

## Information on Data Collection and Organization from the SGS-LTER

This data package was produced by researchers working on the Shortgrass Steppe Long Term Ecological Research Project. This project was supported by National Science Foundation from 1982-2014. This data package includes one or more tab-delimited data tables, tab-delimited files that denote header definitions and data types for each column, and detailed metadata within an Ecological Metadata Language document (i.e. XML). Example image files of plots, digital datasheets, or schematics of the experimental design may also be included when applicable.

Background information on the SGS-LTER project is contained in related series of objects within the Digital Collections of Colorado and the Colorado State University archives. Together data packages and other background information, and items such as images, proposals, and reports contribute to a comprehensive SGS-LTER collection.

The data tables and associated EML documents represent components of the LTER data package, which may be discovered and accessed through secondary repositories serving specific ecosystem science domains (e.g. PASTA (LTER Network Repository), DataONE, or The Knowledge Network for BioComplexity).

*The following information is copied from the SGS-LTER field protocols to provide specific details on how these data were collected.*

### **ARS #32 Grazing and Soil Texture (GZTX)**

**Principal Investigator(s):** Daniel Milchunas

**Study Objectives:** to evaluate the aggradation and degradation of ecosystem structure and function in response to long-term grazing by cattle.

#### ***What to know before you start sampling:***

- ✓ *Have you visited each GZTX site and are you aware of the coordinate system within each treatment area*
- ✓ *You have been provided with random coordinates and cage locations for clipping*
- ✓ *You have been instructed on how to clip biomass and NOTE: the GG NPP plots in Sections 7 and 19 will be clipped differently for the ARS*
- ✓ *You have noted what to clip and what not to clip **\*\*OLD-STANDING DEAD in the NPP PLOTS in the GG Treatment of sections 7 and 19 SHOULD BE COLLECTED FIRST FOR ARS SAMPLES\*\****
  - *clip live and recent dead by species*
  - *For GG – NPP 7 and GG- NPP 19 GG-NPP ONLY- FIRST collect 'old' standing dead (biomass NOT produced in the current year). For all other sites the standing old dead is sorted out the same way, but not saved.*
  - *no lichen, no cactus, no litter*
  - *only new, green growth on shrubs*

- ✓ *You have trained the crew on clipping protocols*
- ✓ *You have been provided labels and various sample bags for clipped samples*
- ✓ *You have been instructed on how to move and restake the cages for next year*
- ✓ *You have been instructed on how to inventory and deliver bags to the sample prep lab at CSU*
- ✓ *You have the sample check-off sheet*
- ✓ *You have been instructed on what to do if you see grub-kill and/or other disturbances*
- ✓ **IF YOU HAVE NOT RECEIVED INSTRUCTION ON IDENTIFICATION AND COLLECTION OF 1) live, 2) recent dead, 3) old standing dead, 4) litter, 5) lichen (not collected for biomass), and 6) shrub recent year growth THEN *STOP* AND DO NOT CLIP.**

### **Study Area Locations and Design:**

There are 4 treatments at 3 of the 6 sites (24, 19, 11) including grazed/grazed, grazed/ungrazed, ungrazed/grazed, and ungrazed/ungrazed. There are 5 treatments of the remaining 3 sites (7C, 5A, and 5B) including an additional rodent/ungrazed treatment. The codes are GZ/GZ, GZ/UN, UN/GZ, UN/UN, and RO/UN (rodent ungrazed). It is important to code the treatments correctly – remember, “what used to be, then what is now.” Be sure you know what site, and treatment you are working in –check your maps. *All six treatment maps are in separate files.*

### **Field Procedures for digital photography:**

Stand directly over the plot to gain a bird’s eye view of the plot. Be sure that the wood frame is delimiting the plot as accurately as possible. Run your finger along the edge of the frame and pull vegetation in that is rooted within the frame and out that is rooted outside of the frame. A photo may need to be taken of the vegetation underneath a cage. In this case, remove the stakes around the cage and place the middle frame under the cage in the center of the plot. Lift and rotate the cage one meter to the east and south and re-stake the cage. Pictures should be captured at a 640 x 480 resolution. Review the picture on the screen to be sure that the image was captured. Keep track of the image # and plot label in the digital camera orange field book or on a data sheet that is provided. Place a pin flag with the plot and transect number or coordinates in the middle of the metal frame after you capture the image. This marks the center of the plot that was beneath a cage. It is very important to keep this record in case we need to go back and verify a digital image.

### **Archiving Images:**

The images will be stored on the extra memory cards. Label each memory card with the date and Number Card of Total Number of Cards. Record the date, project, and image number in the orange field book that is kept with the camera. When you fill a memory card, remove it from the camera and return it to the black cabinet. Insert a fresh memory card and label it correctly. Remove the batteries from the camera and put them

in the charger overnight. The images will be downloaded from the memory card and archived by the data manager.

### Clipping Protocol:

The NPP plots are located under the cages in the grazed treatments. The cages are moved, secured, and labeled earlier in the field season. In 24 and 11 there are four cages in each grazed treatment. In 19 there are 4 cages in the UG treatment and 4 NPP plots sampled in the ungrazed exclosures. *In 19 GG 10 cages will be installed to harvest 10 NPP samples, however only 4 UTIL samples need to be harvested.* In 7C, 5A, and 5B, there are ten cages in each grazed treatment. In areas that contain cages, NPP samples are clipped from under the cages and utilization (UTIL) sample are clipped 3 meters to the east of each cage, unless a disturbance exists or you will reach the end of the treatment area. Be sure to record the coordinates for the UTIL plots on the sample bags. Make notes any time you sample the UTIL plot in another direction or distance from the NPP plot due to a disturbance, etc. In the ungrazed treatments, only NPP samples are collected. The NPP samples may come from the first 4 or 10 plots that were sampled in 24, 19, and 11 or 7C, 5A, and 5B, respectively during the cover and density study. Flags for these plots should have been left in the ground after sampling for cover and density. Upon collection of the NPP samples, remove the flags so not to leave equipment behind in the field.

Clip around the cactus, as not to disturb the future growth of the calodes. ***In the GG treatment of section 7 and 19 NPP standing-old dead should be collected FIRST from the NPP plots for the ARS.*** This means that all old-standing-dead is put in one bag for each plot first. Old-standing-dead is "standing", NOT the LITTER that is lying on the surface of the ground. Both recent dead and old standing-dead are standing and both are dead, but they are not the same, and need to be collected differently. Clip just above crown-level, except for shrubs. Clip only current year growth of shrubs that is green and has leaves, and which grows from an older, woodier branch. All live plus recent dead material needs to be harvested from the plot by species. Old-dead is not included in the sample (the gray colored material). You can brush the basal old-dead material away from the clipped material with your fingers and sort out other taller stems. – check your plot before moving to the next one. **Do not collect pach (lichen) or clip cactus for this sampling.**

Plots are clipped by species. It is usually easier to first clip species other than BOGR and BUDA. There are only some times when combining of species may be done. You must follow these rules when combining species.

- 1) The only time combining is allowed is when two species are each less than a gram (this may be a seedling, a few leaves, or one very small stem or leaf of an individual).
- 2) Some species are never combined even if there is only a very small quantity – these are BOGR, BUDA, SPCO, and CAHE.

- 3) When combining never combine forbs with shrubs, grasses with forbs, etc. Only combine grasses with grasses, forbs with forbs, and shrubs with shrubs. Envelopes that contain combined species should have codes for all species on the envelope.

Place all envelopes or small bags from each plot into the largest sample bag from that plot. Note all small mammal, ant and any other disturbances on the largest sample bag from that plot. This is usually, but not always, the BOGR bag. If there happens to be one or more large bags from one plot, keep track of them by labeling the bags "1 of 3, 2 of 3, 3 of 3". Make sure that your writing is clear and legible and that the bags are labeled using a sharpie permanent marker.

### Example Label

Labeling for GZTX	Example
Study	GZTX
Date (day, month, year)	01 08 00
Site	19
Treatment	GZGZ
Sample Type	NPP (or Util)
Plot number	P – 1
X, Y coordinates	(24, 48)
Species 4 letter code from	CAHE
<i>List of Herbarium Plants, Central</i>	
<i>Plains Experimental Range, Collections</i>	
<i>Primarily of C.H. Wasser, M. Schoop and A. Engel</i>	

### QAQC Instructions:

**IMPORTANT---** When starting a site-treatment, one person will be in charge of checking-off plots, for all clip-teams, on master check sheet as a team starts to clip the plot. Each team will call the coordinates of the plot they are starting to the person with the check-off sheet (this is the 'call-check'). If you are ready to move to the next treatment at a site, do not leave the treatment with bags. All bags should be left at one collection point (in the treatment, not the truck). If the 'call-check' person is not the last to leave the treatment, he/she will leave the check sheet at the bag collection point. The last person leaving the treatment must check that all plots are there (this is the 'final-check'), and that they are labeled correctly. This entails more than just counting the number of bags---are there two labeled the same?---are all envelopes in the large bag labeled the same?--Is there a paired UTIL bag for each caged plot in the currently grazed treatments? ARE THE PLOT COORDINATES CORRECT? At this time, the master-check-sheet should have two check-marks beside each plot coordinate number (1 for the 'call-check', and 1 for the 'final-check'). If leaving for lunch or for the day before all plots in a site-treatment have been clipped, check-off plots on master sheet when physically **standing in the treatment**--not at

the truck or at headquarters. Give Mark the check-off sheet when all plots for all site-treatments have double check marks.

**Delivery Instructions:**

When you are finished collecting samples at each location, gather all bags together and sort them out by site and treatment. Then check that all plots are there for each treatment and plot type, and they are labeled correctly. This entails more than just counting the bags— are there two labeled the same? - Are all envelopes and small bags within the larger sample bags labeled with the correct location, site-treatment -plot numbers, and species codes?

**IMPORTANT:** Place the bags in the drying oven at a temperature of 55 C – not more and not less. Arrange bags by site or location in the oven. Be careful not to rip bags on the metal shelves of the drying oven.

**IMPORTANT:** Organize the samples bags by project and then location and then put them in a larger bag to be transported to the SGS-LTER Sample Prep Lab. Double check that all of the plots sampled from one location are being transported to the SGS-LTER Sample Prep Lab together. Label the larger bags with the year the samples were collected, the name of the project, and the site, treatment and plot numbers from which the samples were collected. Make sure that the larger bags are tied down in the back of the pick-up truck when they are being transported to CSU campus. Keep an inventory of what bags have been brought to campus and what bags remain in the drying oven.

**Random Coordinates and Check-off Sheets are in separate files.**

## **SGS-LTER Lab Protocol for GZTX-NPP Clipped Sample Sorting, Weighing & Data Recording**

### **Preparation**

You will need these items to follow this protocol:

- Clipped samples from the SGS-LTER Gztx-Npp field experiment
- Desk top or lab bench space large enough to accommodate your samples, equipment and data records.
- Two-decimal place balance
- Large tray for sample sorting
- Preprinted data sheets
- Weighing pans sized for samples (usually pie tin size or larger)
- Tweezers, pencils, fine and extra fine point black sharpies, fine point red sharpie
- A large orange plastic trash bag clearly labeled “Bag of Weighed Working Samples”

### **Weighing procedure**

Take out one Plot Bag of samples from a large plastic field sack. Each Plot Bag should be clearly marked with a full ID including Experiment Name, Clipping Date, Site #, Grazing Treatment, UTIL or NPP and Plot #. Record all Plot ID info on your pre-printed data sheet.

Then remove all the smaller sample sacks from the Plot Bag. These smaller sample sacks contain all the plant material that was clipped from that plot this year and are divided into Plant Functional Groups by sack. The smaller sample sacks should also be clearly marked with the Plot ID information, as well as a Functional Group Code. Each small bag must be sorted and weighed. A weight must be recorded for all Plant Functional Groups for each plot, even if that weight is “0”. For this reason the preprinted data sheets have a line included for every functional group in each plot section.

### **The Functional Group Codes are as follows:**

**BOBU** (*Blue Grama and Buffalo Grass*)

**CSAG** (*Cool Season Annual Grasses*)

**CSPG** (*Cool Season Perennial Grasses*)

**FORB** (*Herbaceous flowering plants that are not grasses or grass-like*)

**OSD** (*Old Standing Dead vegetation from previous year's growth*)

**SS** (*Sub-shrubs*)**WSPG** (*Warm Season Perennial Grasses*)

A complete list of the individual plant species associated with each functional group that are commonly found in our experiment area can be found by the two decimal place balance in the lab.

If your plot bag includes a CSPG bag, start with that bag. Check the contents of the CSPG bag for the presence of STCO (*Stipa comata* or *Needle and Thread grass*). STCO may be easily recognized by its distinct Needle and Thread shaped seeds. If STCO is present then the STCO seeds may also appear in the BOBU bag. STCO seeds found in the BOBU bag should be sorted out and added into the CSPG bag if there are a significant amount of them (>5). (Please note: *Stipa comata* was a very prevalent species the year the first version of this protocol was written, and its seed heads were often found in the BOBU samples. I don't know if this step would be helpful for the current year, but thought I'd leave it in the protocol just in case.)

The usual protocol is to completely sort through all the functional group bags for a given plot and then weigh the sorted samples. This allows all samples in the plot to be placed in their appropriate functional groups before any weighing is done. The sorting may be done as a team effort if there is more than one person sorting samples at any given time. This team approach helps to reduce the confusion of having many open bags and sorting containers spread around the sorting area. It also helps the workers learn from each other and makes the work seem to go faster at the same time.

Two species sometimes included in the BOBU sample by mistake are *Carex* species (sedges) and AGSM (western wheatgrass). If you find a BOBU sample that doesn't look quite right, it could be because a lot of *Carex* or AGSM are present in it. Here are some hints for distinguishing BOBU from *Carex* or AGSM:

**BOBU** - Besides the characteristic seed heads of Blue Grama and Buffalo Grass, a good marker for BOBU is the ring of "hair" that appears near the base of the stem. (See pages 82 and 88 of North American Range Plants for illustrations.)

**Carex** - *Carex* has the v-shaped leaf typical of sedges. It is also a distinct shade of green and usually has three leaves to a stem. *Carex* seed heads may also be present. (See page 326 of North American Range Plants for illustrations.)

**AGSM** - Western Wheatgrass (*Agropyron smithii*) is characterized by a heavier stem that displays clasping auricles. Also, AGSM usually grows in single tillers. (See page 200 of North American Range Plants for illustrations.)

When you are done sorting and separating the functional group samples for a single plot, place each sorted sample in a tared weighing vessel and weigh to two decimal places.

Record the weights on the preprinted data sheet, and return the individual samples to their small bags. Using your red sharpie, mark the bags (including the plot bag) with a “W” (for weighed). Replace the small bags into their “plot bag” and place the plot bag in the large plastic sack labeled “Bag of Weighed Working Samples”. When all the plot bags from a large plastic sack of field samples have been weighed and added to the “Bag of Weighed Working Samples”, they may be returned to their original large plastic field sack, and the field sack should be labeled “Weighed”. You are now ready to start sorting and weighing another large plastic sack of field samples. Good work!



## **SGS-LTER Lab Protocol for 2010 GZTX-NPP Clipped Sample Combining and Grinding**

### **Preparation**

You will need these items to follow this protocol:

- One large bag of weighed samples from the SGS-LTER Gztx-Npp field experiment. This bag should contain all the plot bags for one Location/treatment of the Gztx-Npp experiment.
- Desk top or lab bench space large enough to accommodate your samples, equipment and data records
- Medium Wiley mill with quart sized mason jar for catching ground material
- Previous training in the safe operation of the Wiley mill
- Scintillation vials and labels for ground samples
- Large tray for holding unground samples
- Pie tin for subsampling ground samples
- Grinding check-off list
- Brushes, pencils, large and small spoons
- Fine and extra-fine point black sharpies, extra fine point red sharpie

### **Grinding procedure**

1. Take all the plots bags for a unique location/treatment out of the large plastic bag of weighed samples. Separate the plot bags into two groups, one group of even-numbered plot bags and one group of odd-numbered plot bags. Check against your grinding check-off list to make sure all plot bags are present for this location and treatment.
2. There will be six labeled vials for this treatment. There should be a BOBU vial, an OTHER vial and a STANDING DEAD vial for “All Even Plot #'s” and “All Odd Plot #'s”. (If labeled vials have not been provided, preprinted labels for the sides of the vials have been provided. You may make the vials yourself using the preprinted labels for the side of the vials and the extra fine point black sharpie to label the vial caps to match the side labels.)
3. Remove the BOBU bags from all odd numbered plot bags. Check off on grinding list to make sure all BOBU bags are present.
4. Empty the BOBU samples onto the large tray one at a time for grinding.
5. After you have emptied the contents of the first BOBU bag onto the tray, give the sample a final quick scan to check for appropriate species composition and sample weight. If you have any doubt about the species composition of this sample, please do not go any farther with your grinding before asking Judy or Kevin to look at the sample. Correct species composition must be confirmed before grinding samples. If

you think the weight recorded for this sample may be in error, please reweigh the sample now. The new weight should be the same or very close to the recorded weight and should reflect your observation of the sample size; if not a mistake may have been made in the initial weighing or recording of data. In either case please record the new weight in the Notes column of the grinding check-off list and write “reweighed before grinding” next to the new weight. Sometimes weights may be recorded wrong because of a misplaced decimal point or because the weighing pan was not tared properly. This is an important step, because once samples are ground it is impossible to determine either their correct weight or species composition.

6. Now you are ready to place the sample in the grinder funnel and begin grinding as soon as there is enough sample material to do so. **Never use your hand to reach into the grinder while operating the machine!!!!** There are wooden pestles to use to push the sample down through the grinder funnel and into the grinding chamber. If a sample gets caught in the grinder and stops the grinding action, turn off the grinder and wait until you hear any motor or grinding noises stop before unlocking the safety. Only then should you open the grinder and reach inside with a brush, tweezers or other implement to dislodge the sample. **The Wiley mill blades are sharp and can easily cut your skin. The blade action is very strong and can easily cut to a level well beyond skin deep.**
7. Repeat steps 5 and 6 until the BOBU samples from all the Odd # Plot bags have been ground through the mill.
8. Unlock the safety latch and then brush any small bits of sample remaining in the funnel down into the grinding chamber. Carefully open the grinding chamber door. There is likely to be ground material remaining in the mill, so be sure to hold a pie pan under the mill when opening. Working from top to bottom brush the remaining plant material from the grinder into the pan. There may be quite a lot of plant material remaining in the grinder that needs to be brushed out.
9. Remove the Mason jar containing the ground sample. Then brush any ground material remaining in the bottom grinder opening into the pan.
10. Mix the ground sample well in the Mason jar and then dump the ground plant material into the pie pan as carefully and evenly as possible. Prepare the ground material for sub-sampling by spreading it out evenly in the pan.
11. Using a small lab spoon subsample the ground material from each quarter of the pie pan. Take a scoop of ground plant material from the outside edge of the pan and near the center of the pan for each quarter. If this amount of sub-sampling does not fill the scintillation vial to near “shoulder” level, then repeat the sub-sampling between each quarter of the pan---so you have effectively sub-sampled the pan by eighths.

12. Cap vial and place in box. Discard any remaining ground material for this sample. One vial is all that you need.
13. Vacuum out the Wiley mill thoroughly with the shop vac. Use a brush to dislodge ground material from the nooks and crannies in the grinding chamber while vacuuming. Also vacuum the Mason catch jar, the tray and anywhere else where plant material has fallen. Vacuuming prevents cross-contamination among the samples and helps keep the area clean while you work.
14. Reassemble the Wiley mill and you're ready to start grinding your next set of samples---the BOBU bags from the even numbered plot bags. Just repeat this series of steps (3-13) with the even numbered plot bags of BOBU.
15. After finishing both the Odd and Even numbered sets of BOBU samples, you're ready to continue with the STANDING DEAD samples. Follow the same series of steps (3-14) for the STANDING DEAD samples. Then, proceed to the OTHER samples after reading the following paragraph.

The actual grinding process for the OTHER samples is the same as for the BOBU and STANDING DEAD samples. The OTHER samples are also combined in sets of "Odd Number Plots" and "Even Number Plots". The difference between grinding BOBU and OTHER samples is that the OTHER samples usually contain multiple bags of samples from each plot bag. By definition the OTHER\* samples are composed of all other plant group samples remaining after BOBU and STANDING DEAD samples have been removed from the plot bags. This makes the grinding process for OTHER more complex, as all remaining small bags from each plot need to be checked against the grinding check off list. Then each individual sample needs to be given a quick final scan for species composition and sample weight before grinding. Finally there may be more cumulative sample material to grind and subsample. That is why it is recommended to start grinding with the BOBU samples for each Location/ Treatment and then proceed to the STANDING DEAD samples before finishing up with the OTHER samples. When you are finished grinding the OTHER samples it's time to begin with a new large bag of samples from a different Gztx-NPP Location/Treatment. Good work!

\* The OTHER category may be composed of any or all of the following plant functional groups for any given plot:

CSAG  
CSPG  
FORB  
SS  
WSPG

*(J.Hendryx, 4-25-2011)*