

Title: TOS Standard Operating Procedure: Survey Method for Assessing Vegetation Cover		Date: 08/08/2018
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TOS STANDARD OPERATING PROCEDURE: SURVEY METHOD FOR ASSESSING VEGETATION COVER

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1 DESCRIPTION

1.1 Purpose

The Plant Biomass and Productivity Science Design (RD[01]) establishes a 10% cover threshold for implementation of growth-form-specific plant biomass and productivity sampling protocols. When visual estimates of vegetation indicate that qualifying vegetation is < 25% aerial cover, a quantitative survey approach is needed to determine whether the 10% cover threshold is met. Implementation of the Survey Method depends on criteria that differ by plot-type:

- Survey implementation criteria for Distributed Plots:
 - Qualifying vegetation < 25% aerial cover by visual estimate, *and is assessed on a per plot basis.*
 - Additional criteria to determine whether survey is required for Vegetation Structure implementation (RD[02]):
 - The NLCD type is not forest (deciduousForest, evergreenForest, mixedForest)
 - There are no single-bole or multi-bole tree individuals in the plot.
- Survey implementation criteria for Tower Plots:
 - Qualifying vegetation is < 25% aerial cover by visual estimate *averaged across all plots.*
 - Additional criteria to determine whether survey is required for Litterfall implementation (RD[03]):
 - Percent cover is assessed for individuals ≥ 2 m height.
 - Additional criteria to determine whether survey is required for Vegetation Structure implementation (RD[02]):
 - < 10% of all Tower Plots contain a single-bole or multi-bole tree.

This Standard Operating Procedure provides guidelines for quantitatively assessing cover of qualifying vegetation and the schedule on which surveys will occur.

1.2 Scope

This document provides a change-controlled version of an Observatory procedure. Documentation of content changes (i.e. changes in particular tasks or safety practices) will occur via this change-controlled document, not through field manuals or training materials.

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1.3 Applies To

The procedure described in this document is used in the following protocols:

Doc #	Title
NEON.DOC.000987	TOS Protocol and Procedure: Measurement of Vegetation Structure
NEON.DOC.001710	TOS Protocol and Procedure: Litterfall and Fine Woody Debris

2 RELATED DOCUMENTS AND ACRONYMS

2.1 Applicable Documents

Applicable documents contain higher-level information that is implemented in the current document. Examples include designs, plans, or standards.

AD[01]	NEON.DOC.004300	EHS Safety Policy and Program Manual
AD[02]	NEON.DOC.004316	Operations Field Safety and Security Plan
AD[03]	NEON.DOC.001155	NEON Training Plan
AD[04]	NEON.DOC.050005	Field Operations Job Instruction Training Plan

2.2 Reference Documents

Reference documents contain information that supports or complements the current document. Examples include related protocols, datasheets, or general-information references.

RD[01]	NEON.DOC.000914	TOS Science Design: Plant Biomass, Productivity, and Leaf Area Index
RD[02]	NEON.DOC.000987	TOS Protocol and Procedure: Measurement of Vegetation Structure
RD[03]	NEON.DOC.001710	TOS Protocol and Procedure: Litterfall and Fine Woody Debris
RD[04]	NEON.DOC.005024	Datasheets for TOS Protocol and Procedure: Survey Method for Assessing Vegetation Cover

2.3 Acronyms

Acronym	Definition
DBH	Diameter at breast height (130 cm)
ddh	Diameter at decimeter height (10 cm)
LTR	Litterfall and fine woody debris
VST	Vegetation Structure

2.4 Definitions

Qualifying vegetation – plants that meet the criteria for consideration for a given plant protocol

LTR – Woody trees and shrubs ≥ 2 m tall.

VST/woody - plants with lignified aboveground tissue that persists from year to year bearing at least one stem with a diameter ≥ 1 cm at decimeter height (ddh).

VST/non-woody – cacti ≥ 10 cm stem length, ferns ≥ 30 cm mean frond length, palms, agave, yucca, ocotillo, and bear grass.

3 SAMPLING SCHEDULE

- The Survey Method for Assessing Vegetation Cover should be scheduled every 5 years at sites that have plots containing qualifying vegetation with $< 25\%$ visually estimated aerial cover.
- The Survey Method may also be scheduled and implemented opportunistically following state-changing events like fire, brush-hogging, etc., in order to determine whether previously scheduled sampling should be suspended.

Cover is most readily assessed while an individual crown is full with leaves. This SOP may be implemented at any time during the active growing season. See Appendix A for the list of protocol x site combinations that are currently scheduled for the Survey Method.

4 SAFETY

This document identifies procedure-specific safety hazards and associated safety requirements. It does not describe general safety practices or site-specific safety practices.

Personnel working at a NEON site must be compliant with safe field work practices as outlined in the Operations Field Safety and Security Plan (AD[02]) and EHS Safety Policy and Program Manual (AD[01]). Additional safety issues associated with this field procedure are outlined below. The Field Operations Manager and the Lead Field Technician have primary authority to stop work activities based on unsafe field conditions; however, all employees have the responsibility and right to stop their work in unsafe conditions.

5 PERSONNEL AND EQUIPMENT

5.1 Equipment

The following equipment is needed to implement the procedures in this document. Equipment lists are organized by task. They do not include standard field and laboratory supplies such as charging stations, first aid kits, drying ovens, ultra-low refrigerators, etc.

Table 1. Equipment list – SOP B: Graph paper survey of aerial cover.

Item No.	R/S	Description	Purpose	Conditions Used	Quantity	Special Handling
Durable items						
	R	Measuring tape, minimum 50 m	Delineate plot, subplot boundaries	All	4	N
	R	Chaining pins or other suitable anchor	Anchor measuring tapes	All	4	N
	S	PVC pipe, 2 m length, max 1" diameter, marking at 1.3 m	Quickly measure total height and find dbh measurement height	All	1	N
	R	DBH tape, 64 cm	Measure stem diameter. Stems present with 5 cm < diameter < 64 cm	All	1	N
Consumable items						
RD[05]		Datasheets	Recording data	All	1	N
	R	Graph paper	Estimate area of woody individuals, and shrub groups			

R/S=Required/Suggested

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5.2 Training Requirements

All technicians must complete required safety training as defined in the NEON Training Plan (AD[04]). Additionally, technicians must complete procedure-specific training for safety and implementation of this procedure as required in Field Operations Job Instruction Training Plan (AD[05]).

5.3 Specialized Skills

No specialized skills are required for this protocol though ability to quickly assess and sketch an area to scale may result in time savings.

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SOP A Preparing for Sampling

A.1 Preparing for Data Capture

Mobile applications are the preferred mechanism for data entry. Mobile devices should be fully charged at the beginning of each field day, whenever possible.

However, given the potential for mobile devices to fail under field conditions, it is imperative that paper data sheets are always available to record data. Paper data sheets should be carried along with the mobile devices to sampling locations at all times.

A.1 Office tasks

1. Transfer all required files containing plot marker locations to the recreational accuracy handheld GPS receiver.
2. Charge and sync mobile digital device.
3. Print backup datasheets in case tablet fails

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SOP B Graph Paper Survey of Aerial Cover

This method is consistent with the technique for measuring the area of shrub groups in the vegetation structure protocol (RD[02]). Here, the survey method is applied to all qualifying vegetation for the protocol for which the survey is being conducted (i.e vst or ltr).

Total aerial cover is estimated using the graph paper mapping technique, with the area covered by an individual determined by counting the number of graph squares within a sketched canopy (Figure 1). Total cover for a given plot (in m²) is summed across all qualifying individuals in the selected plot.

B.1 Preparing for Data Capture

This SOP utilizes graph paper for sketching arrangement of individual crowns of woody individuals within a plot. Mobile applications are the preferred mechanism for data entry. Survey data are entered in the 'Aerial Cover Vegetation Survey [PROD]' fulcrum application.

B.2 Cover measurement

1. Navigate to the target plot.
 - a. If the plot is a Distributed Plot or a 20 m x 20 m Tower Plot, consider the entire plot at once.
 - b. If the plot is a 40 m x 40 m Tower Plot, navigate to the first of two random subplots.
2. Delineate plot boundaries
 - a. Stretch and anchor measuring tape between permanent plot markers
3. Visually assess for presence of any woody vegetation within the plot/subplot boundaries
 - a. Record **targetTaxaPresent** = Yes/No for presence of any qualifying, vst, vegetation (i.e. ≥ 1 cm ddh).
 - b. Record **visualEstimateOfCover** = >25%/<25%
 - 1) For VST Distributed Plot surveys: If visual estimate of total cover is > 25% no additional measurements are necessary, this plot qualifies for protocol implementation.

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4. If **targetTaxaPresent** = 'yes', Record on graph paper and in mobile application:
 - a. **plotID** - SITE_XXX format
 - b. **subplotID** - unique identifier for the subplot being assessed
 - c. **date** – YYYY-MM-DD
 - d. **measuredBy**
 - e. **recordedBy**
5. Draw the crown of each woody individual relative to plot/subplot boundaries (Figure 1).
6. Assign **tempID**, a temporary unique identifier using the form '##_##' where the first two numbers are the subplotID followed by an underscore then an incremental number (01, 02, 03...) for the plot. If the plot is 20 m x 20 m, subplot = 31.
7. Record:
 - a. **crownArea** – square meters, 1 graph paper square = $1\text{cm}^2 = 1\text{m}^2$
 - b. **heightOver2m** – Yes/No, quick assessment of height, using a 2 m length of pvc
 - c. **treeGrowthForm** – Yes/No, does the individual qualify as either a single bole tree or a multi-bole tree (i.e., is DBH of any single bole ≥ 10 cm?)
 - d. If crowns of qualifying individuals overlap:
 - 1) Treat individuals as a group and assign a **tempID** to the group.
 - 2) Assess the aerial cover of the group and record as the **crownArea**.

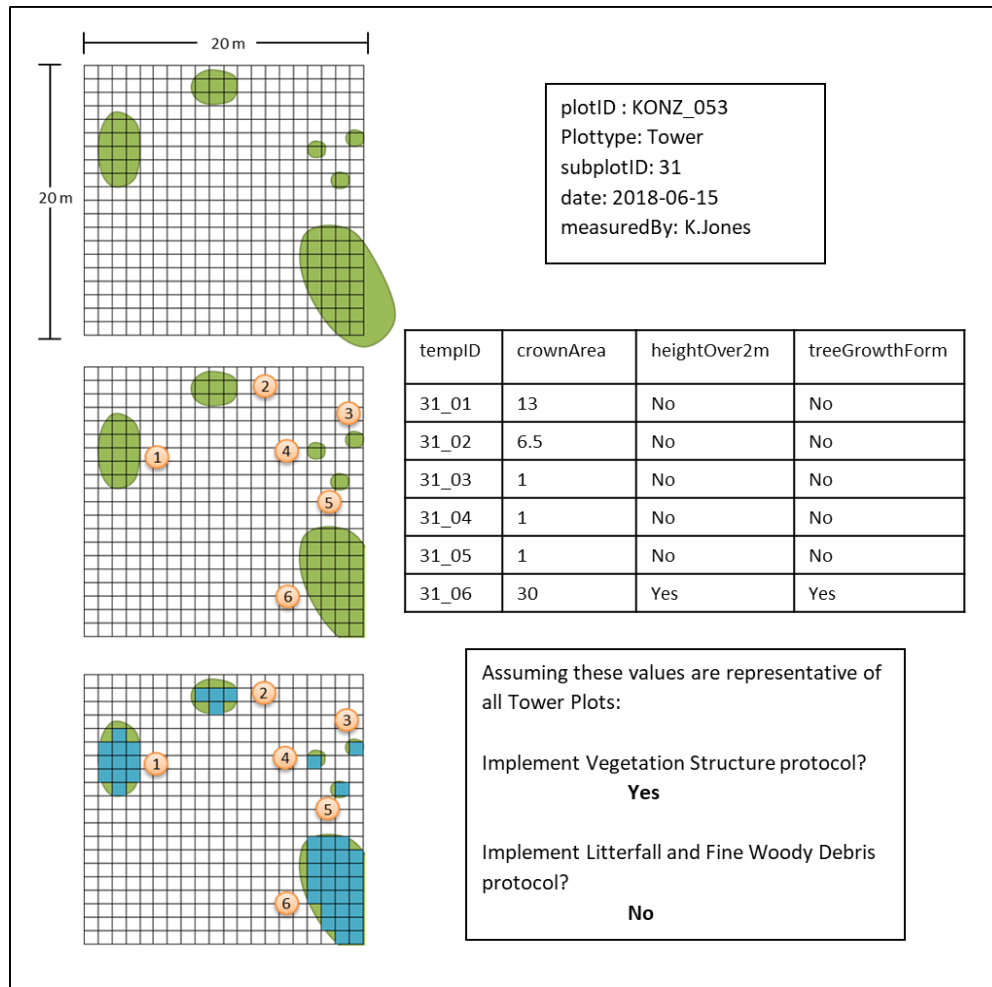


Figure 1. Example of graph paper method for determining area of qualifying vegetation within a 20 m x 20 m subplot.

APPENDIX A SITE SPECIFIC SURVEY SCHEDULE

domainID	siteID	plotType	Est. # of plots	1st survey year	Survey Frequency	Survey type(s)
D03	DSNY	Tower (all)	20	2017	5 y	LTR, VST
D03	DSNY	Distributed	10	2017	5 y	VST
D06	KONZ	Tower	8	2018	5 y	LTR
D06	KONZ	Distributed (all)	20	2020	5 y	VST
D09	DCFS	Tower (all)	30	2020	5 y	LTR, VST
D09	NOGP	Tower (all)	30	2021	5 y	LTR, VST
D09	WOOD	Tower (all)	30	2019	5 y	LTR, VST
D10	CPER	Tower (all)	30	2017	5 y	VST
D10	CPER	Distributed (all)	20	2017	5 y	VST
D11	OAES	Distributed (n=6)	6	2018	5 y	VST
D13	NIWO	Tower (all)	30	2019	5 y	LTR, VST
D14	JORN	Tower (all)	30	2017	5 y	LTR
D14	SRER	Distributed (all)	20	2017	5 y	VST
D18	TOOL	Distributed (all)	20	2020	5 y	VST
D18	TOOL	Tower (all)	30	2018	5 y	VST
D19	HEAL	Distributed (all)	20	2021	5 y	VST
D19	HEAL	Tower (all)	30	2021	5 y	LTR, VST