National Park Service
U.S. Department of the Interior

Natural Resource Program Center

New River Gorge National River
Oak Regeneration Study

Standard Operating Procedures

Version 1.1 (May 2019)

List of Standard Operating Procedures

Site Selection and Plot Establishment

Stand

Photo

Fuel Load

Groundstory Diversity

Tree Regeneration

Poles

Tree Measurements

Quality Assurance / Quality Control

Protocol Revision History

Version numbers will be incremented by a whole number (e.g., Version 1.3 to 2.0) when a change is made that significantly affects requirements or procedures. Version numbers will be incremented by decimals (e.g., Version 1.3 to Version 1.4) when there are minor modifications that do not affect requirements or procedures included in the protocol. For simplicity, all SOPs have the same version number at the same time so that the set of SOPs used in a particular field season can be referenced as a group. As a result, the revision log for each SOP may not include notes for every version since changes may not have made to that SOP during that revision. Some SOPs that have not been changed substantially since the monitoring program began have no notes in their revision history.

Site Selection and Plot Establishment
Version 1.1 (May 2019)

Overview

This SOP provides instruction for locating and establishing plots and for collecting site information.

Definitions

Horizontal distance is the level, straight line distance between two points. This contrasts with slope distance which is measured parallel to the ground surface. Slope distance and horizontal distance are equivalent on flat land. On sloped land, the horizontal distance between two objects is less than the slope distance.

True north is the direction of the North Pole relative to your position. This contrasts with magnetic north—the direction a compass needle points when in the northern hemisphere. Magnetic north varies across the landscape and over time. To locate true north, it is necessary to adjust a compass to account for the differences between true north and magnetic north using a magnetic declination chart or table (e.g., http://www.ngdc.noaa.gov/geomag-web/#declination or http://www.ngdc.noaa.gov/geomagmodels/Declination.jsp).

Site and Plot Diagrams

This study is conducted at two sites in NERI: Backus Mountain and Grandview. At each site, eight treatments of two hectares each have been delineated (Figure 1). Treatments include: fence, prescribed burns, fence and prescribed burns, and control (neither fenced nor burned). Approximately 8 permanent plots will be established in each treatment. Plot locations within each treatment selected from a regular grid of potential plot locations using a generalized random-tessellation stratified (GRTS) design (McDonald 2004; Stevens and Olsen 2004) which creates a randomly-selected, spatially-balanced, selection and allows for a flexible sample size.

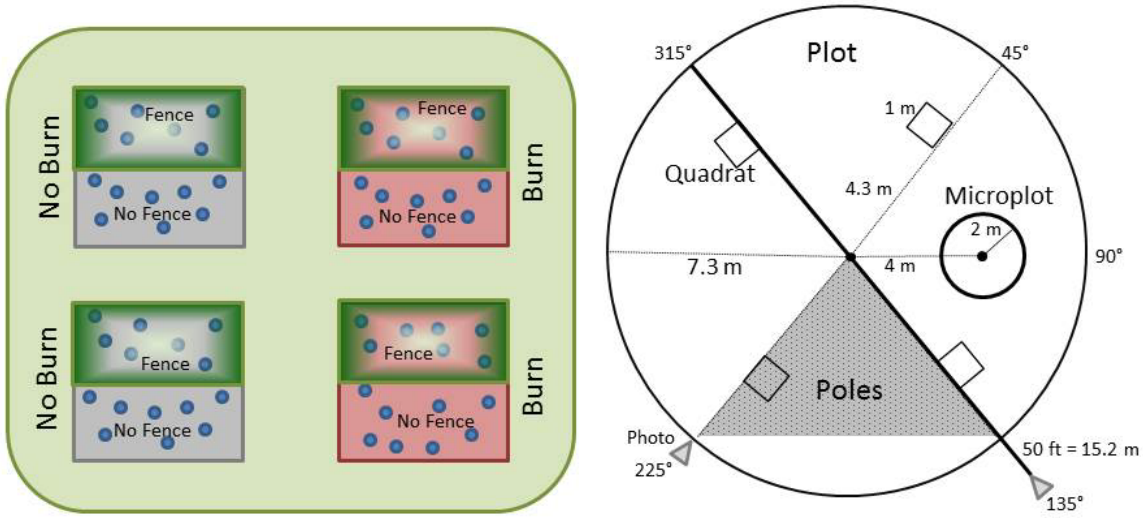


Figure 1. Site sampling design and plot diagrams.

Preparation for Field Work

Before leaving the field house and again before leaving the vehicle near the plot site, check to see if you have all of the necessary equipment. Ensure that all consumable items (data sheets on plain and rite-in-the-rain paper, charged batteries, rebar, galvanized spikes, etc.) have been restocked to sufficient quantities for the number of plots that will be visited during the day. Check that the plot locations have been uploaded into the GPS unit and are displaying correctly. Adjust your compass by dialing **8º West** the declination into the faceplate to the nearest degree. Set the compasses of all field crew members for the same declination.

If you are revisiting previously established plots, read the Plot Notes for the plots you will be visiting that day. Check to see if you need to bring extra rebar to the plot to replace ones that were not installed or were improperly installed during the last visit. Make sure that you have the correct Plot Sheets and Tree Sheets that contain information from prior visits for the plots that will be visited that day.

Locating and Establishing a New Plot Center

Examine park maps, topographic maps, and aerial photography to determine the best route to a preselected plot location. Using GPS and compass, travel to the plot location. Remember that the GPS unit may affect compass readings—keep them sufficiently far apart. Do not take safety risks while traveling to plots. If off-trail topography becomes too steep or difficult, find an alternative route.

To avoid plot location bias, it is very important to establish plot center as close to the pre-defined coordinates as possible. Doing otherwise can lead to serious data bias. As you near the pre-selected location, use the following protocol to locate plot center. The GPS unit will likely not have sufficient precision to navigate exactly to the pre-selected location. Therefore, as soon as the GPS indicates you are within 15 m of the pre-selected location, continue exactly 10 paces (20 steps) in the direction of the pre-selected location and stop. Do not veer off course to avoid obstacles. This is plot center.

At plot center, ensure that the area is within the desired treatment area (in / out of proposed fence line), and is ≥8 m from the park boundary, agricultural fields, roads, developed land, or ephemeral and perennial streams. If the plot center is <8 m from any of the features listed above, move the plot center 10 m horizontal distance perpendicular to the feature. This is the new plot center. If multiple features (roads, fields, streams) are present and there is insufficient space (<20 m between features) to establish a plot, discard the plot and record the reason. Proceed to the next location on the list of plot locations. If the plot presents safety hazards such as cliffs or unstable / hanging snags, discard the plot and record the reason. Proceed to the next location on the list of plot locations.

At plot center, set the 12 inch piece of rebar with an aluminum cap as close as possible to that location. If the rebar cannot be set exactly where you are standing, locate a place in the general vicinity (~2 m radius) where the rebar can be set. Set the rebar cap flush to the ground. The rebar marks the plot center from which all plot measurements are taken.

Recording a New Plot Center with GPS

This protocol assumes the crew is familiar with their particular GPS unit and its functions. Stand over the plot center and create a new waypoint, labelled SITE.TREATCODE.PLOTNUMBER_F. For example, GRND.B.246_F. The F denotes a location collected in the field, as opposed to the potential points generated in the office. Use the Average Locations feature to improve the accuracy of the coordinates. Save the point when the estimated accuracy is less than 5 m. If estimated accuracy is not less than 5 m after 150 points have been averaged, stop collecting points. Attempt to record the plot center location again 1 – 2 hours later when satellite configuration has shifted.

Directions for Locating Fuels Transect, Microplot, Quadrats, and Pole Quarter

Be exact about sighting and distance measurements since the plots are permanent. Distances should be measured to within 0.1 m error, and bearings should be sighted to within 4 degrees error. To measure slope distance, pull the tape taught parallel to the ground surface, ensuring that it is not caught on vegetation. Both ends of the tape must be held at the same height above the ground to keep it parallel to the ground.

When sighting compass bearings, crew members must take care that metal objects do not affect the compass needle, and that the compass is held level (flat) at all times. The compass needle will not show small shifts in azimuth when the compass is tilted. When sighting up or down slope, remember to hold the compass level—do not tilt it relative to the slope.

Determine the location of the transects, the microplot, and the four quadrats using a compass and measuring tape:

1) Run the zero end of the English / metric tape towards the 315° azimuth. Set a galvanized spike flush to the ground at the end of the tape when the 7.3 m mark is on plot center measuring **slope distance**. Run the roll end of the tape 7.3 m **slope distance** from plot center along the 135° azimuth. Set a galvanized spike at 14.6 m along the tape. Extend the tape to 15.2 m to complete the fuels transect. A crew member can begin sampling fuels along this transect.

2) Locate the center of the microplot, 4 m **slope distance** from plot center along the 90° azimuth. Set a galvanized 12 inch spike flush to the ground at the center of the microplot. Temporarily mark the center with a piece of visible equipment.

3) Run the zero end of the tape towards the 45° azimuth. Set a galvanized spike flush to the ground at the end of the tape when the 7.3 m mark is on plot center measuring **slope distance**. Run the roll end of the tape 7.3 m **slope distance** from plot center along the 225° azimuth. Set a galvanized spike at 14.6 m along the tape. A crew member can begin sampling the quadrat along the 45° transect. Place the quadrat at the 2 – 3 meter mark on the 45° and 315° transects. Place the quadrat at the 11.6 – 12.6 meter mark on the 135° and 225° transects.

4) Run third tape between the spikes marking the ends of the 135° and 225° transects. This distance should be 10.3 m. This triangle delineates the area of sampling for pole-sized trees.

When establishing a new plot, if the spike cannot be placed exactly at the prescribed location due to rocks or trees, place the spike along the same azimuth as close as possible to correct distance from plot center. It is important that the spike is on the correct azimuth, even if the spike is not the correct distance from the plot center. Note the location of the spike in Plot Notes on the datasheet (e.g., spike marking the microplot was placed 10 cm closer to plot center on the correct azimuth). The location of the spike marks the center point of the microplot or the far corner of the microplot, even if the spike is not exactly in the prescribed location. If a spike cannot be placed within 0.5 m of the prescribed location due to large rocks or trees, mark the center temporarily with a rock, flagging, or chaining pin while data is recorded. Record in the plot notes why the microplot or quadrat was not marked with a spike.

When revisiting an established plot, read the Plot Notes to determine if the spike locations are different than standard. The location of the spikes mark the center point of the microplot and the far corner of the quadrats, even if the spike is not exactly in the prescribed location. Use a metal detector to search for the spikes in the prescribed locations. To the extent possible, limit the disturbance to the forest floor, leaf litter, and understory vegetation when searching for spikes. Record whether the spikes were located on the datasheet. If the spike cannot be located after a reasonable amount of searching, place a new spike following the guidelines in the preceeding paragraph. If the spike falls in a depositional, erosional, or otherwise disturbed location (e.g. stream channel, drainageway, evidence of human visitation), such that it is likely that the old spike is no longer present, leave the new spike when sampling is completed. Mark on the datasheet that the spike was replaced. If the location of the new spike is not standard, note the location of the new spike in Plot Notes on the datasheet. In normal undisturbed forest settings in which there is no clear reason why the spike cannot be located, remove the new spike when sampling is completed. Mark on the datasheet that the spike was not replaced.

Locating a Previously Established Plot Center

Plots should be visited within 1-2 weeks of previous years' visits. Plan field work so that plots can be sampled on that schedule.

When revisiting a plot, navigate to the site location using directions from previous years, park roads, trails, map and compass, and GPS unit. Do not take safety risks while traveling to plots. If you do not find the previous directions particularly useful, take careful notes in order to provide better directions to the next crew. Road conditions in the West Virginia parks can change dramatically (for better or worse) within one to four years. Update the plot directions as needed to reflect changes in road conditions.

Navigate as close as possible to plot center using the GPS unit. Once you arrive in the general area of plot center, look for paint marks on trees. In most cases, the paint marks are facing plot center. If necessary, look at the Tree Sheet and identify trees that are closest to plot center. Find likely trees to those noted on the data sheet and backsight the likely location of plot center using the distances and azimuths listed on the data sheet. The metal detector can also be used to locate the rebar marking plot center. To the extent possible, limit the disturbance to the forest floor, leaf litter, and understory vegetation when searching for plot center.

Data Collection

SITE. List the name of the site, either: BACK for Backus or GRND for Grandview

TREATMENT. Refer to the field maps to determine the treatment code for your location. Backus uses codes L – S. Grandview uses codes A – H.

PLOT. Plot identification number, unique within each site.

OBSERVERS. First initial and last name of each crew member present.

DATE: Month/day/year that data was collected (e.g., 08/17/2007)

GRTS ORDER. *For new plots only.* Order that this plot fell in the GRTS-determined sampling order.

UTME. *For new plots only.* East Universal Transverse Mercator value of the plot center from the GPS unit once the location of plot center has been determined using the average position function.

UTMN. *For new plots only.* North Universal Transverse Mercator value of the plot center from the GPS unit once the location of plot center has been determined using the average position function.

GPS ACCURACY. *For new plots only.* Positional accuracy of the UTMN and UTME coordinates, in meters, as determined by the GPS unit when the average position function stopped.

ELEVATION. *For new plots only.* Elevation above mean sea level of the plot center, in meters, as determined by the GPS unit.

ASPECT. *For new plots only.* The direction the ground surface of the plot faces. Aspect is measured downslope using a compass. Record aspect to the nearest 1°. If the plot is flat and has no aspect, record "Flat".

SLOPE. *For new plots only*. The predominant down slope angle across plot to the nearest percent. Occasionally, there will be multiple aspects within a plot (in a valley or on a narrow ridge), choose the predominant slope to measure by considering what direction water would eventually flow if poured onto the plot. Slope is determined with a clinometer by sighting parallel to the average incline or decline of the plot. To measure average slope, Observer 1 stands at the upper plot boundary and sights Observer 2 standing at the lower plot boundary. Observer 1 must sight Observer 2 at a height equivalent to the eye-level of Observer 1. Read slope directly as percent (<u>not degrees</u>) from the clinometer.

DIRECTIONS. Directions for driving and walking to the plot, including trails, landmarks, distances, and bearings from identifiable landmarks or reference points. Include parking recommendations where applicable. Be very specific, so that future crews can successfully follow your directions.

PLOT NOTES. Record any unusual plot features or problems encountered during plot setup, including reasons for discarding any pre-selected plot locations. Note any problems or irregularities inserting plot markers. Note any features which indicate plot history, including

evidence of past agricultural, silvicultural, or recreational use regardless of how long ago it may have been.

Equipment List

General:
Topo and aerial photo maps showing plot locations on Rite in the Rain paper
Standard Operating Procedures printed on Rite in the Rain paper
Flagging
Pencils (1 – 2 boxes, with extra lead and erasers)
Black Industrial Sharpies – regular size
Daypacks
First aid kit
Insect repellant (2 bottles)
Poison ivy soap (2 large bottles)
Hard hats (1 per person)

Plot Establishment:
18" long ¾" diameter rebar (1 per plot)
Brass cap with plastic insert (1 per plot)
Rubber mallet
Small metal sledge hammer
Galvanized metal spikes, 10" or 12" long (5 per plot)
Clinometer

Plot Measurement:
GPS unit and spare AA batteries
Metal detector
Compass (3)
50-ft tape, with English and metric units (1)
15-m tape, metric units (2)
Chaining pins (6) with leather sheath
Data sheets (on regular and Rite-in-Rain paper)
Plot and Tree Sheets with previous photo and tree info (on regular and Rite-in-Rain paper)
Enclosed clipboard (2)
Laser hypsometer
Loggers Tape, retractable with distance and DBH measurements (1 for field + 1 spare)
Finley pole (1 for field + 1 spare)
Steiner stick, marked at sapling height cut-offs (2 for field + several spares)
Microplot chains – thin chain or non-stretch rope, 2 m in length (2)
Tree paint (2 cans for field + many spares)
English Ruler (24", sturdy metal)
Metric Ruler (100 cm, sturdy metal)
PVC Quadrat frame - 1 x 1 m, w/ purple 10cm sections spray painted on to aid % cover estimates
10x hand lens (2)
Plastic bags for plant samples
Digital camera and spare batteries
Photo-card (laminated index card)

Black dry erase marker
Extra galvanized metal spikes (5 for field + many spares)

In Field House:
Full-size plant press
Newspaper for pressing plant samples
Box of Rite in the Rain paper
AA Battery recharger
Plenty of spare AA batteries
Replacement reels for loggers tapes (2)
Spare screws and stays for loggers tape (2 sets)
Replacement tapes for 30-m tapes (3)
Leatherman
Gorilla Glue
Flora of the Northeast - Gleason & Cronquist
Illustrated Guide to the Flora of the Northeast - Gleason & Cronquist
Flora of West Virginia - Strausbaugh and Core
The Shrub Identification Book - Symonds
The Tree Identification Book – Symonds
Peterson Field Guide to the Ferns of NE & Central N. America – Cobb, Farnsworth, and Lowe

For Limiting Invasive Species Spread:
Wire brush with teeth (2)
Coarse bristled brush (2)
5 gallon bucket (2)

Revision History

Version 1.0 to 1.1, May 2019
Minor edits to equipment list

Stand Measurements
Version 1.0 (May 2015)

Overview

This SOP collects stand-level measurements within the plot to allow interpretation of other measures, and to assess stand structure and disturbance. This SOP is designed for use only during the summer leaf-on period (approximately May 15 to September 15).

Canopy closure and cover classes do not contain exact breakpoints (e.g., 25%). Classes are either above or below each breakpoint. This encourages the crew to assess and recorded cover classes rapidly, without compromising accuracy.

Data Collection

CROWN CLOSURE. Estimate the percentage of plot area covered by tree crowns directly overhead and record appropriate code. If foliage is not present due to seasonal variation or temporary defoliation, visualize the amount of live crown normally present. Do not visualize foliage that formerly existed on dead branches.

1 0 to 10 %
2 10 to 25 %
3 25 to 50 %
4 50 to 75 %
5 75 to 100 %

DEER IMPACT. Visually inspect the plot and record the level of deer impact observed (adapted from Brose et al. 2008). The browse preference of many common tree and shrub species is listed in Table 1. The browse preference of some common herbaceous species is listed in Table 2. Record this assessment after the quadrats and microplots have been sampled. Remnants of browsed plants may not be obvious without detailed examination of the forest floor. Record the deer impact level using the following codes and criteria:

1 Very low impact. No browse observed. Found only inside well maintained, woven-wire, deer-exclosure fences.
2 Low impact. Browse is absent or scarce. Browse-preferred regeneration is abundant and of varying heights. Browse-preferred plants are present and able to flower and fruit. Stump sprouts, if present, have minimal evidence of browse.
3 Moderate impact. Browse evidence is observed but not common. Browse-preferred regeneration is present but with little variability in height. Stump sprouts, if present, are browsed. Nonpreferred browse and browse-resistant species are common and widespread.
4 High impact. Browse evidence is common, or browse-preferred regeneration is rare to absent. Nonpreferred and browse-resilient vegetation is limited in height growth by deer browsing.
5 Very high impact. Browse evidence is omnipresent, or browse-preferred regeneration is absent. The abundance of nonpreferred vegetation is reduced by browsing. Browse-resilient plants show signs of heavy repeated browsing and a browse line is evident.

Table 1. Browse preferences for tree regeneration and shrubs (adapted from Latham et al 2005).

Browse preference	Scientific name	Common name
High – moderate preference	*Acer rubrum*	red maple
	Cornus spp.	dogwoods
	Fraxinus spp.	ashs
	Liriodendron tulipifera	tulip poplar
	Nyssa sylvatica	blackgum
	Prunus pensylvanica	pin cherry
	Quercus spp.	oaks
	Rubus allegheniensis	Allegheny blackberry
	Sassafras albidum	sassafras
	Tilia americana	basswood
	Viburnum spp.	viburnums
High preference in autumn and winter	*Betula* spp. (*lenta, alleghaniensis*)	birches
	Fagus grandifolia	American beech
	Tsuga canadensis	eastern hemlock
Low preference	*Acer pensylvanicum*	striped maple
	Carya spp.	hickories
	Liquidambar sytraciflua	sweetgum
	Hamamelis virginiana	witch hazel
	Ostrya virginiana	eastern hophornbeam
	Populus spp.	aspen
	Prunus serotina	black cherry
	Robinia pseudoacacia	black locust

Table 2. Browse preference for herbaceous species.

Scientific name	Common name
Preferred browse species	
Actaea spp. (*A. pachypoda, A. podocarpa, A. rubra*)	banberries
Maianthemum canadense	Canada mayflower
Maianthemum spp. (*M. racemosum, M. stellatum*)	false lily of the valleys
Medeola virginiana	Indian cucumber root
Osmorhiza spp. (*O. claytonia, O. longistylis*)	sweetroot
Polygonatum spp. (*P. biflorum, P. pubescens*)	Solomon's seal
Prosartes spp. (*P. lanuginosa, P. maculata*)	yellow fairy bells, mandarin
Smilax spp. (*S. rotundifolia, S. glauca, S. taminoides*)	catbriers
Trillium spp. (numerous*)*	trilliums
Uvularia spp. (*U. grandiflora, U. perfoliata, U. puberula, U. sessilifolia*)	bellworts
Browse preference is debated	
Arisaema triphyllum	jack-in-the-pulpit
Podophyllum peltatum	mayapple
*Actaea racemosa (*formerly *Cimicifuga racemosa)*	black bugbane
Species that are avoided	
Ageratina altissima	white snake root
Dennsteadtia punctilobula	hay-scented fern
Thelypteris noveboracensis	New York fern

FOREST FLOOR: Examine the ground within the plot and estimate the percent cover of each of the categories listed below. Use the following cover classes: <1, 1–2, 2–5, 5-10, 10–25, 25–50, 50–75, 75–95, or 95–100 %. For reference, a 1.3 m by 1.3 m square is equal to 1% cover of the plot area.

> BARE SOIL. Record the percentage of the plot covered by bare soil (mineral or organic). Do not include soil covered by leaf litter.
>
> ROCK. Record the percentage of the plot covered by exposed bedrock or surface rocks (>10 cm).
>
> WATER. Record the percentage of the plot covered by water.
>
> OTHER. Record the percentage of other things that have significant cover (>1% of the plot area; e.g. trash, etc). Make a note of what was recorded as "Other."
>
> TRAMPLED. Record the percentage of the plot showing evidence of trampling by humans, wildlife, or livestock. Trampling is assessed relative to the conditions of adjacent undisturbed soil. Include area occupied by established or unofficial trails traversing the plot, and record type of trail in plot notes.

IS PLOT IN FENCE: Circle Y if plot is inside deer exclosure fence. Circle N if plot is outside deer exclosure fence.

WAS PLOT BURNED: Circle Y if plot was burned since last full sample (not including ¼ samples conducted the growing season after a burn). Circle N if plot was not burned since last full sample.

Literature Cited

Brose, P. H., K. W. Gottschalk, S. B. Horsley, P. D. Knopp, J. N. Kochenderfer, B. J. McGuinness, G. W. Miller, T. E. Ristau, S. H. Stoleson, and S. L. Stout. 2008. Prescribing regeneration treatments for mixed-oak forests in the Mid-Atlantic region. General Technical Report NRS-33. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station.

Latham, R. E., J. Beyea, M. Benner, C. A. Dunn, M. A. Fajvan, R. R. Freed, M. Grund, S. B. Horsley, A. F. Rhoads and B. P. Shissler. 2005. Managing White-tailed Deer in Forest Habitat From an Ecosystem Perspective: Pennsylvania Case Study. Report by the Deer Management Forum for Audubon Pennsylvania and Pennsylvania Habitat Alliance, Harrisburg.

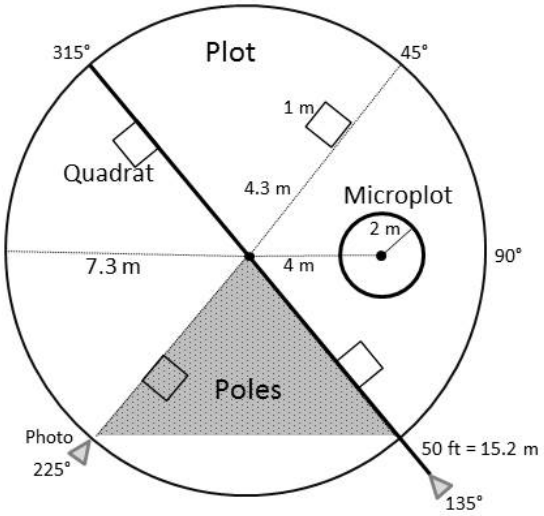
Revision History

<u>Version 1.0 to 1.1, May 2019</u>
Added "Is Plot in Fence" and "Was Plot Burned"? measures described above.

Photographs
Version 1.1 (May 2019)

Overview

This SOP provides instructions for photographing the plot from the ends of the two transects to document changes in the vegetation. Photos are taken at each visit to the plot. Always bring a **copy** of the photos from the latest previous visit into the field to facilitate replication of earlier shots. This can be a set of photographic prints, scanned images, color photocopies generated for this purpose.



Data Collection

Photos are taken from two locations, identified by the gray triangles at the ends of the 135° and 225° transects in the diagram to the right.

Photograph plot as early in the sampling visit as possible in order to minimize visual impacts of trampling.

Stand approximately 2 meters outside the plot beyond the tape ends (at 135° and 225°) when taking photos.

Use the same lens focal length each time you re-photograph, usually extended for maximum range by turning the lens adjuster all the way to the right. Leave the lens on auto-focus.

Compose the photograph so that the scope of the image matches the previous visit's photo as closely as possible. Crew members, flagging, and gear should not be visible in the photo.

Tape between quadrat pins should be in the middle of the image, with the corner of the poles sampling area at the bottom of the photograph.

Never prune vegetation from a plot. If thick vegetation obscures most of the plot, take the photo anyway. Shrubs and small trees located outside the plot can be gently held to the side by other crew members to improve the photograph.

Always hold the labeled photo-card in the lower left corner of the area to be photographed (photo-card labeling instructions provided below). Photos are more useful if they show primarily the vegetation, and space taken up by the photo-card is minimized. When the observer stands at the end of the 135° transect, the photo card will be labeled 315° to denote azimuth which the camera is facing. Likewise, when the observer stands at the end of the 225° transect, the photo card will be labeled 45°.

Take 3 photos at each photo point (see guidance regarding exposure level below).

Take photos at three different exposures for each photo point. First, make sure that the f-stop value is set to 11. If adjustment is needed, hold down the AV button and turn the black dial on top of the camera (located behind the shutter button) until you see "F11" in the upper right corner of the display. Take photos at three exposure levels: 1) optimal, 2) 2/3 of an f-stop underexposed, and 3) 2/3 of an f-stop overexposed. Turn the dial while looking at the exposure level indicator scale inside the viewfinder. Take one photo on the center setting, and two additional photos two points to each side of center (i.e., 2/3 of an f-stop). The image below shows the scale with three white blocks below the scale showing the proper exposure levels.

In dark forest settings, additional photos taken at exposure levels to the right of center may help lighten photos up.

The photo-card should be labeled consistently, according to the following depiction:

Status	Plot ID
Photo Direction	
Site	Date

For example:

Pre-Burn	B.245
315°	
GRND	6/10/2015

Revision History

Version 1.0 to 1.1, May 2019

Minor revisions to clarify where photos are taken and how photos should be labelled. No changes to protocol, just clearer instructions.

Fuel Load Transect
Version 1.1 (May 2019)

Overview

This SOP collects fuel load data on one 50 foot long transect. These data will be collected pre-burn, and at 1, 2, 5, and 10 years post-burn. Immediate post-burn evaluation is optional depending upon project-specific objectives. For consistency, pre-burn fuel sampling should occur prior to leaf off. Data will be collected on FMH-19 datasheet, modified for this project.

Definitions

Litter includes freshly fallen leaves, needles, bark, flakes, cone scales, fruits (e.g., acorns, cones), dead matted grass, and a variety of miscellaneous vegetative parts. Litter does not include twigs and larger stems.

Duff is the fermentation and humus layers; does not include freshly cast litter material. The top of duff is where needles, leaves, fruits, and other castoff vegetative material have noticeably started to decompose. Individual particles usually are bound by mycorrhizal fungal growth. Duff stops at mineral soil.

Dead and downed woody material includes dead twigs, branches, stems, and boles of trees and shrubs disconnected from the base and lying on or above the ground.

Transect Set Up

Run the zero end of the tape towards the 315° azimuth. Set a galvanized spike flush to the ground at the end of the tape when the 7.3 m mark is on plot center measuring **slope distance**. Run the roll end of the tape 7.3 m **slope distance** from plot center along the 135° azimuth. Set a galvanized spike at 14.6 m along the tape. Extend the tape to 15.2 m to complete the fuels transect.

Be exact about sighting and distance measurements since the plots are permanent. Distances should be measured to within 0.1 m error, and bearings should be sighted to within 4 degrees error. To measure slope distance, pull the tape taught parallel to the ground surface, ensuring that it is not caught on vegetation. Both ends of the tape must be held at the same height above the ground to keep it parallel to the ground.

When sighting compass bearings, crew members must take care that metal objects do not affect the compass needle, and that the compass is held level (flat) at all times. The compass needle will not show small shifts in azimuth when the compass is tilted. When sighting up or down slope, remember to hold the compass level—do not tilt it relative to the slope.

Fuels sampling should occur prior to quadrat sampling in order to reduce the compaction of fuels. Care must be taken when sampling near the quadrats in order to minimize trampling of vegetation within the quadrats.

Data Collection

- Record azimuth and percent slope for each transect.

- Dead and Downed Fuels are tallied by size class along a specified length of transects: 1, 10, 100, 1000 hour fuels are sampled along 6, 6, 12, and 50 feet of each fuel transect, respectively.
- 10 Litter and Duff measurements are made at 1, 5, 10, 15, 20, 25, 30, 35, 40, and 45 feet.

Litter and Duff Measurement Rules:

- Measuring litter depths when conditions are moist may inappropriately bias fuel load inputs and subsequent calculations of fuel loading. If time permits, postpone sampling until drier conditions prevail.
- Measure litter and duff to the nearest tenth of an inch.
- Refill hole after measuring litter and duff depth.
- Do not include twigs and larger stems in litter depth measurements.
- Measure through rotten logs whose central axis is in the duff layer
- Occasionally moss, a tree trunk, stump, log, or large rock will occur at a litter or duff depth data collection. Handles these situations as follows.
    - Moss - Measure the duff from the base of the green portion of the moss.
    - Large rocks/boulders - Record the litter and duff depths as zero, even if there is litter or duff on top of the rock.
    - Log, stumps and trees – If a log, stump or tree is in the middle of the litter or duff measuring point, move (i.e., offset) the data collection point one foot to the right, perpendicular to the sampling plane. Note that an offset was made on the data sheet.

Tally Rules for Downed Woody Material:

- Measure woody material first to avoid disturbing it and biasing estimations
- Do not count dead woody stems and branches ***still attached*** to standing shrubs/trees
- Do not count twigs and branches when intersection between central axis of particle and sampling plane is in the duff
- If sampling plane intersects the end of a particle, tally only if the central axis is crossed
- Do not tally any particle having a central axis that coincides perfectly with the sampling plane
- If sampling plane intersects a curved piece more than once, tally each intersection
- Tally uprooted stumps and roots not encased in dirt. Do not tally undisturbed stumps
- For rotten logs that have fallen apart, visually re-construct a cylinder to contain the rotten material and estimate diameter
- Technically, downed fuels should be tallied up to any height. However, for purposes of practicality only measure fuels up to 2 meters in height.

Revision History

Version 1.0 to 1.1 – No Changes

Groundstory Diversity
Version 1.1 (May 2019)

Overview

This SOP measures the composition and abundance of groundstory vascular plants. Species percent cover data are collected in four quadrats. This SOP should be conducted by a person (botanist or vegetation crew leader) familiar with flora of the region, especially herbaceous, graminoid, and fern species. This protocol should be conducted only during the summer months (approximately May 15 to September 15).

Quadrat Set Up

Run the zero end of the tape towards the 45° and 315° azimuths. Set a galvanized spike flush to the ground at the end of the tapes when the 7.3 m mark is on plot center, measuring **slope distance**. Run the roll end of the tapes 7.3 m **slope distance** from plot center along the 135° and 225°azimuths. Set a galvanized spike flush to the ground at 14.6 m along each tape.

Place the quadrat at the 2 – 3 meter marks on the 45° and 315° transects. Place the quadrat at the 11.6 – 12.6 meter marks on the 135° and 225° transects.

Be exact about sighting and distance measurements since the plots are permanent. Distances should be measured to within 0.1 m error, and bearings should be sighted to within 4 degrees error. To measure slope distance, pull the tape taught parallel to the ground surface, ensuring that it is not caught on vegetation. Both ends of the tape must be held at the same height above the ground to keep it parallel to the ground.

When sighting compass bearings, crew members must take care that metal objects do not affect the compass needle, and that the compass is held level (flat) at all times. The compass needle will not show small shifts in azimuth when the compass is tilted. When sighting up or down slope, remember to hold the compass level—do not tilt it relative to the slope.

When establishing a new plot, if the spike cannot be placed exactly at the end of the transect due to rocks or trees, place the spike along the same azimuth as close as possible to the standard distance. It is important that the spike is on the correct azimuth, even if the spike is not exactly 7.3 m from the plot center. Note the location of the spike in Plot Notes on the datasheet (e.g., spike marking the 135° transect was placed 10 cm closer to plot center on the correct azimuth). The end of the tape should always be placed 7.3 m from plot center, regardless of the location of the spike.

When revisiting an established plot, read the Plot Notes to determine if the spikes are different than standard. Use a metal detector to search for the spikes. To the extent possible, limit the disturbance to the forest floor, leaf litter, and understory vegetation when searching for microplot centers. Record on the datasheet whether the spikes were located. If a spike cannot be located after a reasonable amount of searching, place a new spike at proper location, following the guidelines in the preceeding paragraph. If the spike falls in a depositional, erosional, or otherwise disturbed location (e.g. stream channel, drainageway, evidence of human visitation), such that it is likely that the old spike is no longer present, leave the new spike when sampling is completed. Mark on the datasheet that the spike was replaced. If the location of the new spike is

not standard, note the location of the new spike in Plot Notes on the datasheet. In normal undisturbed forest settings in which there is no clear reason why the spike cannot be located, remove the new spike when sampling is completed. Mark on the datasheet that the spike was not replaced.

Data Collection

Species Data

SPECIES. Each quadrat is examined by an observer (vegetation crew leader or contract botanist) familiar with flora of that park. Record the list of all vascular plant species that are rooted in or overhanging the qudrat within 2 m of the ground. Species names follow the Master Plant List in the Vegetation and Soil Monitoring Database, which is based on the USDA PLANTS Database (USDA, NRCS 2007). Refer to the Master Plant List for proper nomenclature.

CONFIDENCE. Record your level of confidence in the species identification for each plant. Your confidence in the identification is independent of the level of taxonomic specificity. You could be very confident in a plant identified only to family, (e.g. Species = Orchidacea; Confidence = 1) because you are sure that it is in that family, but have no idea which genus it is. Similarly, you could be not very confident in a genus- or species-level identification (e.g. Species = Dryopteris sp.; Confidence = 3) for obscure, small, or un-collectable individuals. Use the following codes:

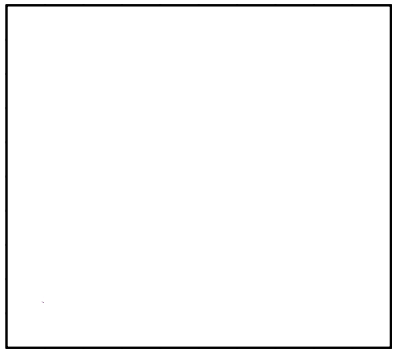
1 = confident
2 = somewhat confident
3 = not very confident

PERCENT COVER CLASS. Within a quadrat, percent cover will be recorded using the following cover classes:

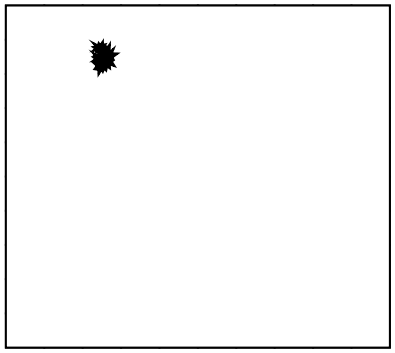
Percent Cover Range	Cover Class	Class Midpoint
Absent	0	0
0–1%	1	0.5
1–2%	2	1.5
2–5%	3	3.5
5–10%	4	7.5
10–25%	5	17.5
25–50%	6	37.5
50–75%	7	62.5
75–95%	8	85.0
95–100%	9	97.5

(from Peet et al. 1998)

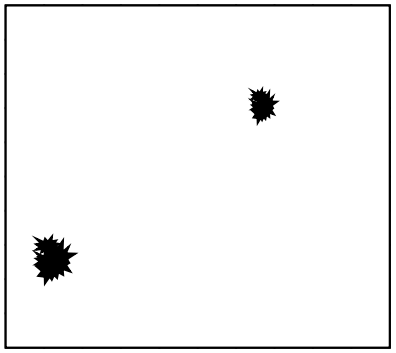
Graphic representations of these cover classes and their midpoints are provided on the following page. Imagine the percent cover of each plant as its shadow on the ground if the sun were directly overhead. Moss or vines growing on a vertical surface (tree or rock) have little percent cover.



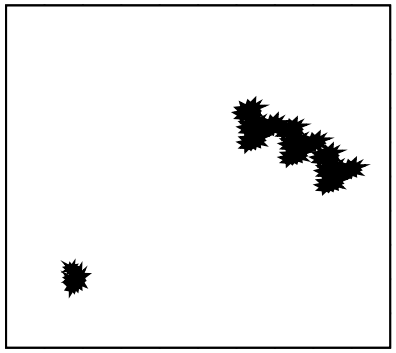
Class 0: Absent



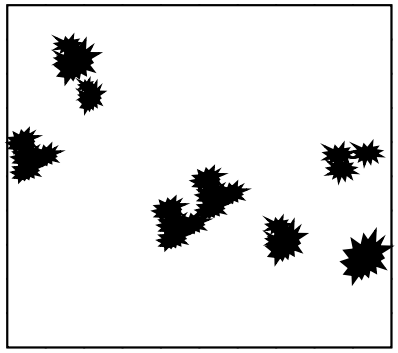
Class 1: 0 – 1 %



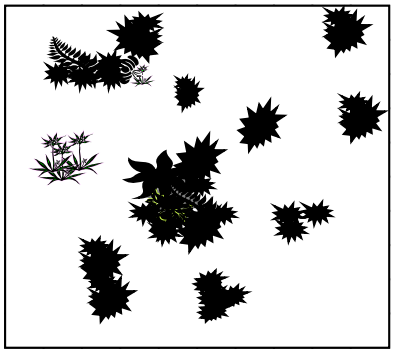
Class 2: 1 – 2 %



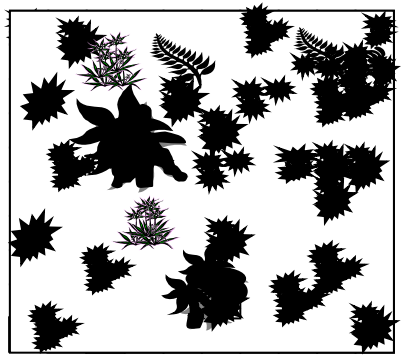
Class 3: 2 – 5 %



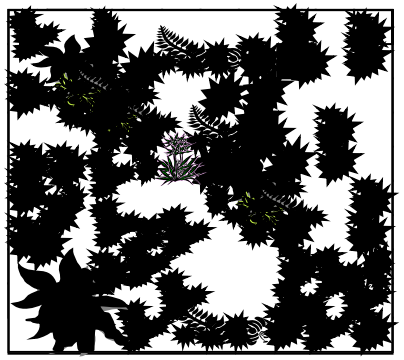
Class 4: 5 – 10 %



Class 5: 10 – 25 %



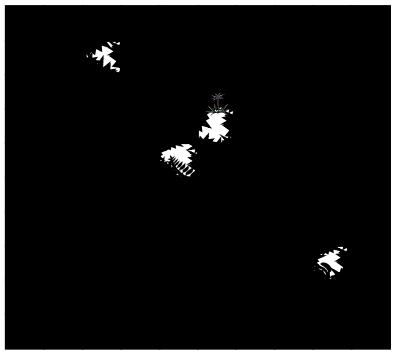
Class 6: 25 – 50 %



Class 7: 50 – 75 %

(modified from Peet et al. 1998)

Class 8: 75 – 95 %



Class 9: 95 – 100 %

Use the 10×10-cm purple and white square sections painted on the quadrat poles to help determine percent cover. Each purple or white square illustrates 1% of the quadrat.

Notice the exact breakpoints (e.g., 25%) are not included in any class. Classes are either above or below each breakpoint. This is not a mistake. The most suitable class should be assessed and recorded as rapidly as possible while maintaining accuracy.

Use the following guidelines to estimate cover:

- For each species, cover is based on a vertically projected polygon described by the outline of the foliage, including any normal spaces occurring between leaves.
- Estimate only foliar cover on plants or portions of plants that fall inside the quadrat frame and are less than 2 m above the ground. Bare twigs or branches without foliage and woody vines without foliage do not count towards cover (e.g. low growing pine or hemlock branches that support no foliage within the quadrat due to shading from the branches above; also large grapevines without foliage in the quadrat).
- For deciduous plants, base percent cover estimates on the current years' growth, by including living, damaged, and dead material only from the current year. For evergreen plants, base percent cover estimates on all green foliage, excluding dead foliage.
- Record the percent cover present at the time of the plot visit. Do not adjust the percent for the time of year during which the visit was made (i.e., for immature or wilted plants).
- Overlap of plants of the same species is ignored. There will often be overlap of plants of different species. Therefore, <u>the total cover for a quadrat may exceed 100%</u>.

Unknown Plants

If a plant cannot be identified to species quickly and confidently, assign the species a specimen number, record genus or family, if possible, and include a short descriptive name. Follow these guidelines to determine whether and how to collect a specimen for subsequent identification:

- Do not collect any plants represented by 5 or fewer individuals (i.e., locally sparse) in the general vicinity of the plot. If an unknown plant is not locally sparse, it can be collected from the plot, outside the quadrats.
- Do not remove entire plants (including roots) from within the quadrats. If the plant occupies greater than 2 % cover and is sufficiently robust, a portion of the plant may be removed from within the quadrat such that the overall cover of the plant within the quadrat is not significantly affected.
- Anytime it is not possible to collect a specimen, collect a photograph. Place a ruler in the photograph for scale, and allow the camera to automatically select the appropriate aperture for the given light conditions. Use the Macro setting or Super Macro setting to take detailed close up photographs of smaller plants.

Deer Browse Indicators

If any of the target species listed in the table below occur in the quadrat, the data described below will be recorded.

Scientific Name	Common Name
Actaea spp. (*A. pachypoda*, *A. podocarpa*, *A. rubra*, *A. racemosa* - formerly *Cimicifuga racemosa*)	baneberries
Arisaema triphyllum	jack-in-the-pulpit
Maianthemum canadense	Canada mayflower
Maianthemum spp. (*M. racemosum*, *M. stellatum*)	false lily of the valleys
Medeola virginiana	Indian cucumber root
Osmorhiza spp. (*O. claytonia*, *O. longistylis*)	sweetroot
Podophyllum peltatum	mayapple
Polygonatum spp. (*P. biflorum*, *P. pubescens*)	solomon's seals
Prosartes spp. (*P. lanuginosa*, *P. maculata*)	yellow fairy bells, mandarin
Trillium spp. (numerous)	trilliums
Uvularia spp. (*U. grandiflora*, *U. perfoliata*, *U. Puberula*, *U. sessilifolia*)	bellworts

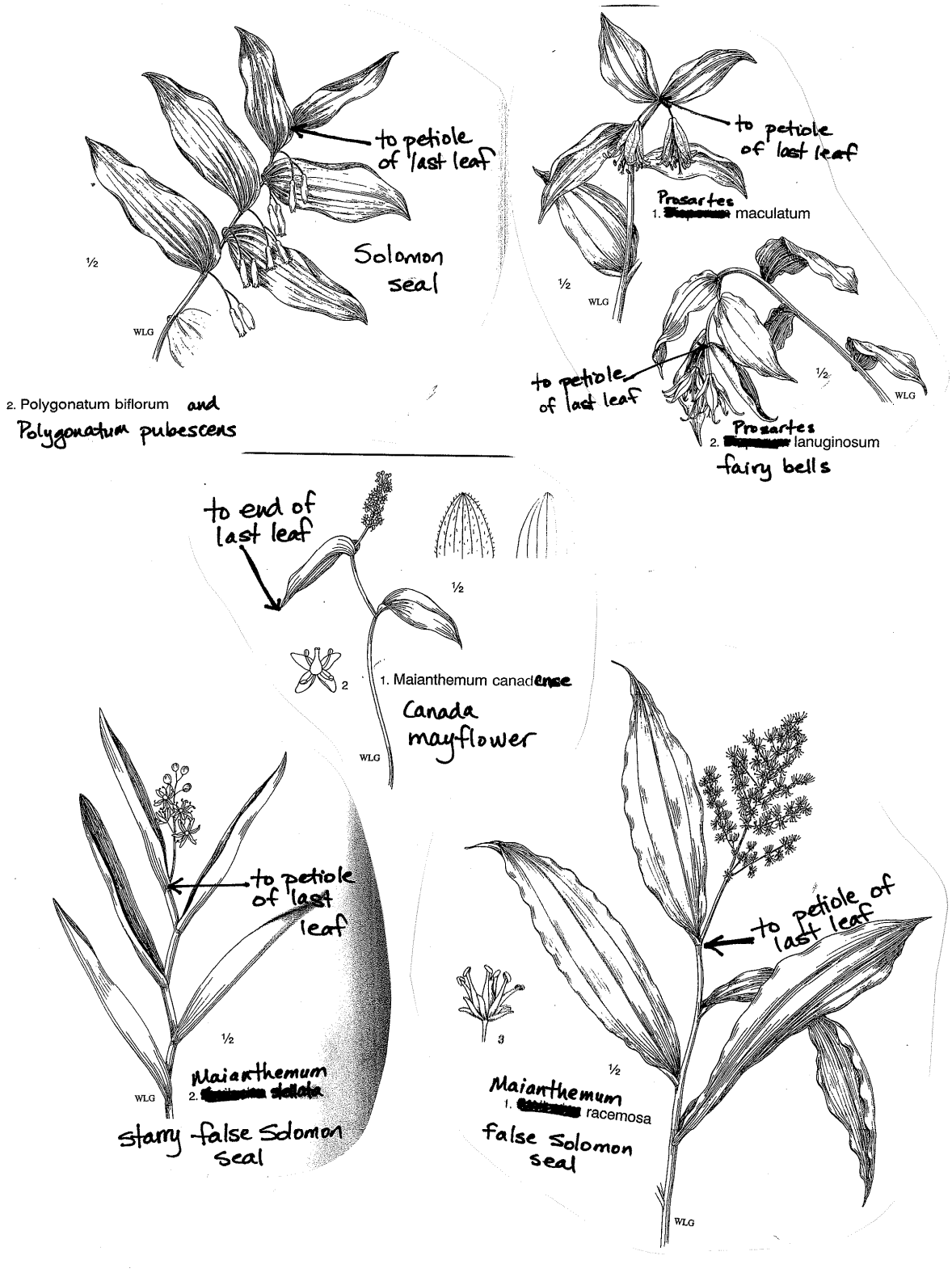
SPECIES. Record the species name only if the species is rooted in the quadrat. Plants that are overhanging into the quadrat but that are not rooted inside are not counted in this section of the protocol.

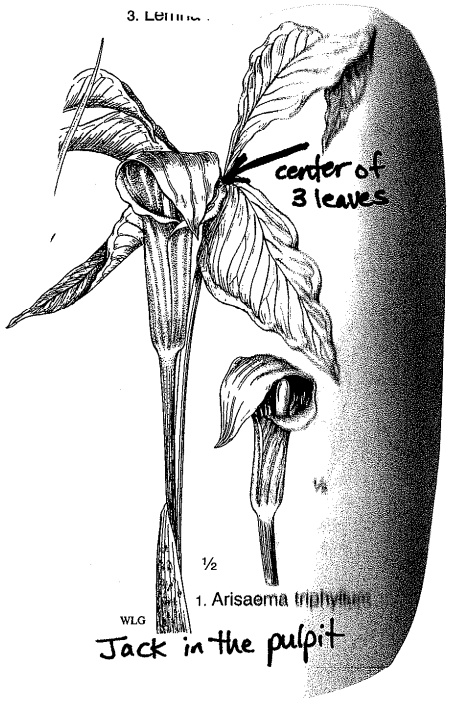
NUMBER OF REPRODUCING PLANTS. For each target species, tally number of plants with evidence of flowering or fruiting using the dot tally system.

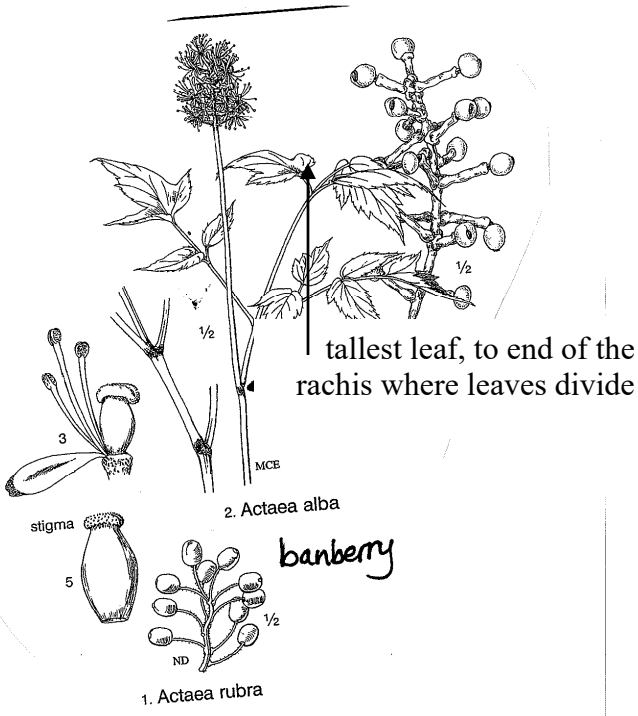
NUMBER OF NON-REPRODUCTIVE PLANTS. For each target species, tally number of non-flowering, non-fruiting plants using the dot tally system.

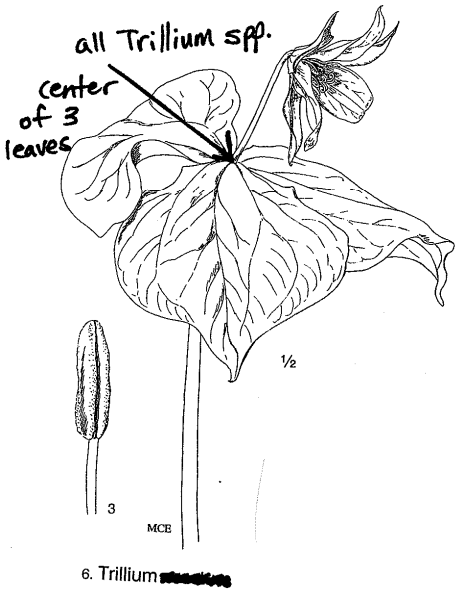
HEIGHT. For each target species, measure the height of the tallest 3 plants in each quadrat. Height is measured in centimeters, to the nearest 1 cm. Start with the plant that appears the tallest and work towards smaller plants until 3 plants have been measured (if 3 are present). To measure height, gently align the plant along a ruler. Realign the ruler along any curves present to account for additional height masked by a curved stem. See the drawings on the following pages that illustrate the point for each species at which height should be measured.

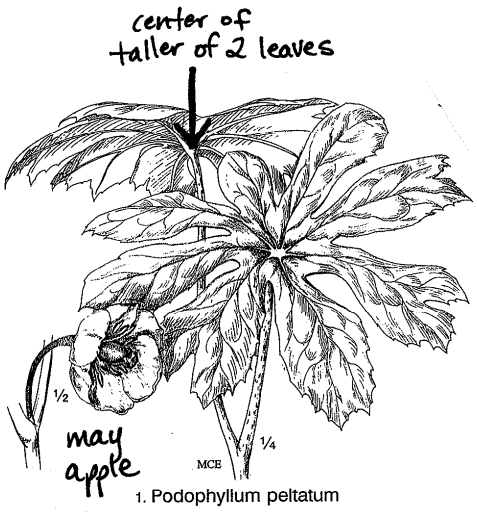
Record the height of the tallest plant under HEIGHT 1. Record the height of the second tallest plant under HEIGHT 2. Record the height of the third tallest plant under HEIGHT 3.

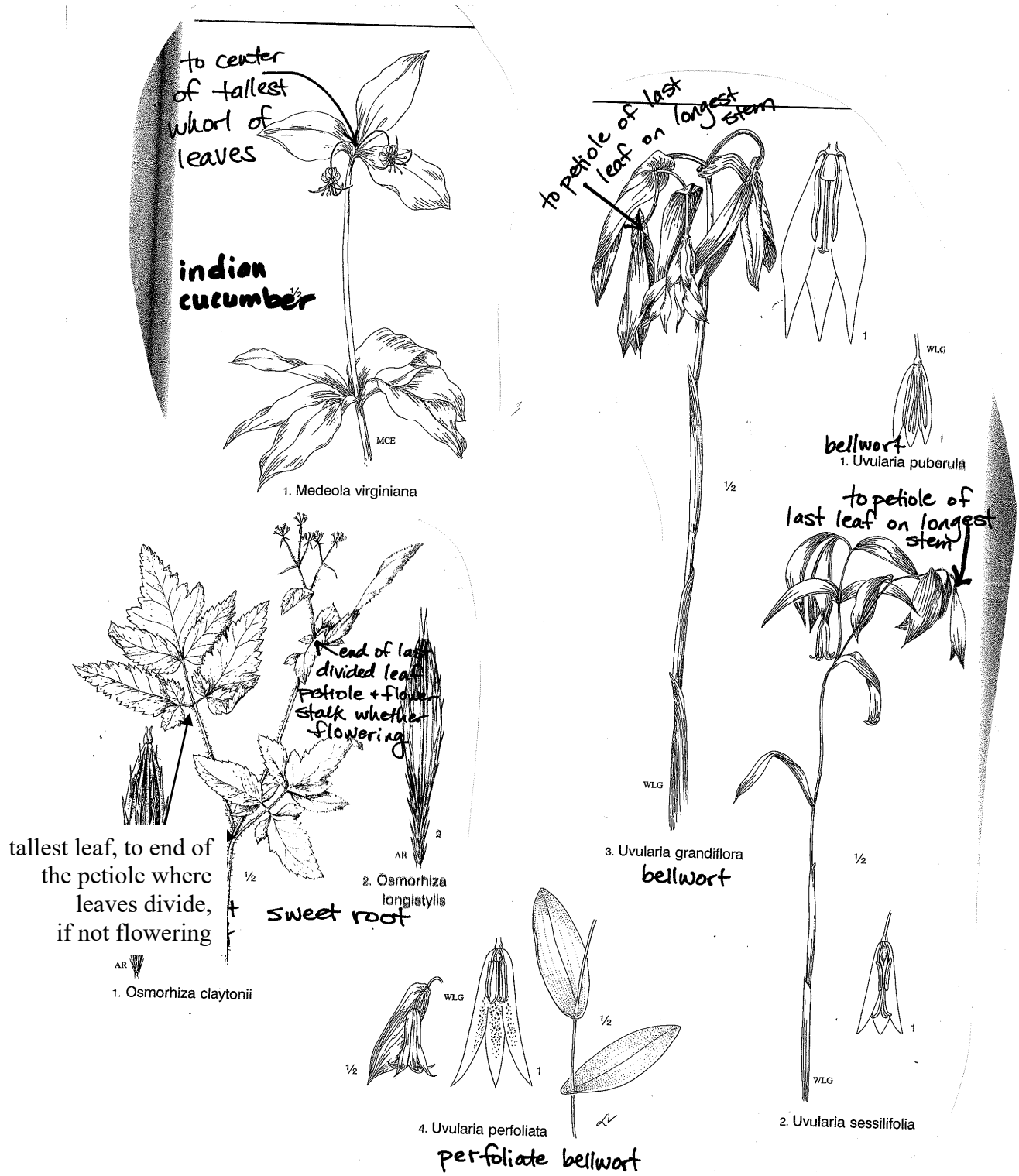

to petiole of last leaf
Solomon seal
½
WLG
2. Polygonatum biflorum and
Polygonatum pubescens
to petiole of last leaf
Prosartes
1. [redacted] maculatum
½
WLG
to petiole of last leaf
½
WLG
Prosartes
2. [redacted] lanuginosum
fairy bells
to end of last leaf
½
2
1. Maianthemum canad[redacted]
Canada mayflower
WLG
to petiole of last leaf
½
WLG
Maianthemum
2. [redacted]
starry false Solomon seal
to petiole of last leaf
3
½
Maianthemum
1. [redacted] racemosa
false Solomon seal
WLG


3. Lemna
center of
3 leaves
½
1. Arisaema triphyllum
WLG
Jack in the pulpit


½
½
tallest leaf, to end of the
rachis where leaves divide
3
MCE
2. Actaea alba
stigma
5
banberry
½
ND
1. Actaea rubra


all Trillium spp.
center
of 3
leaves
½
3
MCE
6. Trillium [redacted]


center of
taller of 2 leaves
½
may
apple
MCE
¼
1. Podophyllum peltatum


to center of tallest whorl of leaves
indian cucumber
1. Medeola virginiana
to petiole of last leaf on longest stem
bellwort
1. Uvularia puberula
to petiole of last leaf on longest stem
end of last divided leaf petiole + flower stalk whether flowering
tallest leaf, to end of the petiole where leaves divide, if not flowering
2. Osmorhiza longistylis
sweet root
1. Osmorhiza claytonii
3. Uvularia grandiflora
bellwort
2. Uvularia sessilifolia
4. Uvularia perfoliata
perfoliate bellwort

Plot Species

A time-constrained search for additional plant species is conducted on the whole 167 m^2 plot by an observer (vegetation crew leader or contract botanist) familiar with vegetation at the park. Record all additional vascular species with foliage that occurs within 2 meters of the ground within the plot, searching for no more than 5 minutes. If portions of the plot are wet, only emergent plants are recorded. Do not re-record species that were already recorded as part of the quadrat sampling.

Record the list of additional species found in the plot on the Quadrat Species datasheet under the heading "Plot Species". Record the level of confidence in species identifications using the confidence codes listed above. Species names follow the Master Plant List in the Vegetation and Soil Monitoring Database, which is based on the USDA PLANTS Database (USDA, NRCS 2007). Refer to the Master Plant List for proper nomenclature.

The objective of the time-constrained search is to capture as extensive a plant list for the plot as possible within a reasonable amount of time. These data are used in reporting presence of invasive species, in tracking biotic homogenization, and in reporting the proportion of native vs. exotic species present on the plot. The number of species recorded on this list will not be monitored over time. Therefore, it is acceptable for other crew members to assist the botanist in compiling the species list. Botanists and crew members may note interesting species they find in the plot outside the 5-minute search and include those species in the list. Time spent keying out specimens in the field is not included in the 5-minute time limit.

References

Braun-Blanquet, J. 1965. Plant sociology: the study of plant communities (Transl. by G.D. Fuller and H.S. Conard) Transl. of 1st edition of Pflanzensoziologie (1928). McGraw-Hill, New York and London.

Daubenmire, R. F. 1968. Plant communities: A textbook of plant synecology. Harper & Row. New York. 300p.

Mueller-Dombois, D. and H. Ellenberg. 1974. Aims and Methods of Vegetation Ecology. John Wiley &Sons. New York, NY.

Peet, R. K., Wentworth, T. R., and P. S. White. 1998. A flexible multipurpose method for recording vegetation composition and structure. Castanea 63: 262–274.

Revision History

Version 1.0 to 1.1 – No Changes

Tree Regeneration
Version 1.1 (May 2019)

Overview

This SOP quantifies live saplings, established seedlings, and shrubs by species on one 2-m radius circular microplot. Seedlings are also quantified by size class. These data yield information on advance regeneration, future cover, and the effects of deer browse.

Definitions

Height of a seedling is the distance from the top of the soil to the top of the terminal bud. Do not include the seedling's leaves or needles in this measurement. Seedling height is determined from stems as they are naturally growing. Height is measured vertically from the top of the soil to the tip of the terminal bud, not along the axis of the stem. Stems should **not** be straightened for measurement. When measuring seedling height, begin the measurement below the leaf litter, at the point where the seedling is rooted in the soil.

Diameter-at-breast-height (DBH) is measured at 1.37 m above the ground line on the uphill side of the tree.

Horizontal distance is the level, straight line distance between two points. This contrasts with slope distance which is measured parallel to the ground surface. Slope distance and horizontal distance are equivalent on flat land. On sloped land, the horizontal distance between two objects is less than the slope distance.

Seedlings are live juvenile trees with at least two true leaves, and that have less than 1.0 cm diameter-at-breast-height (DBH). Any juvenile tree shorter than breast height (<1.37 m tall) is a seedling. A seedling is counted only if it is rooted in the microplot. Seedlings <5 cm in height are not counted in the tally. Refer to the Master Plant List to determine which species are considered trees.

Saplings are live juvenile trees with DBH ≥1.0 cm but <10.0 cm. Saplings are alive if there are any living parts (i.e., leaves, buds, cambium) at or above DBH. Saplings that have been temporarily defoliated are considered alive. A sapling is counted only if it is rooted in the microplot. Refer to the Master Plant List to determine which species are considered trees.

Microplot Set Up

Determine the location of the microplot using a compass and measuring tape. The center of the microplot should be 4 m **slope distance** from plot center along the 90° azimuth. Be exact about sighting and distance measurements since the plots are permanent. Distances should be measured to within 0.1 m error, and bearings should be sighted to within 4 degrees error.

To measure slope distance, pull the tape taught parallel to the ground surface, ensuring that it is not caught on vegetation. Both ends of the tape must be held at the same height above the ground to keep it parallel to the ground.

When sighting compass bearings, crew members must take care that metal objects do not affect the compass needle, and that the compass is held level (flat) at all times. The compass needle will not show small shifts in azimuth when the compass is tilted. When sighting up or down slope, remember to hold the compass level—do not tilt it relative to the slope.

When establishing a new plot, set a galvanized 12 inch spike flush to the ground at the center of the microplot. If the spike cannot be placed exactly at the center of the microplot due to rocks or trees, place the spike along the same azimuth as close as possible to 4 m from plot center. It is important that the spike is on the correct azimuth, even if the spike is not exactly 4 m from the plot center. Note the location of the spike in Plot Notes on the datasheet (e.g., spike marking the microplot was placed 10 cm closer to plot center on the correct azimuth). The location of the spike marks the center point of the microplot, the point from which the 2-m radius is measured, even if the spike is not exactly 4 m from plot center. If a spike cannot be placed within 0.5 m of the actual microplot center (4 m from plot center) due to large rocks or trees, mark the center temporarily with a rock, flagging, or chaining pin while data is recorded. Record in the plot notes why the microplot center was not marked with a spike.

When revisiting an established plot, read the Plot Notes to determine if the spike at the center of the microplot is different than standard. The location of the spike marks the center point of the microplot, the point from which the 2-m radius is measured, even if the spike is not exactly 4 m from plot center. Run a measuring tape 4 m along the 90° azimuth. Then use a metal detector to search for the spike marking the microplot center. To the extent possible, limit the disturbance to the forest floor, leaf litter, and understory vegetation when searching for microplot centers. Record whether the spike was located on the datasheet. If the spike cannot be located after a reasonable amount of searching, place a new spike at the microplot center, following the guidelines in the preceeding paragraph. If the spike falls in a depositional, erosional, or otherwise disturbed location (e.g. stream channel, drainageway, evidence of human visitation), such that it is likely that the old spike is no longer present, leave the new spike at the microplot center when sampling is completed. Mark on the datasheet that the spike was replaced. If the location of the new spike is not standard, note the location of the new spike in Plot Notes on the datasheet. In normal undisturbed forest settings in which there is no clear reason why the spike cannot be located, remove the new spike when sampling is completed. Mark on the datasheet that the spike was not replaced.

Data Collection

Microplot Characterization: Examine the vegetation <2 m in height in the microplot. Record the appropriate percent cover class for each of the vegetation category within the microplot. Imagine the percent cover of the vegetation as its shadow on the ground if the sun were directly overhead. Moss or vines growing on a vertical surface (tree trunk or rock) will have little percent cover. Use the following percent cover categories: 0=0%; 1=<1%; 2=1–2%; 3=2–5%; 4=5–10%; 5=10–25%; 6=25–50%; 7=50–75%; 8=75–95%; 9=95–100%. For reference, a 35 cm by 35 cm square is equal to 1% cover of the microplot area. The total of these four vegetation categories can be less than 100% if portions of the microplot are unvegetated or woody cover is dense. The total can exceed 100% if vegetation is dense and overlapping.

> % NONVAS. Record the percent cover class of nonvascular plants, including moss, but excluding lichens.

% VINE. Record the percent cover class of all woody and herbaceous vine species. Refer to the Master Plant List to determine which species are vines. Vines that are >2m above the ground are not considered here.

% GRAM. Record the percent cover class for all graminoid species, including grasses, rushes, and sedges.

% FERN. Record the percent cover class for all fern species and fern allies such as *Lycopodium* spp..

% HERB. Record the total cover class for all herbaceous species (i.e., vascular plants that are not woody, graminoid, or fern). Refer to the Master Plant List to determine which species are herbaceous.

MICROPLOT SPIKE FOUND? *For plot revisits only*, record whether the spike at the center of each of the four microplots was located. (Refer to Site Selection and Plot Establishment SOP for detailed instructions.)

MICROPLOT SPIKE REPLACED? *For plot revisits only*, record whether the spike at the center of each of the four microplots was replaced, following the guidelines discussed above. (Refer to Site Selection and Plot Establishment SOP for detailed instructions.)

SAPLING SPECIES. Record the USDA PLANTS code for the genus and species of each sapling. Species names follow the Master Plant List in the Vegetation and Soil Monitoring Database, which is based on the USDA PLANTS Database (USDA, NRCS 2007). If species cannot be determined in the field, collect a twig sample with foliage, buds, cones, or flowers, and/or a photograph to make a positive identification later. If possible, collect samples outside the microplot from similar specimens and make a note to correct the species code later. Record genus or family if it is known, and "sp01", "sp02" etc for each unknown species. For saplings that cannot be identified to family, use "UNKCON" for Unknown Conifer and "UNKHDW" for Unknown Hardwood.

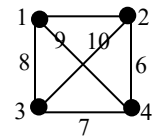
SAPLING DIAMETER. Measure the diameter at 1.37 m above the ground on the uphill side of each sapling. Use the DBH mark on the Finley pole to find the correct height (1.37 m) at which to measure the diameter. See instructions for measuring diameter in unusual situations in the Tree Measurements SOP. Use the DBH side of the logger's tape or calipers to measure the diameter to the nearest 0.5 cm. Juvenille trees with DBH < 1.0 cm are considered seedlings and should be tallied in that section. Remember to tally saplings that do not meet the minimum DBH requirement in the seedling section.

Do not count stump sprouts attached to a live tree as saplings. A tree is considered live if it has any living parts (i.e., leaves, buds, cambium) at or above DBH. Root suckers that are not attached to a tree bole should be measured.

Tally stump sprouts from standing dead trees, measuring each sprout as a separate sapling. A standing dead tree has no living parts (i.e., leaves, buds, cambium) at or above DBH.

For forked saplings, refer to the instructions for measuring forked trees in the Tree Measurements SOP. One additional rule applies to forked saplings with one or more main stems and one or more smaller branches with diameter >1.0 cm at DBH. In order to qualify for a separate diameter measurement, the branch in question must be at least 1/3 the diameter of the main stem and must branch out from the main stem at an angle of 45 degrees or less. Evaluate the angle that the pith enters the main stem, not the general form of the branch extending from the sapling. Branches that are less than 1/3 the diameter of the main stem or branch out from the main stem at an angle greater than 45 degrees should not be tallied.

SEEDLING SPECIES. Record the USDA PLANTS code for the genus and species. Species names follow the Master Plant List in the Vegetation and Soil Monitoring Database, which is based on the USDA PLANTS Database (USDA, NRCS 2007). If species cannot be determined in the field, collect a twig sample with foliage, buds, cones, or flowers, and/or a photograph to make a positive identification later. Samples should not be taken if the entire plant will be killed or entirely removed from the microplot. If possible, collect samples outside the microplot from similar specimens. Record genus or family if it is known, and "sp01", "sp02" etc for each unknown species. For seedlings that cannot be identified to family, use "UNKCON" for Unknown Conifer and "UNKHDW" for Unknown Hardwood.



SEEDLING COUNT. Within each microplot, count the number of live tree seedlings by species in the following height classes: 5–15 cm, 15.1–30 cm, 30.1–100 cm, 1.01–1.5 m, >1.5 m. Record the tally of seedlings on the datasheet using the dot tally system shown at right. Use the Steiner stick and the Finley pole to measure seedling height, following the height measuring guidelines described above. Measure the seedling height where the seedling enters at the top of the O horizon, below the leaf litter. When measuring seedling height with either the Steiner stick or Finley pole, gently push into the leaf litter until contact is made with the soil O horizon. Juvenile trees >1.5 m in height and with a DBH ≥1 cm are not included in the seedling count because they are saplings. Seedlings <5 cm in height are not counted or recorded.

Tree seedlings that originate at a common root collar (i.e., branch under the leaf litter) are independent seedlings. Tally the height of each seedling separately.

If a tree seedling forks or branches above ground, measure the height of the tallest terminal bud and count the seedling as one.

Do not count stump sprouts from a live tree as seedlings. A tree is considered live if it has any living parts (i.e., leaves, buds, cambium) at or above DBH.

Tally stump sprouts from standing dead trees, counting each sprout that forks below the leaf litter as a separate seedling. For stump sprouts forking above the leaf litter, tally the tallest sprout. A standing dead tree has no living parts (i.e., leaves, buds, cambium) at or above DBH.

Revision History

Version 1.0 to 1.1 – No Changes

Pole Measurements
Version 1.1 (May 2019)

Overview

This SOP records species, diameter, and condition of all live and standing pole-sized trees 5.0 – 9.9 cm diameter-at-breast-height on 26.64 m^2 triangular quarter plot. These data provide information on tree regeneration, stand dynamics, and stand structure.

Definitions

Diameter-at-breast-height (DBH) is measured at 1.37 m above the ground line on the uphill side of the tree.

Horizontal distance is the level, straight line distance between two points. This contrasts with slope distance which is measured parallel to the ground surface. Slope distance and horizontal distance are equivalent on flat land. On sloped land, the horizontal distance between two objects is less than the slope distance.

Dead standing trees lack any living parts (i.e., leaves, buds, cambium) at or above DBH, and lean <45 degrees from vertical, as measured along the bole. They need not be self-supported. Once included, standing dead trees are tracked until they no longer qualify as standing dead. Dead trees leaning >45 degrees from vertical are considered coarse woody debris and are measured according to the Coarse Woody Debris SOP.

Live trees have living parts (i.e., leaves, buds, cambium) at or above DBH. Live trees that have been temporarily defoliated or are leaning or fallen are considered live trees. Live trees do not have to be self-supported. They may be supported by other trees, branches, or their crown.

Poles are trees (live or dead) with a diameter between 5.0 – 9.9 cm at DBH. Refer to the Master Plant List to determine which woody species are considered trees.

Quarter Plot Set Up

Run measuring tape 7.3 m **slope distance** from plot center along the 135° and 225° azimuths. Set a chaining pin at 7.3 m **slope distance** from plot center along each tape (pin should be placed at 12.7 m mark on the tape if the tapes are being used to locate all four quadrats). Run a tape between the two chaining pins to form a triangle. The third tape should measure 10.3 meters between the two chaining pins. This triangle delineates the area of sampling for pole-sized trees.

Begin tallying trees from the 135 degree azimuth and continue clockwise to the 225 degree azimuth. A pole will be included only if it is rooted within the triangle delineated by the tapes. For each pole, measure and record the horizontal distance to the front edge of the trunk from plot center using the laser. The front end of the laser (not your eye) should be over plot center while taking the distance measurement. Make sure that "HD" is visible in the laser viewfinder while all distance measurements are taken. If a tree bole is leaning significantly into or out of the plot, do not shoot the tree bole with the laser unless you can see the base of the tree in the viewfinder. Instead, have a crew member stand adjacent to and level with the front of the tree base. Measure the distance to the front of the crew member with the laser.

Measure and record tree azimuth from plot center using a compass. If a tree leans significantly to the right or the left, measure the azimuth from plot center to the center of the stump, not the bole.

Measure the diameter at breast height, using the white DBH mark on the Finley pole to identify the correct DBH height. Unusual DBH situations are discussed in the Tree SOP. Use the tree paint to create a horizontal line 5 cm in length and perpendicular to the tree axis on the bark of the tree. The paint marks the location where the diameter was measured. This will allow accurate remeasurement of DBH during return visits.

Procedure for Plot Revisits

Unique Pole Sheets are created for each plot at the beginning of the season based on pole data from the previous sampling visit. Pole Sheets provide the pole numbers, species, distance, azimuth, and previous status and DBH for each pole. Use the information on the Pole Sheet to locate each pole in the quarter plot. Begin tallying poles from Pole #1, typically the first pole clockwise from the 135 degree transect.

If species identification differs from that shown on the Pole Sheet, the crew leader and one or more crew members with strong tree identification skills should discuss the identity of the tree and decide collectively that the species should be changed before alterations are made to the data sheet. Check the Notes on the Pole Sheet to see if the species identification has been changed before. If uncertainty exists, err on the side of *not* changing the species.

If you find significant errors in distance or azimuth measures, correct them on the datasheet. Clearly mark a line through the old value and clearly write the new value next to it.

It is ***imperative*** that ***DBH be measured on paint line***, no matter where the paint is on the pole. Even if you feel that the paint was incorrectly placed during the previous visit, measure DBH on the paint line. Do not make a new paint line to try to "correct" DBH or measure diameter in a new location where you think DBH should be. Moving DBH from its previously measured location will cause serious misrepresentation of tree growth (or shrinking trees!).

Pay attention to all poles in the plot to make sure that none were missed during previous visits. Check small trees with diameter close to 5.0 cm to determine if they have "grown in" to the sample by attaining at least 5.0 cm diameter since last visit.

For clumped poles, make sure the correct measurements are recorded for the correct pole. Check the Tree Notes on the Tree Sheet for guidance on the arrangement of the poles in the clump.

Data Collection

POLE NUMBER. Assign each live or dead pole a sequential number, starting with 1, 2, 3, etc, on the quarter plot. The pole closest to the 135 degree transect is labeled 1 and pole numbers are assigned proceeding clockwise around the plot. During revisits, new poles added to the sample should be assigned the next available sequential number at the bottom of the list of poles.

SPECIES. Record the USDA PLANTS code for the genus and species of each pole. Species names follow the Master Plant List in the Vegetation and Soil Monitoring Database, which is based on the USDA PLANTS Database (USDA, NRCS 2007). If species cannot be determined in the field, collect a twig sample with foliage, buds, cones, or flowers, and/or a photograph to

make a positive identification later. Record genus or family if known, and "sp01", "sp02", etc for each unknown species. For standing dead poles that cannot be identified to family, use "UNKCON" for Unknown Conifer and "UNKHDW" for Unknown Hardwood.

DISTANCE. Measure the horizontal distance to the front edge of the trunk from the plot center using the laser. Record the distance to the nearest 0.1 meter. When measuring distance with the laser, the front edge of the laser should be directly over plot center, not your eye. The laser measures distance from the front edge of the instrument, not the eye piece.

AZIMUTH. Measure the azimuth from the plot center to each pole, sighting the center of the base of each pole with a compass. Record the true north azimuth to the nearest degree (see Site Selection and Plot Establishment SOP for compass declination instructions).

Note concerning clumped poles: If the same distance and azimuth are recorded for two or more adjacent poles (the poles are clumped), record some identifying feature of each pole in the Notes section. For example, "left", "middle", and "right" in the Notes section for three adjacent poles would signify that from plot center, the poles were measured from left to right. In general, all clumped poles should be measured clockwise. Recording some manner of identifying individual poles within a clump is important so that the remeasurement of DBH is recorded with the correct pole during the next sampling visit.

DBH. Measure pole diameter at breast height (1.37 m) above the ground on uphill side of pole (see figures in the Tree SOP). Do not measure from a pit or atop a mound or emergent rock. Use the white DBH mark on the Finley pole to consistently find breast height. Round diameter measurement to the nearest 0.1 cm. For unusual situations, refer to the Tree SOP for directions.

POLE STATUS. Record a status code for each pole reflecting its current status.

0 No status. Previously tallied pole is no longer in sample because the pole: a) shrunk below 5.0 cm DBH, b) was incorrectly tallied last time, or c) a change in procedure now excludes this pole. Record reason in Notes.
1 Live pole. New live pole in remeasured plots are assumed to be in-growth. If a tallied new pole was obviously missed during a previous inventory, note this in Notes.
2 Standing dead pole.
3 Removed. Previously tallied pole has been cut and removed by humans during harvest, silviculture treatment, or land clearing.
4 Fallen dead pole. Previously tallied pole has fallen and will no longer be tracked as a live pole.

NOTES: Record any unusual pole features or notes required above, including location of diameter measurement if not measured at breast-height or the relative position of clumped poles that have the same distance and azimuth.

Revision History

Version 1.0 to 1.1 – No Changes

Tree Measurements
Version 1.1 (May 2019)

Overview

This SOP records species, diameter, and condition of all live and standing dead trees ≥10 cm diameter-at-breast-height on 7.3-m radius plots. These data provide information on tree growth, mortality, condition, and stand structure and composition.

Caution

Dead trees can be a safety hazard. Crews must exercise caution. Trees deemed unsafe to measure should be estimated but not touched.

Definitions

Diameter-at-breast-height (DBH) is measured at 1.37 m above the ground line on the uphill side of the tree.

Horizontal distance is the level, straight line distance between two points. This contrasts with slope distance which is measured parallel to the ground surface. Slope distance and horizontal distance are equivalent on flat land. On sloped land, the horizontal distance between two objects is less than the slope distance.

Dead standing trees lack any living parts (i.e., leaves, buds, cambium) at or above DBH, and lean <45 degrees from vertical, as measured along the bole. They need not be self-supported. Once included, standing dead trees are tracked until they no longer qualify as standing dead. Dead trees leaning >45 degrees from vertical are considered coarse woody debris and are measured according to the Coarse Woody Debris SOP.

Live trees have living parts (i.e., leaves, buds, cambium) at or above DBH. Live trees that have been temporarily defoliated or are leaning or fallen are considered live trees. Live trees do not have to be self-supported. They may be supported by other trees, branches, or their crown.

Trees are woody species (live or dead) with a diameter greater than or equal to 10 cm at DBH and capable of attaining heights >7 m. Refer to the Master Plant List to determine which species are considered trees.

Procedure for New Plots

Begin tallying trees from the 0 degree (north) azimuth and continue clockwise around the plot.

A tree on the plot boundary will be included only if the center of the stem lies directly on or within the plot boundary. To determine if the center of the stem falls in the plot, measure the horizontal distance from plot center to the front of a crew member standing adjacent to the stump's center. If this distance is greater than 7.3 m, then the tree falls outside the plot and is not tallied. The lean of the tree bole into or out of the plot does not affect whether the tree is tallied.

For each tree, measure and record the horizontal distance to the front edge of the trunk from plot center using the laser. The front end of the laser (not your eye) should be over plot center while taking the distance measurement. Make sure that "HD" is visible in the laser viewfinder while all distance measurements are taken. If a tree bole is leaning significantly into or out of the plot, do

not shoot the tree bole with the laser unless you can see the base of the tree in the viewfinder. Instead, have a crew member stand adjacent to and level with the front of the tree base. Measure the distance to the front of the crew member with the laser.

Measure and record tree azimuth from plot center using a compass. If a tree leans significantly to the right or the left, measure the azimuth from plot center to the center of the stump, not the bole.

Measure the diameter at breast height, using the white DBH mark on the Finley pole to identify the correct DBH height. Unusual DBH situations are discussed below. Use the tree paint to create a horizontal line 5–7 cm in length and perpendicular to the tree axis on the bark of the tree at the location DBH was measured. This will allow accurate remeasurement of DBH during return visits. The paint line should face plot center.

Procedure for Plot Revisits

Unique Tree Sheets are created for each plot at the beginning of the season based on tree data from the previous sampling visit. Tree Sheets provide the tree numbers, species, distance, azimuth, and previous status for each tree. Use the information on the Tree Sheet to locate each tree in the plot. Begin tallying trees from Tree #1, typically the first tree clockwise from the 0 degree (north) transect.

If tree species identification differs from that shown on the Tree Sheet, the crew leader and one or more crew members with strong tree identification skills should discuss the identity of the tree and decide collectively that the species should be changed before alterations are made to the data sheet. Check the Tree Notes on the Tree Sheet to see if the species identification has been changed before. If uncertainty exists, err on the side of *not* changing the species.

If you find significant errors in distance or azimuth measures, correct them on the datasheet. Clearly mark a line through the old value and clearly write the new value next to it.

It is ***imperative*** that ***DBH be measured at the paint line***, no matter where the paint is on the tree. Even if you feel that the paint was incorrectly placed during the previous visit, measure DBH at the paint line. Do not make a new paint line to try to "correct" DBH or measure diameter in a new location where you think DBH should be. Moving DBH from its previously measured location will cause serious misrepresentation of tree growth (or shrinking trees!). If calipers were used to measure DBH during the last visit due to large vines, use calipers to remeasure DBH.

Pay attention to all trees in the plot to make sure that no trees were missed during previous visits. Check small trees with diameter close to 10 cm to determine if they have "grown in" to the sample by attaining at least 10 cm diameter since last visit. Check trees on the plot boundary to determine if they were properly included or excluded. If uncertainty exists, err on the side of *not* changing the previous tally. Trees cannot grow into the plot from across the plot boundary because the distance measurement is taken to the center of the tree stump, which does not change as the tree grows. Use the procedures outlined above in "Procedure for New Plots" and below in "Data Collection" to mark and record data on new trees.

For clumped trees, make sure the correct measurements are recorded for the correct tree. Check the Tree Notes on the Tree Sheet for guidance on the arrangement of the trees in the clump.

Data Collection

TREE NUMBER. Assign each live or dead tree >10 cm DBH a sequential number, starting with 1, 2, 3, etc, on the 7.3-m radius plot. The tree closest to the 0 degree transect is labeled 1 and tree numbers are assigned proceeding clockwise around the plot. During revisits, new trees added to the sample should be assigned the next available sequential number at the bottom of the list of trees.

SPECIES. Record the USDA PLANTS code for the genus and species of each tree. Species names follow the Master Plant List in the Vegetation and Soil Monitoring Database, which is based on the USDA PLANTS Database (USDA, NRCS 2007). If species cannot be determined in the field, collect a twig sample with foliage, buds, cones, or flowers, and/or a photograph to make a positive identification later. Record genus or family if known, and "sp01", "sp02", etc for each unknown species. For standing dead trees that cannot be identified to family, use "UNKCON" for Unknown Conifer and "UNKHDW" for Unknown Hardwood.

DISTANCE. Measure the horizontal distance to the front edge of the trunk from the plot center using the laser. Record the distance to the nearest 0.1 meter. When measuring distance with the laser, the front edge of the laser should be directly over plot center, not your eye. The laser measures distance from the front edge of the instrument, not the eye piece. Remember that horizontal distance is the distance that determines if a tree is in the plot, not slope distance.

AZIMUTH. Measure the azimuth from the plot center to each tree, sighting the center of the base of each tree with a compass. Record the true north azimuth to the nearest degree (see Site Selection and Plot Establishment SOP for compass declination instructions).

Note concerning clumped trees: If the same distance and azimuth are recorded for two or more adjacent trees (the trees are clumped), record some identifying feature of each tree in the Notes section. For example, "left", "middle", and "right" in the Notes section for three adjacent trees would signify that from plot center, the trees were measured from left to right. In general, all clumped trees should be measured clockwise, from left to right. Recording some manner of identifying individual trees within a clump is important so that the remeasurement of DBH is recorded with the correct tree during the next sampling visit. For clumped trees that are not near the plot boundary, the distance and azimuth for each tree can be measured at the point on the tree at which DBH was measured, instead of at the center of the trunk base. This will provide distinctive distance and azimuth readings for each tree in the clump. Do not use this method near the plot boundary where distance is used to determine if trees are in or out of the plot.

DBH. Measure tree diameter at breast height (1.37 m) above the ground on uphill side of tree (see figures below). Do not measure from a pit or atop a mound or emergent rock. Use the white DBH mark on the Finley pole to consistently find breast height. Round diameter measurement to the nearest 0.1 cm.

Make certain that you are reading the correct side of the DBH tape; often one side has standard centimeters and the other side has units calibrated to give the diameter in centimeters when wrapped around the circumference of the tree. Press the hook at the end of the tape into the bark and then run the tape around the trunk, ensuring that the tape is straight and pulled perpendicular to the axis of the trunk (see figures below). Tapes that are not run straight will overestimate the

trunk diameter. Wrap the tape tightly around the tree and read the number where the tape crosses the zero mark at the hook end of the tape.

For unusual situations, determine where DBH should be located on the tree using the guidelines below (also see illustrations below). Always mark the tree where DBH is taken, even if DBH is taken in an unconventional place on the trunk. Note the location of the DBH measurement in Tree Notes, using distances and unique tree characteristics.

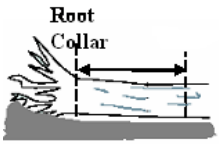
When **re-measuring the diameter of a tree tallied in a previous survey, always take the measurement at the paint mark** unless it is physically impossible (e.g., tree buried by mudslide, paint cannot be found) or there is a new abnormality at the previous diameter measurement point. The data recorder will have the tree DBHs from the previous visit, however, the recorder may not share the previous DBH measurements with the crew member measuring the trees in order to avoid biasing the current measurements. The recorder should make sure that the current tree DBH is greater than or equal to the previous visit's DBH and that the tree has not grown more than 3 cm or shrunk more than 0.3 cm since the previous visit. If the DBH falls within those parameters, the DBH is recorded for the tree. If a live tree has grown more than 3 cm or shrunk more than 0.3 cm, remeasure DBH to determine that there was no error in the current measurement. If the second measurement does not change, record it as the DBH and write in the Notes section that the DBH was double checked. If it is clear that the previous visit's DBH was not measured at the paint mark (due to a swelling, branch, or abnormality), measure above and below the abnormality and select the location that was most likely measured during the previous visit. Write detailed notes in the Note section describing where DBH was taken. Always complete the Diameter Check field and note deviations from previous measurements in the Tree Notes section.

Irregularities at DBH: If there is an abnormality (e.g., swelling, bump, depression, or branch) at DBH, take the measurement just below the abnormality if possible. If the abnormality extends far below DBH, then take the measurement just above DBH. Describe the location of the measurement in Tree Notes.

Missing wood or bark: Do not reconstruct the DBH of a tree that is missing wood or bark. Record diameter of the wood and bark as the tree is, and note that wood or bark was missing in Tree Notes.

Leaning tree: Diameter is always measured perpendicular to the bole axis. Find the point equivalent to breast height (1.37 m) by measuring along the uphill side of the tree. Measure diameter perpendicular to the bole as shown in Picture 3–Leaning Tree below.

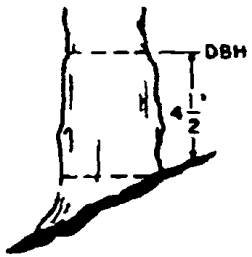
Curved bole: Treat a curved bole as if it were a leaning tree. Measure a straight line from the uphill side of the tree base to 1.37 m. Do not measure along the curve of the bole.



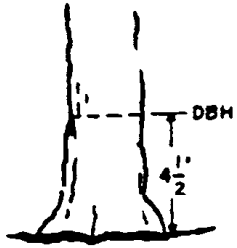
Live windthrown tree: Find the point equivalent to breast-height (1.37 m) by measuring from the top of the root collar along the bole, as shown in picture at right.

Swollen bases: Trees with swollen bases rising higher than 1.0 m are measured 0.5 m above the top of the swelling. Trees with swelling below 1 m are measured at standard DBH.

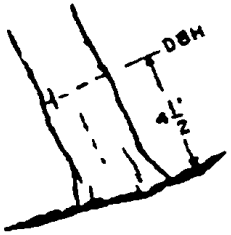
DIAMETER BREAST HIGH MEASUREMENT IN A VARIETY OF SITUATIONS



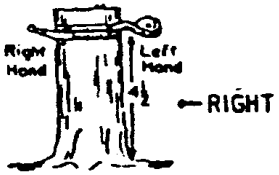
1. Tree on slope



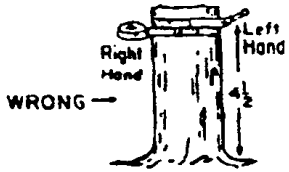
2. Tree on level ground



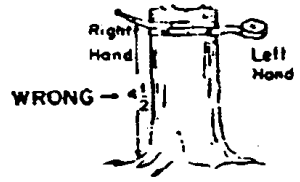
3. Leaning tree



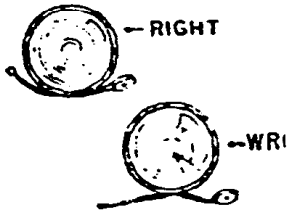
LEFT HANDED - Right hand crossed under.

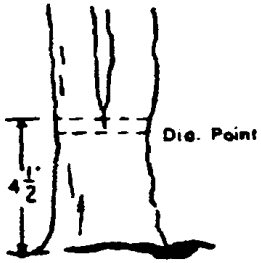


RIGHT HANDED - Left hand crossed over.

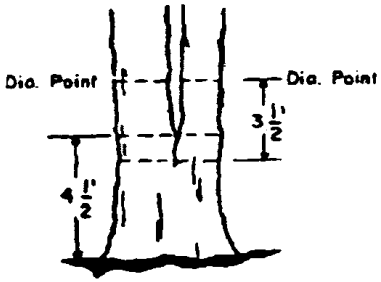


LEFT HANDED - Right hand cross

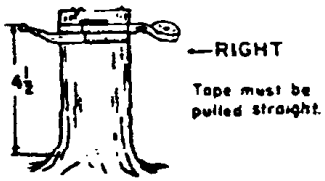




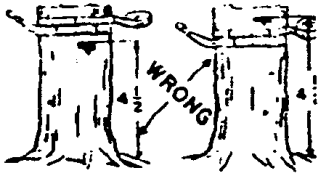
4. Tree forking at or above 4 1/2 feet



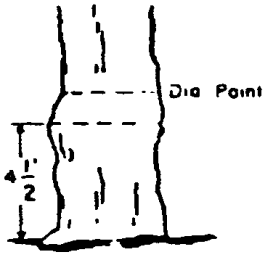
5. Tree forking below 4 1/2 feet



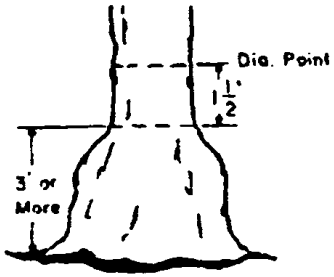
Tape must be pulled straight.



Always assume that the 4 1/2 ft D.B.H. point is at the top of lower tape at this point



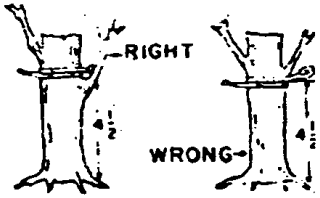
6. Tree deformed at 4 1/2



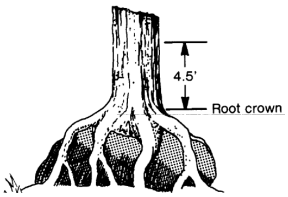
7. Bottleneck tree

The tape must be at right angles to the lean of the tree.

Don't place tape at abnormal place on the bole



Independent trees that grow together: If two or more independent stems have grown together at or above the point of DBH, continue to treat them as separate trees. Estimate the diameter of each, and explain the situation in Tree Notes.



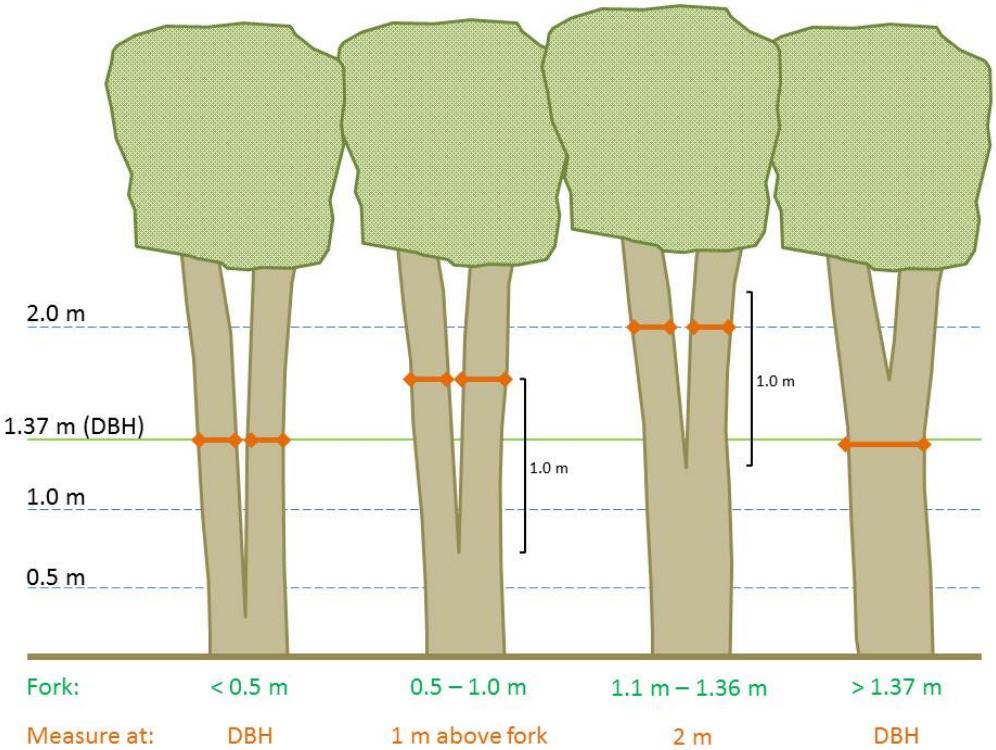
Trees growing on objects: When trees are growing on objects, such as rocks or logs, measure diameter at 1.37 m above the root crown rather than above the forest floor.

Large Vines on Tree Boles: For trees with many large vines (poison ivy or otherwise) on the trunk, measure the diameter of the trunk with the calipers at standard DBH height. If the trunk is not circular, measure the diameter with the calipers from two perpendicular directions and record the average of the measurements. Record in the Tree Notes section that calipers were used.

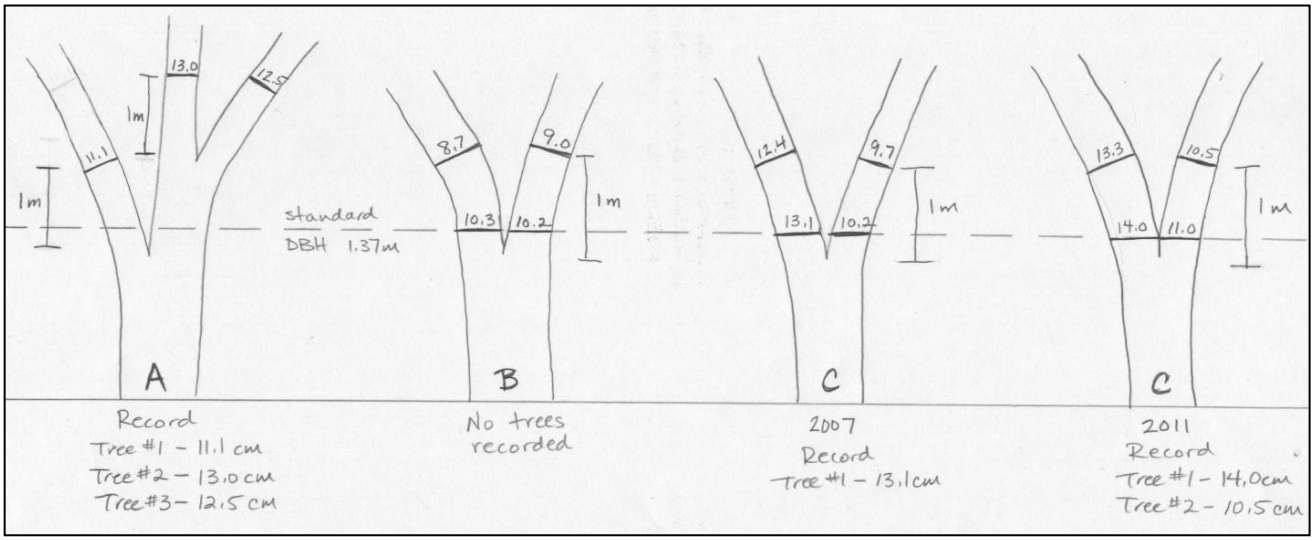
Forked tree: Trees which fork at or above breast height (1.37 m) are tallied and measured as one tree. Diameter should be measured below the point at which forking affects DBH (see Picture 4 above). Paint the trunk with a horizontal mark where DBH was measured. This point should be recorded in Tree Notes.

For trees that fork below breast height (1.37 m), each trunk ≥10 cm is tallied as a separate tree. Use the following rules to measure the DBH of forked trees:

- If the fork is less than 0.5 m above the ground, measure DBH of each trunk at standard breast height (1.37 m).
- If the fork is greater than 0.5 m above the ground, measure the diameter of each trunk at 1 m above the fork, up to a maximum height of 2 meters. Do not measure DBH above 2 meters from the ground to ensure that all future crew members will be able to reach the measurement point.



- If the diameter measurement is < 10 cm for each stem at 1 m above the fork, then the tree is not tallied, even if the diameter measurement at standard DBH height is >10 cm (see Tree B below).
- For trees with multiple forked stems, measure diameter at 1 m above the highest reachable fork to which that stem is connected, as long as stems are >10 cm in diameter (see Tree A below).
- See Tree C below. In 2007, only one stem with diameter of 13.1 is recorded because the smaller stem is <10 cm in diameter at 1 m above the fork. However, in 2011, the smaller stem has grown to >10 cm in diameter at 1 m above the fork. Therefore, the smaller stem is measured at 1 m above the fork, however, the larger stem is still measured at standard DBH where it was originally measured in 2007.
- For clumped or forked trees, stems should be recorded from left to right when facing the trees from plot center. Note the spatial relationship of forked trees to each other in Tree Notes.
- Paint each trunk with a horizontal mark where DBH was measured.



During plot revisits, it is ***imperative*** that ***DBH be measured on the paint mark***, no matter where the paint is on the tree. Even if you feel that the paint mark was incorrectly placed during the previous visit, measure DBH on that mark. Do not make a new paint mark to try to "correct" DBH or measure diameter in a new location. If the Tree Notes indicate that calipers were used for previous diameter measurement, use BOTH tape AND calipers to measure the current diameter. Record both values on the datasheet, clearly indicating which diameter corresponds with which instrument.

DIAMETER CHECK. Record a code for each tree to identify any irregularities in diameter measurement that may affect use of the tree in growth/change analyses. If both codes 1 and 2 apply, use code 2. If code 4 and codes 1 or 2 apply, use code 4. Record in the Tree Notes the words for the second applicable code and why the irregularity occurred (e.g. paint mark could not be found, large poison ivy vines, etc.).

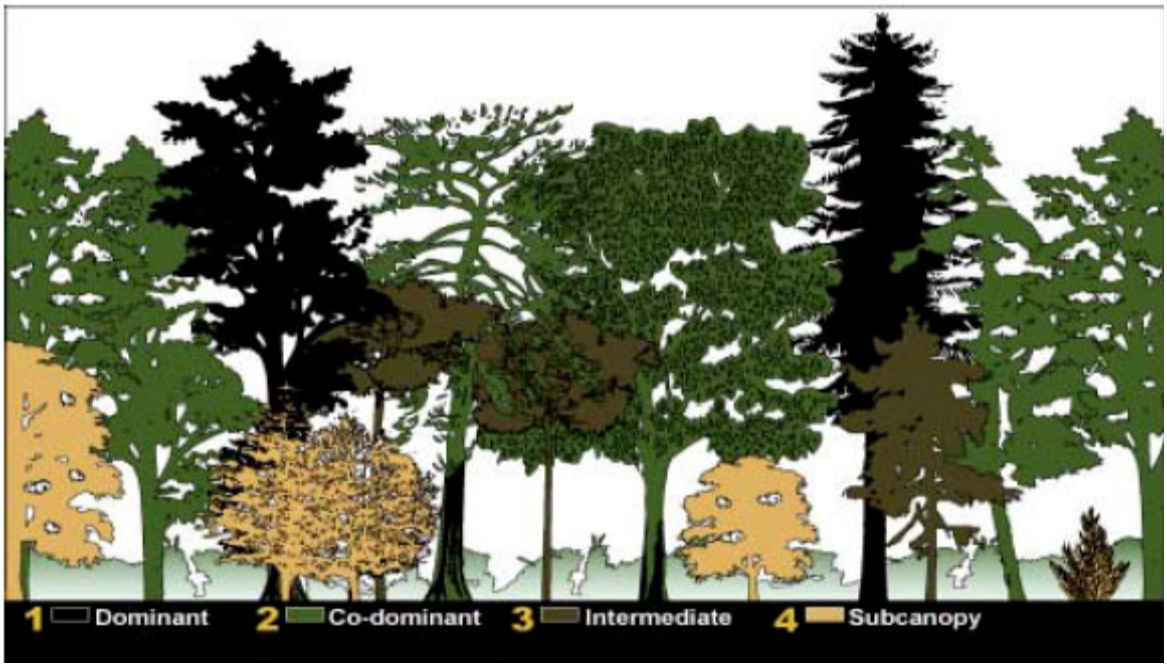
0 Diameter measured accurately.
1 Diameter estimated.
2 Diameter measured at a different location than previous measurement.
3 Code no longer used as of 2014
4 Diameter measured at previous location, but the DBH has changed significantly.

TREE STATUS. Record a status code for each tree reflecting its current status.

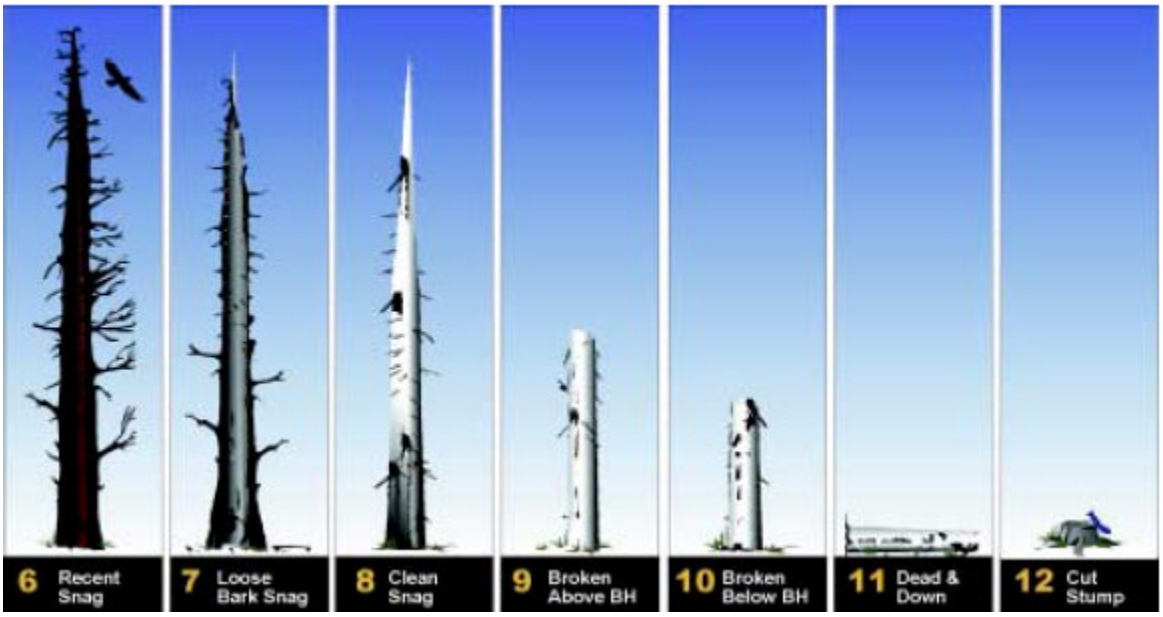
0 No status. Previously tallied tree is no longer in sample because the tree: a) shrunk below 10.0 cm DBH, b) moved outside the plot boundaries, c) was incorrectly tallied last time, or d) a change in procedure now excludes this tree. Record reason in Tree Notes.
1 Live tree. New live trees in remeasured plots are assumed to be in-growth. If a tallied new tree was obviously missed during a previous inventory, note this in Tree Notes.
2 Standing dead tree.
3 Removed. Previously tallied tree has been cut and removed by humans during harvest, silviculture treatment, or land clearing.
4 Fallen dead tree. Previously tallied tree has fallen and will no longer be tracked as a live tree.

CROWN CLASS. Assign crown class code describing tree crown position in canopy and amount of sunlight received (see illustrations below). Use codes 1 – 5 for live trees and codes 6 – 10 for dead trees as follows:

1 Dominant – crown extends above the general level of the canopy, receiving full light from above and some light from sides. These trees are taller than the average tree in stand and have well-developed crowns, but may be crowded from the sides.
2 Co-dominant – crown at the general level of the canopy, receiving full light from above but little direct light from sides. Typically, co-dominant trees have medium-sized crowns and are crowded on the sides; in dense stands, co-dominant trees have small crowns.
3 Intermediate – tree is shorter than co-dominant trees, but with a crown either below or extending into the crowns cover formed by the co-dominant and dominant trees; these trees usually have small crowns and are considerably crowded on the sides.
4 Subcanopy – crown is entirely below the general level of the canopy and receives no direct light from above or from the sides, except in newly formed canopy gaps.
5 Open Grown / Isolated – Trees receiving full sunlight from above and all sides. Typically, these are single tree of the same general height and size as other trees in the area, but where the stand is open and trees are widely separated so dominance is difficult to determine.



6 Recent Snag – Trees that are recently dead with bark intact. Branches and needles may also be intact.
7 Loose Bark Snag – Trees that have been dead several years on which the back is partially deteriorated and fallen off; tops are often broken.
8 Clean Snag – Trees that have been dead several years with no bark left. Usually most of the branches will be gone as well; tops are often broken.
9 Broken Above BH – Trees that have been dead a long time with no bark, extensive decay, and that are broken above breast height.
10 Broken Below BH – Postburn trees that extended above breast height preburn, but no longer do. Note: Only record data for a tree the first time you find it down.



TREE NOTES: Record any unusual tree features or notes required above, including location of diameter measurement if not measured at breast-height or the relative position of clumped trees that have the same distance and azimuth. Record the species of vine present.

References

Miller, I., D. Lachance, W. G. Burkman, and D. C. Allen. 1991. North American Sugar Maple Decline Project: organization and field methods. General Technical Report NE-154. Radnor, PA: US Department of Agriculture, Forest Service, Northeastern Forest Experiment Station.

Pyle, C., and M. M. Brown. 1998. A rapid system of decay classification for hardwood logs of the eastern deciduous forest floor. Journal of the Torrey Botanical Society 125: 237–245.

United States Forest Service. 2005a. Forest Inventory and Analysis National Core Field Guide Phase 3 – Crowns: Measurements and Sampling. Version 3.0. United States Forest Service.

United States Forest Service. 2005b. Forest Inventory and Analysis National Core Field Guide Phase 3 – Downed Woody Materials. Version 3.0. United States Forest Service.

Revision History

Version 1.0 to 1.1 – No Changes

Data Quality Assurance and Quality Control
Version 1.1 (May 2019)

Overview

Careful, accurate data collection and stewardship are critical to the success of the vegetation monitoring program. This SOP describes data quality assurance and quality control (QA/QC) procedures for the vegetation monitoring process. Ensuring data quality must be a priority during training, and throughout the data collection, entry, verification, and validation process.

Training

The crew leader is responsible to ensure that all crew members:

1) can correctly identify plant species,
2) understand all field protocols,
3) understand data fields and values on paper field forms and in the database.

Crew members are responsible for learning species identification, field protocols, and all data fields and values on paper field forms and in the database. In addition, each crew member is responsible to do the following whenever they are unsure or unclear about the protocol:

1) Do not guess or decide for yourself.
2) **Read the relevant standard operating procedures** in the binder.
3) Ask the crew leader or other crew members.
4) Call the supervisor.
5) Take copious and clear notes about the uncertainty.
6) Follow through to securing guidance and correcting the uncertainty.
7) Err on the side of collecting too much data.

Data Collection

All data values shall be called out and repeated when one crew member is measuring and one crew member is recording. The measurer shall clearly call out the value record. The recorder shall clearly repeat the value aloud as it is recorded, to ensure that the value was heard and recorded accurately. If the measurer does not hear a response from the recorder, the measurer shall repeat calling out the measurement until a response is obtained. **Print legibly** all information on datasheets using pencil.

At the end of every plot, before the crew leaves the site, crew members must review all sections of the paper data sheets to ensure all fields are complete and no obvious errors exist. Each data sheet must be reviewed by someone other than the person who originally recorded the data on that sheet. Once it has been determined that the data sheet is complete, a crew member will sign his or her initials in the "DATA QC" box in the upper right hand corner of the page. The most common data omissions are:

- Any data associated with the last few trees in the plot
- Microplot Vegetation Characterizations (% cover of nonvascular, vine, graminoid, etc)

Scan the original paper data sheets to electronic .pdf files within one week of data collection, and check to ensure all original data is present and legible. Deliver the electronic files to the ERMN Plant Ecologist to store them in a building separate from the original data sheets.

Revision History

Version 1.0 to 1.1 – No Changes