50			10.		- 3	- 33	18.			
Racomitrium lanuginosum	500	92	18	35.	100	520	18	35	100	327	tik:	35	100	32) b	i lis	5 3	0.0	1 .	1	1	0.1	0.1	0.1	100	587	0.1	5.	504	0.1	1	1	0.1	1	10	10	2	S	
Sanionia uncinata																. 1		1	0.01	0.1		0.1		0.1	0.1			0.01	0.1									
phagnum balticum	- 2			10.	- 33	- 3	100	12.	- 20	- 2	2	30	20	. 0	1	. 0.1			122		- 51				1331						12.	- 20	- 121		12.	- 20	- 2	т
phagnum compactum				11								30																										
phagnum fuscum	98	32	100	188	95	0.01	75	152	951	38	82	52	201	321 0	8 16	2 8	1 3	1 8	15%	951	320	82	62	951	325	22	68	200	320	82	88	951	325	- 22	15%	301	323	+
pnagnum luscum phagnum girgensohnii			70	22	0.00	5.01	700		900		70		967					70	100	0.00		70	100	900		70		900		200		0.00		900		400		+
	- 120	28)	186	13.5	- 100	20/	18	100	438	201	18.	56	.00	20 3	13	. 0.1		18	100	.00	201	732	0.1	.00	201			.000	25/	pe.	3.5	- 100	20	18	8.6	200	- 81	+
phagnum lenense	- 10	1 2	1 12	25	100	- 2	12.	2.		2	14		80		10	. 0.1	-	1 12	25		- 2	12	0.1		2	2			-:	1.5	2.	- 12	- 22	- 1	3.	- 22	- 2	F
phagnum lindbergii	-	-			-									400		- 290								-		_											-	-
phagnum majus		- 80	18	186	100	- 85	3.8	38	100	85	18	30	20	100	1 3	. 2		18	169	100	90	18	100	500	80	8	(e)	100	-80	18	169	38	80	18	86	300	-80	L
phagnum rubellum	100		1	100	1		2.5					0.		2 - 2		. 1	200	0.5	100			2.5	0.							2.5	100				10			
phagnum squarrosum	- 20	100	12	186	2.0	- 6	- 89	26		- 20	100		200	20		. 0.1			186	- 20	- 23	2		-		×	<b>%</b>	201	- 24	- 32	K.	200	120	100	Re.	100	100	
phagnum teres			1 ×	3.0		100	- 10					30		· 2	. 3			0.5			10	×	30		10	×	30				30				30	10		
phagnum warnstorfii	26	. 2	1 12	15%	. 26	28	176	15%	. 25	120	120	5%	265	2 3	2	á., š	1	130	. 15%	. 90	(8)	Ş.,	5å	263	28	8	·	. 30				- 35	120	100	56		72	
phenolobus minutus	100	90	79	159	900	- 60	792	56	200	90	792	56	200	40 Z		.01 0.1	0.	0.01		1	1	0.5	0.1	200	9		0.01	0.01	0.1	0.01	0.01	0.1	90	2	0.1	0.01	9	Т
placnum sphaericum		1.		100					• • • •									200.50														0.1						t
tereodon holmenii	- 10	1 6	12	188	1 2		38	100	- 127		100		10					0.01		-67	100			20		2	0.01	101			13	83				100		f
tereodon normenii tereodon subimponens							1.22		4000					90 1				0.01		• 000					0.01					1.0		• • • •				400		+
	- 100	- 80	5.8	150	100	- 80	5.25	200	500	80	535	20.	500				8	1.3	120	100	80	1.8	36	000	-201		10°	:00	*	5.25	100	100	80	525	28.	500	80	+
traminergon stramineum	1	- 5	1	100	1			100			2.5	0.	100	. 0	-1	9 .			100					100			200				0.0		-				-	H
etralophozia setiformis	- 80		- 100	2.0			- 2	20	- 60		× .			*						- 60	8				8	*				- 2			- 6	- 52	0.01		- 6	L
omentypnum nitens			- ×	39			- 1	30			× .		100		. 3	. 0.0	1 .			- 0		× .		1	10	1	1				30		- 0		30	10		
ritomaria quinquedentata	\$33	. 2	38	15%	20	20	36	198	. 100	20	100	58	200	20 . 3	1 10	a	8 B	0.5	15%	. 93	220	56	58 3	0.1	223	8	0.1	200	123	56	0.1	0.1	223	376	58	300	20	

## 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 n	nass (kg)	mass (g)
ND_RV_0										ND_RV_03									
	Bet.pub Bet.pub	1 6		0.8 28.3	7	5.7 5.3	2.2	0.1 8.1			Bet.pub Bet.pub	0.3 0.2		0.1	1.5	0.2	1.2	0.0	4.5 1.6
	Bet.pub	9		63.6	8	8.2	4.2	22.3			Bet.pub	1		0.8		0.3	2.3	0.1	91.8
	Lar.sib	1		0.8		4.8	1.5	0.2			Bet.pub	0.2				1	2	0.0	1.6
	Lar.sib	4		12.6	6	5.8	0.7	4.9			Lar.sib	5		19.6		0.3	2.7	5.3	5279.9
	Pin.syl	16		201.1	9	0.9	8.3	79.1			Lar.sib	5		19.6		2.9	6.7	6.9	6935.7
	Pin.syl	16		201.1	9	0.5	9.8	79.1	79067.0		Lar.sib	7		38.5		5.8	9.2	12.5	12520.7
	Pin.syl	3.5		9.6	4	2.8	1.3	2.3			Pin.syl	17		227.0		0.1	9.7	91.4	91437.0
	Pin.syl	3		7.1	4	1.8	3.3	1.6			Pin.syl	6		28.3		3	6.5	11.0	11027.0
	Pin.syl	14		153.9	9	1.8	3.8	57.4			Pin.syl	11		95.0	9	4	9.7	32.4	32397.0 16539.0
	Pin.syl Pin.syl	12		113.1 7.1	8	1.2	1.2 4.5	39.7 1.6	39707.0 1637.0		Pin.syl Pin.syl	8		50.3 63.6		4.5 4.5	6.7 0.1	16.5 20.8	20813.0
	Pin.syl	7		38.5	8	1.2	5.6	13.3			Pin.syl	4		12.6		6	2.4	3.1	3147.0
	Pin.syl	12		113.1	9	1.8	6.3	39.7			Pin.syl	2		3.1		6.2	5.8	0.9	851.5
	Pin.syl	3.5	35	9.6	5	1.8	7.5	2.3	2269.7		Pin.syl	12	120	113.1	7	6.7	0.2	39.7	39707.0
	Pin.syl	12		113.1	9	2.8	4.8	39.7			Pin.syl	8		50.3		7.4	7.4	16.5	16539.0
12	Pin.syl	6.5	65	33.2	6	2.5	2.8	12.0	12025.5	17	Pin.syl	16	160	201.1	9	8.5	2.5	79.1	79067
	Pin.syl	0.5		0.2		2.8	1.8	0.3			Pin.syl	9		63.6	7	8	0.8	20.8	20813.0
	Pin.syl	6		28.3	6.5	3.6	7.7	11.0	11027.0		Pin.syl	8		50.3		9.8	1.6	16.5	16539.
	Pin.syl	14		153.9	9	3.2	8.5	57.4		20	Pin.syl	13	130	132.7	8.5	9.3	6.3	48.0	48029.
	Pin.syl	13		132.7	8	4.5	5.8	48.0		ND DV 04									
	Pin.syl	11		95.0		4.5	0.8	32.4		ND_RV_04							2.2		
	Pin.syl	5		12.6 19.6	5.5	5.5	0.7	3.1 9.8			Bet.pub	1		0.8 95.0		4.1 9.7	2.3	0.1 36.9	91. 36868.
	Pin.syl Pin.syl	7		19.5	7.5	5.2 5.7	0.7	13.3	9789.0 13277.0		Bet.pub Lar.sib	11		95.U 28.3		3.5	3.5	7.0	36868. 6978.
	Pin.syl	20		314.2	11	7.2	2.8	134.6			Lar.sib	1.5		1.8		8.5	1.6	0.4	424.
20	yı	20	200	514.2	- "	7.2	2.0	10-4.0	.0.010.0		Pin.syl	11		95.0		0.2	4.2	32.4	32397.
ND_RV_0	12										Pin.syl	5		19.6		1.2	6.7	6.1	6050.
	Bet.pub	6	60	28.3	7.5	46	7	8.1	8099.4		Pin.syl	21		346.4		1.2	6.7	151.0	151037
32	Bet.pub	0.6		0.3		7.2	9.2				Pin.syl	21		3.1		2.5	8.7	0.9	851.
33	Bet.pub	1		0.8		7.5	6.5	0.1			Pin.svl	2		3.1		3.6	3.4	0.9	851
	Bet.pub	7.5		44.2	7	7.6	5.8	14.2			Pin.syl	15		176.7		4.5	0.4	67.7	67709.
37	Lar.sib	20	200	314.2		7.5	3.6	111.6			Pin.syl	4	40	12.6	4	4.5	2.5	3.1	3147.
	Lar.sib	21		346.4	13	9	8.2	129.7	129736.5		Pin.syl	0.5		0.2	1.2	4.6	2.4	0.3	319.
	Pin.sib	4		12.6	- 5	8.2	7.6	3.1			Pin.syl	5		19.6		4.5	3.1	6.1	6050.
	Pin.syl	3		7.1	3.5	0.2	3.3	1.6			Pin.syl	15		176.7	9	6.5	5.7	67.7	67709.
	Pin.syl	0.5	_	0.2		0.4	3.4				Pin.syl	1.5				6.2	6.8	0.6	614.
	Pin.syl	16		201.1	10	1.7	3.2				Pin.syl	7	70	38.5	6	8.5	2.6	13.3	13277.0
	Pin.syl Pin.syl	10		78.5 7.1	8.5 1.5	1.2	3 1.8	26.1 1.6	26099.0 1637.0		Pin.syl Pin.syl	0.5		0.2 12.6		9.7	8.8	0.3 3.1	319.
	Pin.syl	2.5		4.9		2.3	0.5	1.0			Pin.syl	0.4		0.1		9.7	3.5	0.3	299.
	Pin.syl	2.0		3.1	2.2	2.5	0.5	0.9			Pin.syl	16		201.1		9	3.1	79.1	79067
	Pin.syl	5		19.6		3.3	2	9.8		20	Pin.syl	8		50.3		9.5	1.5	16.5	16539.
9	Pin.syl	10	100	78.5	8	2.5	8.8	26.1	26099.0										
10	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.
12	Pin.syl	2	20	3.1	4	3.6	9.5	0.9	851.5	5	Bet.pub	1	10	0.8	3	0.7	9.7	0.1	91.
13	Pin.syl	0.5			2	3.7	9.2	0.3		8	Bet.pub	11		95.0		1.8	4	36.9	36868.
	Pin.syl	0.4		0.1	1	3.3	8.3	0.3	299.2		Bet.pub	0.8		0.5		9.7	4.7	0.1	52.
	Pin.syl	3		7.1	4.5	4.3	9.5	1.6			Bet.pub	7.5		44.2		9	4.2	14.2	14150.:
	Pin.syl	0.5		3.1 0.2	4	4.7 4.3	9.6 9.7	0.9	851.5 319.5		Lar.sib Lar.sib	7	70 20	38.5	2.5	0.7 3.5	9.2 3.5	11.6 0.7	11605. 744.
	Pin.syl Pin.syl	0.6		0.2		4.3 5.5	9.7	0.3	341.0		Lar.sib	12		113.1		3.0	3.5	34.8	34776.
20	Pin.syl	7	70	38.5	8.5	5.5	9.5	13.3			Pin.sib	0.7		0.4		0.7	10	0.4	364.
	Pin.syl	6	60	28.3	8	5.7	9.2	11.0		9	Pin.sib	8	80	50.3	6	1.5	3.5	9.6	9563.
22	Pin.syl	2	20	3.1	3.5	5.5	1	0.9	851.5	26	Pin.sib	0.7	7	0.4	1	9.5	4	0.4	364.
	Pin.syl	2		3.1	3	6.3	0	0.9	851.5		Pin.syl	2.5		4.9	3.2	0.8	1.8	1.2	1180.
	Pin.syl	10		78.5	8.5	6.2	2.5	26.1			Pin.syl	6		28.3		1	7.8	11.0	11027.
	Pin.syl	3.5		9.6 12.6	6	6.5 6.7	3.5 4	2.3	2269.7 3147.0		Pin.syl	4.8 18	48 180	18.1 254.5	8.5	2	5 3.4	5.3 104.8	5308. 104819.
	Pin.syl Pin.syl	7		12.5	7	6.9	4.5	13.3			Pin.syl Pin.syl	18		254.5 176.7		3.8	3.4	104.8	104819. 67709.
	Pin.syl	1		0.8		6.9	4.7	0.4			Pin.syl	14		153.9		5	0.2	57.4	57363
	Pin.syl	3.5		9.6		6.2	5.5	2.3			Pin.syl	14		153.9		6	6.9	57.4	57363
	Pin.syl	3	30	7.1	5	7.5	9.5	1.6	1637.0		Pin.syl	2	20	3.1	3	7.5	6.2	0.9	851.
31	Pin.syl	1	10	0.8	2.2	7.6	9.2	0.4	442.9	17	Pin.syl	7	70	38.5		8.7	5.3	13.3	13277
	Pin.syl	0.5		0.2	1.8	7.6	4.2				Pin.syl	4		12.6	5	8.5	5.5	3.1	3147.
	Pin.syl	3.5		9.6		7.4	4	2.3			Pin.syl	0.4		0.1		8.5	6.5	0.3	299.
	Pin.syl	3		7.1 50.3	5 7	7.4	2.7	1.6			Pin.syl	0.4		0.1		8 8.7	7.2	0.3 2.3	299. 2269.
	Pin.syl Pin.syl	8		3.1	3	7.5	1.5 1.2	16.5 0.9			Pin.syl Pin.syl	3.5 6.5		9.6		9.1	8.1	12.0	12025.
	Pin.syl	1.5		1.8	3	4.8	0.8	0.6	614.1		Pin.syl	7	70	38.5		9.2	5.8	13.3	13277.
	Pin.syl	7.5	70	38.5		9.0	1.6	13.3			Pin.syl	0.3		0.1	0.8	9.5	1.8	0.3	280.
	Pin.syl	3		7.1	6.5	8.2	1.8	1.6	1637.0									- 12	
46	Pin.syl	7		38.5		8.2	9.7	13.3											
47	Pin.syl	2		3.1	3	10	9.7	0.9	851.5										
	Pin.syl	5		19.6	6.5	9.2	9.5	9.8	9789.0										
	Pin.syl	2		3.1	3	10	9.4		851.5										
	Pin.syl	4.5		15.9	5.5	9.2	3	4.4											
51	Pin.syl	8	80	50.3	7.5	9.7	1.3	16.5	16539.0						-				

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	202.20	100.20	04.70
	51.38	223.67 2413.41	1.00 247.36			282.28 189.3 651.49 999.2		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										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	1.00 369 60	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		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	681.62 109.98	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	419.73		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	403.77	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	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	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	1.36	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	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	21.36	0.00	1.06	9.16	31.46	0.00	0.56	15.28	26.78	0.00	59.68	366.93	652.37	1258.30	0.00	132.48	2043.14			
Average s.d.	58.81 54.51	15.34	0.00	0.47	13.86 3.60	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	45.00	40 EC	0.00	0.40	7.00	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	42.56 11.06	0.00	0.10	7.88 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			

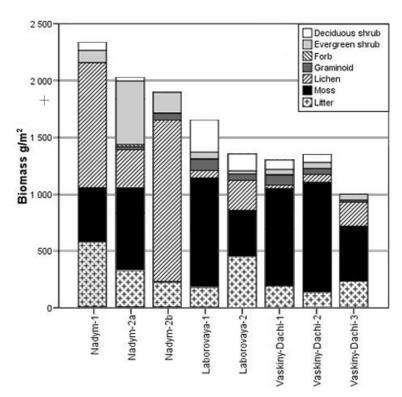


Figure 31. Average total biomass for each of the study sites excluding tree biomass at Nadym-1 and including dead moss and dead lichen components.

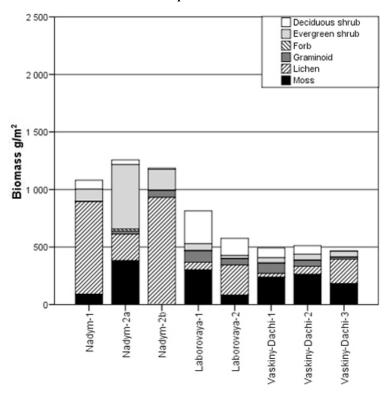


Figure 32. Average live biomass for each of the study sites excluding tree biomass, litter, dead moss, and dead lichen.

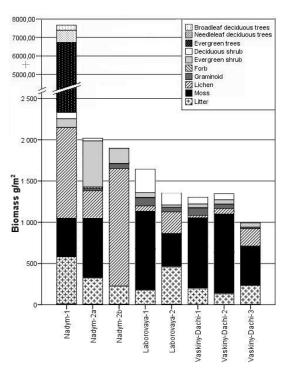


Figure 33. Average total biomass for each of the study sites including tree biomass at Nadym-1.

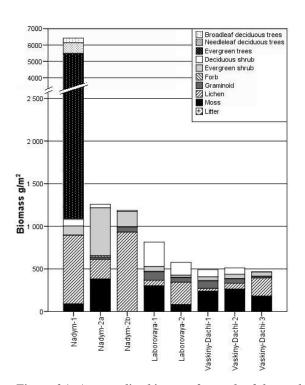


Figure 34. Average live biomass for each of the study sites including tree biomass at Nadym-1.

## 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.

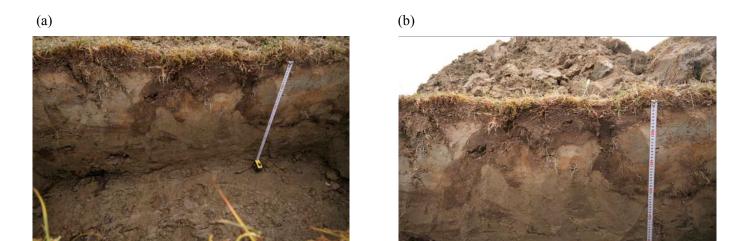


Figure 43. (a) Soil pit at Vaskiny Dachi-1 (pit №9), lower microsite. (b) Close up of pit wall.

- 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)





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	-

### References

- Von Post, L. and Granlund, E. 1926. Södra Sveriges Torvtillgångar I. Sveriges Geologiska Undersökning, Yearbook, 19.2 Series C, No. 335. pp1–127, Stockholm. English translation in: Damman AWH and French TW (1987), The Ecology of Peat Bogs of the Glaciated Northeastern United States: A Community Profile. US Department of Interior, Fish and Wildlife Service, Research Development, National Wetlands Research Center. Washington, DC. Biological Report. 85 (7.16) 1-115.
- 2. Munsell soil color charts. Determination of soil color quoted in part from U.S. Dept. Agriculture Handbook 18-Soil Survey Manual
- 3. Soil Taxonomy. A Basic System of Soil Classification for Making and Interpreting Soil Surveys; Second Edition, 1999

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## REFERENCES

## Nadym

- Melnikov, E.S. 1983a. Geocryological Conditions in the Permafrost Zone of the Western Siberian Gas Province. Novosibirsk: Nauka, 199 pp. (In Russian.)
- Melnikov, E.S. 1983b. Landscapes of the Permafrost Zone in the Western Siberian Gas Province. Novosibirsk: Nauka, 185 pp. (In Russian.)
- Melnikov, E.S. (Ed.) 1999. Explanatory notes to the map of natural complexes of the North of West Siberia for the purpose of geocryological prediction and planning of natural-protection measures under the mass

- construction. (Scale 1:1,000,000). Moscow: VSEGINGEO, 36 pp. (In Russian.)
- Melikov, E.S. and Grechishchev, S.E. (Eds.) 2002. Permafrost and oil & gas development. Moscow: GEOS, 402 pp. (In Russian.)
- Melnikov, E.S., Veisman, L.I. Kritsuk, L.N., Moskalenko, N.G., Tagunova, L.N. 1974. Landscape indicators of engineeringgeological conditions and their decoding criterions in the North of West Siberia. Moscow: Nedra Publisher, 132 pp. (In Russian.)
- Moskalenko, N. G. 1999. Anthropogenic Vegetation Dynamics of Permafrost in the Cryolithozone Plains of Russia. Nauka, Novosibirsk.
- Moskalenko N.G. 1984. Predictions as to the recovery of the vegetation cover destroyed by human activities in the North of Western Siberia. *Polar Geography and Geology*, 8: 147-154.
- Moskalenko N.G. 1995. Role of plant cover in permafrost zone. *Russian Geocryology*, 1: 58-65.
- Moskalenko N.G. 1998. Impact of vegetation removal and its recovery after disturbance. Proceedings Permafrost Seventh International Conference, Yellowknife, Canada, 763-769.
- Moskalenko, N.G. 1999. Anthropogenic Vegetation Dynamics of Permafrost in the Cryolithozone Plains of Russia. Novosibirsk: Nauka, 280 pp. (In Russian.)
- Moskalenko N.G., Pavlov A.V. 2000. Ecosystem monitoring of West Siberia North. Biodiversity and Dynamics of Ecosystems in North Eurasia, 1(2): 195-197.
- Moskalenko, N.G. 2003. Interactions between vegetation and permafrost on some CALM grids in Russia. Proceedings of the Eighth International Conference on Permafrost, 21-25 July 2003, Zurich, Switzerland, 2: 789-794.
- Melnikov, E.S., Leibman M.O., Moskalenko N.G., Vasiliev A.A. 2004. Active Layer Monitoring in West Siberia Polar Geography, vol. 28, № 4: 267-285.
- Moskalenko N.G. 2005a. Monitoring of the cryosphere in West Siberia northern taiga. 1st CliC International Science Conference, Beijing, China. CIPO, Tromso: 64-65.

- Moskalenko N.G. 2005b. Permafrost temperature regime of northern taiga landscapes in West Siberia. 2nd European Conference on Permafrost. Abstracts. Potsdam, Terra Nostra, Germany: 138-139.
- Moskalenko, N.G. (ed.) 2006. Anthropogenic Changes of Ecosystems in West Siberian Gas Province. Moscow: RASHN, 358 pp. (In Russian).
- Moskalenko N. Impact of climate changes on West Siberia northern taiga ecosystems. Proceedings of the VIII International Symposium on Cold Region Development. Tampere, Finland September 25-27, 2007: 98-99
- Pavlov, A.V., Moskalenko, N.G. 2002. The thermal regime of soils in the North of Western Siberia. Permafrost and Periglacial Processes, 13: 43-51.
- Ponomareva, O.E. 2005. Monitoring the frost mound surface dynamics along a gas pipeline route Nadym-Punga, northern taiga zone of West Siberia. 2nd European Conference on Permafrost. Abstracts. Potsdam, Germany, 12-16 June: 190.
- Ponomareva O. 2007. Impact of climate change on dynamics of processes in West Siberia. Proceedings of the VIII International Symposium on Cold Region Development. Tampere, Finland September 25-27: 99-100.

#### Laborovaya

- Bliss, L. C., and N. V. Mateveyeva. 1992. Circumpolar arctic vegetation. Pages 59-89 in F. S. Chapin III, J. F. Reynolds, G. R. Shaver, and J. Svoboda, editors. Arctic ecosystems in a changing climate: an ecophysiological perspective. Academic Press, New York.
- Botch, M. C., T. V. Gerasimenko, and Y. C. Tolchelnikov. 1971. Mires of the Yamal Peninsula. Botanchiski Zhurnal:1421-1434.
- CAVM Team, D.A.Walker, W. A. Gould, L. C. Bliss, S. A. Edlund, M. K. Raynolds, S. C. Zoltai, F. J. A. Daniëls, C. Bay, M. Wilhelm, E. Einarsson, G. Gudjonsson, A. Elvebakk, B. E. Johansen, G. V. Ananjeva, D. S. Drozdov, A. E. Katenin, S. S. Kholod, L. A. Konchenko, Y. V. Korostelev, E. S. Melnikov, N. G. Moskalenko, A. N. Polezhaev, O. E. Ponomareva, E. B. Pospelova, I. N. Safronova, R. P. Shelkunova, B. A. Yurtsev, M. D. Fleming, C. J. Markon, D. F. Murray, and S. S. Talbot.

- 2003. Circumpolar Arctic Vegetation Map. Conservation of Arctic Flora and Fauna (CAFF) Map No. 1, U.S. Fish and Wildlife Service, Anchorage, AK.
- Forbes, B.C. (1997) Tundra disturbance studies. IV. Species establishment on anthropogenic primary surfaces, Yamal Peninsula, northwest Siberia, Russia. Polar Geography 21:79-100.)
- Ilyina, I. S., E. I. Lapshina, V. D. Makhno, L. I.
  Meltzer, and E. A. Romanova. 1976.
  Vegetation of the West Siberian Plain, In.
  1:1,500,000. in I. S. Ilyina, editor. GUGC,
  Moscow.
- Meltzer, L. I. 1984. Zonal division of tundra vegetation of the West Siberian plain. Pages 7-19 in I. A. V. Belov, editor. Vegetation of western Siberia and its mapping. Akademia Nauk, Novosibirsk.
- Vilchek, G. E., and O. Y. Bykova. 1992. The origin of regional ecological problems within the northern Tyumen Oblast, Russia. Arctic and Alpine Research 24:99-107.
- Yurtsev, B. A. 1994. Floristic division of the Arctic. Journal of Vegetation Science 5:765-776.

#### **Vaskiny Dachi**

- Leibman, M.O. 1994. Cryogenic landslides and their interaction with linear constructions on Yamal Peninsula, Russia. In: D.W.Smith and D.C.Sego (eds.) Proc. of the 7th International Cold Regions Engineering Specialty Conference, Edmonton, Alberta, Canada: 865-869.
- Leibman, M.O. 1995. Preliminary results of cryogenic landslides study on Yamal Peninsula, Russia. Permafrost and Periglacial Processes, 6: 259-264.
- Leibman, M.O. 1998. Active layer depth measurements in marine saline clayey deposits of Yamal Peninsula, Russia: procedure and interpretation of results. Permafrost. Seventh International Conference, June 23-27, 1998, Proceedings, Yellowknife, Canada: 635-639.
- Leibman, M.O. 2001. Procedures and results of active-layer measurements in marine saline deposits of Central Yamal. Earth Cryosphere V(3): 17-24
- Leibman, M.O., Archegova, I.B., Gorlanova, L.A., Kizyakov, A.I. 2000. Stages of cryogenic landslides on Yugorsky and Yamal

- Peninsulas. Earth Cryosphere, IV(4): 67-75 (In Russian).
- Leibman, M.O., Egorov, I.P., (1996) Climatic and environmental controls of cryogenic landslides, Yamal, Russia. Landslides. Balkema Publishers, Rotterdam: 1941-1946.
- Leibman, M.O., Kizyakov, A.I., Sulerzhitsky, L.D., Zaretskaya, N.E. 2003. Dynamics of the landslide slopes and mechanism of their development on Yamal peninsula, Russia. Proceedings of the International Conference on Permafrost, Zurich 21-25 July 2003. A.A.Balkema Publishers, Rotterdam, Netherlands I: 651-656.
- Leibman, M.O., Lakhtina, O.V., Miklyaev, S.M., Titova, I.R.. 1991. Peculiarities of cryogenic processes expansion and their role in relief formation at the Western Yamal. In: Denudation in Permafrost Zone. Moscow: Nauka, 92-99 (in Russian).
- Leibman, M.O., Rivkin, F.M. & Saveliev, V.S. 1993a. Hydrogeological aspects of cryogenic slides on the Yamal Peninsula. International Permafrost Conference, Sixth, Beijing. Proceedings 1: 380-382.
- Leibman, M.O., Rivkin, F.M., and Streletskaya, I.D. 1993b. Chemical and physical features of the active layer as related to landslides on Yamal Peninsula. Joint Russian-American Seminar on Cryopedology and Global Change, Pushchino, 1992. Post-Seminar Proceedings: 257-262.
- Leibman, M.O., Streletskaya, I.D. 1996. Migration of chemical elements and ions in the active layer and upper part of permafrost in connection with thermodenudation processes on Yamal Peninsula. Proc. of the First conference of Russian geocryologists, book 2. Moscow: Faculty of Geology MSU: 390 -398 (In Russian).
- Leibman, M.O., Streletskaya, I.D. 1997. Land-slide induced changes in the chemical composition of active layer soils and surface-water run-off, Yamal Peninsula, Russia. I.K.Iskandar, E.A.Wright, J.K.Radke, B.S.Sharratt, P.H.Groenevelt, and L.D.Hinzman (eds.) Proc.of the International Symposium on Physics, Chemistry, and Ecology of Seasonally Frozen Soils, Fairbanks, Alaska, June 10-12, 1997, CRREL Special Report 97-10, CRREL, Hanover: 120-126.
- Leibman, M.O., Streletskaya, I.D., Konyakhin, M.A. 1997. Estimation of the dynamics of

- the surface at Bovanenkovo gas field (Central Yamal) during the period 1949-1990. Geomorphologia, 2: 45-48 (In Russian).
- Romanovskii, N.N., Gravis G.F., Melnikov E.S., Leibman M.O. (1996) Periglacial processes as geoindicators in the cryolithozone. In: A.R.Berger, W.J.Iams (eds.). Geoindicators. Assessing rapid environmental changes in earth systems. A.A.Balkema publisher, Rotterdam: 47-68.
- Streletskii D.A., Streletskaya I.D., Rogov V.V. & Leibman M.O. 2003. Redistribution of ions within the active layer and upper permafrost, Yamal, Russia. In: M.Phillips, S.M. Springman, L.U. Arenson (Eds.) Permafrost: Proceedings of the 8th Intern. Conference on Permafrost, Zurich, Switzerland, 20-25 July 2003. A.A. Balkema Publishers, 2, 1117-1122.
- Ukraintseva, N.G. & Leibman, M.O. & Sreletskaya, I.D. 2000. Peculiarities of landslide process in saline frozen deposits of central Yamal, Russia. In: E. BROMHEAD, N. DIXON AND L-L IBSEN (eds), Landslides. Proc. VIII International Symposium on Landslides 3, London: Thomas Telford, 1495-1500.
- Ukraintseva, N.G. & Streletskaya, I.D. 1999. Landscape indication of surface soil on West Yamal landslide slopes. In K.N. Dyakonov, I.I. Mamai (eds.), Lomonosov Moscow State University Landscape School: Traditions, Achievements, Future, 120-129. Moscow: RUSAKI (In Russian).
- Ukraintseva, N.G. 1997. Willows tundra of Yamal as the indicator of salinity of superficial sediments. Results of basic research of Earth cryosphere in Arctic and Subarctic. Novosibirsk: Nauka Publisher, 182-187 (in Russian).
- Ukraintseva, N.G., 1998. Distribution of shrub tundra on Yamal. Biogeography, materials of Moscow Center of Russian Geographical Society, Moscow, RGO Publisher, v.7, 46-53 (in Russian).
- Ukraintseva, N.G., Leibman, M.O. 2000. Productivity of willow-shrub tundra in connection with landslide activity. In: '30th Arctic Workshop', INSTAAR, University of Colorado, Boulder, CO USA, March 15-19 2000, 150-152.
- Ukraintseva, N.G., Leibman, M.O. 2007. The effect of cryogenic landslides (active-layer detachments) on fertility of tundra soils on

Yamal peninsula, Russia. In: V.Schaefer, R.Schuster & A.Turner (eds.) Conference Presentations: 1st North American Landslide Conference, June 3-8, 2007, Vail, Colorado. Association of Environmental & Engineering Geologists. Omnipress: 1605-1615.

Ukraintseva, N.G., Leibman, M.O., Streletskaya, I.D., Yermokhina, K.A., Smetanin, N.N. 2002. Monitoring of the landslide on saline frozen deposits in typical tundra subzone (Yamal, Bovanenkovo Gas-field area). Proc. of the International conference Ecology of northern teritories of Russia. Problems, prediction of situation, ways of development, solutions. Arkhangelsk, 17 - 22 June 2002,in 2 books, book 1: 832-837. Arkhangelsk: Institute of ecology of the North UrB RAS.

Ukraintseva, N.G., Streletskaya, I.D., Ermokhina, K.A. & Yermakov, S.Yu. 2003. Geochemical properties of plant-soil-permafrost system at landslide slopes, Yamal, Russia. Proceedings of the International Conference on Permafrost, Zurich 21-25 July 2003. A.A.Balkema Publishers, Rotterdam, Netherlands II: 1149-1154.

#### **Soil Descriptions**

Von Post, L. and Granlund, E. 1926. Södra Torvtillgångar Sveriges I. **Sveriges** Geologiska Undersökning, Yearbook, 19.2 Series C, No. 335. pp1-127, Stockholm. English translation in: Damman AWH and French TW (1987), The Ecology of Peat Bogs of the Glaciated Northeastern United States: A Community Profile. US Department of Interior, Fish and Wildlife Service, Research Development, National Wetlands Washington, Research Center. DC. Biological Report. 85 (7.16) 1-115.

Munsell soil color charts. Determination of soil color quoted in part from U.S. Dept. Agriculture Handbook 18-Soil Survey Manual.

Soil Taxonomy. A Basic System of Soil Classification for Making and Interpreting Soil Surveys; Second Edition, 1999.

#### **Species List**

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

Ignatov M.S., Afonina O.M., Ignatova E.A. et al. Check-list of mosses of East Europe and North Asia // Arctoa. 2006. Vol. 15. P. 1-130.

Konstantinova N.A., Potemkin A.D. Liverworts of the Russia Arctic: an annotated check-list and bibliography // Arctoa. 1996. Vol. 6. P. 125-150.

Kristinsson, H., Zhurbenko, M. 2006: Panarctic lichen checklist (http://archive.arcticportal.org/276/01/Panarc tic lichen checklist.pdf)

#### **Biomass Sampling Procedures**

Epstein, H. E., et al. 2007 submitted. Phytomass patterns across the full temperature gradient of the arctic tundra, *Journal of Geophysical Research - Biogeosciences*.

Kade, A., V. E. Romanovsky, and D. A. Walker. 2006. The N-factor of nonsorted circles along a climate gradient in Arctic Alaska. Permafrost and Periglacial Processes 17:279-289.

Walker, D.A., H.E. Epstein, J.G. Jia, A. Balsar, C. Copass, E.J. Edwards, W.A. Gould, J. Holllingsworth, J. Knudson, H. Meier, A. Moody, and M.K. Raynolds. 2003. Phytomass, LAI, and NDVI in northern Alaska: relationships to summer warmth, soil pH, plant functional types and extrapolation to the circumpolar Arctic. *Journal of Geophysical Research*, 108 (D2):8169, doi:10.1029/2001JD000986.

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.

#### Tree Biomass Equations

Muukkonen, P. & Mäkipää, R. 2006. Biomass equations for European trees: addendum. Silva Fennica 40(4): 763–773.

Zianis, D., Muukkonen, P., Mäkipää, R. & Mencuccini, M. 2005. Biomass and stem volume equations for tree species in Europe. Silva Fennica Monographs 4. 63 p.

#### Other Methods Papers

Barbour, M. G., J. H. Burk, W. D. Pitts, F. S. Gilliam, and M. W. Schwartz. 1996.

- Terrestrial Plant Ecology. Addison Wesley Longman, Menlo Park, CA.
- Buckner, D. L. 1985. Point-intercept sampling in revegetation studies: maximizing objectivity and repeatability. Pages 110-113 *in*. ESCO Associates, Inc., paper presented at the American Society for Surface Mining and Reclamation meeting, Denver, CO, October 1985.
- Cottam, C., and J. T. Curtis. 1956. The use of distance measures in phytosociologial sampling Ecology **37**:451-460.
- Mueller-Dombois, L. D., and H. Ellenberg. 1974. Aims and Methods of Vegetation Ecology. John Wiley and Sons, New York.
- Shimwell, D. W. 1971. The Description and Classification of Vegetation. University of Washington Press, Seattle.

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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	ect	Trans	ect	Trans	ect	N	lean
Species								Bottom	Тор	Bottom	Тор	Bottom
0.5												
1.5												
2 2.5												
3												
3.5												
4.5												
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23 23.5												
24												
24.5 25												
23												

# 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:								
					o from N:					
Obse	rver:	_Slope:			Grid photo					
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					1	Same and the same and			
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**

La	ndforms		ITE DESCRIPTION CODES	So	il Units
l	Hills (including kames and morai			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 ter	т 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 slough		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
1	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	
	Island	1	Extremely xeric - almost no moisture; no plant growth		
	Plain - residual surface	2	Very xeric - very little moisture; dry sand dunes	•	
ĺ	Tidin - residual surface	3	Xeric - little moisture; stabilized sand dunes, dry ridge	to:	ns ·
•		4	Subxeric - noticeable moisture; well-drained slopes, ri		
		5	Subxeric to mesic - very noticeable moisture; flat to	1	
	rficial Geology (Parent Material)		gently sloping		Snow free most of winter; some snow cover
u	Glacial tills	6.	Mesic-moderate moisture; flat or shallow depressions	~	persistsafter storm but is blown free soon
	Glaciofluvial deposits	7	Mesic to subhygric - considerable moisture; depression		afterward
	Active alluvial sands	8	Subhygric - very considerable moisture; saturated but		
	Active alluvial gravels	0	< 5% standing water < 10 cm deep	,	most of winter
	Stabilized alluvium (sands & grav	O	Hygric - much moisture; up to 100% of surface under	. 4	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		Snow bank persists 1-2 weeks after melt out
			50 to 150 cm deep; lakes, streams	7	Snow bank persists 4-8 weeks after melt out
	Drained lake or lacustrine organic	i.	50 to 150 cm deep, takes, streams		
	deposits				Snow bank persists 8-12 weeks after melt out
_	Lake or pond organic, sand, or sil		D. F. J. (40.00)		Very short snow free period
	Undifferentiated sands		il Moisture (from Komárková 1983)		Deep snow all year
1	3	1	Very dry - very little moisture; soil does not stick toge		
	Roads and gravel pads	2	Dry - little moisture; soil somewhat sticks together		nimal and Human Disturbance (degree)
	Loess	3	Damp - noticeable moisture; soil sticks together but co		No sign present
	Fine sand	4	Damp to moist - very noticeable moisture; soil clumps		Some sign present; no disturbance
5		5	Moist - moderate moisture; soil binds but can be	2	Minor disturbance or extensive sign
6	Marine clay		broken apart	3	Moderate disturbance; small dens or light
	•	6	Moist to wet - considerable moisture; soil binds and s		grazing
			to fingers	4	Major disturbance; multiple dens or
u	rficial Geomorphology	7	Wet - very considerable moisture; water drops can be		noticeable trampling
	Frost scars		squeezed out of soil	5	Very major disturbance; very extensive
	Wetland hummocks	8	Very wet - much moisture can be squeezed out of soil		tunneling or large pit
	Turf hummocks	9		1	A STATE OF S
	Gelifluction features	10	Very saturated - extreme moisture; soil is more liquid		nimal and Human Disturbance (type)
	Strangmoor or aligned hummock		than solid	1	Ptarmigan scat
	High- or flat-centered polygons			2	Caribou tracks
	Mixed high- and low-centered po	olvec	ons	3	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% fros			_	Vehicle tracks
	Well-developed hillslope water tr				ability
-	and small streams > 50 cm deep	JORG		-1	. <del>-</del> .
2	Poorly developed hillslope water	trac	ks.	2	Subject to occasional disturbance
J			ographic Position	3	
,	< 50 cm deep Gently rolling or irregular micror			3	disturbance such as solifluction
	, , ,			4	
	Stoney surface		Side slope	4	Annually disturbed
	Lakes and ponds		Footslope or toeslope	5	Disturbed more than once annually
	Disturbed		Flat	_	
	Hill hummock		Drainage channel		xposure Scale
	Wetland		Depression		Protected from winds
20		_ 7	Lake or pond		Moderate exposure to winds
				3	Exposed to winds
1					Very 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

- Epstein, H. E., et al. 2007 submitted. Phytomass patterns across the full temperature gradient of the arctic tundra, *Journal of Geophysical Research Biogeosciences*.
- Walker, D.A., H.E. Epstein, J.G. Jia, A. Balsar, C. Copass, E.J. Edwards, W.A. Gould, J. Holllingsworth, J. Knudson, H. Meier, A. Moody, and M.K. Raynolds. 2003. Phytomass, LAI, and NDVI in northern Alaska: relationships to summer warmth, soil pH, plant functional types and extrapolation to the circumpolar Arctic. *Journal of Geophysical Research*, 108 (D2):8169, doi:10.1029/2001JD000986.
- 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
										535			30
	- 65												
	-35									200			
	0												
	- 65									1.00			
										333			
										2000			
										1.00			

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

<b>Equisetum</b>	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			
						A I		
				-				
-				-				
			1	-			-	
				4	4			10
			-	-		5	-	
							1	0.
	-					8		X
			1	+	-		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 Cladonia pleurota
Alectoria ochroleuca Cladonia pyxidata
Arctocetraria andrejewii Cladonia rangiferina

Asahinea chrysantha Cladonia cf. scabriuscula
Baeomyces rufus Cladonia sgamosa

Baeomyces rufus Cladonia sqamosa
Bryocaulon divergens Cladonia stellaris
Bryoria nitidula Cladonia stricta
Cetraria delisei Cladonia 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

Peltigera canina

Peltigera cf. frippii

Peltigera malacea

Cladonia furcata

Peltigera maiacea

Peltigera polydactylon-group

Cladonia gracilis

Cladonia grayi

Cladonia grayi

Peltigera leucophlebia

Peltigera cf. neckeri

Cladonia macrophylla
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



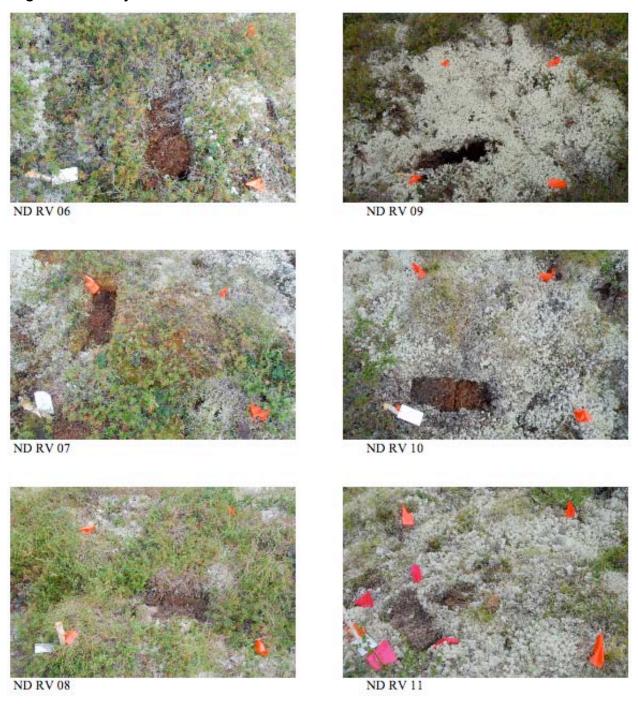
ND RV 02



ND RV 04



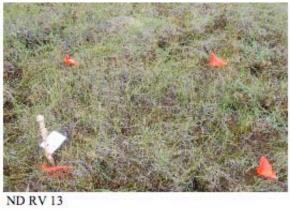
# Vegetation - Nadym 2







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



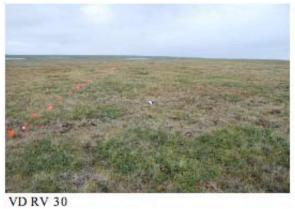


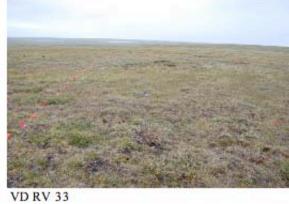
VD RV 29



VD RV 27

# Vegetation - Vaskiny Dachi 2



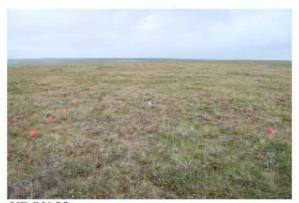




VD RV 31



VD RV 34



VD RV 32

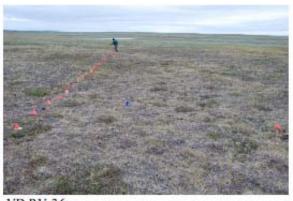
# Vegetation - Vaskiny Dachi 3



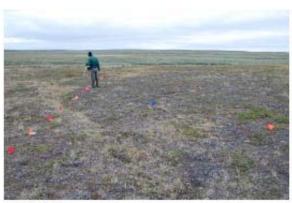
VD RV 35



VD RV 38



VD RV 36



VD RV 39



VD RV 37