

Vegetation Monitoring Procedure for the Southern Plains Grassland Protocol

Standard Operating Procedure (SOP) #14: Circular Quadrat Sampling

Version 3.1 (May 2025)

Revision History Log:

Previous Version #	Revision Date	Author	Changes Made	Reason for Change	New Version #
1.0 (Version 1.0 is internal only)	5/17/22	M. Owen	Changed “Rapid Assessment” procedure name to “Circular Quadrats.” Reduced size of sampling area from 100-m to 25-m buffer around the transect, and updated plot diagram; removed cover classes; added canopy cover of woody species not rooted in quadrat; edited and reorganized.	New name to match updated procedure; prevent plot overlap; improve accuracy of cover estimates; collect data on all woody species; improve clarity and format.	2.0
2.0	5/20/23	M. Owen	Returned cover classes to methods; added new figures and further detail about electronic data collection.	Ocular cover estimates less accurate w/o cover classes.	2.1
2.1	5/01/24	M. Owen	Cover no longer recorded, changes to field randomization method, database updates, QA/QC augmented.	Switch to presence/absence, improve data quality and management.	3.0
3.0	5/1/2025	M. Owen	Clarified recording of overhead canopy not rooted in plots.	Improve ability to follow procedure.	3.1

This Standard Operating Procedure explains the methods necessary to sample vegetation in 10 circular quadrats randomly located within a 25-m buffer of the 50-m transect. The quadrats are circles with a 1-m radius, and a new set of ten is randomly generated for each sampling event. Field sampling of quadrats should not occur until the crew has set up and photographed the transect line. Procedures are done in this order to avoid trampling vegetation along the transect and to keep crew members out of plot photos.

Preparation for Data Collection

Creation of Random Sampling Points

1. The SOPN Data Manager will generate the quadrat center points for each transect before the field season begins. They maintain a geodatabase containing the sampling frames (25-m buffer zones around each 50-m transect) and randomly generated points for each year. The sampling frames are drawn so that they include any vegetation communities contained in the plot’s designated stratum and eliminate all communities outside of the designated stratum. Any overlap between neighboring plot perimeters is split evenly between the two.

2. The random quadrat locations are generated using the *Create Random Points* tool in ArcGIS Pro to generate 15–20 points for each transect in a park. Points are excluded from a 5-m buffer placed around the inside edge of the sampling perimeter, and a 2-m buffer placed around the transect line. This is done so that quadrats will not overlap the transect or fall outside the perimeter. Points must also be 2 m apart so that they don't overlap. Points are reviewed individually, and extras are deleted randomly until 12 remain. Points are then numbered 1 through 12.

Prepare Paper Data Sheet(s) or the Field Laptop

1. Refer to the Plot Revisit Sheet. This form shows all location information for the plot—transect origin and end point UTMs, directions to the plot, annual field notes, and a list of all species codes recorded at the plot during vegetation sampling. Check for any notes referring to unknowns and/or voucher specimens that need to be collected.
2. If using paper data sheets, be sure to record the park, plot name, date, and recorder/observer at the top of all pages. Remember to print data sheets double sided so that one side of the sheet can be used for the first 5 quadrats, and the other side can be used for the remaining 5 quadrats.
3. If using a field laptop, open the Grasslands Database. Access the data for the appropriate plot and enter the relevant information into the tab header (Visit Date, Rotation, Data Recorder/Observer for all procedures, etc.). If the rotation is unknown, select “Grasslands.”
4. Remember to record any plot disturbance, such as mowing, herbicide spray, fire, animal disturbance, etc., in the Field Notes tab, as discussed in SOP #3—Plot Design and Setup. Record the percentage of the transect and overall plot affected. Additional field notes can be made for any information pertinent to vegetation sampling or crew safety.

Select Equipment

The crew must choose how to delineate the 2-m-diameter circular plots while sampling. Favorable ways to do this are:

1. Tie two chaining pins together with paracord, ensuring that the full length of the cord and chaining pins is 1 m long. Secure one chaining pin in the ground to act as the center of the circular plot. The second chaining pin may be rotated around the first to act as the 1-m radius. If the crew finds it helpful, a third chaining pin can be tied to the center pin as well, so that the full 2-m diameter can be delineated on the ground. It can be helpful to mark the center pin with tape so that you don't forget which one is which.
2. Utilize two plunking poles that have been labeled with cm measurements for the Line-Point Intercept protocol. Ensure that the poles are visibly marked at 1 m. Place one pole in the ground to act as the center point, and rotate the second pole around it to act as the 1-m radius. If helpful, use three poles, so that the full 2-m diameter can be delineated.

Data Collection

Navigating to Quadrats

1. Navigate to each quadrat using a GPS unit. Each plot will have 10 quadrats and two oversamples. The quadrats will be labeled in the GPS unit by plot and numbered 1 to 12. Numbers 11 and 12 are the oversamples. Quadrats 1–10 are given priority for sampling and must be declared unsuitable before an oversample can be used.
2. On occasion, quadrats will be located in an area unsuitable for monitoring. If a quadrat is inaccessible or unsafe (this includes near rattlesnakes), located in a body of water or thick brush, or on the transect line, disregard the point and substitute the first oversample instead (# 11). If a second quadrat is unsuitable, substitute oversample 12. Make a field note (see SOP #14) in the database or a written note on the data sheet, stating the quadrat number discarded, the reason why, and the oversample number used to replace it. In the unlikely event that more than two oversamples are needed, field randomization should be used to generate a new quadrat location:
 - From the center of the transect (25 m), spin the dial on a compass without looking. Have a second technician randomly state when to stop.
 - Randomly select a number between 1 and 50. Take the randomly selected number of paces (50-cm paces) in the direction of the compass orienting arrow (the shed) to reach the new quadrat location. If the route is unsafe, repeat the process until a safe direction is determined.
 - Record the coordinates for the new location (in WGS84 UTM's) on the data sheet or in the Field Notes tab. Remember to make a note stating the quadrat number discarded and the reason why.

Sampling Quadrats

1. Sampling is best conducted in pairs, with one technician acting as an observer and the other as a recorder. Once the observer is finished sampling each quadrat, have the recorder search for additional species. Studies have shown that more species are detected with two observers than with one.
2. Upon arrival at a quadrat location, mark the center point with either a changing pin or plunking pole. Get as close to the location as the GPS unit will allow—make sure the GPS unit is completely zoomed in. Delineate the 1-m-radius (2-m-diameter) circular quadrat using the equipment chosen during data collection prep.
3. The observing technician should then call out all living plant species rooted 50% or more within the quadrat. Move the measuring tool in a circle and continue calling out all new species until confident that all plants have been found. Remember to check under taller vegetation, as it can hide other species.

4. Record plant names using standardized six-letter codes: the first three letters of the genus and the first three letters of the species. Codes will be followed by a number if duplicates exist: the most common example at SOPN parks is ERIANN1 and ERIANN2. The database will show the full species name in the dropdown menu for any code entered. On paper data sheets, be sure to check the species list each time to determine if there are numbers at the end of a given code, as it can be difficult to ascertain the intended species name when numbers are missing. For species identified to the genus level only, use the first 5 letters of the genus name, taking care in matching the code to the proper genus in the database drop-down menu. On paper data sheets, crews should write out the entire genus followed by “sp.” For unknown species, follow the procedures outlined in SOP #10, Management of Unidentified Taxa.
5. After recording all species rooted 50% or more within the circle, record the codes of any trees and shrubs (but not subshrubs or succulents) rooted outside the quadrat but with cover overhead, even if they have already been recorded. This may include trees that are far overhead and difficult to estimate, but do the best that you can. In the database, mark each of these species as “canopy” (Figure 1), and if using a paper data sheet make a note that the species cover is “canopy.”
6. If using paper data sheets, the data will either need to be entered into the database while at the plot or at the end of the same day. If entered after leaving the plot, a second technician must perform a 100% check (meaning that 100% of the entered data must be double-checked). Do not discard paper data sheets—they will need to be scanned (see SOP #13, Daily Data Management).

Point:	Species Code:	Cover Class	Canopy:	Notes (double click to zoom):
1	SPOAIR		☐	
1	PASSMI		☐	
1	ASCSUB		☐	
1	POPDEL		☒	Tree or shrub with overhead cover but rooted outside quadrat
*			☐	

Figure 1. Circular Quadrats tab in the Data Entry Form, showing the quadrat number (Point) and Species Codes. Leave the Cover Class blank. When recording the overhead presence of woody species rooted outside the quadrat, be sure to check the Canopy box. The line will then highlight in green. NPS figure

QA/QC and Database Backup

Once data collection is finished, the crew lead (or lead technician) is responsible for ensuring that all QA/QC checks are completed, and, if using the database, that a pdf of the field data (field data sheet) is printed and a backup of the database is made before leaving the plot.

1. Confirm that 10 quadrats were sampled, and species were recorded no more than once per quadrat. There are queries for this in the database.
2. To verify that species codes were recorded correctly, the recorder should read the listed species codes out loud to the observer and check for misspellings or species that are not on the park species list. If working alone, read the list of species codes to the crew lead. If using the database, a list of species recorded may be queried. Any plants that are not on the park species list must be labeled as unknowns (see SOP #10).
3. Confirm that all unknown plants have been collected or photographed and entered into the Unknown Plant Tracking Log (see SOP #10).
4. If using the database, print a field data sheet and save the file to the appropriate park folder. For example, LAMR field data sheets will be saved to the C:\Grasslands\Data\Raw_Datasheets\LAMR folder. Use the following nomenclature: “PARKlast 2 digits of year + Transect name + Date printed”. If edits are made to the plot data later in the day, a new field data sheet must be printed. Do not overwrite previous data sheets; add a lowercase letter to the end of the file name.
5. Exit the database and save a backup. File path for backups: C:\Grasslands\Data\Backups; then save it into the appropriate park folder.