SAGE STEPPE PROJECT MONITORING HANDBOOK

Updated July 7, 2011

TABLE OF CONTENTS

1 INTRODUCTION

The purpose of this guide is to provide interagency personnel with clear and concise instructions to complete the minimum level of vegetation monitoring required for inclusion in the Sage Steppe Project Monitoring Database. Additional monitoring strategies and methodologies may be included at the discretion of the reporting office, but this guide sets the baseline monitoring requirements for Sage Steppe Projects.

The Sage Steppe Project Monitoring Database is envisioned to be a critical component of the adaptive management strategy for conducting Sage Steppe Restoration projects as set forth in the final environmental impact statement completed in April of 2008. The goal of the database is to provide managers, decision makers and the public with real time progress reports of restoration efforts and successes in order to inform future actions.

Section 2 of this guide provides a description of each monitoring component and outlines the protocol that must be fulfilled to meet minimum data requirements. Monitoring schedules and complete instructions for monitoring activities are provided in detail. Section 3 contains the field data sheets to be used for each method described.

The success of the Sage Steppe Project Monitoring Database depends on a committed and concerted effort by all agencies involved to be consistent at all levels of monitoring data collection and reporting. Therefore it is imperative that this guide be followed as the exclusive source of instruction for conducting project database monitoring. Periodic consultation among partner agencies to determine the efficacy of this guide and to discuss the possible need for revision is recommended.

2 MONITORING COMPONENTS

2.1 NOXIOUS WEEDS

The purpose of the Noxious Weed Monitoring Protocol is to determine the occurrence, density and extent of noxious weeks (CA and/or NV, on selected A, B and C rated species and OR on selected A, B, and T rated species) pre- and post-treatment.

MONITORING SCHEDULE

All noxious weeds are to be inventoried within the project area beginning in the growing season prior to project initiation and again in a minimum of one (1) and five (5) growing seasons following the treatment.

REPORTING DATA

The presence of noxious weed species will be recorded on the "Noxious Weeds Monitoring Data Sheet" included in Section 3 of this handbook. Appropriate noxious weed information will be transferred to the collaborative Sage Steppe monitoring database.

NOXIOUS WEEDS MONITORING PROTOCOL

Noxious weeds will be identified by species and their location and extent will be recorded using Global Positioning System (GPS). At a minimum, ocular surveys will be conducted as follows:

Pre-treatment

Surveys will be conducted on:

a) pre-existing noxious weed sites

b) existing permanent and temporary roads and trails

c) in and adjacent to existing disturbed areas

Post-treatment

Surveys will be conducted on:

a) pre-existing noxious weed sites

b) permanent and temporary roads and trails, including any new temporary roads and skid trails created during project implementation

c) in and adjacent to disturbed areas, including those areas disturbed during project implementation

2.2 OLD GROWTH JUNIPER RETENTION

Old growth juniper trees are a vital component of sage steppe ecosystems, providing habitat for numerous plants and animals. As such, the retention of old growth juniper trees is one of the key components for restoration practices. The tree retention objectives are to preserve those trees that were present at or before the mid-1800s for their many social and ecological values. This monitoring approach is based on a random, representative sample of old growth juniper trees.

This protocol primarily covers the required short-term compliance monitoring requirements for juniper removal. However, optional long term monitoring opportunities such as tracking juniper growth, range and wildlife habitat use, or the effects of firewood cutting operations may be readily added. Additional measures or varying methodology may be employed, so long as the base information outlined here is provided for the database.

MONITORING SCHEDULE

Old growth juniper will be sampled beginning in the growing season prior to project initiation and again at least once after all treatment activity has been completed.

REPORTING DATA

Descriptions of individual old growth juniper pre- and post-treatment will be recorded on the "Old Growth Juniper Data Sheet." This data sheet can be found in Section 3 of this handbook. The percent of identified old growth juniper found to be dead or damaged on a project will be transferred to the Sage Steppe Monitoring Database at the completion of the project. A proprietary spatial database will be maintained separately with the treatment units, tree numbers, and monitoring tree coordinates.

IDENTIFYING OLD GROWTH TREES

Old growth juniper trees are defined as trees that are 150 years old or greater, and will be identified using morphological characteristics:

- Rounded or unsymmetrical tops that may be sparse and contain dead limbs
- Deeply furrowed, fibrous bark on the trunk that is reddish in color
- Branches near the tree base that may be very large and covered with fruitcose lichens
- Limited terminal leader growth on branches in the upper 25% of the canopy

OLD GROWTH MONITORING PROTOCOL

The protocol requires two primary visits to the site: the first is prior to the treatment to set the basis for the compliance monitoring and any optional long term monitoring, and the second is the compliance check on a post treatment basis.

Pre-Treatment: Monitoring Establishment

Prior to project implementation, make a determination of the appropriate number of well-distributed old growth trees as the sample. The number and distribution of trees will be dictated by the density and distribution of old growth juniper present in the unit. It is recommended to establish approximately one (1) sample tree per 20 acres of treatment unit in stands where old growth is prevalent. Fewer trees will be required in areas with less frequent old growth juniper across the balance of the unit.

In the field:

- Randomly select a sample old growth juniper tree.
- Establish a reference point, preferably in a southerly direction from the tree, where the sample tree may be readily observed and measured.
- Take a minimum of one full picture of the sample tree.
- Locating the sample trees on a map is also desirable for relocation and general information purposes even with GPS data.
- Do not physically mark or disturb the sample trees in any manner.
- Record the following information on the “Old Growth Juniper Data Sheet”:
    1. Surveyor Name
    2. Monitoring Date
    3. Unit Identification
    4. Tree Number
    5. Reference Point (RP) Coordinates (UTM NAD 83)
    6. RP Bearing & Distance to Tree
    7. Stump High Diameter (+/- 0.1”) (optional)
    8. Tree Height (+/- 1.0’) (optional)
    9. Picture Number(s)
    10. Map Location
    11. Any significant descriptions of tree, such as existing damage or defect

Post-Treatment: Compliance Monitoring

This work can be performed during the process of compliance inspection of the unit. After the completion of treatment activities, use the reference point coordinates and tree descriptions from pre-treatment records to relocate sample trees:

- A photograph should be taken from the reference point as post-treatment visual record and then provide any description of significant damage.
- If utilizing the data for optional long term monitoring, re-examine the tree height to determine if the terminal leader has been damaged, which may affect the previously recorded height measurement.
- Record the following information on the "Old Growth Juniper Data Sheet":
    1. Surveyor Name
    2. Monitoring Date
    3. Tree status (unaffected, harvested, killed, or severely damaged)
    4. Description of damage or apparent cause of death
    5. Photo number(s)
    6. Updated description information

Post Treatment: Long Term Monitoring (optional)

The only additional work required for long term monitoring is to establish the desired sample size (i.e. this may be a subset of the initial trees), select specific trees, and the return interval for re-measurement. This is an optional measure that may be used to track the condition of the old growth component through time.

2.3 VEGETATION COMPOSITION

The purpose of the Vegetation Composition Monitoring Protocol is to determine the pre- and post-treatment vegetation cover and composition by key species, within each dominant ecological site in the project area.

MONITORING SCHEDULE

Vegetation composition will be monitored within the project area beginning in the growing season prior to project initiation and again in a minimum of two (2), five (5), ten (10), and fifteen (15) growing seasons following treatment.

REPORTING DATA

Vegetation survey data will be recorded in the field on the "Line-point Intercept Data Form." Use one data sheet per 50 m transect if using 3 transects, or one data sheet per 50 m segment of a single 150 m transect. Photo point records will be identified using a "Photo Point ID Card." Hard copies of these data sheets can be found in Section 3 of this handbook. Automated calculation Line-point intercept data forms for use with portable devices can be found online at: http://usda-ars.nmsu.edu/monit_assess/autocalcs_main.php

Monitoring data will be kept in the project records and retained for future public review. A summary of the vegetation composition records will be transferred to the collaborative Sage Steppe Monitoring Database at the completion of the project. A proprietary spatial database will be maintained separately with the treatment units and transect coordinates.

VEGETATION MONITORING PROTOCOL

The protocol employs two methods for monitoring vegetation composition: line-point intercepts are used to quantify vegetation and litter cover, and photo points are used to qualitatively monitor vegetation changes over time.

Site Selection

A minimum of one established benchmark ("permanent") line-point intersect transect for each dominant ecological site (or similar community classification) will be established within each treatment type in the project area. Monitoring site locations should be designated by the monitoring agency using an accepted method for random site selection.

For example, sites may be randomly stratified based on soil layers in a GIS, using a buffer from the edge of the ecological site to minimize the probability of crossing ecological boundaries. Randomly selected plots should be examined in the field to ensure that they are representative of the desired ecological site and do not cross ecological boundaries, and plot locations should be shifted to the nearest representative site if necessary.

Transect Layout

Record the location of permanent plots with a GPS (UTM NAD 83). Monitoring plots will use one of two designs:

1. A spoke design with 3 50 m transects extending outward from a center point (Figure 1). The first transect should be oriented along a random azimuth or pointing 0˚ due North (no declination). The other two transects extend 120° off of the first.
    - Drive a witness post into the ground.
    - Secure one end of a measuring tape by driving stakes into the ground 5 m (15 ft) from the witness post at 120° intervals to mark the beginning of the 3 transects.
    - Extend measuring tapes 50 m along each transect azimuth, and secure the end of each with a stake. Transect lines should be taut and as close to the ground as possible.
2. A single 150 m transect oriented along a random azimuth (Figure 2). Use this design if the 3 spoke transects might cross an ecological or treatment boundary.
    - Drive a witness post into the ground.
    - Secure one end of a measuring tape by driving a stake into the ground 5 m (15 ft) from witness post along the transect azimuth.
    - Extend measuring tapes 150 m along the transect azimuth, and secure the far end with a stake. Transect lines should be taut and as close to the ground as possible. Intermediate stakes will likely be required.

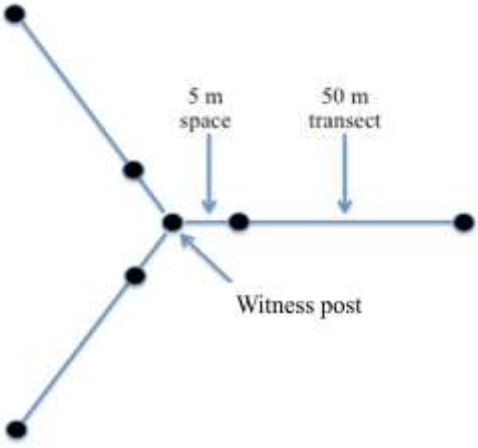


Figure 1. Transect spoke design

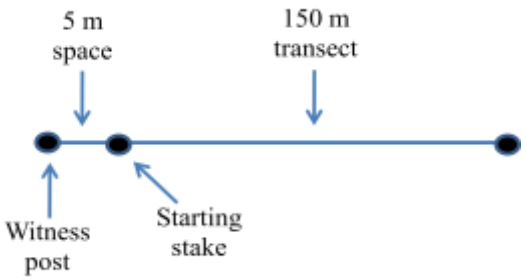


Figure 2. 150 m transect design

Equipment List:

- Witness post
- 2-6 rebar stakes (depending on transect design), with optional colored caps for visibility
- 3 50m measuring tapes
- Compass and GPS
- Pin flag
- Camera
- Data sheets, pencils/pens

Line-point Intercept

1. Begin at the "0" end of the transect tape. Use a total of 3 data sheets: one per 50 m transect if using 3 transects, or one data sheet per 50 m segment of a single 150 m transect.

2. Working from left to right, move 1 m along the tape to the first point on the line. Always stand on the same side of the line.

3. Drop a pin flag to the ground from a height of approximately 75 cm (2.5 ft) next to the tape.

    3.1 The pin should be vertical

    3.2 The pin should be dropped from the same height each time.

    3.3 Do not guide the pin all the way to the ground. It is more important for the pin to fall freely to the ground than to fall precisely on the mark.

4. Once the pin flag is flush with the ground, record every plant species it intercepts.

    4.1 Record the species of the first stem, leaf or plant base intercepted in the "Top layer" column using the PLANTS database species code (http://plants.usda.gov), a four-letter code based on the first two letters of the genus and species, or the common name.

    4.2 If no leaf, stem or plant base is intercepted, record "NONE" in the "Top layer" column.

    4.3 Record all additional species intercepted by the pin. Record points where only dead plants or plant parts by circling the species on the data form.

    4.4 Record herbaceous litter as "L," if present. Litter is defined as detached dead stems and leaves that are part of a layer that comes in contact with the ground. Record "WL" for detached woody litter that is greater than 5 mm (~1/4 in) in diameter and in direct contact with the soil.

    4.5 Record each plant species only once, even if it is intercepted several times.

    4.6. If you can identify the genus, but not the species either use the PANTS database genus code (http://plants.usda.gov) or record a number for each new species of that

genus. ALWAYS define the genus portion of the code and the functional group at the bottom of the data form (ex: *Artemisia* species = AR01).

4.7 If you *cannot* identify the genus, use the following codes:

AF# = Annual forb (also biennials)
PF# = Perennial forb
AG# = Annual graminoid
PG# = Perennial graminoid
SH# = Shrub
TR# = Tree

If necessary, collect a sample of the unknown for later identification.

4.8 Foliage can be live or dead but only record each species once. If both live and dead canopy for the same species is hit on the same point, record the live canopy. Be sure to record all species intercepted.

5. Record whether the pin flag intercepts a plant base or one of the following in the "Soil Surface" column.

R = Rock (> 5 mm or ~1/4 inch in diameter)
BR = Bedrock
EL = Embedded litter
D = Duff
M = Moss
LC = Visible biotic crust on soil
S = Soil that is visibly unprotected by any of the above

5.1 For unidentified plant bases, use the codes listed under 4.7.

5.2 Record embedded litter as "EL" where removal of litter would leave an indentation in the soil surface or would disturb the soil surface. Record duff as "D" where there is no clear boundary between litter and soil and litter is not removed during typical storms.

5.3 Additional categories may be added, such as "CYN" = dark cyanobacterial crust.

6. Calculating percent foliar cover

6.1 Count the total number of plant intercepts in the "Top layer" column and record this number in the blank provided.

6.2 Plant intercepts include all point where a plant is recorded in the "Top layer" column. Do not include points that have a "NONE" in the "Top layer" column.

6.3 Multiply the number of plant intercepts by 2 and record "% foliar cover" in the blank.

7. Calculating percent bare ground

7.1 Count the total number of points along the line that have bare ground and record this number in the blank provided.

7.2 Bare ground occurs **only** when:

A. There are no plant intercepts ("NONE" is recorded in the "Top layer" column).

B. There are no litter intercepts ("Lower layers" columns are empty).

C. The pin only intercepts bare soil ("S" recorded in the "Soil surface" column).

7.3 Multiply the number of bare ground hits by 2 and record "% bare ground" in the blank.

8. Calculate percent basal cover

8.1 Count the total number of plant basal intercepts in the "Soil surface" column and record this number in the blank provided.

8.2 Plant basal intercepts occur anytime the pin intercepts a live or dead plant base (Species code recorded in "Soil surface" column).

8.3 Multiply the number of basal intercepts by 2 and record "% basal cover" in the blank.

9. Calculate mean site values of % foliar cover, % bare ground, and % basal cover by averaging the values from all 3 data sheets.

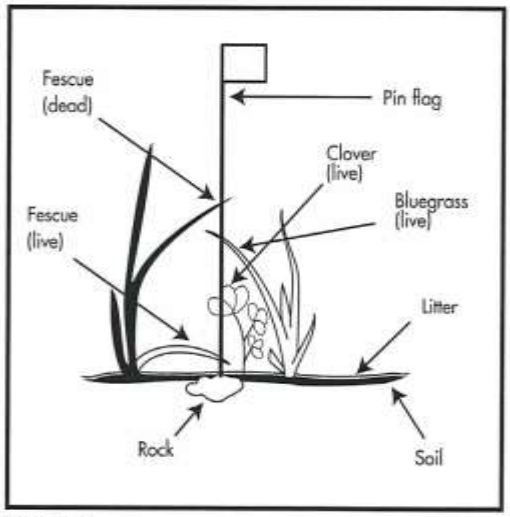
9.1 Average $= \frac{(value1+value2+value3)}{3}$

Long-Term Methods: Line-point intercept

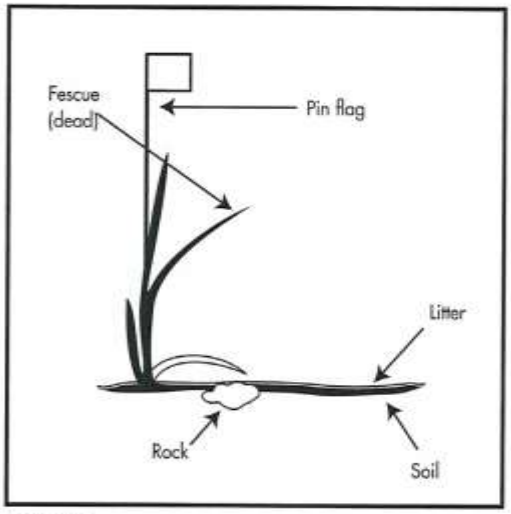
Table 2. Sample data form for examples illustrated below. Points 1 and 2 show the first two points on a line. In Point 1, the pin flag is touching dead fescue, live bluegrass, clover, live fescue, litter and a rock. Record fescue only once, even though it intercepts the pin twice. In Point 2, the flag touches fescue, then touches litter and finally the fescue plant base. Table 2 shows how to record these two points on the data form.

Pt.	Top layer	Lower layers			Soil surface
		Code 1	Code 2	Code 3	
1	Fescue	Bluegrass	Clover	L	R
2	Fescue	L			Fescue
3	Fescue	L			S
etc.					

Figure 8. Area defined as plant base and included as basal cover.



Point 1



Point 2

Photo Point

Take one photograph per transect line at each monitoring plot: 3 photographs for the spoke design, and one for the 150 m transect design.

1. Record photo information

    1.1 Record date, location, precipitation and management history since the last photos were taken on a 7.5x12.5 cm (3x5 in) "Photo Point ID Card."

2. Set up first photo

    2.1 Label "Photo Point ID Card" and lean it next to or hang it on the first transect stake, marking the beginning of the first transect.

3. Take first photo (Figure 3)

    3.1 Set camera body on top of the witness post and point it down the first line.

    3.2 Place bottom of nearest transect pole at the photo's bottom center.

    3.3 Take photo

4. Repeat steps 2 and 3 for the other two photos (if using a spoke transect design).

Figure 3. Photographer is at plot center and Photo Point ID Card marks beginning of one of the three transects.

2.4 DENSE JUNIPER RETENTION

The purpose of the Dense Juniper Retention Monitoring Protocol is to determine whether dense juniper retention objectives have been met. Based on aerial photography, pre-treatment and post-treatment maps of dense juniper (≥ 20% canopy closure of juniper) will be created. The percent of non old growth dense juniper remaining in the project area after project completion will be calculated by comparing pre- and post-treatment canopy cover maps. The method used to calculate percent canopy cover from the aerial imagery is to be determined, and this function may eventually be incorporated into the Sage Steppe Monitoring Database.

MONITORING SCHEDULE

Percent of dense juniper retained should be estimated as soon as possible following treatment. The timing of GIS-based calculations of the percentage of dense juniper retained will be dependent on the availability of post-treatment aerial photography for the specific project area.

REPORTING DATA

The estimated percentage of dense juniper retained within a project will be provided to the collaborative Sage Steppe monitoring database at completion of the project.

DENSE JUNIPER FIELD MONITORING

Once post-treatment aerial photography is available, dense juniper retention will be quantified in a GIS. However, monitoring agencies should collect the following information in the field:

1. Make an initial post-treatment estimate of the percent of non old growth dense juniper remaining within the treatment area.
2. Make sure that a digitized polygon of the treatment perimeter exists for submission to the database.

3 SAMPLE DATA SHEETS

NOXIOUS WEEDS MONITORING DATA SHEET

Surveyor Name(s):

Monitoring Date:

Treatment Project Name/Number:

Noxious Weed Species Identified	Acres Infested	Location of Infestation Center Point (UTM NAD 83)

OLD GROWTH JUNIPER DATA SHEET

Essential Pre-Treatment Data:

1. Surveyor Name(s) _____ 2. Monitoring Date _____

3. Treatment Project Name/Number_____

4. Tree Number _____

5. Reference Point (RP) Coordinates (UTM NAD 83) _____

6. Bearing and Distance RP to Tree _____

7. Stump High Diameter (+/- 0.1") (optional) _____

8. Tree Height (+/- 1.0') (optional) _____

9. Photo Number(s) (attach photos)_____

10. Map Quad_____ T&R&S_____

11. Tree Description (damage/defect)_____

_____

12. Notes:

Essential Post-Treatment Data

1. Surveyor Name(s) _____ 2. Monitoring Date _____

3. Tree Status: unaffected severely damaged killed harvested

(circle appropriate descriptor)

4. Description of damage or apparent cause of death _____

_____

5. Photo Number(s) (attach photos)_____

6. Updated Description Information_____

_____

Line-point Intercept Data Form

Page _____ of _____ Shaded cells for calculations

Plot: _____ Line #: _____ Observer: _____ Recorder: _____

Direction: _____ Date: _____ Intercept (Point) Spacing Interval = _____ cm (____ in)

Pt.	Top layer	Lower layers			Soil surface	Pt.	Top layer	Lower layers			Soil surface
		Code 1	Code 2	Code 3				Code 1	Code 2	Code 3	
1						26					
2						27					
3						28					
4						29					
5						30					
6						31					
7						32					
8						33					
9						34					
10						35					
11						36					
12						37					
13						38					
14						39					
15						40					
16						41					
17						42					
18						43					
19						44					
20						45					
21						46					
22						47					
23						48					
24						49					
25						50					

% foliar cover = ____ top layer pts (1st col) x 2 = ____ %

% bare ground* = ____ pts (w/NONE over S) x 2 = ____ %

% basal cover = ____ plant base pts (last col) x 2 = ____ %

Top layer codes: Species code, common name, or NONE (no cover).

Lower layers codes: Species code, common name, L (herbaceous litter), WL (woody litter, >5 mm (~1/4 in) diameter).

Unknown Species Codes:

AF# = annual forb
PF# = perennial forb
AG# = annual graminoid
PG# = perennial graminoid
SH# = shrub
TR# = tree

Soil Surface (do not use litter):

Species Code (for basal intercept)

R = rock fragment (>5 mm (~1/4 in) diameter)
BR = bedrock, M = moss
LC = visible biotic crust on soil
S = soil without any other soil surface code
EL = embedded litter (see page 10)
D = duff

**Bare ground occurs ONLY when Top layer = NONE, Lower layers are empty (no L), and Soil surface = S.*

Site:

Date:

Plot:

Line #:

Direction:

Photo point ID card

8

4 DATABASE REPORTING STANDARDS

NAMING COVENTION

Naming conventions for Sage Steppe Restoration Projects should be determined by reporting office. At the time of reporting to the database, each project component will be assigned a unique identification code.

REPORTING DATA RESULTS

The requirements for data summary and reporting will be determined once the final Sage Steppe Monitoring Database is complete.