

# BIOMASS PROTOCOL: FORAGE COLLECTION

## Field Guide

### Purpose

The purpose of this paper is to document standardized protocol that quantitatively estimates forage availability for semi-arid sagebrush steppe ecosystems. This documented protocol seeks to ensure accuracy and consistency across all rangeland research projects conducted at the Idaho State University GIS Training and Research Center.

### Equipment

- Bags to weigh clippings – large paper grocery bags work well
- Bags to store clippings – small, paper “lunch” sacks work well
- Digital camera
- Compass
- GPS receivers (2)
  - Trimble – used to acquire perimeter, plot center, and field data entry. A Trimble GeoXH is preferred or other receiver capable of 0.10m accuracy (@95% CI).
  - Sony – used to geo-tag photo point images
- Hoops (up to 2) – plastic-coated wire hoops with 2.36 meter circumference (0.44 m<sup>2</sup>)
- Marker – Sharpie marker to mark lunch sacks
- Scales with heavy-duty clips (2)
  - Small Pesola scale – (Preferred) used for smaller volume of clippings (<300 grams) and is preferred as it is more precise
  - Large Pesola scale – used for larger volume of clippings (>300 grams)
- Sheers
  - Electric – (Preferred) Use to clip forage. Preferred as it is easier, faster, and more consistent.
  - Hand clippers –Used as a backup for the electric clippers in the event these become inoperable.
- Measuring tape (optional) – use to check site dimensions or distance to edges, if needed

### In the Field

#### *Part 1: Picking the right site location*

Due to the nature of the area or the specific study, “directed” samples (locations found based on previously determined qualifications) may be used, otherwise random sample locations are typically generated for forage estimation. Site criteria for accurate forage biomass estimation included the site being a homogeneous area at least 20 x 20 meters in size (use the measuring tape if needed to check these dimensions) with still larger areas being preferred. The site should consist of at least 80% grass, forbs, and/or standing litter, with plot center at least 70 meters from any “edges” including roads, fences, or power lines (use the measuring tape as needed), and with plot perimeters >100 meters from nearby plots. Preference is given to sites with perimeters located > 250 meters apart.

Directed sample sites can be located by surveying the study area by truck. Many homogeneous forage sites tend to be found near farming communities, with CRP lands replanted with crested wheatgrass (*Agropyron cristatum*) being very common.

Other sites can be found deeper within the Big Desert study area, but tend to be smaller, difficult to locate, and often had a thick understory of shrubs not immediately visible from the road. Recently burned areas are also good areas to sample, especially areas burned within two years and replanted with grasses. Burned areas older than two years tended to have large populations of rabbitbrush (*Chrysothamnus viscidiflorus*).

## Part 2: Data collection

*\*Note: It is assumed that collection teams will consist of two people and one Trimble GPS receiver. If only one person is performing forage collection, the order presented is recommended (site perimeter can be collected last) but not necessary. If a third person is present, items needing assistance are noted below. This protocol, as described, cannot accommodate more than three people.*

### **Perimeter**

1. The location of the site perimeter can be done by one person while the second person sets up plot center.
2. If the area of interest (AOI) is sharply defined, walk as close to the edge as possible. For areas not well defined, try to stay in areas where shrubs make up <20 % of the total cover. For large areas, include a representative sample of the area, and make a note that the actual area was larger.
  - 2a. Notes can vary greatly, depending on the nature of the study. Talk to the project supervisor to get an idea of expectations.
3. For questions on how to use the GPS-based field form, see Appendix A “Using the Forage Form”.
4. Once the perimeter is complete, go to plot center and take photos.

### **Plot Center data collection and Photo-points**

5. This task can be completed while the first person collects the site perimeter (see above).
  6. Select a location near the center of the sample site.
  7. Start the Sony GPS receiver by holding down the power button until the green and yellow lights start flashing. Wait to take pictures until the blinking green light slows down to a slower, steady pace (This means the receiver has collected a satellite).
  8. Zero the Pesola scales using an empty paper bag of the appropriate size for the sample site.
  9. Use the compass to note cardinal directions (N, S, E, and W). Leave the compass out for taking photos.
  10. Quadrant sampling begins in the Northeast quadrant, proceeds to the Southeast, Southwest, and ends with the Northwest quadrant.
- \*Note: If a third person is present they may take photo points while the second person starts collecting forage data. Otherwise, the first person can take photos after completing acquisition of the site perimeter.*
11. Photos are taken in the following order starting with North, then East, South, and finishing with West. Make sure the Sony GPS is collecting (the green “GPS” light is blinking slowly). Photos should include a small amount of skyline (with sky taking up no more than ¼ of the total picture), but is not required if a large hill blocks the view.
  12. Using the Trimble GPS receiver, collect the location of plot center and enter the file number (a 4-digit number displayed on the digital camera while viewing the picture) in the appropriate location of the GPS-based field form.
  13. All personnel should help finish clipping, bagging, and weighing forage as necessary.

## **Forage collection**

14. Standing with your back to the Northeast quadrant, toss one hoop over your shoulder. Using the hoop as an outline, clip all forage material (grass, forb, or standing litter) that is rooted within the hoop's perimeter. Clip forage consistently to approximately ¼ inch stubble height. The hoop doesn't have to lie in a circle; if it lands as a "figure 8" it can still be used. Place all clipped material in the weighing bag. Use the smaller Pesola scale to weigh forage if possible. If it is windy, use your body to shield the bag as best you can. If it is very windy, return to the truck to take weights.

15. With the Trimble GPS receiver, enter the weight for the appropriate quadrant into the field form, and select the dominant plant growth stage for that quadrant (this information can be entered whenever the GPS is available). Transfer the material into a collection bag, and label the bag with the date, quadrant number, and wet weight. If the forage material needs to be divided into multiple bags, label each part with a number and total parts (ex. 1 of 2, or 1 / 3). Try to keep loss of plant material to a minimum.

### **Part 3: Post-collection weights and Oven-drying**

If weather conditions in the field were difficult, or a more precise wet weight is needed, re-weigh forage as soon as you return to the office. Forage material will slowly dry with time, and if stored in a sealed container can collect moisture which can affect accurate final weights.

Forage shall be dried in the collection bags in ovens at 75 C for 48 hours and then weighed again. This is the dry-weight of the forage sample.

### **Part 4: Final Calculations and Conversions**

Final measurements need to be expressed in kilograms per hectare (kg/ha). Conversions can either be done in MS Excel and copied into ArcGIS and computed there using the field calculator within ArcMap.

To estimate forage availability, first sum all four quadrant samples together to arrive at a total forage weight for each sample site.

The total weight is first converted to pounds per acre (lbs/acre):

$$\text{lbs/acre} = 5.0262 * g$$

lbs/acre is then converted to kg/ha:

$$\text{kg/ha} = \text{lbs/acre} * 1.121$$

## **Reference Literature**

Sheley, R., S. Saunders, and H. Charles. 2003. "AUM Analyzer" Reprinted May 2003 Montana State University. URL: <http://www.montana.edu/wwwpb/pubs/mteb133.pdf>

*Reference to this protocol should be made as follows:*

Studley, H., K. Davis, and K. T. Weber, 2009. Biomass Protocol: Forage Collection. ISU GIS Training and Research Center URL = [http://giscenter.isu.edu/research/Techpg/nasa\\_postfire/To\\_PDF/Protocol-ForageSampling.pdf](http://giscenter.isu.edu/research/Techpg/nasa_postfire/To_PDF/Protocol-ForageSampling.pdf)

# Appendix A – Using the Forage “Polygon” Form

Make sure the Forage form is editable.

Make sure the GPS has obtained satellite signal, then select “polygon” from the drop down menu. All of the satellite collection buttons will be activated. Click the last of these (the satellite with 3 points) and begin walking. The slower the pace, the more “detailed” the shape will. If the GPS loses satellite signal, just wait until it has gotten it back before continuing on. **DO NOT TOUCH ANY OTHER BUTTON ON THE SCREEN UNTIL THE POLYGON IS COMPLETE** (doing so will cancel the polygon, and you will have to start over)!

To complete the polygon, click the satellite button again. This will close the polygon, automatically filling in any gap between the user’s location and the starting point with a straight line.

At the bottom of the form are a series of buttons. To fill out the form, click the green arrow ( → ) and enter the ID number, date, and any notes. Clicking “OK” will close and save the form and point.

If at any point during the polygon a mistake is made, clicking the red “X” near the arrow will cancel the polygon.

If the satellite buttons are not available, make sure the GPS has satellite signal with an appropriate PDOP. If so, then click the shape (polygon) button again.

If the Forage point form is also available to be edited, just clicking the satellite button with the single point will automatically collect the point data. Changing the shape to “point” is unnecessary.