Date: 2022-06-20	*Version:* 2 (earlier versions of the protocol exist for 2005-2018)	*Authors:* H. Boehner, K. A. Bråthen *Co-authors:* E. Soininen, V. Ravolainen, X. Murguzur and L. E. Støvern contributed to earlier versions of the protocol

TALL SHRUB TUNDRA MODULE:

Plant measurements in meadow and heath

Motivation

Riparian meadows and willow thickets are tundra communities of high productivity and herbivore activity, and are therefore considered as important community types in tundra ecosystems. We want to study state stability and plant productivity in these communities. State stability as a measure of how stable the communities are and plant productivity as a measure of ecosystem productivity because plants are the basis for the trophic ecosystem. We will estimate plant productivity in terms of standing crop, and state stability in terms of standing crop, reproduction and functional group composition of vascular plants at the peak of the growing season.

Neighbouring heaths to the riparian system are habitats for birds and small rodents and can make up extensive areas in the tundra. Heath habitat is primarily a target in the small rodent module, but the protocol for plant abundance measurements is the same as in meadow communities and is therefore described here.

The protocol is used both for an observational time-series running since 2005 and a more recently established herbivore exclosure experiment. The experiment aims at understanding the effect of excluding mammalian herbivores on the state stability and plant productivity of meadow and heath communities, communities that are currently expected to change in response to climate change.

State variables:
Plant measurements in meadow habitats are used for the following state variables:

- Shrub abundance (V2)
- Biomass of plant functional groups; forbs (V5), graminoids (V6), woody groups (V7)
- Plant community composition of species and functional groups (V8)
- Flowers and other indicators of plant reproductive output (V9)
- Vascular plant species richness and biodiversity (V10)
- Herbivore exclusion impact on meadow state variables (V12)

Plant measurements in heath habitats are used for the following state variables:

- Biomass of plant functional groups: herbaceous groups (V16), woody groups (V17)

- Plant community composition of species and functional groups (V18)
- Flowers and other indicators of plant reproductive output (V19)
- Vascular plant species richness and biodiversity (V20)
- Herbivore exclusion impact on heath state variables (V22)

Reference to method:
Plant abundance is estimated using point intercept frequency (Bråthen & Hagberg 2004, Jonasson 1988). Species groupings are based on functional units (Bråthen et al. 2007, Ravolainen et al. 2013).

Spatial study design

Point intercept frequency and shrub monitoring is conducted within the COAT Varanger intensive design. The intensive design includes 48 sampling sites, nested in five river valley sections. Each river valley section has 4-5 sites in meadow habitat, 4-5 sites in heath habitat near to productive areas (river valleys) and 4-5 sites in heat habitat far from productive areas. Komagdalen has three sections, while Vestre Jakobselv has two. All sites are included in the observational time-series whereas only the sites in Vestre Jakobselv are included in the herbivore exclosure experiment. The complete list of siteIDs included in the current data collection in 2020 is:

Locality	**Section**	**Site ID meadow (m)**	**Site ID heath_near (hn)**	**Site ID heath_far (hf)**
Komagdalen (ko)	komagdalen_ovre (ko)	ko_ko_m_a ko_ko_m_b ko_ko_m_c ko_ko_m_d ko_ko_m_e	ko_ko_hf_a ko_ko_hf_b2 ko_ko_hf_c ko_ko_hf_d2 ko_ko_hf_e	ko_ko_hf_a ko_ko_hf_b ko_ko_hf_c ko_ko_hf_d ko_ko_hf_e
Komagdalen (ko)	Komagdalen_midtre (km)	ko_km_m_a ko_km_m_b ko_km_m_c ko_km_m_d ko_km_m_e	ko_km_hf_a ko_km_hf_b ko_km_hf_c ko_km_hf_d ko_km_hf_e	ko_km_hf_a ko_km_hf_b ko_km_hf_c ko_km_hf_d ko_km_hf_e
Komagdalen (ko)	Sandfjorddalen (sa)	ko_sa_m_b ko_sa_m_c ko_sa_m_d ko_sa_m_e ko_sa_m_f	ko_sa_hf_b ko_sa_hf_c2 ko_sa_hf_d ko_sa_hf_e ko_sa_hf_f	ko_sa_hf_b ko_sa_hf_c ko_sa_hf_d ko_sa_hf_e ko_sa_hf_f
Vestre Jakobselv (vj)	Torvhaugdalen (to)	vj_to_m_a vj_to_m_b vj_to_m_c vj_to_m_d	vj_to_hf_a2 vj_to_hf_b2 vj_to_hf_c vj_to_hf_d	vj_to_hf_a vj_to_hf_b vj_to_hf_c vj_to_hf_d
Vestre Jakobselv (vj)	Bearaveaijohka (be)	vj_be_m_a vj_be_m_b vj_be_m_c vj_be_m_d vj_be_m_e	vj_be_hf_a vj_be_hf_b vj_be_hf_c2 vj_be_hf_d2 vj_be_hf_e2	vj_be_hf_a vj_be_hf_b vj_be_hf_c vj_be_hf_d vj_be_hf_e

These sites are in the GPS-file “intensive sites meadow heath Varanger 2020.gpx”.
https://uitno.app.box.com/file/655735580225

Observational time-series

Each site has a permanently marked 15x15 m sampling quadrat. Within the quadrat, 24 triangular plots (40 cm each side) are placed along three lines (Figure 1). Plant measurements are conducted in each plot.

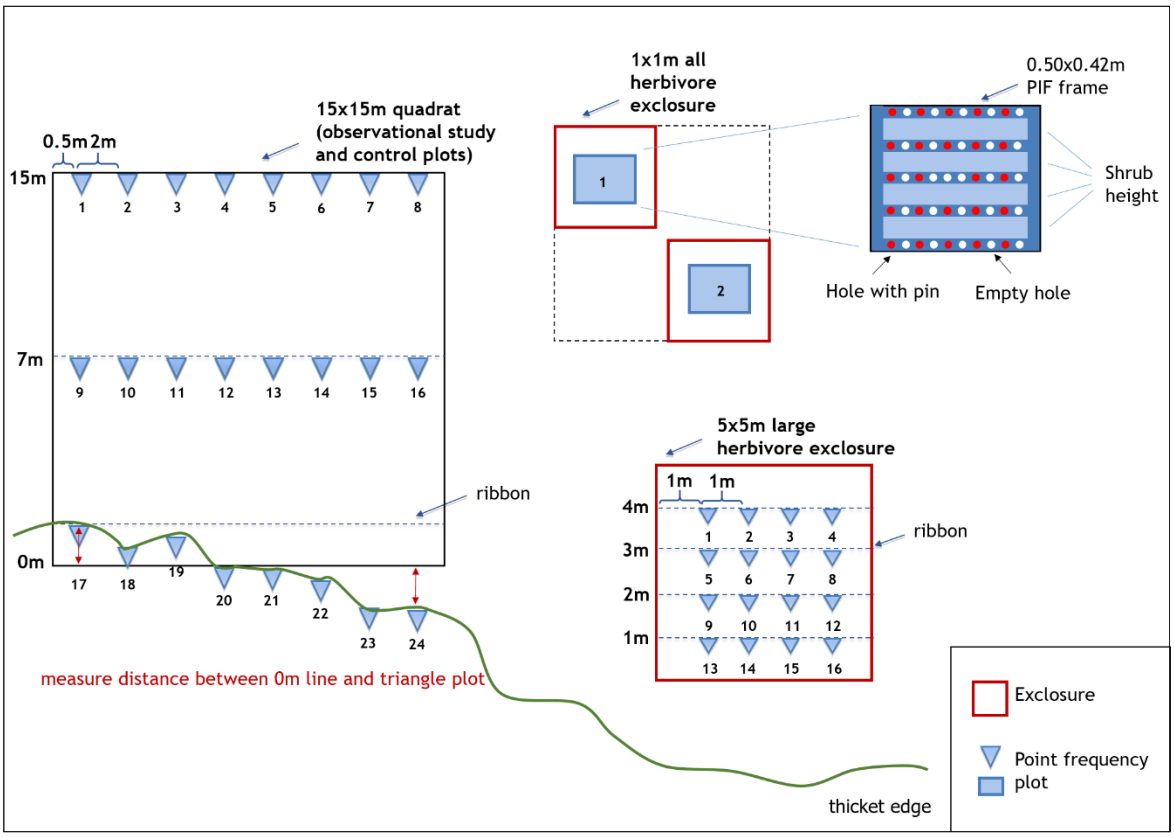


Figure 1: Study design within a site with a 15x15 m quadrat (observational time-series and control plots for the herbivore exclosure experiment), a 5x5 m Large herbivore exclosure and two 1x1 m All herbivore exclosure. Exclosures exist only in Vestre Jakobselv. Point frequency plots are placed within each quadrat.

Herbivore exclosure experiment

Each site at Vestre Jakobselv has plots for point intercept frequency with three treatments:

Large herbivore exclosures: Larger mammalian herbivores such as reindeers are excluded by 5x5 m fences with a mesh size of 10 cm. Within each large herbivore exclosure, 16 triangle plots (40 cm sides) are placed along four lines (Figure 1). Plant measurements are conducted in each plot.

All herbivore exclosures: All mammal herbivores are excluded by two 1x1 m exclosures with chickenwire with a mesh size of 1.3 cm and a flap which is attached to the ground around the exclosures to prevent rodents from digging into the cage (Figure 2). The two exclosures are set up in

opposite corners of a 5x5 m quadrat at each site. Within each exclosures, plant measurements are conducted in a 50x42 cm plot, which is placed in the middle of the exclosure (Figure 1).

Figure 2: Left: Example of a meadow site with the Large herbivore exclosure in the front and the All herbivore exclosures in the back. The open 15x15 m sampling quadrat is to the right of the exclosures. Right: All herbivore exclosure (Photos: Hanna Boehner and Eeva Soininen).

Open control: Plot 1 to 16 from the observational time series are also used as control plots for the exclosure experiment.

Temporal study design

All plant measurements are conducted in late July and early August, during the peak biomass season.

Procedure

Placement of plots for the observational time series: Triangular plots are placed every second meter along the three lines. At the meadow sites, the lines are placed at 15 m (outer), 7 m (middle) and 0 m (inner) distance from thicket edge. At the heath sites, the quadrat side running closest to, and alongside the thickets, is used as the 0 m line (Figure 1).

The first plot (i.e. plot nr. 1) is placed along the 15 m line and is placed 0.5 m inwards from the right corner of the quadrat (facing towards the thicket). Two pins are placed along the lines and the third pin is pointing towards the thicket (this pin will be outside the quadrat along the 0m line). The next plot is placed two meters further to the left along the line (2.5 m from the corner) and so on.

Along the inner line (0m) at meadow sites with thickets, adjustments of triangular plot placement is necessary because the thicket edge is seldom straight. The ribbon is placed as close as possible to the inner line (0m), where the ribbon can be laid down in a straight line. Each triangle plot is moved towards the thicket edge (defined as where the thicket is 1 m high) and placed beneath the canopy cover (Figure 1).

If the inner line does not reach the thicket edge, the triangle plot is moved out of the quadrat (maximum 10 m away from the quadrat) and placed beneath the canopy cover.

Placement of plots in Large herbivore exclosures: Triangular plots are placed every meter along four lines (Figure 1).

The lines and the plots have the same orientation as in the observational study. The lines a placed at 4 m, 3 m, 2 m and 1 m distance from the side of the exclosure that runs along the thicket edge.

The first plot (i.e. plot nr. 1) is placed in along the 4m line and is placed 1m inwards from the right corner of the exclosure (facing towards the thicket). Two pins are placed along the lines and the third pin is pointing towards the thicket. The next plot is placed one meter further to the left along the line (2 m from the corner) and so on. At the heath sites, the exclosure side running closest to, and alongside the thickets, is used as the 0m line.

Placement of plots in All herbivore exclosures: Plots are placed in the middle of each exclosure by placing a 42x50 cm point intercept frame. Plot 1 is the plot that is furthest away from the thicket edge, plot 2 is the plot that is closest to the thicket edge.

Plant abundance: Point intercept frequency is recorded in each plot. A triangle frame with one pin per corner (3 pins per plot) and sides of 40 cm is used in the observational study and the Large herbivore exclosures whereas a 50x42 cm point intercept frequency frame with 24 pins is used in the All herbivore exclosures.

The point frequency frame has to be set straight down without intentionally bending or moving the plants. For each plot, count and record the number of times each species or plant group (in case species cannot be identified to species level) is touching the pins. An overview of functional groups and those species that should always be registered at species levels is in Table 1.

Point intercepts are in principle registered at species level. However, if species cannot be identified, counts are either registered on genus level or are grouped to functional groups. A list of groups (genera, functional groups) that should be used for these species is given in the appendix.

New species or genera should be only added if it is confirmed that a certain species has been found.

Table 1: Functional groups and species which have to be recorded separately.

Functional group	Species
Evergreen dwarf shrubs	*Empetrum nigrum*
Deciduous dwarf shrubs	*Betula nana, Vaccinium myrtillus*
Green willows	
Grey willows	
Prostrate willows	*Salix herbaceae*
Evergreen non woody	
Sedges and rushes	
Narrow leaved grasses	*Nardus stricta*
Broad leaved grasses	*Deschampsia cespitosa, Calamagrostis sp.*
Forbs	*Rumex acetosa*
Hemiparasites	
Horsetails	
Deciduous vascular cryptogams	

Different types of plant parts are registered separately. The three registered categories are vegetative (leaves and non-woody stems), reproductive and woody parts. For forbs, the reproductive part is the flower and the peduncle. The flower is defined as the flower itself and downwards the peduncle until it has branched twice. For species without a branching peduncle, the whole peduncle is considered as reproductive, or down to the first leaf below the whorl. For graminoids, the fertile straw and the flower are recorded as reproductive, all leaves as vegetative. Reproductive structures of a species that are present in the triangle plot but not touching a pin are recorded with the value 'x'. For woody species, the woody part is defined as the stem (including the green stem of *Vaccinium myrtillus)*.

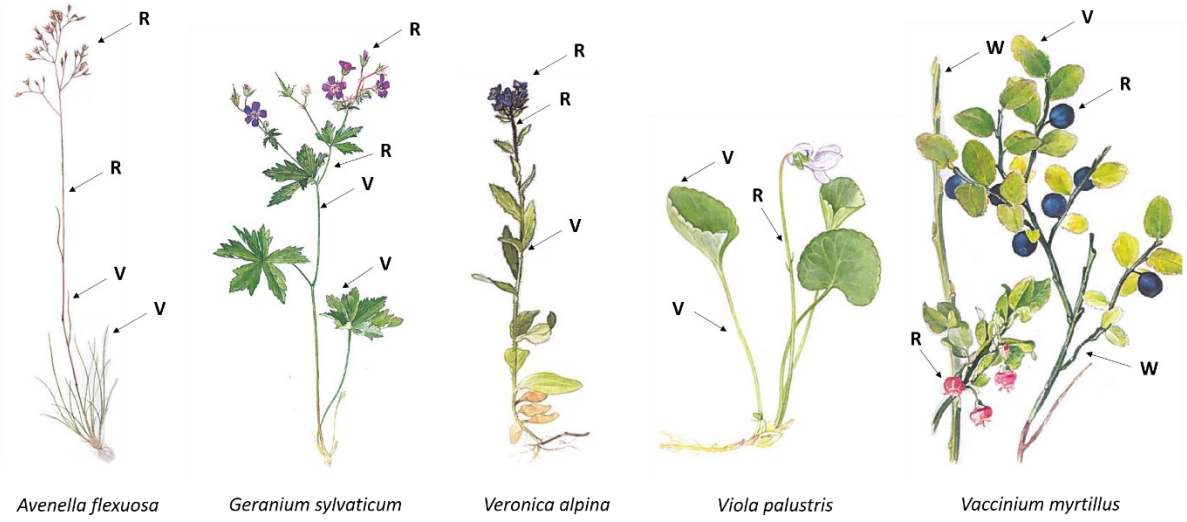


Figure 3: Definition of vegetative, reproductive and woody parts of different plant species.

For species with many small, narrow leaves, like *Selaginella selaginoides*, and *Empetrum nigrum*, number of hits is not counted for each and every leaf touching the pin, but rather per branch. Green leaves of *Empetrum nigrum* are counted as vegetative parts, the stems are counted as woody parts and brown leaves are registered as standing dead (not counted).

If the plants reach above the height of the point frequency frame, the number of times the plant would touch the pin up to hip height is estimated. If plants enter the plot from the side, having roots outside the plot and touching the pins inside the frame, they are still included in the analyses.

Plant species presence: Presence of plant species or genus that do not touch the pin but are found in the plot is registered by giving the value 'x'. Even if some species were registered into functional group for abundance data, their presence should be registered at species level. See Appendix for info on difficult species for which presence can be registered into genera.

In particular, grasses are often difficult to identify to species level when counting point intercepts and are often registered into functional groups. However, if grass species present in the plot can be identified to genera or species level this should be recorded in addition.

Ground cover: Ground cover is registered separately for the following categories as presence per pin (max 1 hit per pin): Standing dead parts or litter of vascular plants, mosses (all moss species except peat mosses), peat mosses (*Sphagnum* sp.), lichen and bare soil or stone. In addition, small rodent activity is distinguished from litter (i.e. if plant litter is clearly chewed by rodents, if tunnels or feces are present) and registered as presence per pin by giving a value between 1 and 3 if signs of small

rodent activity are touching the pins. If there is small rodent activity in the plot but not touching the pin, it is registered by giving the value 'x'.

Height of thicket forming shrubs: Height of thicket forming shrubs (e.g. *Betula* sp., *Salix* sp. in both heath and meadow sites) within the plots is measured with accuracy to nearest 10 cm. If the thicket is very low and close to the ground or of there are no shrubs in the plot, the value 0 is given (values are rounded to the nearest 10 cm, i.e. shrubs below 5 cm are rounded to 0 cm, shrubs between 5 and 14 cm are rounded to 10 cm and so on). Maximum shrub height is measured once in triangular plots and four times in rectangular plots (All herbivore exclosures). For the latter, maximum shrub height is measured in each of the four segments of the point frequency frame. [Make sure 10 cm intervals are marked on at least one of the pins with permanent marker or use a measuring stick]

Canopy height of willow thickets (observational time-series at meadow sites only): Height of willow thickets is measured along the inner line (0 m) in meadow quadrats of the observational study. In each triangle the height of the thicket is measured with accuracy to nearest 10 cm using a meter stick (or telescope stick). If the triangle is not placed underneath a thicket (e.g. in Sandfjorddalen), 0 cm is recorded.

Thicket edge monitoring (observational time series at meadow sites only): In order to monitor the thicket edge, the distance between the triangle plots and the quadrat edge (0 m) is measured for the plots along the inner line. If the triangle plot is placed on the 0 m line, the distance is 0, if the triangle plot moved into the quadrat, the distance from the 0 m line is measured in positive meters (e.g. 1 m) and if the triangle plot is moved out of the quadrat, the distance from the 0 m line is recorded in negative meters (e.g. -2 m).

Size of thicket patches: If one of the lines is crossing/touching a stretch of a thicket more than 10 cm long (defined as patches of *Salix* sp. and/or *Betula* sp. that are at least 50 cm tall at the tallest point and covering at least 1m^2 area) their full extent along the ribbon (±10 cm) is registered. If the ribbon touches the same thicket patch several times (i.e. either by one individual or several individuals making a common canopy), measure the extend of the patch from first to the last time the patch touches the ribbon.' Triangle plots should be placed underneath the thicket edge (Figure 4).

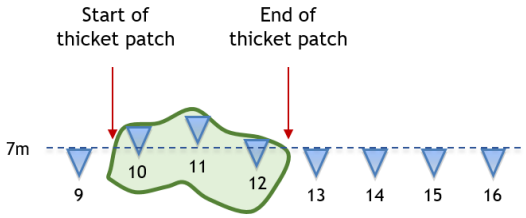


Figure 4: Measure the extend of thicket patches from where it touches the ribbon the first time to where it touches the ribbon the last time.

Equipment needed

- Triangle point frequency frames with 3 pins
- 50x42 cm point frequency frames with 24 pins (or at least 5 pins if one pin is moved from hole to hole) (only in Vestre Jakobselv)
- Measuring tape (2 pieces of 30 m)
- Some nails to fix the measuring tape on the ground
- Tablet computer
- Reserve paper field sheets in case of trouble with computer
- Meter stick
- Flora, notebook and pen

Information recorded in the field – tablet field form

Data sampling using tablets requires careful data naming and data handling.

Before field work: Field forms with the species list (based on earlier species registrations) of the plots are available in the COAT Box folder "Protocol/Data sheets for writing data in the field /Point intercept data Varanger". There are three folders (observational time-series, large herbivore exclosures and all herbivore exclosures) and in each folder there is a field form for each site. The field forms have to be saved on the tablets before leaving for field work.

At each field site, fill in one field form per treatment. All files need to be renamed (add year) and saved to the right folder.

For each field form record site-ID, date, name of the person who is registering the point intercepts and add any comments in the provided columns in the field form. In addition, record site-ID, date and location of the data (which tablet, folder name or paper field form) in the fieldbook or a separate form. When finished with all plots, make sure that everything is entered correctly, that the file has the correct name and is saved in the correct folder.

For each plot:

- Record number of **point intercepts** of each species per plot (summed for the 3 pins in triangle plots and per pin in rectangular plots) separately for vegetative, reproductive and woody plant parts. Record species and reproductive parts that are present in the plot but not touched by a pin by giving the value 'x'
- Species that are not listed in the field form should be entered in the provided rows (**Additional species**). When entering new species, write the correct scientific names or abbreviations (e.g. emp_nig) as given in the species list in the second sheet of the field form.
- If it is not feasible to record point intercepts on species level (especially for graminoids), register number of point intercepts on functional group level in the provided section in the field form (**Functional groups**). In addition, species presence should be recorded by giving the value 'x' in the appropriate row of the species list
- Record ground cover and small rodent activity as presence per pin (max 1 hit per pin) in the provided section in the field form (**Ground cover**)
- Record the height of thicket forming shrubs *(Betula nana, Salix* sp.) in the provided row in the field form (**Shrub height**)
- Record the canopy height of willow thickets along the inner line of the 15x15 m quadrats in the provided row in the field form (**Canopy height**)

- For triangle plots along the inner line of the 15x15 m quadrats, record the distance between the quadrat edge (0 m) and the triangle plot in the provided row in the field form (**Distance between triangle and inner line**) (0 if the plot is placed on the inner line, positive numbers if the plot is inside the quadrat, negative numbers if the plot is outside the quadrat and no entry if the quadrat does not have a thicket edge or if the thicket edge is more than 10 m away from the quadrat)
- Record the size of *Salix* or *Betula* patches in the provided section in the field form (**Thicket patches**)
- **Save the file after each plot**

Every evening: Copy the file to a memory stick as a back-up latest at the end of the day and sign a list with which plots have been done and where the data is stored.

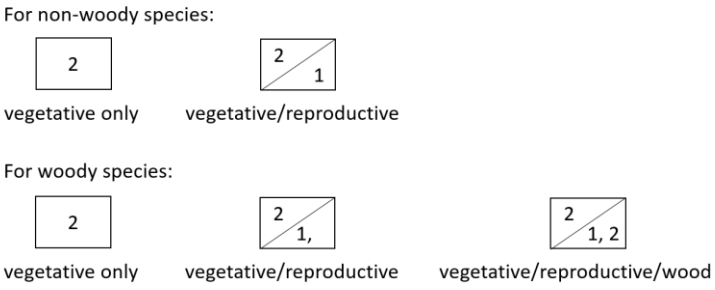
<u>Information recorded in the field – paper field form – as backup to pads</u>

Before field work: Paper field forms are available in the COAT Box folder "Protocol/Data sheets for writing data in the field /Point intercept data Varanger". There are three folders (observational study, large herbivore exclosures and all herbivore exclosures) and in each folder, there is a template for paper field forms. These should be printed for all sites (48, 18 and 36 copies respectively) in case the tablets do not work.

At each field site: Always take enough paper field forms with you!

For each field form and plot, record the same information as when recording data with the tablet field forms.

To separate between vegetative, flowering and woody plant parts, enter data as following:



Every evening: All filled in forms must be verified in terms of correct and reasonable entries (i.e. double check entries with very high numbers of hits) and readable writing. Take a photo of each filled form as a back-up.

<u>Data processing</u>

For data on tablets: Tablets and USB sticks with back up of the data must be delivered to Kari Anne Bråthen, Eeva Soininen, Leif Einar Støvern or Hanna Boehner. In addition, all data files (from tablet and paper field forms) and as well as information about who received the field equipment and where it was placed should be sent to Kari Anne Bråthen (kari.brathen@uit.no) and Hanna Boehner (hanna.bohner@uit.no).

For data on paper sheets: If data is recorded on paper field sheets, all field observers are in charge of typing their data into digital format (unless otherwise agreed with the data set responsible). The data should be entered in the same template as used when recording data with the tablets. The templates are stored in the COAT Box folder "Protocol/Data sheets for writing data in the field /Point intercept data Varanger".

Training requirements and specialized skills

Good knowledge of tundra plant species is required for recording point intercept frequency on species level, especially in the species rich meadow habitats.

New field observers must be trained by experienced observers and the whole field team must 'calibrate' at the beginning of the field season to make sure all observers count point intercepts in the same way.

References

Bråthen, K. A., Ims, R. A., Yoccoz, N. G., Fauchald, P., Tveraa, T., & Hausner, V. H. (2007). Induced shift in ecosystem productivity? Extensive scale effects of abundant large herbivores. *Ecosystems*, *10*(5), 773–789. *https://doi.org/10.1007/s10021-007-9058-3*

Bråthen, K. A. and Hagberg, O. (2004), More efficient estimation of plant biomass. Journal of *Vegetation Science*, 15, 653-660. *https://doi.org/10.1111/j.1654-1103.2004.tb02307.x*

Jonasson, S. (1988). Evaluation of the Point Intercept Method for the Estimation of Plant Biomass. *Oikos, 52*(1), 101-106. *doi:10.2307/3565988*

Ravolainen, V. T., Bråthen, K. A., Ims, R. A., Yoccoz, N. G., & Soininen, E. M. (2013). Shrub patch configuration at the landscape scale is related to diversity of adjacent herbaceous vegetation. *Plant Ecology and Diversity*, *6*(2), 257–268. *https://doi.org/10.1080/17550874.2013.773104*

Appendices

LEGEND
species that should ALWAYS be analysed on species level (both presence/absence and abundance (PF))
Species presence/absence should always be recorded. For abundance data (PF), can be group to genus if necessary and if that is not possible, to functional group.
Pre-defined categories that cover several species. Presence/absence mostly on genus level. Can be grouped to functional groups for abundance (PF) if necessary.
species presence of difficult species that can be identified should always be recorded (e.g. if flower is present); PF can be done on species or genus level

Abbreviation	Species	Norwegian_names	PF_functional_group
agr_mer	*Agrostis mertensii*	fjellkvein	broad_leaved_grasses
agr_sp	*Agrostis sp*	kvein	broad_leaved_grasses
alc_alp	*Alchemilla alpina*	fjellmarikåpe	small_forbs
alc_sp	*Alchemilla sp*	marikåpe	small_forbs
aln_inc	*Alnus incana*	gråor	deciduous_dwarf_shrubs
alo_pra	*Alopecurus pratensis*	engrevrumpe	broad_leaved_grasses
and_pol	*Andromeda polifolia*	kvitlyng	evergreen_dwarf_shrubs
ang_arc	*Angelica archangelica*	kvann	small_forbs
ant_nip	*Anthoxanthum nipponicum*	fjellgulaks	broad_leaved_grasses
ant_syl	*Anthriscus sylvestris*	hundekjeks	tall_forbs
arc_alp	*Arctous alpinus*	rypebær	deciduous_dwarf_shrubs
ath_sp	*Athyrium sp*	storburkne	deciduous_vascular_cryptogams
ave_fle	*Avenella flexuosa*	smyle	narrow_leaved_grasses
bar_alp	*Bartsia alpina*	svarttopp	Hemiparasites
bet_nan	***Betula nana***	**dvergbjørk**	**bet_nan**
bet_pub	*Betula pubescens var pumila*	fjellbjørk	deciduous_dwarf_shrubs
bis_viv	*Bistorta vivipara*	harerug	small_forbs
bot_lun	*Botrychium lunaria*	marinøkkel	deciduous_vascular_cryptogams
cal_lap	*Calamagrostis lapponica*	finnmarksrørkvein	broad_leaved_grasses
cal_neg	*Calamagrostis neglecta*	smårørkvein	broad_leaved_grasses
cal_pal	*Caltha palustris*	bekkeblom	small_forbs
cal_phr	***Calamagrostis phragmitoides***	**skogrørkvein**	**cal_phr**
cal_sp	*Calamagrostis sp*	rørkvein	broad_leaved_grasses
cam_rot	*Campanula rotundifolia*	blåklokke	small_forbs
car_aqu	*Carex aquatilis agg*	nordlandsstarr	sedges_rushes
car_big	*Carex bigelowii*	stivstarr	sedges_rushes
car_bru_can	*Carex brunnescens/canescens*	seterstarr	sedges_rushes
car_lac	*Carex lachenalii*	rypestarr	sedges_rushes
car_lim	*Carex limosa*	dystarr	sedges_rushes
car_liv	*Carex livida*	blystarr	sedges_rushes
car_nig	*Carex nigra*	slåttestarr	sedges_rushes
car_pra	*Cardamine pratensis agg*	engkarse	small_forbs
car_sax	*Carex saxatilis*	blankstarr	sedges_rushes
car_sp	*Carex sp*	starr	sedges_rushes

car_vag	*Carex vaginata*	slirestarr	sedges_rushes
cer_alp	*Cerastium alpinum agg*	fjellarve	small_forbs
cer_cer	*Cerastium cerastoides*	brearve	small_forbs
cer_fon	*Cerastium fontanum*	arve	small_forbs
cer_sp	*Cerastium sp*	arve	small_forbs
cha_ang	*Chamerion angustifolium*	geitrams	tall_forbs
cha_sue	*Chamaepericlymenum suecicum*	skrubbær	small_forbs
cir_het	*Cirsium heterophyllum*	kvitbladtistel	tall_forbs
com_pal	*Comarum palustre*	myrhatt	small_forbs
des_alp	*Deschampsia alpina*	fjellbunke	broad_leaved_grasses
des_ces	***Deschampsia cespitosa***	**sølvbunke**	**des_ces**
dip_alp	*Diphasiastrum alpinum*	fjelljamne	evergreen_non_woody
emp_nig	***Empetrum nigrum***	**krekling**	**emp_nig**
epi_ana	*Epilobium anagallidifolium*	dvergmjølke	small_forbs
epi_hor	*Epilobium hornemannii*	setermjølke	small_forbs
epi_pal	*Epilobium palustre*	myrmjølke	small_forbs
epi_sp	*Epilobium sp*	mjølke	small_forbs
equ_arv	*Equisetum arvense*	åkersnelle	equ_sp
equ_pal	*Equisetum palustre*	myrsnelle	equ_sp
equ_pra	*Equisetum pratense*	engsnelle	equ_sp
equ_sp	*Equisetum sp*	sneller	equ_sp
equ_syl	*Equisetum sylvaticum*	skogsnelle	equ_sp
equ_var	*Equisetum variegatum*	fjellsnelle	equ_sp
eri_ang	*Eriophorum angustifolium*	duskull	sedges_rushes
eri_sp	*Eriophorum st*	myrull	sedges_rushes
eup_sp	*Euphrasia sp*	augnetrøst	small_forbs
eup_wet	*Euphrasia wettsteinii*	fjellaugnetrøst	Hemiparasites
fes_ovi	*Festuca ovina*	sauesvingel	narrow_leaved_grasses
fes_rub	*Festuca rubra*	raudsvingel	narrow_leaved_grasses
fes_sp	*Festuca sp*	svingel	narrow_leaved_grasses
fil_ulm	*Filipendula ulmaria*	mjødurt	small_forbs
gen_niv	*Gentiana nivalis*	snøsøte	small_forbs
ger_syl	*Geranium sylvaticum*	skogstorkenebb	tall_forbs
geu_riv	*Geum rivale*	enghumleblom	tall_forbs
green_willows	***Green willows***	**grønnbladete_vier**	**green_willows**
grey_willows	***Grey willows***	**gråbladete_vier**	**grey_willows**
gym_dry	*Gymnocarpium dryopteris*	fugletelg	deciduous_vascular_cryptogams
har_hyp	*Harrimanella hypnoides*	moselyng	evergreen_dwarf_shrubs
hie_alp	*Hieracium alpina agg*	fjellsvæver	small_forbs
hie_odo	*Hierochloe odorata*	vanleg marigras	broad_leaved_grasses
hie_sp	*Hieracium sp*	svæve	small_forbs
hup_sel	*Huperzia selago*	lusegras	evergreen_non_woody
jun_com	*Juniperus communis*	einer	evergreen_dwarf_shrubs
jun_fil	*Juncus filiformis*	trådsiv	sedges_rushes
jun_sp	*Juncus sp*	siv	sedges_rushes

jun_tri	*Juncus trifidus*	rabbesiv	sedges_rushes
kal_pro	*Kalmia procumbens*	greplyng	evergreen_dwarf_shrubs
lin_bor	*Linnaea borealis*	linnea	small_forbs
luz_mul	*Luzula multiflora*	engfrytle	sedges_rushes
luz_sp	*Luzula sp*	frytle	sedges_rushes
luz_spi	*Luzula spicata*	aksfrytle	sedges_rushes
luz_sud	*Luzula sudetica*	myrfrytle	sedges_rushes
lyc_ann	*Lycopodium annotinum*	stri kråkefot	evergreen_non_woody
lyc_cla	*Lycopodium clavatum*	mjuk kråkefot	evergreen_non_woody
lyc_sp	*Lycopodium sp*	kråkefot	evergreen_non_woody
mel_pra	*Melampyrum pratense*	stormarimjelle	Hemiparasites
mel_sp	*Melampyrum sp*	marimjelle	Hemiparasites
mel_syl	*Melampyrum sylvaticum*	småmarimjelle	Hemiparasites
mil_eff	*Milium effusum*	myskegras	broad_leaved_grasses
min_sp	*Minuartia sp*	tuvearve	small_forbs
myo_sp	*Myosotis sp*	minneblom	small_forbs
nar_str	***Nardus stricta***	**finnskjegg**	**nar_str**
oma_nor	*Omalotheca norvegica*	setergråurt	small_forbs
oma_sup	*Omalotheca supina*	dverggråurt	small_forbs
ort_sec	*Orthilia secunda*	nikkevintergrøn	evergreen_non_woody
oxy_dig	*Oxyria digyna*	fjellsyre	small_forbs
par_pal	*Parnassia palustris*	jåblom	small_forbs
ped_lap	*Pedicularis lapponica*	bleikmyrklegg	Hemiparasites
ped_sp	*Pedicularis sp*	myrklegg	Hemiparasites
phe_con	*Phegopteris connectilis*	hengjeveng	deciduous_vascular_cryptogams
phl_alp	*Phleum alpinum*	fjelltimotei	broad_leaved_grasses
phy_cae	*Phyllodoce caerulea*	blålyng	evergreen_dwarf_shrubs
pin_sp	*Pinguicula sp*	tettegras	small_forbs
pin_vul	*Pinguicula vulgaris*	vanleg tettegras	small_forbs
poa_alp	*Poa alpina*	fjellrapp	broad_leaved_grasses
poa_sp	*Poa sp*	rapp	broad_leaved_grasses
pot_nor	*Potentilla norvegica*	norsk mure	small_forbs
pot_sp	*Potentilla sp*	mure	small_forbs
pyr_min	*Pyrola minor*	perlevintergrøn	evergreen_non_woody
pyr_sp	*Pyrola sp*	vintergrøn	evergreen_non_woody
ran_acr	*Ranunculus acris agg*	engsoleie	small_forbs
ran_rep	*Ranunculus repens*	krypsoleie	small_forbs
ran_sp	*Ranunculus sp*	soleie	small_forbs
rhi_min	*Rhinanthus minor*	småengkall	Hemiparasites
rho_ros	*Rhodiola rosea*	rosenrot	small_forbs
rub_cha	*Rubus chamaemorus*	molte	small_forbs
rum_ace	***Rumex acetosa***	**engsyre**	**rum_ace**
rum_acet	*Rumex acetosella*	småsyre	small_forbs
sag_sp	*Sagina sp*	småarve	small_forbs
sal_her	***Salix herbaceae***	**musøre**	**sal_her**

sal_sp	*Salix sp*	vier	Willows
sau_alp	*Saussurea alpina*	fjelltistel	small_forbs
sco_aut	*Scorzoneroides autumnalis*	følblom	small_forbs
sel_sel	*Selaginella selaginoides*	dvergjamne	evergreen_non_woody
sib_pro	*Sibbaldia procumbens*	trefingerurt	small_forbs
sol_vir	*Solidago virgaurea*	gullris	small_forbs
ste_bor	*Stellaria borealis*	fjellstjerneblom	small_forbs
ste_med	*Stellaria media*	vassarve	small_forbs
ste_nem	*Stellaria nemorum*	skogstjerneblom	small_forbs
ste_sp	*Stellaria sp*	stjerneblom	small_forbs
tar_sp	*Taraxacum sp*	løvetann	small_forbs
tha_alp	*Thalictrum alpinum*	fjellfrøstjerne	small_forbs
tri_ces	*Trichophorum cespitosum*	bjønnskjegg	sedges_rushes
tri_eur	*Trientalis europaea*	skogstjerne	small_forbs
tri_spi	*Trisetum spicatum*	svartaks	broad_leaved_grasses
tro_eur	*Trollius europaeus*	ballblom	tall_forbs
vac_myr	*Vaccinium myrtillus*	blåbær	deciduous_dwarf_shrubs
vac_uli	*Vaccinium uliginosum*	blokkebær	deciduous_dwarf_shrubs
vac_vit	*Vaccinium vitis-idaea*	tyttebær	evergreen_dwarf_shrubs
vah_atr	*Vahlodea atropurpurea*	rypebunke	broad_leaved_grasses
ver_alp	*Veronica alpina*	fjellveronica	small_forbs
ver_sp	*Veronica sp*	veronika	small_forbs
vio_bif	*Viola biflora*	fjellfiol	small_forbs
vio_epi	*Viola epipsila*	stor myrfiol	small_forbs
vio_pal	*Viola palustris agg*	myrfiol	small_forbs
vio_sp	*Viola sp*	fiol	small_forbs