

## Snapshot Tundra Phenology Protocol

**Goal:** We would like to implement a less intensive phenology sampling method that provides important information on peak flowering, and can be used to estimate duration of flowering of common species in arctic and alpine areas.

**Why?** To contribute important phenological data to assist with large scale synthesis of phenological shifts with warming

**What?** Recording date of snowmelt (if known) and the proportion of flowering and senescing tundra plants at three points within the growing season – experimental plots not required

If you have questions, you can reach me at any time:

Janet Prevéy, SLF-WSL ([janet.prevey@gmail.com](mailto:janet.prevey@gmail.com))

### Equipment needed:

- Fieldbook, datasheets, and pencil
- GPS, 1 meter square quadrat, measuring tape, and pins to mark the edges of plots (this equipment is only necessary if you need to create monitoring plots)

### Plot setup:

- If you do not already have monitoring plots at your site (e.g. ITEX plots) you can designate 1 m<sup>2</sup> plots to monitor phenology.
- Plots should be distributed systematically, at least 10 meters apart, across a vegetation type. For example, you can pick a random starting point and lay out the tape measure in a straight line. Mark off a 1 x 1 m square area to use as a monitoring plot every 10 meters. Record GPS location of each plot.
- Plots can be marked with rocks or other markers at the four corners, and there should be 6 or more replicate plots per vegetation type

### Snowmelt date:

- If at all possible, record the day of snowmelt in the experimental plots, either at the scale of the plot or the scale of the site. Even if you cannot provide the exact date of snowmelt, a range (e.g., between day 151 and 156) or even an upper limit (e.g., before day 175) is helpful.
- A plot is considered “snow free” on the day that 10% or less of the plot area is covered by snow. However, if you have previously collected phenology and snowmelt data and used different criteria to determine date of snowmelt, then use whatever criteria you have used in the past.

### Sampling dates:

- Flowering phenology should be recorded on three days over the summer, ideally over the time of peak flowering for most plant species. Peak flowering times will vary from species to species, site to site, and year to year.

- Pick three days spaced at least 7 days apart over the middle of the summer (to capture pre-peak, peak, and post-peak flowering), or collect data on the following specific dates. Based on the previous phenological measurements from all ITEX sites, the following dates should capture flowering duration of many species: June 19, July 9, and July 29 at mid-Arctic latitude sites.

**Snapshot phenology measurements:**

- On the three sampling dates, record flowering phenology on all species of interest per plot, or, if there are marked plants in plots, then record flowering on the marked plants. You can decide which species you would like to observe, however, species that we are particularly interested in are listed at the end of the protocol.
- If you have experimental plots receiving different treatments (e.g., ITEX control and OTC plots), it is important to record phenology on all control and treated plots, and note treatments on the datasheet (attached)
- To measure flowering phenology, record the total number of buds, mature flowers, immature capsules or seeds and mature capsules or seed dispersal on each individual of the species of interest (or marked individuals) in all plots on the three dates.
- A bud is an unopened flower. A flower is considered mature as soon as there is visible pollen (e.g., the corolla is open) or the stigma is receptive. Immature capsules are flowers that are no longer receptive (e.g., anthers have senesced and/or seeds have begun developing). Mature capsules contain fully ripe seeds that are ready for dispersal. For more information about species-specific phenological stages for several common species, see the ITEX manual, chapter 8.

**Intensive methods (not required):**

- If you have the time, and you are at your field site for most of the summer, it would be great if you could also collect more detailed phenology data. These methods are very similar to methods in the ITEX protocol for measuring first observed flowering and flower senescence per plot.

**Intensive measurements:**

- Phenological events of interest are: 1) Date snow free, 2) Date of first flower opening, and 3) Date of last flower senescing
- If possible, begin observations in late May with two observations per week until mid-June. The snow free date is recorded for the plot in general, after which you examine the species of interest by scanning the entire plot for the next phenological event.
- Note the date that you observe the first flower of each species opening in each plot, and the date you observe the last flower senescing (petals falling, flowers closing) in each plot. After peak flowering, observations should be made one time per week until flowers have senesced, at which time observations can cease.
- Determination of first flowering and flower senescence will vary from species to species. Descriptions of phenological stages for several common species are outlined in Chapter 8 of the ITEX manual (attached). If you have any questions about observations, please contact Janet Prevey.

**Thank you very much for your participation!**

**Species of greatest interest:**

(However - we could use measurements from any species observers are interested in!)

- *Cassiope tetragona*
- *Dryas octopetala*
- *Eriophorum angustifolium*
- *Eriophorum russeolum*
- *Luzula arctica*
- *Luzula confusa*
- *Poliginum bistorta*
- *Poliginum viviparum*
- *Ranunculus nivalis*
- *Salix arctica*
- *Salix polaris*
- *Salix rotundifolia*
- *Saxifraga oppositifolia*
- *Silene acaulis*
- *Vaccinium uliginosum*
- *Vaccinium vitis-idaea*