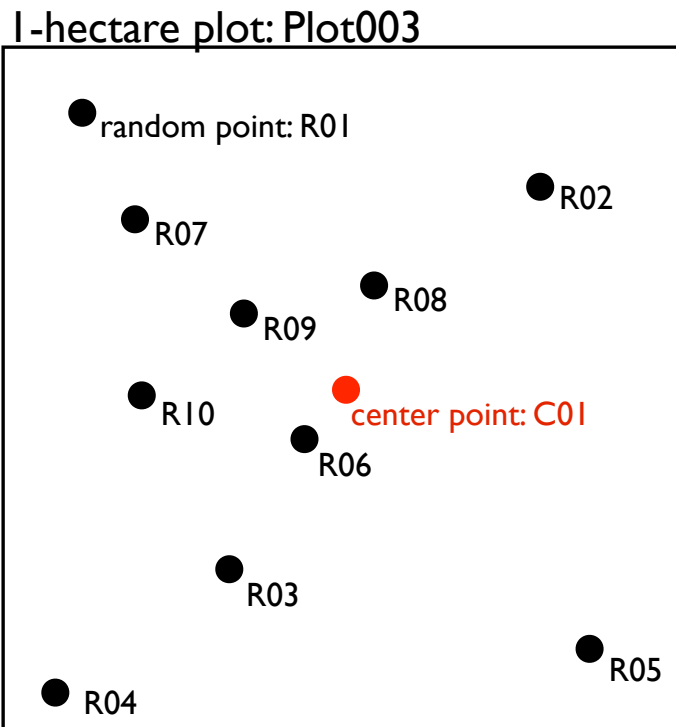


Equipment needed:

1. 4 one-meter-long pieces of PVC tubing, marked at 10 cm increments with a black Sharpie (mark numbers 1-9).
2. 4 PVC elbows to connect tubes into a square quadrat
3. 10 x 10 cm square frame. A piece of stiff gauge wire works.
4. A bamboo pole or PVC tube that has been marked with a black Sharpie at 1 cm increments with every 10 cm written in large print.
5. Random number tables or a generator (i.e. stopwatch, see below for explanation).

Vegetation sampling should take place between mid-July and mid-August for consistency with prior vegetation sampling. By this time, much plant growth is complete, so measurements should not vary too much with date. Minimizing the sampling window as much as possible is generally important to remove this temporal variation, but this is more important for looking at change in plant height and density than species composition and percent cover. Sampling largely overlaps with 1-hectare plots that were surveyed at least once between 2002 and 2009.



Plot labeling: Each Plot ID begins with **PLOT** followed by a three-digit plot number, the sample type, and the sample number. The three-digit plot number corresponds to the “universal plot number” used in previous years’ bird and plant surveys. The sample type denotes whether the sample is at a center point (**C**) of a historical 1-hectare plot, a sample randomly selected from within the 1-hectare plot (**R**), or permanent (**P**), which refers to samples that have permanent markers (including any plots done around abandoned sampling equipment, such as wooden stakes or PVC wells). The sample number is a two-digit number that provides unique identifiers

to samples within a sample type, within a 1-hectare plot. For example, the 14th random sample from within universal plot 3 should be recorded as **PLOT003R14**. In most cases, there will only be one sample labeled with a **C** for each 1-hectare plot, which should be labeled **C01**. If the sample is not located in a historical plot, record **XXX** for the plot number – e.g. **PLOTXXXP01**.

The center point and permanent points should be surveyed using the full protocol outlined below (front and back on the data sheet). Random points should be surveyed using the streamlined set of measurements in green below (front of the data sheet only). Random points should be pre-loaded on a GPS unit, and care should be taken to get as close as possible to the point. If any portion of a random sample falls in a ditch, discard the point and select the next down the list. Do NOT just move the sample to one side of the ditch.

Sampling should follow the order listed on the datasheet and outlined below to avoid disturbance to the vegetation that could bias subsequent measurements.

Locating the sampling frame

1. Place meter frame in any orientation such that target point lies at center of the frame. When possible, all of the random samples within a 1-hectare plot should be done on the same day.

Vegetation cover measurement

2. Estimate the cover of major vegetation types as seen from above the sample. If each plant species was a different color, and you took a high-resolution picture of the sample from overhead, the percentage of pixels of each color is what we are aiming to estimate. We are focusing on the plants listed on the data sheet (including bare ground) such that values add to 100%: *J. gerardii*, *S.patens*, *D. spicata*, *S. alt* short form, *S. alt* tall form, *Salicornia sp.*, *I. frutescens*, *Limonium sp.*, *P.australis*, bare ground, wrack, and thatch. Note that we are estimating the tall and short forms of *S. alterniflora* separately. Short form is less than 14 inches tall. If a plant not listed on the datasheet is present and its coverage is greater than 5%, you may add it to a blank slot on the datasheet. **But record the percentage of all the major species on the datasheet, even if it is less than 5%.** When a cover is less than 1% (as can happen with *Salicornia*), it's fine to round up to 1%. Each species cover estimate should be broken out into live vegetation and dead (but not thatch) vegetation. For example, if the sample frame is 60% *S. patens*, 20% of which is dead (but not thatch), record 40% under ***S. patens* – alive** and 20% under ***S. patens* – dead**. Be sure that the sum of all cover types listed on the front page of the datasheet (which includes the live and dead subcategories for each species) is 100%.

Thatch height

3. Measure the distance from the ground to the top of the thatch at the center point in cm.

Bearing

4. Take the bearing along one side of the sample square to the nearest half-degree. Be as accurate as possible.

Vegetation height measurement

5. Measure the height (in cm) and record the species of the tallest piece of vegetation at each of the four corners of the frame. Be sure to follow the stem of the tallest vegetation down to the mud and hold it flush against the measuring stick.

Vegetation density measurement

6. Generate 2-digit random numbers for the vegetation density measurements. Ideally, this will have been done going out into the field using an online random number generator (this approach is best because it gives greater confidence that the numbers truly are random). If this has not been done, an alternative is to use the stopwatch or timer function on a watch. One person would press stop at periodic intervals, yielding 2-digit millisecond values. Be sure to write the random numbers in the appropriate box on the datasheet.
7. Use these numbers to place the 10 x 10 cm frame for each vegetation density measurement, using the southern most corner of the square as the origin of an X-Y plane. For example, for 26, go to the 2 (20 centimeter) mark on the PVC tube that is along the X-axis and 6 mark on the tube that is along the Y-axis. Place the 10 cm frame where these values meet in the center. For a zero or a nine, the small frame will lie against the edge of the meter frame, up against the PVC.
8. Once the location for the density count has been established, count the number of stems within the 10 X 10 cm frame for each of three groups: 1) *J. gerardii*, 2) *S. patens*, and 3) all other species combined.
9. Repeat this process for five measures of stem density for each sample frame. If a pair of random numbers is repeated within the five pairs selected, simply select another pair of numbers.

Frequently asked questions

What is thatch, and what is dead vegetation? Thatch is dead vegetation that is lying down, but rooted, that often (but not always) has live vegetation sticking up through it. When thatch is no longer rooted, it is wrack. The grass species (with the exception of *P. australis*) make thatch, although *D. spicata* most often has dead plants that are standing up, and thus have not yet become thatch. Dead *Limonium*, *Salicornia*, *P. australis*, and *I. frutescens* do not fit our definition of thatch, but dead plants should be noted in the comments, as described above. Sometimes in the tall *S. alterniflora*, the layer of thatch is very loose, so defining what constitutes thatch vs. dead plants is difficult. In these cases, go with thatch as the "main" layer that is lying down, and don't worry about the sticky-uppy stuff that protrudes above this horizontal layer.

What do I record for thatch height if there is no real thatch layer? Zero.

I'm doing a survey at high tide, and the live vegetation is covered by water. While standing water usually falls under the "bare" category, we ignore any water that covers live vegetation – just pretend it's not there. When possible, it's a good idea to avoid doing vegetation surveys during the highest tides.

When doing the percent cover measurement, is it OK to dig around in the grass to figure out which plants are dead, look for rare cover types I might be missing, and ID any ambiguous stems? Yes. Just be sure to follow the protocol outlined above once you have good idea of what's in the plot and are ready to take the percent cover measurement.