DATA COLLECTION PROTOCOL: DEAD AND LIVE SAGEBRUSH

Field Guide

Purpose

The paper documents a standardized protocol for the identification and collection of field observations describing the location of living and dead big sagebrush plants (Artemesia tridentate Nutt.) for use with remotely sensed imagery. This protocol seeks to ensure the accuracy and consistency of all field data collected at the O'Neal Ecological Reserve during the summer of 2010 by GIS Training and Research Center field personnel.

This protocol requires a team of two field personnel.

Equipment

- Bags to store clipped twigs – small, paper "lunch" sacks.
- Digital camera
- GPS receivers (2)
    - Trimble – used to acquire plot center and perform field data entry. A Trimble GeoXH is preferred or other receiver capable of 0.10 m horizontal positional accuracy (@95% CI following post-processing).
    - Sony – used to geo-tag photo point images
- Marker – permanent Sharpie marker to mark lunch sacks
- Hand clippers – to clip sagebrush twigs.
- Measuring tape – to check site dimensions or distance to edges, as needed

In the Field

Part 1: Site location

This study will take place entirely within the O'Neal Study Area. For this study random sampling may be used in combination with image segmentation to preselect areas of interest within the study area. If this process is not successful, a directed sampling approach will be used using *a priori* knowledge of the study area. Site criteria for dead and live sagebrush sample points is a homogeneous area at least 2 x 2 meters in size to accommodate the footprint of the highest resolution imagery used in the study, Worldview-2 (1.84 m x 1.84 m per pixel). Ideally, an equal number of dead and live sagebrush sites will be located.

Plot Center data collection and Photo-points

1. Navigate to a randomly generated point.

2. Start the Sony GPS receiver by holding down the power button until the green light starts flashing. Wait to take pictures until the blinking green light slows to a slower, steady blink pace (This means the receiver has collected a satellite).

3. Use the compass to note cardinal directions (N, S, E, and W). Leave the compass out for taking photos.

4. Photos are taken in the following order starting with north, then east, south, and finishing with a photo to the 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.

5. Enter the file number of the photos (a 4-digit number displayed on the digital camera while viewing the picture) in the appropriate location of the GPS-based field form.

6. Determine if this site is representative of a live-sagebrush site or a dead-sagebrush site. Record this using the GPS field form. If a stand is mostly dead with 1 live bush or the other way around, it is classified by the majority – but it should represent close to 100% Live sagebrush, Dead sagebrush, or Other (not sagebrush – must differentiate between sagebrush, bitterbrush, and rabbitbrush)
    a. If other, all other data null and void but pictures and FID; move to next randomly generated point.

7. Determine if the homogeneous site area (live- or dead- sagebrush) is consistent with Landsat, SPOT 5, or Quickbird/Worldview2 (QB/WV2) spatial resolution. Make the appropriate selection using the GPS field form. Note: use the tape measure to determine these areas. A sample site is considered consistent with Landsat imagery if the area is homogenous over a 15 m radius from plot center. Similarly, it is considered consistent with SPOT 5 imagery if the area is homogeneous over a 5 m radius from plot center, or for QB/WV2 imagery, if the area is homogeneous over a 1 m radius from plot center. In the beginning measure these resolutions with a tape measure to select the largest area of consistency until familiar.
    a. If the stand is live sagebrush but does not represent $\geq$ 25% of the pixel size, it will be delineated as other and no further data will be collected save for N, E, S, and W facing pictures.
    b. If declared as dead, the stand must be as large as finest resolution, QB/WV2, with a 2 m radius and represent nearly 100% or pure pixel of dead

i. 75% of a pixel is okay, but if the stand represents only 50% of a pixel then the next pixel size down should be considered for homogeneity.

8. Estimate sagebrush age. Take a maximum of four samples at each sample point, one within each quadrant (NW, NE, SE, and SW). Measure maximum base stem diameter using calipers (+/- 1mm) to approximate age of each plant (Perryman, Olson 2000). Measurements may only be taken of live sagebrush within 15 m of the center point.
    a. *Post processing - Age* = 6.1003 + 0.5769(*diameter*)

9. Estimate sagebrush height. Use a meter stick to assign stands to height classes; i.e. < 1 m, 1 - 2 m, > 2 m. Measurements should only consider live sagebrush.

10. Take a Sample - Locate a big sagebrush plant. Select a twig in the upper canopy that is approximately 5 mm in diameter (or slightly larger) and clip a 30 cm portion of that twig. Do not remove any leaves from the sample – bending it okay.
    a. Main stem should be roughly the diameter of a pencil

11. Weigh the twig sample (+/- 1 g) and place it in a sample bag. Make sure the scale is tiered to the weight of the bag. Do not remove any material from the twig once it has been weighed. Write the sample ID on the bag and indicate if this sample represents a dead (D) or live (L) sagebrush site. Up to four twigs may be collected per site. Staple the bag.

12. If a randomly generated point is determined to be a stand of dead sagebrush, measure 30 m in the 8 compass directions as follows: N, directly E from north pixel, directly S from NE pixel, directly S from east pixel, directly W from southeast pixel, directly W from south pixel, directly N from southwest pixel, directly N from west pixel ending in the NW pixel. A flag will be placed at the center point of each 30x30 m pixel for reference. Adjacent pixels determined to be dead will be marked with a “T” on a 3x3 data collection kernel to be returned to, while those determined to be live will be marked with a slash and ignored. Sample plots determined to be live will not follow the adaptive method because it represents the matrix, whereas dead sagebrush represents the target feature. Adaptations will cease after the second (or third tier) adaptation from a randomly generated point.

    a. For adaptive samples (representing dead sagebrush), place an X on paper grid representing adjacent cells that are also dead to be returned to after data collection in the first cell is complete.

    b. Place a flag at the center point to be returned to.

c. Returning to flag at the center point of the cells adjacent to dead stands that have been marked with an X. Place the Trimble GPS receiver on the ground with its antenna positioned to obtain a clear view of the sky. Begin averaging positions for point acquisition.

d. Follow steps 2-11

e. Apply adaptive measures of steps 12-a, and 12-b as appropriate; remove previously accounted for cells.

f. Random generated points will be numbered 10, 20, 30, etc…. For each adaptive sample taken numbered IDs will be as follows: 11, 12, 21, 22, etc. This will differentiate random generated samples from adaptive samples.

Part 3: Post-collection weights and Oven-drying

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

Plant material 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

All field data will be entered into a personal Geodatabase following guidelines established at the GIS Training and Research Center.