
ADAPT Vegetation standard description protocol

By Paul Grogan, Greg Henry, Robert Grant and Esther Lévesque.

Please record the following details before digging the soil pit for the standard ADAPT soil measurements at each site:

1. Landscape photographs: Take at least four of the vegetation at the site (e.g. in North, South, East and West directions) that each include the soil sampling location in the foreground and the surrounding vegetation on the landscape. Photos should be taken at an oblique angle to the land surface so that the horizon is close to the top of the image.
2. Vertical photographs of the plants and soil surface:
 - a. Delineate three plots within the vegetation-type that is representative of where the soil pit will be dug using a square frame (quadrat) or several measuring tapes. The three plots should be at least 15 m apart. Plot size should be at least 50 cm x 50 cm in tundra vegetation and larger for taller vegetation (e.g. 1 m x 1 m for low shrubs; and 2 m x 2 m in tall shrubs). Record the plot size in the appropriate space in the top row of the Table 2 (one table per plot).
 - b. Position the camera vertically (~ 1.3 m) above the plot and take several close-up photos of the vegetation (and bare soil/rock). If the vegetation is tall (i.e. > 50 cm high), use a tripod if available or something to elevate the camera (to record images of ~ 4 m² or greater). Ensure that the edges of the plot quadrat are in the photograph. See example provided in Figure 1.



Figure 1. A 0.5 m x 0.5 m plot within a photograph of tundra vegetation.

3. In the same plots, identify the dominant growth forms and estimate visually their percent cover within the framed area of the plot using the categories in the Table(s) 2.
4. Measure vegetation heights of each plant growth-form in the plot.
 - a. For vascular plants, randomly choose 3 to 5 plants of each growth-form and measure height (cm) from ground to the tip of the tallest shoot of each plant (i.e. the vertical distance, not necessarily following the stem if it is bent or angled). Record all the heights for each growth-form in the table.
 - b. For mosses, measure the height/depth of the green and brown portions separately if both are present. For example, in a representative area of mosses, measure the distance (e.g. 1.5 cm) from the uppermost green tissue tips to the mineral soil surface if the latter is obvious. Alternatively, if there is extensive underlying brown moss tissue below the green portion (normally still attached), measure from the green tips to the green/brown transition depth, and then afterwards measure the depth of the brown tissue down to the mineral soil (e.g. 5 cm), and record both in the table. This differentiation helps to determine the photosynthetic moss tissue from that which supports it and is in essence part of the litter/soil organic matter.
5. Complete the site description part of the table 2 and 3 and make a note of any trees that are within 25 m of the plot, and include any observations on landscape drainage, thermokarst etcetera.

Optional photographic method for biomass measurements at each site that can be related to satellite remote sensing data.

The attached protocol was developed for the IPY project CiCAT to assess vegetation biomass and LAI using digital photographs and to relate them to satellite-based remote sensing data. It has been tested for Arctic tundra vegetation (<50 cm height) only. Measurements of biomass and LAI for vegetation types at ADAPT sites would be valuable and you are encouraged to attempt these measurements if possible.

Protocols for taking vertical photographs and field measurements of plant height for biomass and LAI estimation in Arctic tundra (for vegetation height < 0.5 m).

Selecting site and plots:

1. Sites of the selected vegetation-type should be fairly homogeneous over at least 3 • 3 TM pixels (i.e. 90 m • 90 m) to allow the field measurements to be related to remote sensing signals. The corners of the site should be marked with permanent stakes and their coordinates recorded with a GPS (see below).
 2. Select sites and plots as early as possible in the growing season. Ideally, each site should be made up of 20 permanent monitoring plots.
 - Since the relatively homogenous area in most sites is not perfectly square, select the monitoring plots in the direction with the longest homogenous area.
 - Each permanent monitoring plot should be 0.5 m • 0.5 m, and separated from each other by 3-5 m.
 - Mark the entire site using coloured plastic flagging tape or at the four corners.
 3. Record GPS latitude and longitude coordinates to at least 4 digits of the second for each plot (i.e., xx° xx' xx.xx" for both latitude and longitude).
-

4. If the sites are to be permanent, use stakes (wooden or metal) pushed into the ground to mark the corners of each 0.5m • 0.5m plot.
 - Mark each stick with coloured plastic flagging tape.
 - Place a 0.5 m • 0.5 m frame over the plot (see Figure 1)
 - Outside the plot, clearly label the plot with a plot number.

Taking photographs:

Using a digital camera, separately photograph each 0.5 x 0.5 m plot by positioning the camera about 1.3 m from the ground (for low lying tundra vegetation) directly above the plot. This can be done by mounting a camera on a tripod or by holding it by hand. Make sure that the frame is centred in the photograph and not too close to the edges. If possible, set the camera so a near-infrared band is taken.

- Images should be stored in compressed format such as JPEG (high resolution).
- In a spreadsheet, record the filename, GPS position and the date and time of each photograph.
- To obtain the most valuable information this should be done for each plot every 5 days from the beginning to the end of growing season. However, if this is not feasible, having a picture taken during peak biomass will also provide valuable information.

Note: The ideal condition for taking photos is an overcast or cloudy sky. If photos have to be taken on a sunny day, the photographer should face the direction of sun to avoid the shade inside the plot. Also avoid using flash if possible. If on the scheduled date the photos cannot be taken, a make-up photo should be taken the following day.

Measuring mean height:

5. Randomly select and measure the height of 5 representative plants for each species within a plot.
 - a. Height should be measured from ground surface to the highest leaf of the randomly selected individual
 - b. Record the heights in the spreadsheet.
 - c. To obtain the most valuable information, measurements should be taken for each plot every 5 days. If measurement can not be made in a scheduled day, a makeup measurement should be made on the next day. If it is not feasible to repeat measurements every 5 days, measurements taken during peak biomass will provide the most valuable information.

*Note: If 5 plants for a species cannot be found, fewer can be measured.

Tables 2 and 3. ADAPT Vegetation standard description.

PLOT number: Quadrat size = cm x cm

| Plant group | % cover | | | | | | | Heights |
|--|---------|------|------|-------|--------|--------|---------|---------|
| | 0% | 0-1% | 1-5% | 5-25% | 25-50% | 50-75% | 75-100% | (cm) |
| Evergreen shrubs (e.g. <i>Cassiope</i> , <i>Ledum</i> , cranberry) | | | | | | | | |
| Deciduous shrubs (e.g. birch, willow, alder) | | | | | | | | |
| Graminoids (sedges, rushes, grasses) | | | | | | | | |
| Forbs (broad-leaved herbaceous plants, not graminoids) | | | | | | | | |
| Mosses (if present, record green and brown tissue heights/depths separately) | | | | | | | | |
| Lichens | | | | | | | | |
| Rock and stones | | | | | | | | |
| Bare soil | | | | | | | | |

| | |
|---|--|
| Photograph identifier numbers associated with this plot | |
| Name and institution of collector | |
| Date of collection | |
| Site name for the location of collection | |
| GPS of the location (WGS84 Lat-Long) | |
| Main vegetation type (indicate major tree species if they occur within 25 m of sampling location) | |
| Total soil organic layer depth (i.e. depth of the brown/black surface organic material) | |
| Other information or comments | |