Modified-Whittaker

Description

The Modified-Whittaker plot design is a vegetation sampling design that can be used for assessing plant communities at multiple scales. The plot measures 20 m by 50 m (1,000 m^2) and contains nested subplots of three different sizes. A 5 m by 20 m (100- m^2) subplot is placed in the plot's center, and two 2 m by 5 m (10- m^2) subplots are placed in opposite corners of the plot. There are a total of ten 0.5 m by 2 m (1- m^2) subplots. Six are arranged systematically inside and adjacent to the 1,000- m^2 plot perimeter and four are arranged systematically outside and adjacent to the 100- m^2 subplot perimeter. Plots are placed parallel to the major environmental gradient of the vegetation type being sampled to encompass the most heterogeneity. Rectangular plots placed parallel to the major environmental gradient of a vegetation type encompass more heterogeneity and recover greater species richness than round or square quadrats. Because this holds true at all scales, this shape is kept consistent for the plot and its nested subplots

Previous Uses

- Used to calculate native, non-native, and total plant species richness at the 1 m^2, 10 m^2 , 100 m^2 , and 1000 m^2 scales.
- Used in monitoring the spread of non-native species and evaluating range conditions and trends at local, regional, and national scales.
- Used to construct species-area curves from the nested subplot design to estimate larger-scale richness patterns.
- The systematic placement of the subplots makes the design easy to use in the field and to use as long-term study plots because of easy relocation.
- Used to quantify species richness and cover.
- Used to capture greater species richness and more unique species than other plot designs.
- Used to detect locally rare and patchy species not captured in smaller plots.
- Used to pick up non-native species not detected by other smaller-scale methods so better for the early detection of non-native plant invasions.

Notes

- Design is expensive and time consuming. Greater cost may limit the number of plots, thus increasing the probability of missing important locations across the landscape, reducing the environmental gradient sampled, and making extrapolation to unsampled areas difficult. This could also limit the frequency of resampling sites, sacrificing the early detection of vegetation trends.
- Field difficulties in certain habitat types (dense vegetation, etc.).

Equipment Needed

- 100m tape (2)
- 50m tape

- Ground stakes (8)
- Marking flags (~25)
- Meter stick
- 1 m^2 subplot frame (0.5 x 2m)
- 10 m^2 subplot frame (2 x 5m)
- Compass
- 2.5 cm diameter soil increment core (if need soil analysis)
- Plastic baggies (for soil samples)
- GPS Unit
- Reference materials (floristic keys, etc.)
- Materials to collect unknowns (see http://www.nrel.colostate.edu/projects/fhm/equipment/PlantCollecting/PlantCollectingRig.htm)

How to Set Up

1. Look around the area and determine the environmental gradient in order to position the long side (50 m) of the 1000 m^2 plot (K) parallel to the gradient. (The goal is to cover the most variation possible.)
2. Using two 100 m tapes (1 and 2), lay out the main plot (K) 20 x 50 m rectangle. Anchor tape ends at the starting point (right bottom corner, label 0,0). Using a compass to shoot a 90^o angle, run tapes out following the arrows. Anchor the 20 m and 50 m corners.
3. Flag 7.5, 12.5, 35, and 55 m marks of tape (1), and 15, 35, 57.5, and 62.5 m marks of tape (2).
4. Using a 50 m tape (3) and the flags marked at 7.5 m and 35 m of tape (1) and 15 m of tape (2), determine and anchor the starting point (0, 50 m) of subplot C (inner rectangle). Moving clockwise, lay out this subplot.
5. Take a magnetic azimuth (bearing) of tape (1) and tape (2) at the (0, 0) corner. Write it down on your field notebook with the plot name, site description and UTM coordinates from the GPS unit. (Or use the site description sheet.)
6. Starting from the (0,0) point of K, walk to the 8 m mark of tape (1) and place the 0.5 x 2 m subplot frame along the inside boundary of the K plot. Record all the species present within the subplot. Measure their average heights and determine (estimate) their percent cover. Flag unknown species as you encounter them, and make their labels (numbers) even if you aren't collecting them right away.
7. When finished at this location, pick up the subplot frame and moving clockwise, repeat step 6 until all ten 1-m^2 subplots are completed. There are six subplots around the inside of K plot, and four subplots around the outside of the C subplot.
8. Using flags and the subplot frame, set up subplot A and B. (Subplot A and B can be sampled in sequence with the 1-m^2 subplots). Record the species present in the A, B, and C subplots.
9. Walk through the entire K (1,000-m^2) plot and record any species new to the plot.
10. Label and collect unknowns.

Methodology

At each ground truth sampling point, a modified-Whittaker nested vegetation sampling plot is established. Plants should be sampled during peak phenology of most species. In the ten 1-m^2 subplots, record the absolute foliar cover (%) and height (cm) by species. Species that occupy <1% cover in a subplot are typically recorded as 0.5%. The cover (%) of bare ground, rock, litter (i.e., detached dead plant material), duff (i.e., attached dead plant material), water, and dung are usually recorded for our purposes, but this can be modified to your particular study. Cumulative plant species (i.e., additional species found in either the subplots or plot) are recorded successively in the ten 1-m^2 subplots, the two 10-m^2 subplots, the 100-m^2 subplot, and the remaining unsampled area of the 1,000-m^2 plot. We use a GPS to document the locations of the plots and incorporate the data directly into a GIS database.

Optional: Within each 1-m^2 subplot, cryptobiotic crust cover can be recorded by level of development. Our determination of crust development is based on the National Park Service (NPS) Soil Crusts Condition Assessment Index, used primarily to monitor disturbance impacts. This index uses a 10-point scale to classify crust structure, from 0 (i.e., bare ground with no crusts present) to 10 (i.e., well-developed crusts). We modified the index to a 20-point scale that details the stages of well-developed crusts. With this index, the developmental stage of cryptobiotic crusts can be recorded in eight classes from 1 (i.e., weakly developed) to 20 (i.e., fully developed).

Optional: During field sampling, five soil samples can be taken in the corners and the center of each modified-Whittaker plot with a 2.5 cm diameter soil increment core to depths of 15 cm and pooled into one composite sample. For each sample, surface litter (if present) should be removed. If, due to rocks or other site characteristics, the core is unable to reach an approximate depth of 15 cm, two cores at depths averaging 7 cm should be taken to ensure adequate volumes of soil for laboratory procedures.

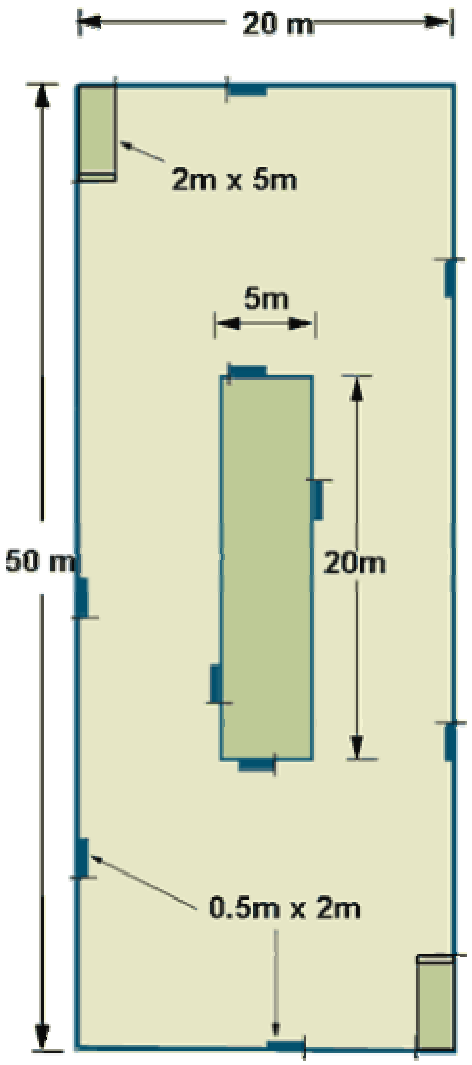
Citation

(Stohlgren et al. 1995)

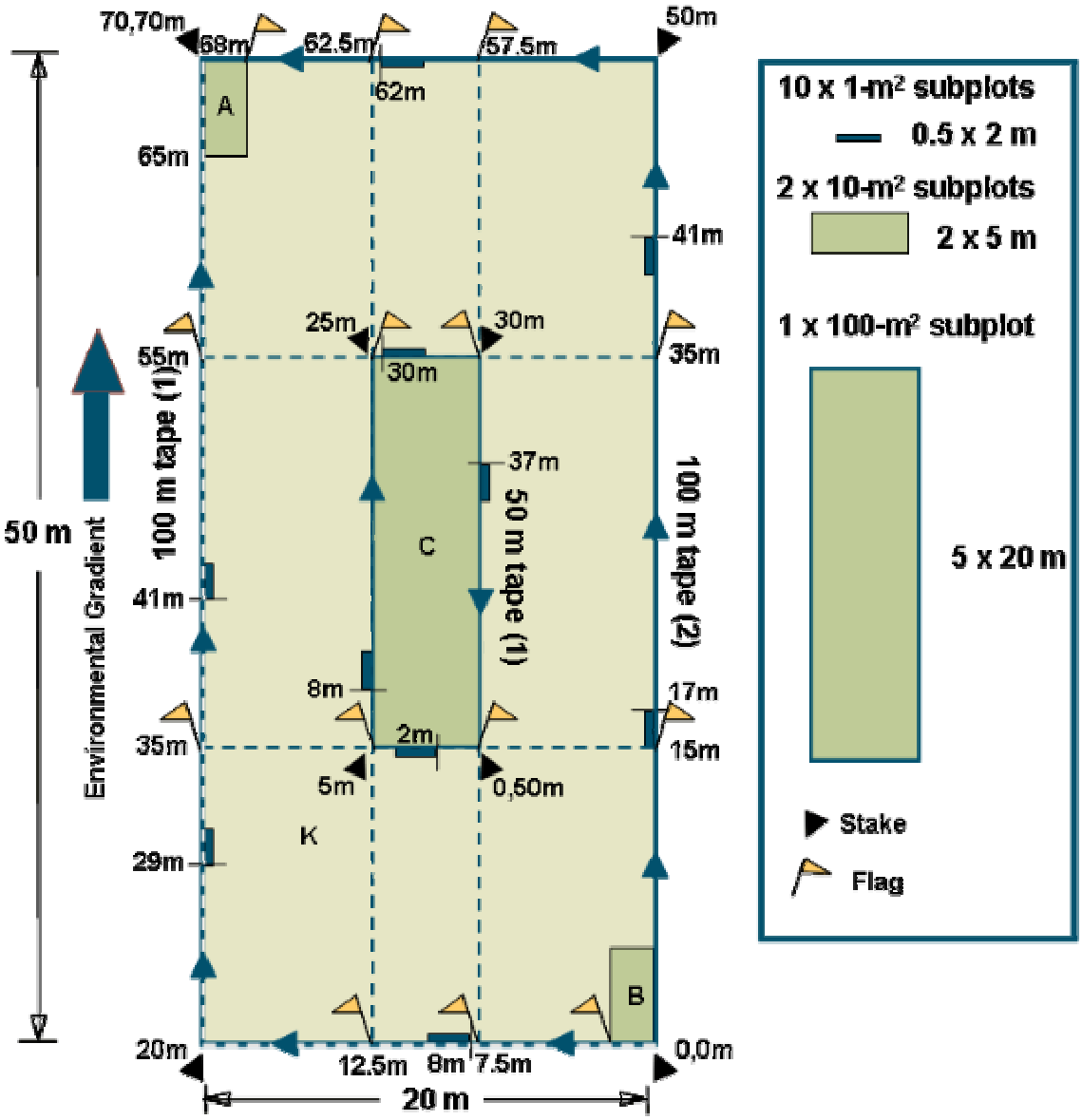
Stohlgren, T.J., M.B. Falkner, L.D. Schell. 1995. A Modified-Whittaker Nested Vegetation Sampling Method. Vegetatio 117(2):113-121.

Figures

Plot Design



Plot Setup


70,70m
68m
62.5m
57.5m
50m
A
62m
65m
41m
25m
30m
55m
35m
30m
37m
50 m tape (1)
100 m tape (2)
C
41m
8m
17m
2m
35m
15m
5m
0,50m
K
29m
B
20m
12.5m
8m
7.5m
0,0m
20 m
50 m
Environmental Gradient
100 m tape (1)
10 x 1-m² subplots
0.5 x 2 m
2 x 10-m² subplots
2 x 5 m
1 x 100-m² subplot
5 x 20 m
Stake
Flag