

## Snow depth measurements

### Motivation

The thickness of the snow cover (snow depth) is an important determinant of how well the ground is insulated from ambient air temperatures and snow season length (phenology). The snow depth measurements are connected to monitoring of snow beds (plant communities and lemming winter habitat occupancy/grazing impact) and hummock tundra (lemming summer habitat occupancy), and are a part of COAT Varanger's small rodent module.

### **State variables:**

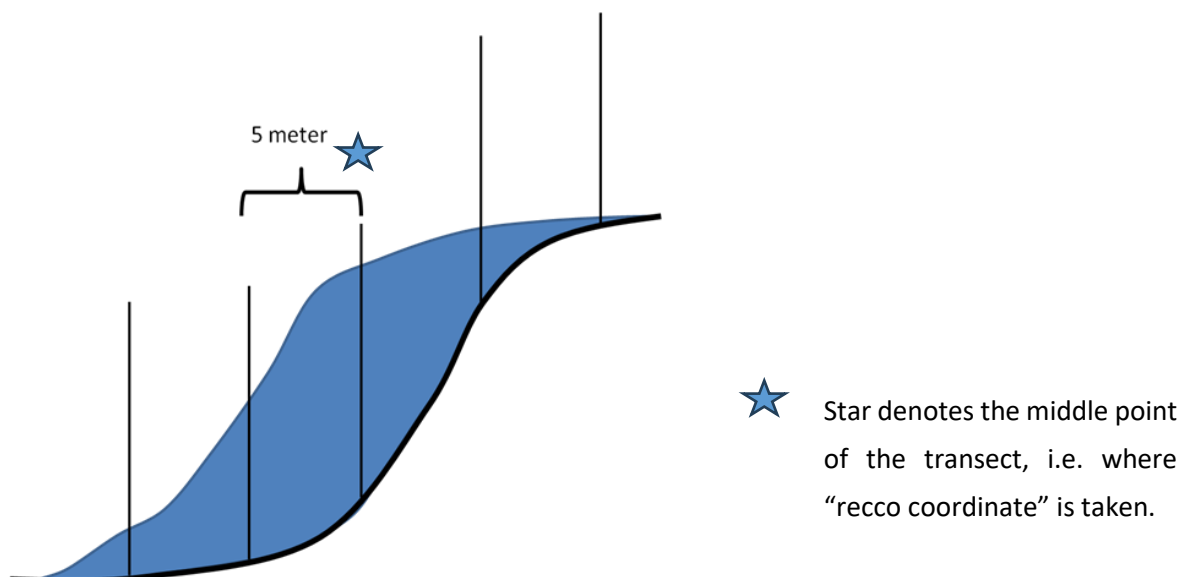
- CT2 snow depth

### Spatial study design

The snow depth measurements are conducted within COAT Varanger's intensive monitoring locations; Komagdalen and Vestre Jakobselv. At both locations, snow depth is measured according to two designs:

**1. Altitudinal snow bed transects:** One of the two transects per locations where plant communities and lemming winter activity (pellets counts) are monitored each summer is included. See description for "mountain slope" sections in the study design protocol for COAT. The selected sections/transects are "Bearaveaijohka" at Vestre Jakobselv and «Kjøltindan» at Komagdalen.

At each snow bed site within the transect snow depths are measured next to a recco (i.e. middle point of the snowbed) and then, 5m and 10m distance uphill and downhill from the middle point (see figure).



**2. Camera trap monitoring design of lemmings:** Snow depth measurements are made at a subset of sites where the camera traps are placed both in lemming summer habitat (hummock tundra) and in

winter habitat (snow beds). See description for “lemming block” sections in the study design protocol for COAT. Measurements are taken at 5 points, as for the altitudinal snow bed transects. The midpoint should be at the recco-brick that is placed 15m away from the camera trap to avoid disturbance of the snow pack close to the trap.

A list of sites where snow depth measurements are done is given in the Appendix. GPS files that include all relevant sites are stored at COAT Box/Fieldwork/Varanger GPS files for fieldwork and are called “snowbeds lemming transect 2019.gpx” and “small\_mammal\_cameras\_2021.gpx”.

A separate GPS-file called “recco\_coordinates\_COAT\_Varanger\_2024.gpx” has coordinates for the exact middle points of the transects (denoted with star in the above figure). These were marked with recco detector bricks during 2019-2023, but the recco brick setup is no longer in use.

### **Temporal study design**

The snow depth measurements are done once per year, during late March.

### **Procedure**

Snow depth per measurement point: Use snow probe that is maximum 4 meters long, so max depth you can measure is 3.7m. Enter the probe straight down (see figure). Compass directions for uphill and downhill from recco are given in Appendix.

### **Equipment needed**

- Snow depth probe
- Notebook, pencil, GPS
- Compass

### **Information recorded in the field**

For each snowbed, record site ID, date, observers. For each sampling point, record position (**0**=middle point, **+5**=5 m uphill, **+10**=10 m uphill, **-5**=5 m downhill, **-10**=10 m downhill) and snow depth. Note a comment if you are uncertain or do not reach the bottom.

### **Data processing**

All field observers are in charge of typing their data into digital format (unless otherwise agreed with the data set responsible, Nigel Yoccoz).

Template datasheet is called “template\_snowdepth\_COAT.xlsx” and 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 included additional 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 who will quality-check them and store them in COAT data portal.

### **Training requirements and specialized skills**

No special skills are needed.

## Appendix

Sites for annual snow depth measurements at Vestre Jakobselv. Sites for additional snow pits in the lemming camera trapping design are also indicated.

section	site	Compass direction "uphill" from "recco point".
Bearalveaijohka	vj_be_sn_1	220
	vj_be_sn_2	230
	vj_be_sn_3	250
	vj_be_sn_4	220
	vj_be_sn_5	240
	vj_be_sn_6	220
	vj_be_sn_7 – 2 recco here ?!	190
	vj_be_sn_8	200
	vj_be_sn_11	270
	vj_be_sn_12	10
	vj_be_sn_13	210
	vj_be_sn_14	240
	vj_be_sn_15	240
	vj_be_sn_17	0
	vj_be_sn_19	NA
	vj_be_sn_20	320
	vj_be_sn_21	290
	vj_be_sn_22	160
	vj_be_sn_24	220
	vj_be_sn_25	270
Reinhaugen	vj_re_sn_1	200
	vj_re_sn_2	140
	vj_re_sn_3	108
	vj_re_sn_4	140
	vj_re_sn_5	76
	vj_re_sn_6	34
	<b>vj_re_hu_1 – snow pit site</b>	50
	vj_re_hu_2	250
	vj_re_hu_3	120
	<b>vj_re_hu_4 – snow pit site</b>	0
	vj_re_hu_5	110
vj_re_hu_6	0	
Gåsevannan	vj_ga_sn_1	10
	vj_ga_sn_2	190
	vj_ga_sn_3	0
	vj_ga_sn_4	140

	vj_ga_sn_5	180
	vj_ga_sn_6	20
	<b>vj_ga_hu_1 – snow pit site</b>	180
	vj_ga_hu_2	310
	vj_ga_hu_3	140
	vj_ga_hu_4	180
	<b>vj_ga_hu_5 - snow pit site</b>	320
	vj_ga_hu_6	30
Skoarrajohka	<b>vj_sk_hu_1 – snow pit site</b>	315
	vj_sk_hu_2	240
	vj_sk_hu_3	270
	vj_sk_hu_4	290
	vj_sk_hu_5	135
	<b>vj_sk_hu_6 – snow pit site</b>	270
	vj_sk_sn_1	330
	vj_sk_sn_2	310
	vj_sk_sn_3	315
	vj_sk_sn_4	255
	vj_sk_sn_5	225
	vj_sk_sn_6	240
Tranemyra	vj_tr_sn_1	290
	vj_tr_sn_2	190
	vj_tr_sn_3	300
	vj_tr_sn_4	290
	vj_tr_sn_5	260
	vj_tr_sn_6	290
	<b>vj_tr_hu_1 – snow pit site</b>	320
	vj_tr_hu_2	320
	<b>vj_tr_hu_3 – snow pit site</b>	180
	vj_tr_hu_4	290
	vj_tr_hu_5	40
	<b>vj_tr_hu_6 – snow pit site</b>	180

Sites for annual snow depth measurements in Komagdalen. Sites for additional snow pits in the lemming camera trapping design are also indicated.

section	site	Compass direction “uphill” from “recco point”
Kjøltindan	ko_kj_sn_1	240
	ko_kj_sn_2	190
	ko_kj_sn_3	210
	ko_kj_sn_4	230
	ko_kj_sn_5	220
	ko_kj_sn_6	190

	ko_kj_sn_7	190
	ko_kj_sn_8	170
	ko_kj_sn_9	170
	ko_kj_sn_10	210
	ko_kj_sn_11	170
	ko_kj_sn_12	30
	ko_kj_sn_13	110
	ko_kj_sn_14	220
	ko_kj_sn_15	160
	ko_kj_sn_16	180
	ko_kj_sn_17	130
	ko_kj_sn_18	180
	ko_kj_sn_19	180
	ko_kj_sn_21	160
	<b>ko_kj_sn_22 – snow pit site</b>	170
	ko_kj_sn_23	150
	ko_kj_sn_24	160
	ko_kj_sn_25	160
	ko_kj_hu_1b	180
	ko_kj_hu_2b	160
	ko_kj_hu_3b	150
	<b>ko_kj_hu_4b – snow pit site</b>	180
	ko_kj_hu_5	30
	Ko_kj_hu_6	NA
Hubejohka	ko_hu_hu_6	0
	ko_hu_sn_1	0
	<b>ko_hu_hu_2b – snow pit site</b>	0
	ko_hu_sn_2	198
	ko_hu_hu_3b	0
	ko_hu_sn_3	200
	ko_hu_sn_4	210
	ko_hu_hu_4	230
	ko_hu_sn_5	240
	<b>ko_hu_hu_5 – snow pit site</b>	0
	ko_hu_hu_1	190
	ko_hu_sn_6	NA
Ryggfjellet	<b>ko_ry_sn_1 – snow pit site</b>	170
	ko_ry_sn_2	220
	ko_ry_sn_3	170
	ko_ry_sn_4	200
	ko_ry_sn_5	140
	ko_ry_sn_6b	180
	<b>ko_ry_hu_1b – snow pit site</b>	180

	ko_ry_hu_2	210
	ko_ry_hu_3	280
	ko_ry_hu_4	250
	ko_ry_hu_5	180
	ko_ry_hu_6	330
Gargas	ko_ga_hu_1b	40
	<b>ko_ga_hu_2 – snow pit site</b>	270
	ko_ga_hu_3	300
	ko_ga_hu_4b	0
	ko_ga_hu_5	270
	ko_ga_hu_6	290
	ko_ga_sn_1b	190
	ko_ga_sn_2b (snow pit site until 2022)	230
	ko_ga_sn_3	140
	ko_ga_sn_4b	110
	ko_ga_sn_5	140
	<b>ko_ga_sn_6 – snow pit site</b>	250