

Forest Structure & Composition Monitoring Protocol Standard

Background:

In 2009, after several years of collaboration by partners in the Allegheny Highlands landscape of the Appalachian Fire Learning Network (FLN), The Nature Conservancy and George Washington and Jefferson National Forests adopted the Forest Structure and Composition Monitoring Protocol for use in controlled burns and other vegetation management treatments. Before developing this protocol, partners first identified the specific characteristics or attributes that could be used to define an ecological system's integrity or condition. By assessing the current state of these attributes for ecological systems found in the region, partners generally found that Appalachian pine-oak forests have experienced increased canopy closure, increased density of fire-intolerant species, diminished oak and pine regeneration, and lack of herbaceous groundcover from their historic range of variability. Partners subsequently determined desired landscape conditions for those systems and developed key indicators for successful maintenance and restoration of those conditions. This Monitoring Protocol was specifically designed to measure changes in those key indicators of ecological condition over time. Data collected for this Protocol is designed to be entered into a shared FEAT/FIREMON Integrated (FFI) database for retrieval and analysis.

Objectives:

This Monitoring Protocol was developed as part of an adaptive management program. As such, monitoring objectives are derived from resource and fire management program objectives which should be periodically re-evaluated. Examples of management or burn objectives designed to be measured by this Monitoring Protocol include:

- Decrease overall canopy cover from 90% Pre Burn to 80% one full year post-burn.
- Decrease deciduous canopy cover by 10% from Pre Burn conditions within one year post-burn.
- Decrease the number of stems <4" dbh of fire-intolerant/shade-tolerant trees/shrubs (e.g., red maple, white pine, yellow poplar) in the mid-story by 50% within 5 years post-burn.
- Decrease the number of red maple stems 1-4" dbh by 50% within one year post-burn.
- Decrease the number of sassafras stems < 1" dbh to 200 stems/acre within 5 years post-burn.
- Increase groundcover of native graminoids by 5% within one year post-burn.
- Increase the number of snags >4" dbh by 5% within one year post-burn.
- Increase the number of regenerating *Quercus* spp. stems/acre by 5% within 5 years post-burn.

Monitoring Objectives: To estimate forest structure and composition within the controlled burn or treatment area.

Sampling Objective: Estimate with 90% confidence all forest structure and composition variables within 20% of their true values. Refer to the Fire Monitoring Handbook (2003) or the Southern Region Prescribed Fire Effects Monitoring Guidebook (2011) for further information on goal and objective setting.

Plot Location and Establishment:

FLN partners initially desired to establish plots in three broad community types: dry, dry-mesic, and mesic. Since that time, the George Washington National Forest revised Land and Resource Management Plan (anticipated 2013) identifies several broad ecological system groups which align to these FLN broad community types, e.g., pine forests and woodlands, oak forests and woodlands, cove forests. At a minimum and when possible, plots should be distributed equally across these broad types within treatment units. Where establishment across all broad types within a unit is not possible, managers should aim for equal distribution across a landscape or larger management unit. Ecological zones (Simon 2011) can also be used to categorize plots and later combined into broader types during analysis. Other monitoring types (e.g., table mountain pine, old growth, commercial harvest) could also be considered for locating plots. See the Southern Region Prescribed Fire Effects Monitoring Guidebook (2011) for further guidance on plot selection. *Reference Appendixes I and II for a crosswalk of community and system types.*

All plots should be located based upon the following guidelines:

- Locate plot center at least 90' from a road or trail and from a major landform or vegetation type break to eliminate "edge-effect" and potential differences in fire behavior.
- Locate plot centers at least 90' apart to eliminate possibility of double counting trees with the prism method.
- Determine plot center location by a method that ensures an unbiased location selection. Suggested methods include: using ArcGIS Hawth Tools on a map of unit, or when in field, close eyes, turn around three times and throw a rock over your shoulder.
- Geo-reference plot centers with a GPS unit and define the plot center with a stake (rebar is recommended, but other materials may be used). It is recommended that three reference trees near plot center are also marked, their species noted, and distance and direction from plot center recorded.

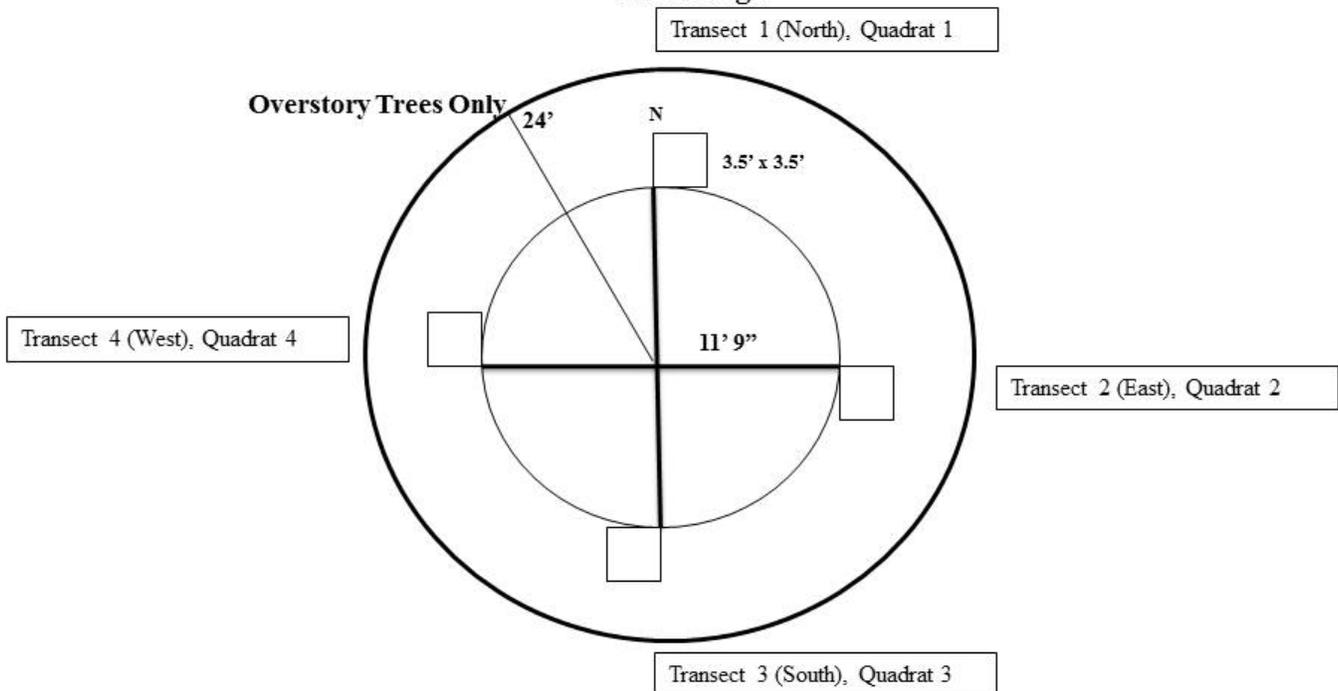
Sampling Methods:

This Monitoring Protocol uses a nested macro plot design and standard vegetation monitoring methods. These methods include: 11' 9" radius circular plots (0.01 ac), 11' 9" long transects, 3.5' x 3.5' quadrats, and fixed radius circular basal area (.24 ac) samples.

Plot Installation:

To define plot boundaries use measuring tape or cord cut to size to measure from the plot center out 11' 9". Quadrats are located at the end of each 11' 9" radius along each cardinal direction.

Plot Design



Field Equipment Recommended:

2' rebar, 4' conduit, or t-post for marking plot centers
Hammer
Compass (2)
Clipboards (2)
GPS
Pencils
Sharpies
Site maps
Monitoring Protocol (Rite-in-Rain)
Copies of Data Forms (Rite-in-Rain)
Tape measures (2)
Cord (11' 9" long)
Cord (24' long)

Tree Tags (Brass or aluminum)
Tree Nails
Diameter tape (feet/inches)
Tree ID book
Digital Camera
GRS Densimeters
3.5' x 3.5' quad frame (1)
Flagging
Paint for marking center point/reference trees
Range pole
Small Dry Erase Board
Dry Erase Markers

Photo Point Monitoring Methods:

Take 4 photographs of the habitat structure from the center of the plot: one facing North, one facing the canopy directly over plot center, one looking down on plot center, and one facing South (see examples below). Include in the photo an information board with the following:

Unit Name and Plot Number
Month/Date/Year
Direction of Photo
Monitoring Status: (Preburn, Baseline, Burn 1 Immediate Post, Burn 1 Year 1, etc.)



- Lean the information board against the range pole or have a second person hold it in the photo frame view. DO NOT stand in the center of frame holding the photo board.
- Place camera over plot center and set range pole 11'9" away. Take picture with camera lens zoomed out to include as much of the landscape as possible.
- Focus the camera on the environment surrounding the plot, not the person holding the information board or the board itself.
- Make sure the camera is set for the correct exposure and aperture for existing light conditions.



- It is very important to duplicate the same view of trees and other vegetation in subsequent photos. If possible, attach copies of all photos to your field notes and take them with you on each visit.

Name each photo according to the FFI file and photo naming convention:

Region#Forest#District#_BurnUnitName_MonitoringStatus_Bearing_YearMonthDate

Example of photo naming convention: 080815_MudBranch01_Baseline_North_20100507

Reference Appendix II for forest and district codes.

Cover Points by Transect (Canopy cover estimates using a densiometer): Using a Geographic Resource Solution (GRS) densiometer, determine canopy cover (deciduous, evergreen, sky) at 20 points within each plot. Beginning 2’4” from plot origin, face North and walk out along the transect taking a reading every 2’ 4”, tallying canopy cover in table on Cover Points by Transect data form (1 tally per 2’4” reading, 5 tallies per transect). Record only what falls in the cross hair of the densiometer; do not move vegetation out of the way. Record dead branches or limbs as Sky cover. Record deciduous evergreen as evergreen and make a note on the data form. Record total hits per canopy cover type for each transect. Repeat facing East, South and West. *Reference Appendix IV for directions on GRS Densiometer use.*

Cover Frequency (3.5’ x 3.5’ quadrats understory cover including Woody Stems up to 3.5’ tall): Estimate percent aerial cover of grasses (including sedges & rushes), forbs (broad leaved plants, non-woody), ferns (including ferns, clubmoss, and horsetails), trees/shrubs, woody vines and priority non-native invasive species by cover class. Aerial cover is defined as the percentage of ground obscured by vegetation. Measure the area of ground cover by the outermost perimeter of the natural spread of plant leaves. Small openings within the canopy are included. Record the name of any priority non-native invasive species under the comments column on the data sheet. Include sub-shrubs in the forb category. *Reference Appendix VI for definitions of life-forms.*

Density- Quadrats (3.5’ x 3.5’ quadrats density only woody stems 6” to 3.5’ tall): Count all woody stems (trees and shrubs ONLY) 6” to 3.5’ in height. Tally by species.

Trees- Individual OVERSTORY (Trees/Shrubs 4.0” and larger DBH and >3.5’ tall):

Measure DBH and tag all overstory trees within the sampling area (24 ft. radius from plot center). Record species, tag number, status, and crown class for each tree measured. Living and dead trees are tagged with sequentially numbered brass or aluminum tags nailed into the trees at breast height. Orient the tags so that each faces the plot center. Start in the North quadrat (1), and move clockwise ending in the West quadrat (4).

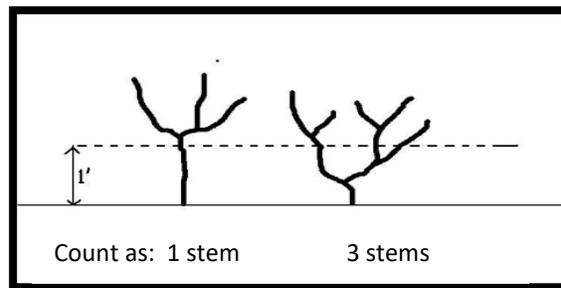
- Drive nail into the tree at BH, so that the tag hangs down and away from the tree and several centimeters of nail remains exposed, leaving ample space for tree growth.
- Measure DBH just above the nail. Include trees on the plot boundary line if >50% of their bases are within the plot. Include snags; note individual as “SNAG” if you cannot identify what the species was when alive.
- Record crown class using the codes below. *For assistance determining crown position and snag codes, reference Appendix VIII.*

Crown Class

O	Open Grown	RS	Recent Snag
E	Emergent	LBS	Loose Bark Snag
D	Dominant	CS	Clean Snag
C	Codominant	BAD	Broken Above DBH
I	Intermediate	BBD	Broken Below DBH
S	Suppressed	DD	Dead and Down
SC	Subcanopy	CUS	Cut Stump

Trees- Individual (Trees/Shrubs 1.0” – 3.9” DBH and >3.5’ tall): Measure DBH on all tree/shrub saplings (stems <4.0” and > 1.0” DBH and > 3.5’ tall). Record DBH and species for each tree/shrub measured. Include snags; if species of a dead tree or shrub is unknown record as SNAG under species column on the data sheet. Start in the North quadrat (1), and move clockwise ending in the West quadrat (4). *Reference Appendix V for DBH measuring guidelines.*

Trees- Saplings (Diameter Class) (Trees/Shrubs 0.1” – 0.9” DBH and >3.5’ tall): Count and record number of stems by species for all tree/shrub saplings < 1.0” DBH and > 3.5’ tall. **Note:** Each stem that branches off less than 1’ from the ground is considered an individual. Start in the North quadrat (1), and move clockwise ending in the West quadrat (4). *Reference Appendix VII for examples of the Forest Structure and Composition Monitoring FFI Picklist of common species and USDA species symbols.*



How to count resprouts-If the bole of a fallen tree is below Breast Height (BH), and the individual is resprouting, treat the sprouting branches as individuals and place them in the appropriate size class (seedling, pole or overstory). Include clarifying comments on data sheet, especially for resprouting trees. If the main bole of a sprouting species has died, but the tree is sprouting from the base, consider the main bole dead.

Timing, Frequency and Monitoring Status: *Refer to Appendix IX for list of monitoring status categories*

- Monitoring will be conducted Pre Burn to establish a baseline.
- Conduct monitoring during growing season during the visit Pre Burn and preferably at same time of year for each subsequent re-sampling post-burn.
- Take photo points within 6 months of burn for immediate post-burn effects (optional), which will be referred to as Burn01ImmedPost (or number of times the unit has been burned).
- Re-sample plots 1 full year after the burn, during the same season as the Pre Burn visit (which may be second growing season post-burn). Therefore, Year 1 monitoring should be conducted 1 full growing season after the burn has taken place.
- Data should be collected again after 5 full years after the first burn. If this unit is re-burned before this time, start monitoring sequence over beginning with Burn 02 Year 1.
- If a unit is planned for burning and has a Pre Burn visit but is NOT burned, Pre Burn data should be re-collected every 5 years.
- If a unit has been burned prior to the installation of monitoring points, use the Baseline category as the first monitoring status instead of Pre Burn.

Appendix I: Crosswalk of Communities and System Types *Crosswalk between Ecological Zones, GW ESE Tool Systems, NatureServe Ecological Systems, Virginia Natural Heritage Program Ecological Groups or Community Types, and Allegheny Highlands FLN Systems. *See Appendix II for note.*

Ecological Zone	map code	GW ESE Tool Systems (Forest Plan)	map code	NatureServe Ecological System	map code	LANDFIRE BpS	Virginia Heritage Program Ecological Groups or Community Types	FLN Systems	
Spruce	1	Spruce Forest	1	Central and Southern Appalachian Spruce-Fir Forest	1	6113500 5713500	Spruce-Fir Forests	Mesic	
Northern Hardwood Slope	2	Northern Hardwood Forest	2	Appalachian (Hemlock)-Northern Hardwood, Southern Appalachian Northern Hardwood	2	6113700	Central App. Northern Hardwood Forests		
Northern Hardwood Cove	3	Cove Forest	3			6113090 5713090	High Elevation Rich Cove Forests		
Acidic Cove	4			6113180 5713180	Acidic Cove Forests				
Spicebush Cove	25				Acidic Cove Forests, High Elevation				
Rich Cove	5				Appalachian Rich Cove Forest				
Alluvial Forest	6			Floodplains, Wetlands, and Riparian Areas	4	Central Appalachian River Floodplain, Central Appalachian Stream and Riparian	6		6114710 5714710
Floodplain Forest	23	6114720 5714720	Piedmont / Mt. Floodplain Forests						
High Elevation Red Oak	8	Oak Forests and Woodlands	5	Central and Southern Appalachian Montane Oak	8	6113200 5713200	Northern Red Oak Forests		Dry-Mesic
Montane Oak Rich	24			Southern Appalachian Oak Forest	9	6113150 5713150	Central Appalachian Montane Oak-Forest (Rich Type)		
Montane Oak Slope	9						Montane Mixed Oak and Oak-Hickory Forests		
Montane Oak Cove	15			Montane Mixed Oak and Oak-Hickory Forests					
Colluvial Forest	7			Northeastern Interior Dry-Mesic Oak Forest	13	6113030	Montane Mixed Oak and Oak-Hickory Forests		
Dry Mesic Oak	13			S. Ridge & Valley / Cumberland Dry Calcareous Forest	14	6113760 5713760	Dry-Mesic Calcareous Forests		
Dry Mesic Calcareous Forest	14			Central Appalachian Dry Oak-Pine Forest	10	6113690	Oak / Heath Forests		
Dry Oak Evergreen Heath	10								
Dry Oak Deciduous Heath	11								
Low Elevation Pine	16	Pine Forests and Woodlands	6	Southern Appalachian Low-Elevation Pine	16	6113530 5713530	Pine-Oak / Heath Woodlands (in part) Oak / Heath Forests (in part)	Dry	
Pine-Oak Heath (eastside ridge)	17			Southern App. Montane Pine Forest and Woodland, Central Appalachian Pine-Oak Rocky Woodland (in part)	18	6113520 5713520	6113770 5713770		Central and Southern Appalachian Pine-Oak / Heath Woodlands
Pine-Oak Heath (westside ridge)	18								
Pine-Oak Heath (ridgetop)	19			Central Appalachian Pine-Oak Rocky Woodland (in part), Appalachian Shale Barrens	22	6113770 5713770	6113400		Central Appalachian Xeric Shale Woodland
Pine-Oak Shale Woodlands	22								
Shale Barren	21	Cliff, Talus and Shale Barrens	7	Appalachian Shale Barrens	21	6113400	Central Appalachian Shale Barrens		
Alkaline Woodland	12	Mafic Glade and Barrens and Alkaline Glades & Woodlands	8	Central Appalachian Alkaline Glade and Woodland	12	6114000	Montane Dry Calcareous Forest & Wdls.	Dry-Mesic	
Mafic Glade and Barren	26			Southern and Central Appalachian Mafic Glade and Barrens	26	N/A	Low Elevation Basic Outcrop Barrens,		
							High Elevation Outcrop Barrens		
						Mt. & Piedmont Basic Woodlands			



Appendix II: Crosswalk of Communities and System Types *Crosswalk between Ecological Zones, Jefferson ESE Tool Systems, NatureServe Ecological Systems, Virginia Natural Heritage Program Ecological Groups or Community Types, and Allegheny Highlands FLN Systems. *Note: Map codes 16 and 17 are different between the GW and Jefferson; however this will not affect use in GIS because the two forests are in separate shapefiles.*

Ecological Zone	Map Code	Jeff ESE Tool Systems (Forest Plan)	NatureServe Ecological System	Virginia Heritage Program Ecological Groups or Community Types	FLN Systems
Spruce	1	Spruce Forest	Central and Southern Appalachian Spruce-Fir Forest	Spruce and Fir Forests	Mesic
Northern Hardwood Slope	2	Northern Hardwood Forest	Appalachian (Hemlock)-Northern Hardwood/Southern Appalachian Northern Hardwood	Northern Hardwood Forests	
Northern Hardwood Cove	3	Cove Forest	Southern and Central Appalachian Cove Forest	High Elevation Rich Cove Forests	
Acidic Cove	4			Acidic Cove Forests/High Elevation Acidic Cove Forest	
Rich Cove	5			Rich Cove and Slope Forests	
Spicebush Cove	25			Appalachian Rich Cove Forest	
Rich Slope	55			Rich Cove and Slope Forests	
Alluvial Forest	6	Floodplains Wetlands	Central Appalachian Stream and Riparian	Piedmont / Mountain Alluvial Forests	
Floodplain Forest	23	Riparian Areas	Central Appalachian River Floodplain	Piedmont / Mountain Floodplain Forests	
Alkaline Woodland	12	Mafic Glade and Barrens Alkaline Glades	Central Appalachian Alkaline Glade and Woodland	Montane Dry Calcareous Forest & Wdls.	
Mafic Glade and Barren	26		Southern and Central Appalachian Mafic Glade and Barrens	Mt. & Piedmont Basic Woodlands	
Grass Bald	30		Southern Appalachian Grass and Shrub Bald (in part)	Grass and Shrub Balds (in part)	
Colluvial Forest	7	Oak Forests and Woodlands	Northeastern Interior Dry-Mesic Oak Forest	Montane Mixed Oak and Oak-Hickory Forests	Dry-Mesic
High Elevation Red Oak	8		Central and Southern Appalachian Montane Oak	Northern Red Oak Forests Oak / Heath Forests (in part)	
Montane Oak-Hickory (Slope)	9		Southern and Central Appalachian Northern Red Oak-Chestnut Oak	Montane Mixed Oak and Oak-Hickory Forests	
Dry Oak Evergreen Heath	10		Central Appalachian Dry Oak-Pine Forest	Oak / Heath Forests (in part)	
Dry Oak Deciduous Heath	11				
Dry Mesic Oak	13				
Dry Mesic Calcareous Forest	14		Northeastern Interior Dry-Mesic Oak Forest	Dry-Mesic Calcareous Forests	
Montane Oak-Hickory (Cove)	15		Southern and Central Appalachian Northern Red Oak-Chestnut Oak	Montane Mixed Oak and Oak-Hickory Forests	
Dry Calcareous Forest	17		Southern Ridge & Valley /Cumberland Dry Calcareous Forest Central Appalachian Alkaline Glade and Woodland	Montane Dry Calcareous Forests and Woodlands	
Montane Oak-Hickory (Rich)	24		Southern and Central Appalachian Northern Red Oak-Chestnut Oak	Montane Mixed Oak & Oak-Hickory-Forest (Rich)	
Acid Glade	27		Central Appalachian Pine-Oak Rocky Woodland	Mountain / Piedmont Acidic Woodlands	
Basic Oak-Hickory	31		Northeastern Interior Dry-Mesic Oak Forest	Basic Oak-Hickory Forests	
Mixed Oak / Rhododendron	44		Southern and Central Appalachian Cove Forest	Oak / Heath Forests (in part)	
Shortleaf Pine Oak	16	Pine Forests and Woodlands	Southern Appalachian Low-Elevation Pine	Mountain / Piedmont Acidic Woodlands	Dry
Pine-Oak Heath (westside ridge)	18	Pine Forests and Woodlands	Southern Appalachian Montane Pine Forest and Woodland, Central Appalachian Pine-Oak Rocky Woodland (in part)	Central and Southern Appalachian Pine-Oak / Heath Woodlands	

Pine-Oak Heath (ridgetop)	19		Central Appalachian Pine-Oak Rocky Woodland (in part)	
Pine-Oak Shale Woodlands	22		Appalachian Shale Barrens	Central Appalachian Shale Barrens
Xeric Pine-Oak	222		Central Appalachian Pine-Oak Rocky Woodland	Mountain / Piedmont Acidic Woodlands
Shale Barren	21	Cliff, Talus, Shale Barrens	Appalachian Shale Barrens	Central Appalachian Shale Barrens
Limestone-Dolomite Barren	29		Southern Ridge and Valley Calcareous Glade and Woodland	Limestone and Dolomite Barrens

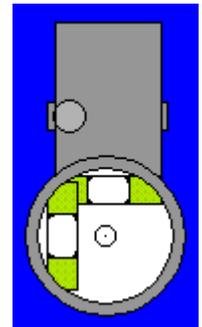
Appendix III: Forest and District Codes

08 08 0000 GEORGE WASHINGTON & JEFFERSON NATIONAL FOREST

- 08 08 0002 NORTH RIVER RANGER DISTRICT
- 08 08 0003 JAMES RIVER RANGER DISTRICT
- 08 08 0004 LEE RANGER DISTRICT
- 08 08 0006 WARM SPRINGS RANGER DISTRICT
- 08 08 0011 EASTERN DIVIDE RANGER DISTRICT
- 08 08 0012 CLINCH RANGER DISTRICT
- 08 08 0013 GLENWOOD/PEDLAR RANGER DISTRICT
- 08 08 0014 MOUNT ROGERS NATIONAL RECREATION AREA
- 08 08 0015 NEW CASTLE RANGER DISTRICT

Appendix IV: Directions for using a GRS Densiometer

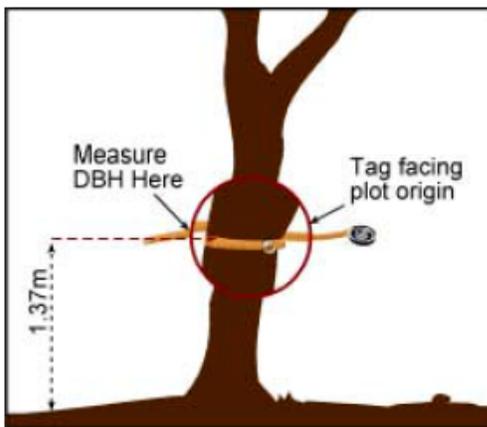
The GRS Densiometer is used with the point-transect method of sampling. The GRS Densiometer is a tool that uses a mirror to project a view of the sample location point in the canopy above to the person holding the Densiometer on the ground. The GRS Densiometer can be aligned to give an exact vertical line-of-sight into the canopy. Mounted inside the viewing tube are two bubble-line level vials. Simply sight through the Densiometer until the vials' bubbles are both level, then record the characteristics of the feature(s) that covers the point when the 'dot' is centered in the circle.



Appendix V: Measuring DBH

General Guidelines:

- Measure tree diameter 4.5' from the ground.
- Trees that fork below 4.5' are considered individuals. For trees with a fork height above 4.5' count as a single stem.
- If tree is growing vertically on a slope, measure the DBH from the upper side of the slope.
- Measure the DBH of a leaning tree by leaning with the tree and measuring perpendicular to the tree bole.
- If the main bole of a sprouting species has died, but the tree is sprouting from the base, consider the main bole dead (SNAG).
- If the bole of a fallen tree is below breast height, and the individual is re-sprouting, count the sprouting branches as individuals and place them in the appropriate size class. Include clarification in the comments section of the datasheet.



For additional DBH clarification, reference the *Fire Monitoring Handbook (2003) pages 91-102.*

Appendix VI: Lifeforms

Fern: a nonflowering vascular plant that possess true roots, stems, and complex leaves and that reproduce by spores

- Examples: Christmas fern, horsetail, clubmoss, etc

Forb: a plant with no persistent woody stem that is also not a grass or grass-like species.

- herbaceous, broad leaved plants, non-woody
- Examples: Maximilian Sunflower, Common Milkweed, Black-eyed Susan, Virginia bluebells, mayapple, bloodroot, Ward's bladderpod, etc.

Grass: a plant with jointed stems, slender sheathing leaves, and flowers born in spikelets of bracts (gardenweb.com).

Grass-like species include rushes and juncus species

- graminoids (grasses, sedges, rushes)
- Examples: big bluestem, long hair sedge, silky oatgrass, deer-tongue, red fescue, Virginia wild rye, Canada rush, etc.

Invasive: introduced species that can thrive in areas beyond their natural range of dispersal. These plants are characteristically adaptable, aggressive, and have a high reproductive capacity. (USDA.gov)

- non-native and invasive species (both of concern and not)
- Examples: tree-of-heaven, Japanese honeysuckle, garlic mustard, Johnson grass, Kudzu vine, tall fescue, English ivy, periwinkle, Japanese barberry, etc.

Vine: an elongating plant, having no rigid stem capable of supporting its own weight, that climbs or trails onto and over other plants and objects (Elzinga).

- woody vines
- Examples: Virginia creeper, poison ivy, Carolina jessamine, climbing bittersweet, crossvine, etc.

Woody:

Shrub: a woody plant with a habit smaller than a tree, the ultimate size usually less than 12' tall and 4" diameter. Commonly with multiple main stems (Lance).

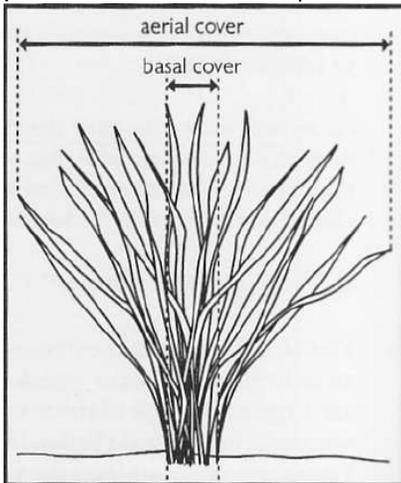
Tree: a woody plant with a well-developed main trunk at least 4" diameter at breast height (4 ½ ft.) at maturity (Lance).

- Shrub examples: American hazelnut, huckleberry, blackberry, American holly, azalea, rhododendron, deerberry, mountain laurel, etc.

Definitions of Cover:

Aerial cover: vegetation covering the ground surface above the ground surface. Small openings within the canopy are included.

(Basal cover – area where the plant intersects the ground. Not used in Forest Composition and Structure Monitoring)



References:

Sampling Vegetation Attributes. Interagency Technical Reference. Ed. Bureau of Land Management's National Applied Resource Sciences Center. BLM/RS/ST-96/002+1730. 1996.

Elzinga, C. L., D. W. Salzer, J. W. Willoughby. 1998. Measuring and Monitoring Plant Populations. BLM Technical Reference 1730-1.

Appendix VII: Common Species in Forest Structure and Composition Monitoring Plots Picklist with USDA Species Symbols

Common Name	Scientific Name	Symbol
American Basswood	<i>Tilia americana</i>	TIAM
American Beech	<i>Fagus grandifolia</i>	FAGR
American chestnut	<i>Castanea dentata</i>	CADE12
American witchhazel	<i>Hammamelis virginiana</i>	HAVI4
Bear Oak	<i>Quercus ilicifolia</i>	QUIL
Black Locust	<i>Robinia pseudoacacia</i>	ROPS
Black oak	<i>Quercus velutina</i>	QUVE
Blackgum	<i>Nyssa sylvatica</i>	NYSY
Blue Ridge blueberry	<i>Vaccinium pallidum</i>	VAPA4
Blueberry	<i>Vaccinium sp.</i>	VACCI
Catawba Rhododendron (Rosebay)	<i>Rhododendron catawbiense</i>	RHCA8
Chestnut oak	<i>Quercus prinus</i>	QUPR2
Common serviceberry	<i>Amelanchier arborea</i>	AMAR
Coralberry	<i>Symphoricarpos orbiculatus</i>	SYOR
Common winterberry	<i>Ilex verticillata</i>	ILVE
Cucumber Tree	<i>Magnolia acuminata</i>	MAAC
Deerberry	<i>Vaccinium stamineum</i>	VAST
Flowering Dogwood	<i>Cornus florida</i>	COFL2
Eastern hemlock	<i>Tsuga canadensis</i>	TSCA
Eastern white pine	<i>Pinus strobus</i>	PIST
Great rhododendron	<i>Rhododendron maximum</i>	RHMA4
Greenbrier	<i>Smilax sp.</i>	SMILA2
Hawthorn Sp.	<i>Crataegus sp.</i>	CRATA
Hickory	<i>Carya sp.</i>	CARYA
Black Huckleberry	<i>Gaylussacia</i>	GABA
Mockernut hickory	<i>Carya alba</i>	CAAL27
Mountain laurel	<i>Kalmia latifolia</i>	KALA
Mountain magnolia	<i>Magnolia fraseri</i>	MAFR
Northern red oak	<i>Quercus rubra</i>	QURU
Pignut hickory	<i>Carya glabra</i>	CAGL8
Pink azalea	<i>Rhododendron periclymenoides</i>	RHPE4
Pitch pine	<i>Pinus rigida</i>	PIRI
Red maple	<i>Acer rubrum</i>	ACRU
Rhododendron	<i>Rhododendron</i>	RHODO
Sassafras	<i>Sassafras albidum</i>	SAAL5
Scarlet oak	<i>Quercus coccinea</i>	QUCO2
Shagbark hickory	<i>Carya ovata</i>	CAOV2
Snag		SNAG
Sourwood	<i>Oxydendrum arboreum</i>	OXAR
Striped Maple	<i>Acer pensylvanicum</i>	ACPE
Sugar maple	<i>Acer saccharum</i>	ACSA3
Sweet birch	<i>Betula lenta</i>	BELE
Sweet cherry	<i>Prunus avium</i>	PRAV
Table mountain pine	<i>Pinus pungens</i>	PIPU5
Tulip (yellow) poplar	<i>Liriodendron tulipifera</i>	LITU
Virginia pine	<i>Pinus virginiana</i>	PIVI2
White oak	<i>Quercus alba</i>	QUAL

Appendix VIII: Overstory Measurements

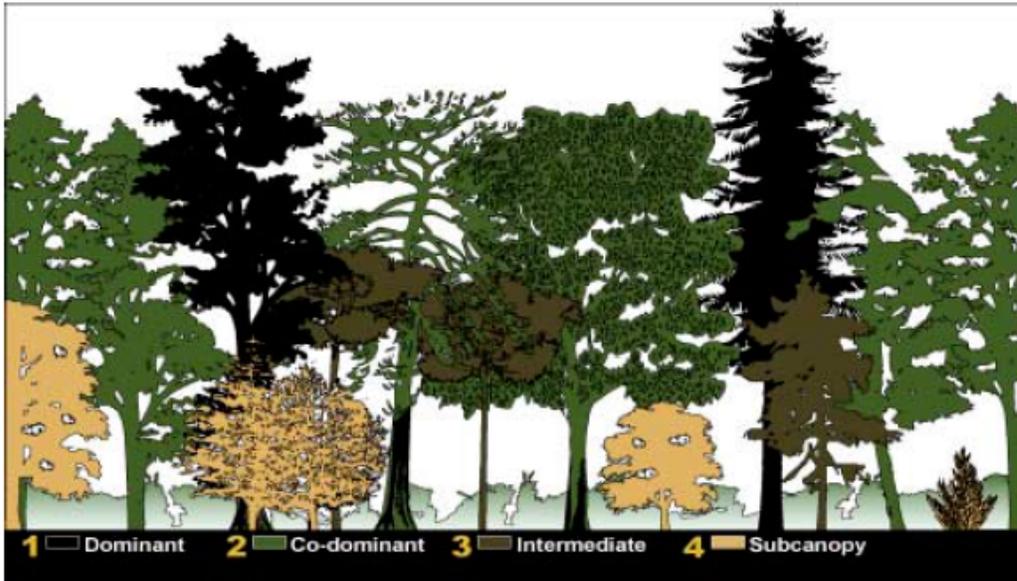


Figure 29. Crown position codes for live trees.
A fifth code (5) is used for isolated trees.

Table 17. Descriptions of live tree crown position codes.

1 Dominant	Trees with crowns extending above the general level of the crown cover, and receiving full light from above and at least partly from the side; these trees are larger than the average trees in the stand and have well-developed crowns, but may be somewhat crowded on the sides.
2 Co-dominant	Trees with crowns forming the general level of the crown cover and receiving full light from above, but comparatively little from the sides; these trees usually have medium-size crowns, and are more or less crowded on the sides.
3 Intermediate	Trees shorter than those in the two preceding classes, but with crowns either below or extending into the crown cover formed by co-dominant and dominant trees, receiving little direct light from above, and none from the sides; these trees usually have small crowns and are considerably crowded on the sides.
4 Subcanopy	Trees with crowns below the general level of the crown cover and receiving no direct light from above or from the sides.
5 Open Growth/ Isolated	Trees receiving full sunlight from above and all sides. Typically, these are single trees 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.

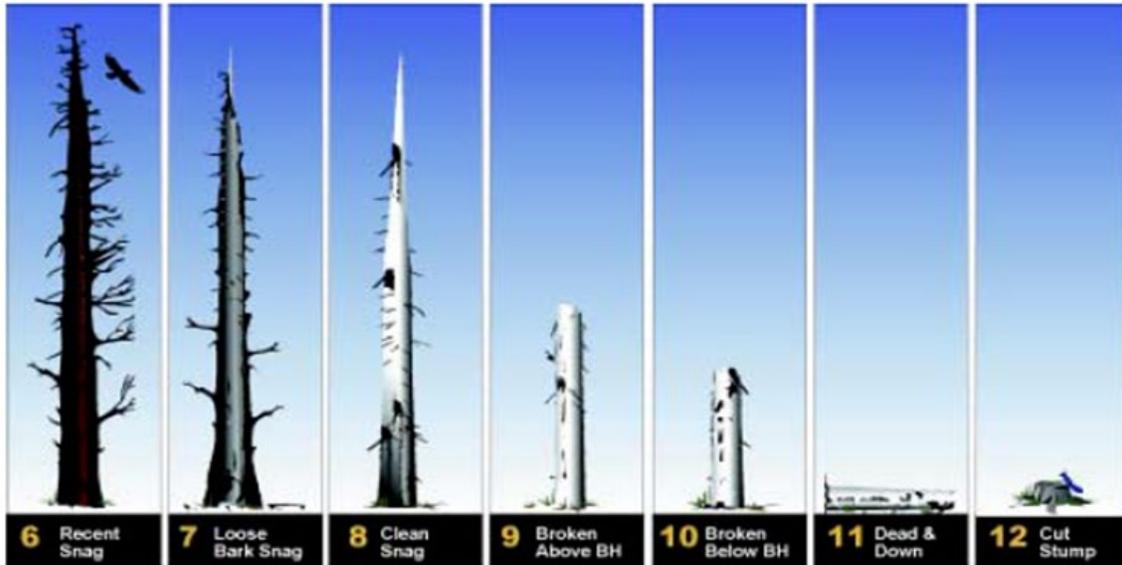


Figure 30. Crown position codes for dead trees.

Table 18. Descriptions of dead tree crown position codes.

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 bark 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 BH.
10	Broken Below BH	Postburn trees that extended above BH preburn, but no longer do. Note: Only record data for a tree the first time you find it broken.
11	Dead and Down	Postburn trees that stood preburn and have since fallen or been consumed. Note: Only record data for a tree the first time you find it down.
12	Cut Stump	Postburn trees that stood preburn and has been cut as a result of fire operations. Note: Only record data for a tree the first time you find the stump.

Appendix IX: Monitoring Status

Monitoring Status	Comment (Description and Appropriate Use)
Baseline	Used in situations where the first data collected is not collected at the beginning of fire reintroduction. Used in lieu of "Pre Burn" data, since it is not technically "pre" burn.
Baseline Year 5	Used in situations where the first data collected is not collected at the beginning of fire reintroduction. Used in lieu of "PreBurn" data, since it is not technically "pre" burn. Used if baseline is taken after five years after original baseline, due to plots not being burned within 5 year time frame.
Burn01ImmedPost	Data collected immediately after the 1st burn. Usually is limited to Fuels, Severity and Photos, unless dictated by additional objectives.
Burn01 <1 Year	Data collected less than one full year after the burn. Often used when unit was burned in spring, and vegetation data collected in subsequent growing season. R8 5140 Guidebook directs districts to collect data one full year post-burn (which may be 2nd growing season post-burn). This is not the preferred visiting schedule, and is included here only if the plot is accidentally visited at this time.
Burn01 Year 1	Data collected one full year after the 1st burn, preferably during growing season (which may be 2nd growing season post-burn). Overstory and Midstory Tree diameters do not need to be re-collected at this time, unless dictated by Objectives.
Burn01 Year 5	Data collected 5 full years after the 1st burn. If unit is re-burned before this time, start monitoring sequence over (for example, Burn02 Year1, Burn02ImmedPost) without using this Status.
Burn02ImmedPost	Data collected immediately after the 2nd burn. Usually is limited to Fuels, Severity and Photos, unless dictated by additional objectives.
Burn02 <1Year	Data collected less than one full year after the burn. Often used when unit was burned in spring, and vegetation data collected in subsequent growing season. R8 5140 Guidebook directs districts to collect data one full year post-burn (which may be 2nd growing season post-burn). This is not the preferred visiting schedule, and is included here only if the plot is accidentally visited at this time.
Burn02 Year 1	Data collected one full year after the 2nd burn, preferably during growing season (which may be 2nd growing season post-burn). Overstory and Midstory Tree diameters do not need to be re-collected at this time, unless dictated by objectives.
Burn02 Year 5	Data collected 5 full years after the 2nd burn. If unit is re-burned before this time, start monitoring sequence over (for example, Burn03 Year1, Burn03ImmedPost) without using this Status.
Burn03ImmedPost	Data collected immediately after the 3rd burn. Usually is limited to Fuels, Severity and Photos, unless dictated by additional objectives.
Burn03 <1 Year	Data collected less than one full year after the burn. Often used when unit was burned in spring, and vegetation data collected in subsequent growing season. R8 5140 Guidebook directs districts to collect data one full year post-burn (which may be 2nd growing season post-burn). This is not the preferred visiting schedule, and is included here only if the plot is accidentally visited at this time.
Burn03 Year 1	Data collected one full year after the 3rd burn, preferably during growing season (which may be 2nd growing season post-burn). Overstory and Midstory Tree diameters do not need to be re-collected at this time, unless dictated by Objectives.
Burn03 Year 5	Data collected 5 full years after the 3rd burn. If unit is re-burned before this time, start monitoring sequence over (for example, Burn04 Year1, Burn04ImmedPost) without using this Status.
RX BURN +YEAR	Place marker to indicate date of a prescribed burn. You must include the year in the name. No protocols will be associated with this date.
WILDFIRE +YEAR	Place marker to indicate date of a wildfire. You must include the year in the name. No protocols will be associated with this date.



Plot Information Sheet

Directions: Complete Once Per Plot.

Enter information into Macro Plot tab under Project Management.

Plot Name and Number: _____

Monitoring Type: _____

Burn Unit: _____

District: _____

Site Characteristics

Elevation:

Elevation Units:

Aspect (deg):

Hill Slope (%):

Location

Note: FFI requires coordinates in decimal degrees. Please convert if recording lat/long differently.

Longitude

Latitude

(East-West):

(North-South):

Example:-78.720944

Example-38.007861

Installation

Install Date:

Located by:

NOTES (including any data collection methods you did differently than directions- enter in Comments tab under Project Unit):



Plot Photos

Plot Name and Number: _____

Date: _____

Data Collector(s): _____

Monitoring Status: Baseline Burn # _____ YR 1 YR 5 Other:
(Circle One)

Directions:

Take 4 photographs of the habitat structure from the center of the plot: facing North, the canopy directly over plot center, of the plot center stake, and facing South. Include in the photo an information board with the following:

Unit Name and Plot Number
Month/Date/Year
Direction of Photo
Monitoring Status: (Preburn, Baseline,
Burn 1 Immediate Post, Burn 1 Year 1, etc.)

Photo Naming Convention –

Region#Forest#District#_BurnUnitName_MonitoringStatus_Bearing_YearMonthDate

Example: 080815_MudBranch01_Baseline_North_20100507

Reference Appendix II in protocol for forest and district codes.

Write photo name below:

North: _____

South: _____

Comments (may want to make note of any significant changes, fire severity, etc.):

It is very important to duplicate the same view of trees and other vegetation in subsequent photos. If possible, attach copies of all photos to your field notes and take them with you on each visit.

Have the photos been printed and attached to data sheets? Yes / No

Download photos immediately and save them with electronic copies of data.



Cover- Points by Transect (Canopy Cover Estimates using a Densiometer)

Plot Name and Number: _____

Date: _____

Data Collector(s): _____

Monitoring Status: Baseline Burn # _____ YR 1 YR 5 Other:
(Circle One)

	Distance from Center					
Transect 1 (North)	2'4"	4'8"	7'2"	9'6"	11'9"	Total
CC-Deciduous						___/5
CC-Evergreen						___/5
CC-Sky						___/5
Transect 2 (East)	2'4"	4'8"	7'2"	9'6"	11'9"	Total
CC-Deciduous						___/5
CC-Evergreen						___/5
CC-Sky						___/5
Transect 3 (South)	2'4"	4'8"	7'2"	9'6"	11'9"	Total
CC-Deciduous						___/5
CC-Evergreen						___/5
CC-Sky						___/5
Transect 4 (West)	2'4"	4'8"	7'2"	9'6"	11'9"	Total
CC-Deciduous						___/5
CC-Evergreen						___/5
CC-Sky						___/5

Directions: Using a GRS (Geographic Resource Solution) densiometer, determine canopy cover (deciduous, evergreen, sky) at 20 points within each plot. Beginning 2'4" from the plot origin, face North and walk along transect taking a reading every 2' 4", tallying canopy cover in table above (1 tally per 2'4" interval). Record only what falls in the cross hair of the densiometer, do not move vegetation out of the way. Record dead branches or limbs as Sky cover. Record deciduous evergreen as evergreen and make a note on the data form. Record total hits per canopy cover type for each transect. Repeat facing East, South and West. Reference Appendix III for directions on GRS Densiometer use.

FFI Information	
Number of Transects	4
Transect Length	11.9 (feet)
Number Points/Transect	5



Cover_Frequency

(3.5' x 3.5' Quadrats Understory Cover including Woody Stems up to 3.5' Tall)

Plot Name and Number: _____

Date: _____

Data Collector(s): _____

Monitoring Status: Baseline Burn # _____ YR 1 YR 5 Other:
(Circle One)

If % Cover is:	0	>0-5	>5-25	>25-50	>50-75	>75-95	>95-100
then record as:	0	2.5	15	37.5	62.5	85	97.5

FFI Note: The recorded % cover is referred to as the Daubenmire scale in the Cover pull-down menu.

Transect/Quadrat	Lifeform	% Cover	Comments	Transect/Quadrat	Lifeform	% Cover	Comments
1 (North)/ 1	C-Fern			3 (South)/ 3	C-Fern		
1 (North)/ 1	C-Forb			3 (South)/ 3	C-Forb		
1 (North)/ 1	C-Grass			3 (South)/ 3	C-Grass		
1 (North)/ 1	C-Invasive			3 (South)/ 3	C-Invasive		
1 (North)/ 1	C-Vine			3 (South)/ 3	C-Vine		
1 (North)/ 1	C-Woody			3 (South)/ 3	C-Woody		
2 (East)/ 2	C-Fern			4 (West)/4	C-Fern		
2 (East)/ 2	C-Forb			4 (West)/4	C-Forb		
2 (East)/ 2	C-Grass			4 (West)/4	C-Grass		
2 (East)/ 2	C-Invasive			4 (West)/4	C-Invasive		
2 (East)/ 2	C-Vine			4 (West)/4	C-Vine		
2 (East)/ 2	C-Woody			4 (West)/4	C-Woody		

Directions: Estimate percent aerial cover of grasses (including sedges & rushes), forbs (broad leaved plants, non-woody), ferns (including ferns, clubmoss & horsetail), trees/shrubs, woody vines and priority non-native invasive species by cover class. Only determine aerial cover of lifeforms up to 3.5' tall. Aerial cover is defined as the percentage of ground obscured by vegetation. Measure the area of ground cover by the outermost perimeter of the natural spread of plant leaves. Small openings within the canopy are included. Record the name of any priority non-native invasive species under the comments column on the data sheet. Include sub-shrubs in the forb category. Reference Appendix V for definitions of lifeforms. *Note: Determine which non-native invasive species are of priority concern for each burn unit. Each unit may have a different list of priority non-native invasive species.*

FFI Information	
Number of Transects	4
Transect Length	11.9 (feet)
Number of Quadrats/Transect	1
Quadrat Length	42 (inches)
Quadrat Width	42 (inches)

