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Dwarf shrub records in snowbeds

Motivation

Snowbeds are important habitats of small rodents, especially lemmings. They are also important summer feeding habitats of reindeer. Because the plant community of snow beds is dependent on snow, these habitats are likely to be sensitive to climate change. Erect dwarfs shrubs are not typical snow bed plants, but their abundance in snow bed habitats is expected to increase with warming climate. Dwarf shrub presence recording in snowbeds is part of the small rodent modules monitoring of interactions between climate, small rodents and snowbed vegetation.

State variables: Records of dwarf shrub presence in snow beds are used for calculating state variables V15 ("Plant species abundance and composition: snowbeds").

Reference to method: first publication of these data is in progress (Soininen et al, *in prep*).

Spatial study design

Dwarf shrub presence in snowbeds is recorded in the intensive study design at Varanger, at 79 snowbed sites, nested in four mountain slope sections (19-20 snowbeds per section). Each of the intensive localities has two mountain slope sections.

The complete list of siteIDs included in the current data collection is:

locality	section	site_id
Komagdalen	Kjøltindan	ko_kj_sn_1, ko_kj_sn_2… up to ko_kj_sn_19
Komagdalen	Ruossachokka	Ko_ru_sn_1, ko_ru_sn_2… up to ko_ru_sn_20
Vestre Jakobselv	Torvhaugdalen	vj_to_sn_2, vj_to_sn_3, vj_to_sn_4, vj_to_sn_5, vj_to_sn_6, vj_to_sn_8, vj_to_sn_9, vj_to_sn_12, vj_to_sn_13, vj_to_sn_14, vj_to_sn_15, vj_to_sn_16, vj_to_sn_19, vj_to_sn_20, vj_to_sn_21, vj_to_sn_22, vj_to_sn_24, vj_to_sn_25, vj_to_sn_26, vj_to_sn_27
Vestre Jakobselv	Bearaveaijohka	vj_be_sn_1, vj_be_sn_2, vj_be_sn_3, vj_be_sn_4, vj_be_sn_5, vj_be_sn_6, vj_be_sn_7, vj_be_sn_8, vj_be_sn_11, vj_be_sn_12, vj_be_sn_13, vj_be_sn_14, vj_be_sn_15, vj_be_sn_17, vj_be_sn_19, vj_be_sn_20, vj_be_sn_21, vj_be_sn_22, vj_be_sn_24 vj_be_sn_25

These sites are in the GPS-file "snowbeds lemming transect 2019.gpx". The file is stored in the COAT Box folder "Fieldwork/Varanger GPS files for fieldwork".

Each site has 4 plots (see Figure 1). The plots are numbered as 1 to 4 from left to right when facing the slope. Numbers are written on the wooden poles (some have laminated plastic notes). In each plot, the part to the left of the wooden poles is a control plot (Control plot = C) and the part to the right is a removal plot (Removal plot=R). The removal plot is aimed for monitoring herbivore presence, and the control plot for monitoring of vegetation. The plots are placed at minimum 5m

distance from each other, to ensure that observations of vegetation are independent (i.e. the same plants are not present in several plot pairs).

As melt water can disturb both lemming faeces and vegetation remnants, the plots were placed with the criteria to avoid depressions and places with clear signs of running water as well as steep places.
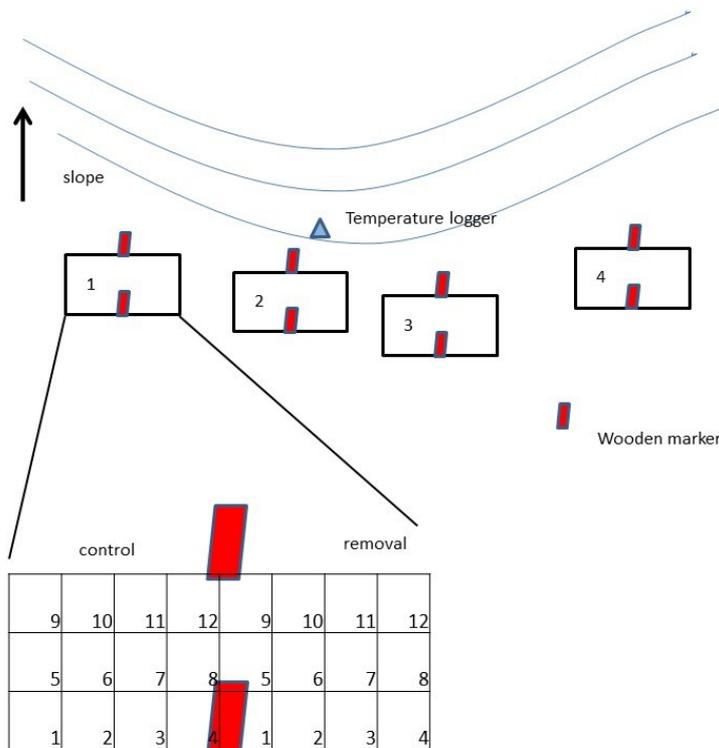

Figure 1. Setup of the pellet count plots and dwarf shrub recording plots within the snow bed design.

Temporal study design

The counts are conducted once per year, soon after snowmelt (during 8.-11.7.), at the same time as the pellet counts in snowbeds.

Procedure
Vegetation recordings are done in the control plots (i.e. the plot to the left when facing uphill). The sampling frame should be placed perpendicularly to the slope.

When the numbers on the wooden poles start to fade, they should be re-marked. When the wooden poles are removed/poorly attached, they should be re-entered properly or replaced.

Equipment needed
- Metal sampling frame (50*37.5 cm, divided into 12 sub-plots cm with thread)
- Datasheets, pencil, writing pad (Datasheet is in COAT Box: https://uitno.app.box.com/file/467528303181)
- Permanent marker (for re-writing plot number on the poles)
- A couple of new wooden poles (to replace the broken ones)

Information recorded in the field

Data is recorded using field sheets that combine observations of dwarf shrubs and pellet counts in snowbeds. The field sheet is called "fieldsheet_snowbed_plant_pellet_COAT_2021.xlsx", and stored in the COAT Box folder "Protocol/Data typing templates".

For each snow bed, record: sampling date, observer. NB if some plots are below snow and you return to do them later, record date separately for each plot.

For each subplot within the removal plot, record:

- Presence/absence (one or zero) of the species listed below; as seen from above. Also record (in the comments field) presence of any other woody plants/ plants that could be identified independent of spring phenology. For example Lycopodium (kråkefot) would be noted, while forbs and graminoids would not be noted.
- If the plant appears to be dead in a given sub-plot (no leaves, no buds, no lively color of stem, no whatsoever signs of life), it is scored absent. If a shrub is present in a sub-plot less than the area of its leaf, it is also scored absent.

Latin name	English name	Norwegian name
Vaccinium myrtillus	Blueberry	Blåbær
Betula nana	Dwarf birch	Dvergbjørk
Empetrum nigrum	Crowberry	Krekling
Vaccinium vitis-ideae	Lingonberry	Tyttebær
Vaccinium uliginosum	Bog bilberry	Blokkebær
Phyllodoce caerulea	Blue heath	Blålyng
Nardus stricta	Matgrass	Finnsjegg
Huperzia selago	Nothern firmoss	Lusegrass
Salix herbaceae	Dwarf willow	Musøre

Plant species to be recorded in the snow bed plots. Example photos (the species can look quite "flat" especially early in the season in the snow beds) are in the Appendix.

Data processing

All field observers are in charge of typing their data into digital format (unless otherwise agreed with the data set responsible). Data is typed using a template called "Template snowbed vegetation data version 2019.xlsx", stored in the COAT Box folder "Protocol/Data typing templates".

The template file is accompanied with instructions (an additional sheet of the template excel file). This includes information on how to record specific types of observations in the template. Follow the datasheet exactly; use exactly the same column names, large/small letters, for factorial values do not add new categories etc.

After completing a data file in excel (one datafile per year and locality), it should be saved as txt-file. Thereafter (unless otherwise agreed), data files are sent to dataset responsible (Eeva Soininen) who will quality-check them and store them in COAT data portal.

Training requirements and specialized skills

Field workers must be able to reliably identify the listed plant species. Example photos are given in the appendix. New field observers must work in teams with more experienced observers until this skill has been acquired.

Appendix: example photos of snowbed plants

Things that may be confusing:

- *Phyllodoce caerulea* can look like *Empetrum nigrum*
- *Trientalis europaea* leaves that are just about to unfold can look like *Vaccinium myrtillus*
- *Bistorta vivipara* can look like *Vaccinium vitis-ideae*
- *Vaccinium myrtillus* may have no leaves but can be identified to be alive based on green stem color

Huperzia selago, Vaccinium myrtillus and Salix herbaceae

Empetrum nigrum and Salix herbaceae

Betula nana

Salix herbaceae and Vaccinium vitis-ideae

Phyllodoce caerulea

Phyllodoce caerulea (in the middle) and Empetrum nigrum