

Cottonwood Data Collection Protocol
Great Sand Dunes National Park
Elk/Bison Grazing Ecology Study

These measurements will be taken to estimate percent consumption of cottonwood saplings, seedlings, and resprouts and recruitment rates of cottonwood subjected to grazing and protected from grazing by elk and bison. Measurements will be taken on all cottonwood plants that fall within each of three 10 m radius circles (5m radius may be used in extremely densely vegetated areas) at each site/treatment (i.e. 3 plots at EBC3U and 3 at EBC3G, etc.). Plot locations should be selected by going a random direction and distance from the center of the site, while making sure that plots do not overlap, are a minimum of 3 meters from exclosure fence, and fall within the cottonwood veg type. Upon first sampling, a rebar post should be placed at the center of each circular plot to mark the plot center throughout the study, tagged as plot A, B or C, and GPS'd. The data fields which appear the data sheet are described below:

1. Location—This is the strata and type for the site being measured. EBC=elk and bison cottonwood, EC=elk only.
2. Observer—Last names of the observer and recorder for the plot.
3. Date—Full date of sampling, including year
4. Site #-Number of the site/replicate—will be 1-4.
5. Treatment—Grazed (G) or Exclosed/Ungrazed (U)
6. Plot—ID letter of individual circular plot—should be A-C.
7. Plant #-Individual plants should be numbered 1,2,3,.... An individual plant consists of all stems coming from an obvious common base, or basal roots from a common tree stump, or clumps of individual stems that are no more than 0.25 m apart. Numbering should begin due north of the plot center and proceed clockwise around the circle. Only plants with 50% or more of the trunk (at a height of 1 m) falling within 10 m of the center should be counted as in.
8. Species—This should be POAN (*Populus angustifolia*) for all plants, but in case we get a willow, aspen, or other tree species in one of the plots, those should be noted as well and heights, canopies, and DBH should be measured as dictated by the size of the plant.
9. Basal sprout—check column to indicate that the entry is a basal sprout. Basal sprouts originate less than 50 cm off ground. Record height, canopy diameter, root crown (where the sprout exits the trunk), and CAG browse counts.
10. Branch—check column to indicate that the tree has branches within 200 cm of ground. To be counted shoots must originate from trunk between 50 and 200 cm off ground and be accessible for browsing (lower than 200 cm). Record only one total CAG browse count for all branches.
11. # Stems—Number of live rooted stems in the clump (for seedlings) or number of trunks (for large trees—any branch exiting the trunk below 1.4 m and having a DBH of at least 2.5 cm counts as a stem)
12. Diameter at breast height (DBH) for stems greater than 2.5 cm dbh—Diameter of tree trunk at 4.5' (1.4 m). This can be measured using a diameter tape which

- converts circumference to diameter, or by using a regular tape measure and estimating trunk diameter from the measuring one side of the tree.
13. % Dead-- This is a visual estimate of percentage of measured canopy which includes dead cottonwood plant material. Percentages should be in categories of 5% (i.e. <5%, 5, 10, 15.....). Trees with multiple trunks should receive one estimate for the entire canopy, unless one stem is entirely dead—if this occurs, that branch is listed as 100% dead and the % dead for the remainder of the tree, excluding this stem, is recorded. Entirely dead trees should be measured as follows: ignore plant entirely if less than 1.4 m tall, record height if between 1.4 and 2.5 m tall, record DBH if greater than 2.5 m tall.
 14. Canopy diameter—The widest diameter of the plant's canopy and the diameter perpendicular to this diameter. Measured in cm.
 15. Height—Height (in cm) from ground to end of tallest leader (browsed or unbrowsed) on plants <2.5 m. In the case of basal sprouts which grow out laterally from a point along the trunk, these cases are measured from the junction with the trunk and are measured as if they are regular sprouts turned on their side.
 16. Diameter at root crown—This measure is taken using a dial caliper and measuring around the base of the plant's stem where it enters the soil. Measured on all basal sprouts and on plants less than 1.4 m tall.
 17. CAG shoots—The number of browsed and unbrowsed Current Annual Growth shoots. These are only shoots that are produced in the current (summer) or most recent (spring) growing season. Browsing on shoots from previous year's growth should not be counted in these tallies. CAG counts should be taken for seedlings, for basal sprouts, and for branches. Basal sprouts (originating lower than 50 cm from ground) should each have their own entry, with a check mark in the basal sprout column. All branches (originating between 50 and 200 cm off ground and not extending above 200 cm) should totaled as one entry, with a check in the branch column. Browse counts can be subsampled if necessary.

Note: Care should be taken during measuring not to break or remove any of the dead branches surrounding the live shoots—this is all that protects these shoots from browsing.

Add any comments necessary at the bottom of the data sheet.