

NPS Alaska Fire and Fuels Circular Plot Monitoring Protocol, Version 1.0

Alaska Fire Management – Fire Ecology Program

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Contents

Overview.....	4
Purpose.....	4
Project-Level Application of AKR Fire Ecology Monitoring Protocol.....	5
<i>Monitoring Goals & Objectives</i>	5
<i>Plot Selection/Location</i>	6
<i>Plot Naming Convention</i>	6
Methods - Overview.....	7
Methods - Detailed.....	11
Plot Layout.....	11
Photographs.....	11
Site Description.....	11
<i>General Site Information</i>	11
<i>Treatment/Fire Description</i>	12
<i>Latitude/Longitude & Photos</i>	13
<i>Vegetation Class</i>	13
Vegetation and Ground Cover.....	13
<i>Ocular Vegetation Cover Estimation</i>	13
<i>Point Intercept Vegetation Cover</i>	14
Tree Density and Measurements.....	15
<i>Tree Density</i>	15
<i>Tree Measurements</i>	15
Active Layer and Soils.....	16
Burn Severity & Duff Consumption.....	17
<i>Burn Severity (Point) & Duff Consumption</i>	17

<i>Composite Burn Index (CBI) - Full Plot Burn Severity Assessment</i>	18
Forest Floor Duff Thickness and Fuel Moisture.....	19
<i>Duff Layer Thickness</i>	19
<i>Fuel Moisture</i>	19
Down Woody Fuels	19
Shrub Density	20
Moose Browse Architecture & Herbivory	20
<i>Moose Browse & Herbivory Data</i>	20
<i>Moose Browse Density</i>	21
Invasive Plant Infestation.....	21
References.....	22
Datasheets.....	24
Plot Data Collection Check List	24
Burn Severity/Duff Consumption.....	24
Fuel Moisture Sampling	24
Site Description.....	25
General Vegetation Information.....	27
Vegetation Point Intercept.....	29
Tree Density Tally	30
Tree Measurements.....	31
Active Layer/Soils.....	32
Burn Severity/Duff Consumption.....	32
Down Woody Debris & Duff Thickness.....	33
Composite Burn Index (CBI) Data Sheet (AK 2020).....	34
Fuel Moisture Data Sheet.....	36
Shrub Density	37

Moose Browse Architecture & Herbivory Data	38
Moose Browse Architecture Density	39
Alaska Exotic Plant Management Team (EPMT) Datasheet (Modified for NPS Alaska Fire Ecology).....	40
Appendix	41
Common Species Codes.....	41
Field Gear List	42
Tree Crown Measurements.....	43
Tree Height Measurements.....	44
Damage Codes for Trees.....	45

Overview

The Alaska NPS Fire and Fuels Monitoring Protocols were developed as a guideline for establishing fire and fuels treatment monitoring projects within Alaska National Park Service lands. The purpose of the Fire and Fuels Monitoring Protocol is to provide a standardized approach to monitor the effects of wildfire and prescribed fire as well as fuels thinning projects implemented by the NPS fire management program. The overarching purpose of the NPS studies which employ the Fire and Fuels Protocol is to provide scientific based information to guide Alaska NPS fire and land management planning, decisions, and practices to maintain and understand fire adapted ecosystems. Monitoring can be used to document changes as a result of fire, implementation of treatments, or effects associated with long-term climate change or fire management activities. This protocol is a NPS specific modification of the field-tested methods created by the Alaska Interagency Fire Effects Task Group (FETG) and compiled in the Fire Effects Monitoring Protocol (Alaska FETG 2007). All or any combination of the protocol methods (e.g., point intercept, tree density, tree measurements, etc.) maybe be used, depending on the objectives of the project.

Purpose

This document provides instructions and datasheets for utilizing a circular plot layout. A separate protocol has been developed for plots with a belt transect layout. It can be found online on the NPS Integrated Resource Management Applications (IRMA) Data Store located here: <https://irma.nps.gov/DataStore/Reference/Profile/2272296>. In general, the circular plot method works well with larger diameter trees that are less dense, while the belt method works well for small diameter trees that are more densely spaced (e.g., black spruce), shrublands or grasslands. The circular plot method provides a larger tree plot size or variable plot size for smaller diameter, dense trees. The circular plot method covers a total of 16-m, which works better for small treatment areas. Standard methods utilized within the circular plot protocol are slightly less rigorous with a shorter transect length (unless an additional transect is added).

This protocol may be used in full. Alternatively, a subset of individual methods may be selected in order to meet the specific monitoring objectives of a project (see [Project-Level Application](#) section). The protocol may be used for the following purposes:

Wildfire Effects Protocol Application: The Fire and Fuels Monitoring Circular Plot Protocol may be utilized to monitor wildfire effects. Project objectives may be met by establishing vegetation/soil plots in front of active fires and evaluating them prior to, during and after fire treatments.

Hazard Fuels Reduction Protocol Application: The Fire and Fuels Monitoring Circular Plot Protocol may be utilized to monitor hazard fuels reduction treatment effects. Project objectives may be met by establishing vegetation/soil plots prior to hazard fuels reduction treatments and evaluating them before and after hazard fuels treatments.

Prescribed Fire Effects Protocol Application: The Fire and Fuels Monitoring Circular Plot Protocol may be utilized to monitor prescribed fire treatment effects.

Project-Level Application of Monitoring Protocol

For specific project level monitoring plans, a Project Monitoring Plan should be prepared using the followings sections:

- 1) Project Description
 - Project Background & Purpose
 - Project Area Description (general vegetation, treatment area)
 - Treatment Goals & Objectives
 - Monitoring Objectives
- 2) Methods Overview
 - Plot Selection and Naming Convention
 - List protocols selected for monitoring, with reference to main AK Protocol document for methodologies. Note any alterations to standard methodologies. (use list from Methods Overview section within this document).
 - Description of any variations to the main protocol.
- 3) Data Management and Sampling Schedule
 - Data entry and data management
 - Sampling Schedule
- 4) Map and/or table of plot location coordinates

Descriptions and recommendations for several of the sections within the Project Monitoring Plan are described below. An overview of the protocol methods along with detailed instructions for each sampling method are provided later in this document.

Monitoring Goals & Objectives

Studies which utilize the Fire and Fuels Protocol may be implemented to meet one or more of the following goals:

- Verify that fire management objectives are met.
- Document long-term trends and natural level of variation in the frequency, extent, and severity of fires, monitor for impacts of climate change.
- Monitor fire and mechanical fuels treatment effects including:
 - Time since fire and burn severity or mechanical treatments on vegetation species composition, vegetation structure, and ground cover in varying vegetation types
 - Time since fire and burn severity or mechanical treatment on soil parameters
 - Time since fire on wildlife habitat
- Document fuels information for fire behavior modeling.
- Monitor fuel moisture of applicable fuel types.

Objectives for monitoring or inventories should be clearly defined before sampling and should follow the SMART rule for objectives. They should provide for unbiased, repeatable assessment of fire and fuels treatment effects and provide measures of whether the management goals and objectives were

met. Refer to the National Park Service Fire Monitoring Handbook (2003) for more information on developing quantifiable objectives.

Plot Selection/Location

Method of plot selection and locations should be documented for all studies. There are numerous ways and methods for selecting plot locations, dependent on the needs of the study. Please refer to other documents for discussion on statistical needs for number of plots and randomization. Below are a few recommendations on how to select plot locations.

Wildland Fire Plots

Locations of pre- and post-fire plots are usually randomly established but a variety of different plot selection methods may be utilized. Two examples of location selection methods used for wildfire pre- and post-fire plots include:

Transect Method

Using the fire perimeter, map draw transects parallel to the head of the fire, flank of the fire, and rear of the fire. Mark 6 points that fit equally along the project transect. For instance, if the transect is 1-mile long, put a point every 1/6th of a mile. Fly or walk the transect and determine if the points are in a vegetation type that should be sampled. If not, fly or walk to the next point.

GIS Method

Use the buffer tool in ArcMap to create a buffer around the current fire perimeter. Ensure the buffer is a distance safe for sampling based on the fire rate of spread. Use the Arc Toolbox random point generator (also available in Alaska Pak tools) to create points within the buffered polygon. Select a minimum spacing of 500 meters between points.

Hazard Fuels Plots

Monitoring plots will typically be randomly established within the treatment zones as well as in control areas immediately adjacent to the treatment areas in stands representative of the pre-treatment forest. GIS layers of the treatment and control areas are utilized to select plot locations. For the control area, a 200-m buffer around the thinning unit is created using ArcGIS. A GIS random point generator and manual manipulation to spread plot distribution is used to establish plots in the treated areas and control area. Plots that fall within parking areas or other built features are not utilized.

Plot Naming Conventions

The plot names should follow this naming convention: PARK-XXX-LOCATION-###, where the first four letters (PARK) is the park code (e.g., DENA or YUCH), the next letters (XXX) are the project identifier, and the third letters (LOCATION) are the location of the plots, such as the fire number or treatment site (e.g., A503 or Headquarters HQ), and the last three are plot identifiers.

For wildland fire plots, example project identifiers include: WF (wildfire) or a project identifier such as VDM (video-moose). For hazard fuels treatment plots, the project identifier will be: HZF (hazard fuels). For prescribed fires, the project identifier should be RX (prescribed fire).

The plot identifiers are numerical as established. Examples of plot identifiers include: DENA-WF-A503-003 and WRST-HZF-HQ-C-03.

Methods - Overview

This section provides a quick reference of methods for each protocol. Full methods are described in the [Methods – Detailed](#) section. A complete plot with all protocols can be laid out and read by an experienced crew in less than 3 hours. All or any combination of the protocol methods may be used, depending on the objectives of the monitoring project.

For simplicity, the myriad of options for customizing monitoring protocols or plot sizes, levels of monitoring intensity, number of plots to install, placement of plots and other variables are not discussed here. It is recommended the user consult many other excellent references on setting up a monitoring study, including Measuring and Monitoring Plant Populations (Elzinga et al. 1998) or the NPS Fire Monitoring Handbook (NPS 2003). Data can be entered into the National Fire Effects Database program FFI (FEAT FIREMON Integrated). Refer to the “FFI Data Entry Instructions for NPS Alaska Manual” (unpublished) for specific data entry guidance.

AK Fire and Fuels Monitoring Program Circular Method Protocol – Overview:

1. PLOT LAYOUT (Figure 1)

- Set up an 8-m radius (16-m diameter) circular plot based on a center-point coordinate.
- The plot azimuth will be north-up so 16-m end of transect is due north of plot center and 0-m end of transect is due south of center-point.
- Lay out a 16-m transect (for point intercept and location of seedling and shrub density subplots). Pull the 0-m end of measuring tape due south 8-m. Then pull the end of the tape in a 16-m straight line to the North (record declination used) and use a chaining pin to stake the 16-m end of the transect. The center point of the plot should be at 8-m on the transect line. Keep the tape as low to the ground as possible.
- For permanent plots, mark the center point of the circular plot with a non-burnable marker (e.g., rebar, conduit, or metal monument). If re-visits are planned, it is recommended to stake the 0-m and 16-m transect ends along with the 8-m center point with wooden lathe.
- Mark each end with flagging and collect a GPS point at plot center.

2. SITE DESCRIPTION (*SITE DESCRIPTION* datasheet)

- General plot description, direction to plots
- Lat/Long, datum, error
- General vegetation class for 8-m radius area
- Take horizontal and vertical photographs of each cardinal direction (N, S, E, W) and the ground from plot center or from each transect end.

3. GENERAL VEGETATION (*GENERAL VEGETATION* datasheet)

- Record estimates of vegetation and substrate % cover for 8-m radius plot area (regardless of tree density circular plot size).

- Record height estimates for tree, tall shrub and low shrub species.
4. **VEGETATION COVER** (*VEGETATION POINT INTERCEPT* datasheet)
 - Point intercept along 16-m transect (32 points, every 0.5-m along 16-m transect line). Use a bike flag or other narrow pole for recording point intercept “hits”. Take points on right side of tape while walking on the left side of tape.
 - Record all trees, shrubs, herbaceous species, include substrate or groundcover that are located at each point along the transect (“hits”).
 5. **TREE DENSITIES** (*TREE DENSITY TALLY* datasheet)
 - In low density forest stands where there are <15 trees within a 4-m radius subplot area, tally all trees > 4.5' (1.37 m) tall located within the entire 8-m radius plot area. In more dense stands, if there are >15 trees in the 4-m radius subplot area, tally all trees located within the 4-m radius subplot only.
 - Within 8-m or 4-m radius circular plots tally trees >4.5' (1.37 m) tall by species, diameter size class (< 5 cm, 5.1-10 cm, 10.1-15 cm, 15.1-23 cm, >23 cm) and status (live or dead).
 - Tally small trees (<4.5' tall) in three 1-m radius subplots centered at 4-m, 8-m and 12-m marks along the transect line (total “seedling” area of 9.42 m² or 0.0048 ac).
 6. **TREE MEASUREMENTS** (*TREE MEASUREMENTS* datasheet)
 - For two trees of each species and diameter size class, record diameter (DBH), height, crown radius, height to live and dead ladder fuels and main crown base height (CBH).
 - Choose trees located closest to plot center (within the 4-m or 8-m radius tree plot).
 - Alternatively, all trees within the plot can be measured if needed to meet project objectives.
 - Record all tree measurements for needleleaf trees. Record only DBH and height measurements for deciduous trees.
 7. **ACTIVE LAYER & SOILS** (*ACTIVE LAYER/SOILS* datasheet)
 - Every 2-m, beginning at 2-m mark (8 total points), record the following:
 - Depth to active layer boundary (rock, ice or seasonal frost)
 - Surface fuel code for the top layer of ground cover (litter, lichen, live moss, dead moss, upper duff, lower duff, mineral soil, etc.)
 - Record soil moisture (%), soil temperature (°C) and pH of soils at each point along transect.
 8. **BURN SEVERITY & DUFF CONSUMPTION** (*BURN SEVERITY/DUFF CONSUMPTION & CBI* datasheets)
 - Post-burn: Record micro-site (point) burn severity using the FMH method. This method identifies 5 levels of severity and provides corresponding severity codes for substrate and vegetation. Record severity every 2-m beginning at the 2-m mark for a total of 8 points.
 - If plots are established pre-fire, duff consumption pins (pre-burn) can be placed every 2-m, for a total of 8 points (co-located with FMH burn severity index points).

- Complete CBI (Composite Burn Index) datasheet for an overall burn severity score and for comparison to remote-sensed burn severity (dNBR or differenced normalized burn ratio). This method is described in FIREMON (Key and Benson 2006).
9. DUFF THICKNESS & FUEL MOISTURE (*DOWN WOODY DEBRIS & DUFF THICKNESS & FUEL MOISTURE* datasheets)
- Record forest floor surface material (litter, lichen, live moss, dead moss, upper duff and lower duff layers) thickness at each end of the transect approximately 1-m off the transect line in locations representative of the forest floor along the transect.
 - Collect duff plugs to determine fuel moisture.
10. DOWN WOODY FUEL LOADING (*DOWN WOODY DEBRIS & DUFF THICKNESS* datasheet)
- Brown's transect extends the full 16-m transect: 0-ft to 6-ft for 1-hr and 10-hr fuels; 0-ft to 12-ft for 100-hr fuels, and 0-ft to 52.5-ft for 1000-hr fuels (1.8-m, 3.66-m, and 16-m).
 - If quantitative fuel loading is needed, place additional Brown's transects at 120° and 240° from origin and mark ends with pin flag.
11. SHRUBS (*SHRUB DENSITY* datasheet)
- Measure shrub density by tallying all shrubs within 8-m radius circular plot. If shrub density is greater than 15 individuals (defined as clusters of stems within 10-cm of one another), then tally shrubs within a 4-m radius circular plot. Record individuals by species, life status and average height.
12. MOOSE BROWSE AND HERBIVORY (*MOOSE BROWSE ARCHITECTURE* or *MOOSE BROWSE DENSITY* datasheets)
- Record evidence and degree of moose browse for two shrub individuals of each browse species located within the 8-radius circular plot. Select individuals located closest to the circular plot center-point.
 - Measure the density preferred moose browse species by tallying all preferred species of shrubs or trees within 8-m radius circular plot. If density is greater than 15 individuals (defined as clusters of stems within 10-cm of one another) then tally shrubs within a 4-m radius circular plot. Record individuals by species, height class and browse architecture.
13. INVASIVE PLANTS (*ALASKA EXOTIC PLANT MANAGEMENT TEAM [EPMT]* datasheet)
- Record observations of invasive plants in monitoring project areas to get a rough idea of presence, location, cover, phenology, and how long it would take to remove invasive plant species from given area.
 - Copies of datasheets should be brought on monitoring projects so that any observed invasive species can be recorded and reported to the NPS Alaska EPMT team.

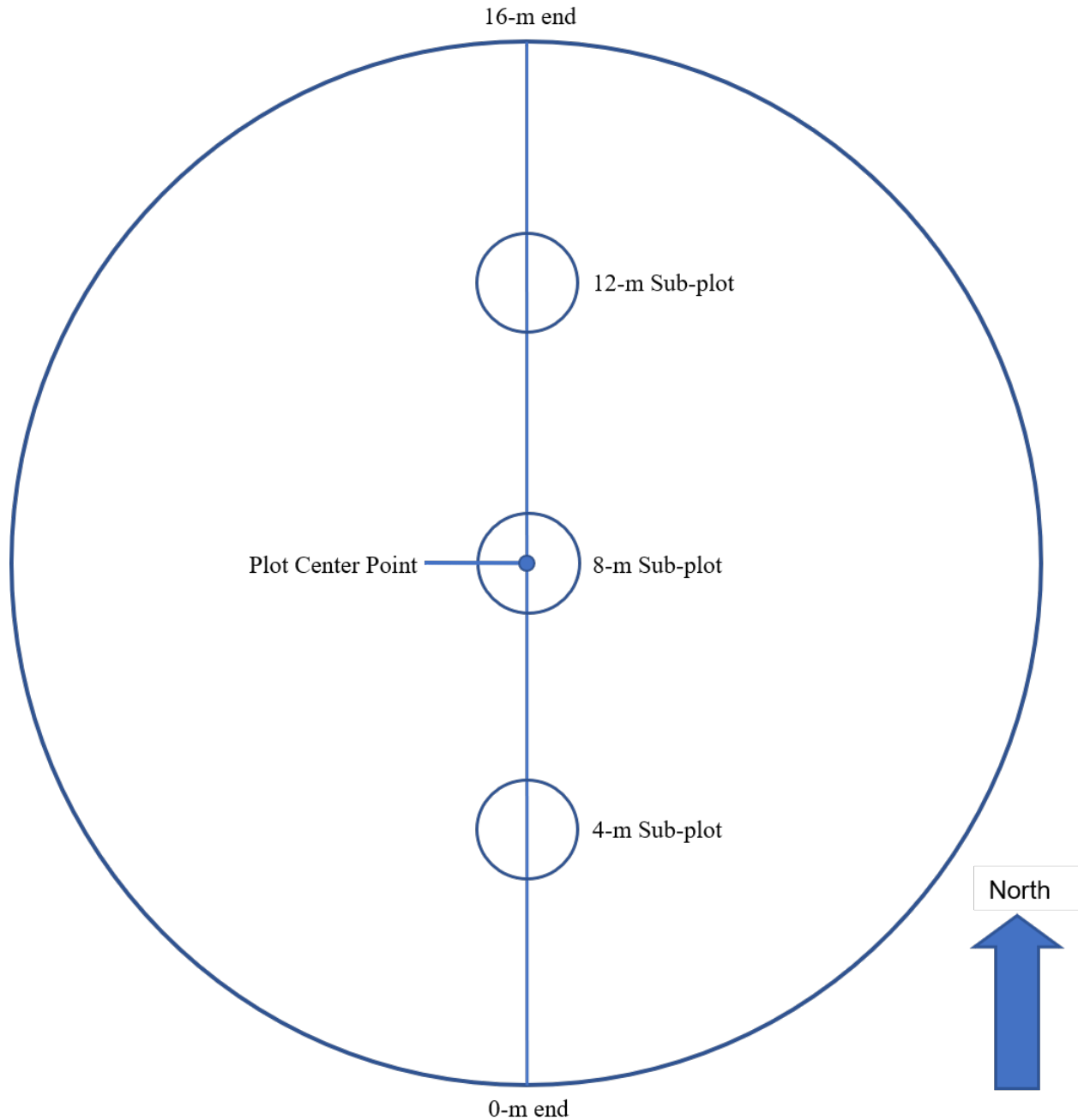


Figure 1. Circular plot layout with an 8-m radius plot size. The transect line runs from south (0-m end) to north (16-m end).

Methods - Detailed

Plot Layout

The standard circular plot configuration is shown in Figure 1. An 8-m radius circular plot will be laid out based on a center-point coordinate. Lay out the plot by staking the center point. Setup a 16-m transect line by pulling the 0-m end of a 30-m measuring tape with a chaining pin due south 8-m (the center point should be at 8-m on the tape). Then pull the end of the tape 16-m in a straight line to the North (record declination used). Use a chaining pin to stake the 16-m end of the transect. For permanent plots, drive markers (e.g., spray-painted 2.5-ft conduit or rebar) into the ground at the plot center-point. If re-visits are planned, it is recommended that both the 0-m and 16-m transect ends in addition to the 8-m center point are marked with wooden lathe for easy re-location. Mark plots with flagging for easy spotting in aerial photo or where needed (if permitted). When laying out plots, avoid walking or trampling on the right side of the transect where vegetation data is collected. Record the coordinates for the center-point (and transects ends if marked) for all plots. Set the GPS to take an average of 20 or more points and record the accuracy in the “Error” field on the *SITE DESCRIPTION* datasheet. Also record waypoint numbers or names. NAD83 Datum will be used in the GPS receivers (standard for DOI agencies).

Photographs

A minimum of nine photos are taken for each plot. Two photos (one horizontal and one vertical) in each cardinal direction (N, E, S, W) are taken from the center-point of the circular plot. An additional photo is taken of the ground at the circular plot center-point. The ground photo should include the plot marker but does not require a photo board. *Alternatively, photos may be taken at each end of the transect facing towards the center point.* For all photos except ground photos, label a dry-erase board with the park-project-location-plot ID (e.g., YUCH-PPF-A324-02), sample date, transect azimuth (direction facing) and designate as CP (center point) → N, CP → S, etc. Hold the board to the edge of the photo frame within 1.5-2 m of the photographer. Hold the camera at a fixed height of 5 ft above the ground. Record photo times on the *SITE DESCRIPTION* datasheet. Aerial photos should be taken of the plot where possible and applicable.

Site Description

General site information is recorded for each plot on the *SITE DESCRIPTION* datasheet. Additional plot location descriptions, diagrams, and additional notes are written on the back of the datasheet. More detailed information on the datasheet fields are provided below.

General Site Information

- **Unit** – Land unit identifier (NPS - four letter park code, e.g., Yukon-Charley Rivers NPr is YUCH) or land unit name (e.g., Steese White Mountains)
- **Project** – Project Identifier: WF (wildfire), PPF (pre/post fire), CBI (burn severity), HZF (for hazard fuels), or PP (paired plots). Also include an identifier for the area, such as a fire name or cabin name.
- **Plot ID** – Unique identifier for the plot within the project. In general, use sequential numbering 01 through XXX.

- **Date** – Sampling date
- **Field Crew** – Names of all field crew members
- **Plot Markers** – Type of marker used to mark plot (wooden lathe, flagging, rebar, etc.)
- **Transect Azimuth** – Record the azimuth of the transect facing from the zero end to the 16-m end, recorded in True North (declination set)
- **Transect Slope** – Record slope from the 0 to 16-m direction, looking down the transect
- **Plot Dimensions**- Plot radius, record units
- **Slope** – % slope of the site, use clinometer
- **Aspect** – Slope aspect (facing downhill). Record azimuth (degrees) based on true north compass setting.
- **Declination Used** – Record declination setting (degrees) on your compass. Determine the declination before going to the field (<https://www.ngdc.noaa.gov/geomag/calculators/magcalc.shtml#declination>). If this was not completed, use declination information provided in the GPS unit. For future sampling, use the declination used in previous visits.
- **Elevation** – Record elevation at center-point of circular plot (in feet or meters, record units) from GPS.
- **Soil** – Record estimate of soil drainage (wet, moist, or dry). Wet soils must have some visible evidence of water, dry soils must be without moisture entirely (e.g., dry sand). Most soils will be categorized as moist.
- **Disturbance** – General note of disturbance to plot and general area (provide more detail including estimated disturbance date in notes where applicable).
- **Fire Indicators** – Record visible evidence of fire (provide more detail in notes where applicable).
- **Estimated Time Since Fire** – Where fire indicators are noted, provide rough estimate of years since plot area burned.
- **Distance to Closest Unburned Tree (m) & Species** – Record the approximate distance to the nearest unburned tree(s) and tree species name(s) for seed source information.

Treatment/Fire Description

- **Plot Type** – Indicate whether a plot is a wildfire, hazard fuels (thinning), prescribed fire (RX) or control plot.
- **Thinning Treatment Phase** – Pre-thinning, post-thinning and time since thinning date. Record as maintenance thinning if second thinning treatment has been implemented.
- **Treatment Year** – Record the year the thinning or hazard fuels reduction occurred.

- **Treatment Type** – Brief description of type of fuels treatment (e.g., 5 ft bole spacing, limb to 5 ft).
- **Fire Number and Fire Name** – Prescribed or wildfire fire name and number
- **Fire Year** - Year of prescribed or wildfire fire
- **Pre or Post Yrs** – Time since wildfire or prescribed fire (years or months). Indicate if pre- or post-fire.

Latitude/Longitude & Photos

- **GPS Type** – Type of GPS used (e.g., Garmin 76CSx Map)
- **GPS Identification** – GPS unit identifier (person's name or unit number)
- **GPS Datum** – GPS datum used; NAD83
- **Description** – Description of where coordinates recorded (e.g., center-point of circular plot, LZ for the plot or other pertinent coordinates).
- **Waypoint number/name** – Waypoint identifier recorded in GPS. Re-name waypoints to indicate plot number and location (usually transect center point). Example of waypoint name: **362-03-CP** (*fire number: 362, plot number: 03, location: CP*) taken at the circular plot center point.
- **Latitude/Longitude** – Record coordinates from GPS unit in decimal degrees.
- **GPS Error** – Before saving the coordinate allow the GPS to average for a minimum of 20 points. Record the error and units (m or ft).
- **Photo Number, Time and Camera** – Description of photos taken, photo time (from camera) and camera used.

Vegetation Class

- **Vegetation Class** - Use the Alaska Vegetation Classification (Viereck 1992) to determine the current vegetation class and pre-disturbance vegetation class (if possible) for the 8-m radius plot area. Describe to Viereck Level IV or V.
- **Vegetation Dominant Species** - Record the dominant species in the 8-m radius circular plot area (particularly if not using the Point Intercept or General Vegetation datasheets). This can be skipped if using the General Vegetation datasheet at the plot.
- **Plot Layout and General Notes** – Use the back page to describe how to get to site, landing zones, disturbance, habitat use and any other pertinent observations. Draw maps, diagrams and sketches when applicable.

Vegetation and Ground Cover

Ocular Vegetation Cover Estimation

On the GENERAL VEGETATION INFORMATION datasheet, record ocular estimates of vegetation and substrate % cover within the 8-m radius plot area (regardless of tree density circular

plot size). The cover classes are defined in 10% increments (1-10%, 11-20%....91-100%). Estimate the cover of each species or substrate and check the appropriate box on the datasheet. If applicable, also estimate pre-fire cover. Due to overlapping components of the canopy cover, total cover can equal more than 100%. Use species scientific names where possible or species codes (first two letters of the genus and the species names) (USDA NRCS 2011, <http://plants.usda.gov/>). Additional species can be added on the second page or by crossing out pre-written species. Estimate average heights in meters for all trees, tall shrubs and low shrubs. Species are listed by forest canopy layer as described below:

- *Tree Layer* – Estimate the percent cover of each tree species and record average tree height (m). If Tree Density and Tree Measurement datasheets are not used, estimate average tree diameter and ladder fuel height. If a single species forms two or more distinct sub-layers, list it on separate rows (e.g., PIGL-sapling, PIGL-overstory, PIGL-dead). Shrubs, such as willows or alders of tree height, are not considered trees.
- *Shrub Layer* - Shrubs are defined as woody plants with multiple stems. Estimate the % cover of tall (e.g., alder), low (e.g., dwarf birch) and dwarf (e.g., low-bush cranberry) shrubs. Provide estimates of tall and low shrub heights (meters). If there are newly established shrubs, identify if plants are new seedlings or re-sprouts otherwise leave the column blank to indicate mature plant.
- *Herb and Graminoid Layer* – This layer is inclusive of all non-woody species observed including graminoids (grasses, sedges, and rushes), herbs/forbs, ferns, horsetails, and club mosses. Estimate the % cover of non-woody species. If there are newly established graminoids or herbs/forbs, identify if plants are seedlings or re-sprouts. Otherwise leave the column blank.
- *Non-vascular Layer* - Estimate the percent ground cover of mosses, lichens and liverworts.
- *Ground Cover Layer* - Estimate the percent ground cover of litter, down woody fuels, mineral soil, water or duff.

Point Intercept Vegetation Cover

Use the VEGETATION POINT INTERCEPT datasheet. The point intercept method is used to determine plant and ground cover along the 16-m transect. Every 50 cm along the 16-m transect, record all plant species and types of surface cover (e.g., mosses, lichens or substrates) intercepted at that point. Start at the 0.5 m mark and record along the right-hand side of the transect. An additional transect can be added to increase the number of points for point intercept. Establish the second transect perpendicular to the first transect (forming a cross in the plot).

Using a ¼” diameter pole (6 ft fiberglass bike flag), gently lower the pole so that the rod is plumb to the ground (on slopes this will not be perpendicular to the ground). At each point intercept, record the species that touch one side of the pole from top to bottom, for example if black spruce was the tallest vegetation “hit” (touching the pole) at that point, black spruce would be recorded first. Similarly, ground cover will always be recorded last.

- *Species Codes* - Record species “hits” using the NRCS four letter plant species codes. Generally, the NRCS species codes are the first two letters of the genus (i.e., *Salix*) and then the first two letters of the species (i.e., *glauca*). (The NRCS code for *Salix glauca* is SAGL.) Refer to the USDA plants database for the most current species codes (NRCS 2011, <http://plants.usda.gov/>). Numbers are also frequently used to differentiate species with alphabetically similar codes (i.e., *Calamagrostis canadensis* code is CACA4). If the exact code is unknown, write the full species full name and the code used on the datasheet.
- *Unknown Species* - If common but unknown species are encountered, collect a sample for later identification. Record it on the datasheet as an identifiable acronym, note a description of the species, and whether it was collected.
- *Dead Trees* - For standing dead trees, record species and indicate that it is dead by adding a D after the species code as a superscript. For dead branches on a live tree, record the species as live.
- *Dead/Damaged Vegetation or Substrate* – Record species and indicate that is dead by adding a D after the species code or as a superscript. The same applies for Charred or Scorched species (use a “C” or “S”). **Note:** Moss-D is not the same as DM.

Tree Density and Measurements

Tree Density

On the TREE DENSITY TALLY datasheet, record the total number of trees taller than 1.37-m (4.5 ft) that occur within the 8-m radius circular plot by species, diameter size class (< 5 cm, 5.1 - 10 cm, 10.1 - 15 cm, 15.1 – 23 cm, > 22.5 cm DBH), and status (live or dead). *In dense stands of trees* with greater than 15 trees in a 4-m radius subplot, tally only trees within the 4-m radius subplot and indicate on datasheet which plot dimensions used (e.g., 4-m radius plot). Also tally trees by disease or insects if this is prevalent (see list of damage codes in the [Appendix](#)). Dead trees with < 45° angle to ground are not tallied. For small "layering" trees, pull trees upright to determine if height is > 4.5 ft. Use a Hagloff DME to determine if trees are rooted within the 8-m or 4-m radius circular plot.

For seedling density, tally all live “seedlings” (less than 4.5 ft tall) by species and life status in three 1-m radius circular subplots located at the 4-m, 8-m, and 12-m marks along the transect (total “seedling” area of 9.42 m² or .0048 ac). Life status options include:

- *Resprouts (R)* - New growth from older root stock.
- *Seedlings (S)* - New plants from seeds < 10cm tall.
- *Mature (M)* – Greater than 10cm tall.

Tree Measurements

On the TREE MEASUREMENTS datasheet, record detailed tree measurements for two live trees (> 4.5 feet tall) of each species and size class. Select trees for measurement which are located within the 8-m or 4-m radius circular tree density plot and are closest to the center point of the plot.

Alternatively, measure all trees within the circular plot if needed to meet the project objectives. If re-

visits are planned, mark the trees with metal tags and unique identifiers. If re-visits are planned, mark the trees with metal tags and unique identifiers. The following tree measurements are recorded: DBH (diameter at breast height), tree height, crown radius, height to live and dead ladder fuels, and main crown base height (CBH). This information will be used to calculate tree density, tree basal area, crown bulk density, and stand height. For deciduous trees, record tree height and DBH **only**. Diagrams illustrating how to record tree measurements are provided in the Appendix ([Figure 2](#) and [Figure 3](#)). Definitions of the parameters measured are as follows:

- *Tree Number* – If it is the first visit to the plot and the tree needs to be marked for revisits, assign a unique number/identifier to the tree, record it on the datasheet and tag the tree with the number assigned. If revisiting a plot with tagged trees, record the unique number/identifier on the datasheet.
- *Species* - Record the species of the tree using the NRCS species codes (NRCS 2011, <http://plants.usda.gov/>). Shrubs, such as willows or alders of tree height, are not considered trees.
- *Diameter at Breast Height (DBH)* - Measure the diameter of the tree trunk in centimeters at 4.5 ft (1.37 m) from the ground using the metric diameter tape measure.
- *Tree Height* - Measure the tree height in meters using a clinometer or laser range finder. Record measurements from 10 to 30 m away from the tree. The taller the tree, the further from the tree the measurement needs to be taken. Use the percent side of the clinometer to calculate tree height. Tree Height (meters) = (distance from tree in meters) x (% to top of tree - % to base of tree). **Note:** if the base % is negative this will be added to the total height (math: minus a negative is positive). See Figure 3.
- *Crown Radius* - Measure the crown radius in centimeters to the average widest branch or dripline of the crown with a tape measure or ruler.
- *Height to Dead Ladder Fuel* – Measure the height in centimeters from the forest floor to the lowest point of a dead branch with a tape measure or ruler.
- *Height to Live Ladder Fuel* – Measure the height in centimeters from the forest floor to the lowest point of a live branch with a tape measure or ruler.
- *Main Crown Base Height (CBH)* - Measure the height in centimeters from the forest floor to the obvious main live crown. Use a clinometer/laser range finder to measure from a distance or measure directly with a tape measure or ruler.
- *Location* – Record the location of the tree along the transect line (e.g., 8.5m or 3.2m).
- *Comments* – Use this field to describe notable aspects of the tree including damage (use damage codes where possible).

Active Layer and Soils

On the ACTIVE LAYER/SOILS datasheet, record active layer depth at 8 points located at 2-m intervals along the transect (except the last point is placed at 15-m). Measure the depth of the active layer at each point by inserting the bike flag or permafrost probe into the ground. Record the depth

(cm) to resistance (active layer boundary). If possible, record whether active layer depth is limited by rock, permafrost, or seasonal frost and note on datasheet. Record the surface fuel codes, soil moisture (%), soil temperature (°C) and pH at each point on transect.

Burn Severity & Duff Consumption

Burn Severity (Point) & Duff Consumption

On the BURN SEVERITY/DUFF CONSUMPTION datasheet (located on the same datasheet as the ACTIVE LAYER/SOILS data), record assessments of burn severity using the burn severity codes (BSC) for both substrate and vegetation. The BSC are described in Table 1. Burn severity is assessed at points located every 2-m along the 16-m transect (except for the last point is located at the 15-m).

Table 1. Burn severity code matrix, modified from NPS Fire Monitoring Handbook (2003).

Burn Severity Code (SBS)	Forest and Shrub Types:	
	Substrate (S)	Vegetation (V)
(5) Unburned	Not burned	Not burned
(4) Scorched	Litter/moss partially blackened; duff nearly unchanged; wood/leaf structures unchanged	Foliage scorched and attached to supporting twigs
(3) Lightly Burned	Litter/moss charred to partially consumed; upper duff layer may be charred but the duff layer is not altered over the entire depth; surface appears black; small woody debris is partially burned.	Foliage and smaller twigs partially to completely consumed; branches mostly intact; less than 40% of the shrub canopy is commonly consumed
(2) Moderately Burned	Litter entirely consumed, leaving coarse, light colored ash; duff deeply charred to lower duff or upper /lower duff interface, but underlying mineral soil is not exposed; woody debris is mostly consumed; logs are deeply charred, burned-out stump holes are common	Foliage, twigs, and small stems consumed; some branches (>0.5 – 2.5 cm) still present. 40-80% of the shrub canopy is commonly consumed
(1) Heavily Burned	Litter and duff completely consumed, or within 1 cm of mineral soil; mineral soil may be visibly altered, sometimes reddish; if present, sound logs are deeply charred, and rotten logs are completely consumed. <i>Marcantia</i> and fire mosses may be present.	All plant parts less than 2.5 cm in diameter are consumed, leaving some or no major stems or trunks; any left are deeply charred
(NA) Not applicable	Inorganic pre-burn	None present pre-burn

To quantify duff consumption from wildfire or prescribed fire, use the following methodology. First, prior to the fire, insert 8 non-flammable burn pins (recommend 15-30” long welding rods) firmly in the ground at 2-m intervals along the transect. Ensure that the tops of the burn pins are flush with the ground surface. If it is not possible to fully insert the burn pin, either cut the burn pin so that is flush with the ground or record the length (cm) of the above ground segment on the BURN SEVERITY/DUFF CONSUMPTION datasheet. Revisit burned plots to record duff consumption as soon as possible or within 1 year of the fire event. Record the length of burn pin segment exposed as a result of the fire.

Composite Burn Index (CBI) - Full Plot Burn Severity Assessment

The COMPOSITE BURN INDEX (CBI) datasheet is used to assess burn severity at the plot level. The Composite Burn Index (CBI) is a ground-based plot methodology utilized to field-verify remotely sensed burn severity measures such as the differenced Normalized Burn Ratio (dNBR). CBI plots are used throughout the National Park Service as a tool for validating the satellite-derived estimates of burn severity delivered by the Monitoring Trends in Burn Severity program (MTBS) of the U.S. Geological Survey. CBI ratings can be taken to assess the overall plot burn severity.

Plots are usually 20-m (non-forested sites) or 30-m (forested sites) diameter circular areas. Plot locations are usually pre-determined prior to field visits to ensure that the full range of likely burn severity levels and vegetation types within the fire perimeter are represented in the final dataset. Usually plots are clustered in groups of 8-10 within hiking distance of one another and a single group of 8-10 plots may be assessed in a day. CBI plots are usually not permanent and plot markers are usually not installed (unless desired by the park for future monitoring).

The Composite Burn Index is based on ocular estimates of the degree of environmental change caused by fire to surface features and vegetation layers (strata). A brief overview of major components is provided here. Strata are based on height above ground and include:

- *Substrates* - Inert surface materials (soil, duff, litter, and downed woody fuels).
- *Herbs, Low Shrubs and Trees < 1m* - Grasses and forbs, as well as shrubs and small trees <3 ft (<1m) tall.
- *Tall Shrubs > 1m and Trees 1-2m* - Tall shrubs greater than 1 meter (3 ft) and trees 1-2 m tall.
- *Intermediate Trees (Subcanopy) 2-8m* - Trees canopy layer situated between “tall shrubs and trees” and “big trees” layers. Trees may be of stratified heights and extend to upper canopy, but crowns receive little direct sunlight.
- *Big Trees (Upper Canopy, Dominant, Codominant Trees) > 8m* - Tree layer taller than intermediate canopy layer which occupies the upper canopy and receives direct sunlight.
- *Total Plot, or Overall* - All strata combined for assessment of total burn severity.

Within each stratum, there are 5 or more burn severity variables assessed. Each variable is scored from 0-3 (0 = unburned, 3 = highest severity). An overall CBI score is calculated for each plot by averaging the individual severity scores from each strata. This overall CBI score is then cross-referenced with the satellite measure of severity to determine the degree of correlation.

Alaska specific modifications to the CBI datasheet include:

- Addition of % Pre-Fire Tussock Cover, Duff Consumed (cm)/Pre-Fire Duff Depth (cm), and % Pre-Fire Moss/Lichen Cover fields.
- Tussock Consumption was combined with Medium Fuels 3-8 in variable.
- CBI_1 variable under the Substrate Strata is used to evaluate Moss/Lichen consumption

The generic “CBI_1” variable listed under each stratum can be customized by project or ecosystem to represent an actual field variable that is not listed on the datasheet.

Forest Floor Duff Thickness and Fuel Moisture

Measurement of litter and duff layer thicknesses is standard for many fire ecology monitoring projects. In some cases, duff moisture measurements may also be needed for a project. Both “duff and litter thickness” and “duff moisture” measurements are conducted using duff plugs (removable sections of forest floor).

When removing duff plugs, do not disturb the forest floor or the vegetation along the transect within the 8-m radius circular plot area. If permafrost or other obstructions limit the depth of the duff plug, measure the layers available and indicate the type and depth of obstruction. Extract the duff plug by carefully cutting down through the forest floor (using a compass saw, trowel and/or shovel) to either mineral soil or permafrost.

Duff Layer Thickness

Duff layer thicknesses are recorded on the DOWN WOODY DEBRIS & DUFF THICKNESS datasheet or, if measured in combination with fuel moisture, on the FUEL MOISTURE datasheet. Remove duff plugs from at least two sites (generally near the 0-m and 16-m transect ends) located at least 1-m away from the transect line. Choose duff plug collection sites that appear to be representative of the forest floor in the larger plot area. Examine the duff plugs and record the thickness of each layer (live moss, dead moss, upper duff and lower duff) down to mineral soil (or permafrost). Collect measurements to the nearest 0.5 cm. Return the duff plug to the hole when measurements are completed.

Fuel Moisture

Duff and live fuel moisture measurements are recorded on the *FUEL MOISTURE* datasheet. For duff moisture, record the duff layer thicknesses as described above then collect samples from each layer of the duff plug. Place the samples in oven-safe Nalgene sampling bottles and record the bottle number on the datasheet. The samples must be weighed before and after drying in the oven.

More detailed information and Alaska specific guides on [duff moisture sampling](#), [live fuel moisture sampling](#), [fuels drying and data entry](#), and [specialized data sheets](#) for Alaska can be found on the AWFCG Fire Research, Development and Application Committee’s – Activities and Products website (<https://www.frames.gov/afsc/partners/frdac/activities-products>).

Additional references include Wilmore (2001), Jandt et al (2005) and Norum and Miller (1984).

Down Woody Fuels

Use the DOWN WOODY DEBRIS & DUFF THICKNESS datasheet to tally the number of woody debris particles along the 16-m transect using the planar intersect method outlined by Brown (1974) and the National Park Service Fire Monitoring Handbook (NPS 2003). Down woody fuel loads are measured in standard units. Table 2 is a summary of the woody debris size classes and the sample distance segments along the transect.

By size class, tally the number of times down woody debris intercepts (crosses) the transect line. For 1000-hr fuels, measure and record the diameter of the 1000-hr fuel (at the line crossing), record as solid or rotten and record the tree species.

Tally dead and down woody materials only. Do **NOT** include cones, needle litter, leaf litter and bark, or stems and branches that are attached to standing trees or shrubs. Record as “NONE” if there are no woody fuels intersecting the transect.

Table 2. Woody fuel types, diameter size classes, and distance segment in which each fuel type is tallied along 16-m transect.

Diameter size	Fuel Type	Distance to Tally Along Transect
0 to 0.25 inch	1-hour fuels	From 0 to 6 foot (1.82 m)
0.26 to 1 inch	10-hour fuels	From 0 to 6 foot (1.82 m)
1.1 to 3 inches	100-hour fuels	From 0 to 12 foot (3.66 m)
> 3 inches	1000-hour fuels Record species, diameter and solid/rotten	From 0 to 52.49 foot (16 m)

Shrub Density

Shrub density is recorded on the SHRUB DENSITY datasheet. To quantify tall shrub density for alder and tall willow species, tally the number of individual shrubs greater than 1-m tall located in the 4-m radius circular plot. Individuals are defined by clusters of stems separated by >10 cm. Where not possible to distinguish between individual shrubs, record the number of *stems above ground* (counted at the ground surface level). Tally shrubs by species and life stage (resprout, mature, decadent and dead). *Mature* shrubs have <50% dead biomass compared to *decadent* shrubs which have >50% dead biomass. Dead shrubs must have no sign of living material on the plant. Record the average height of each shrub species found within the 8-m circular plot or 4-m subplot.

Moose Browse Architecture & Herbivory

Moose Browse & Herbivory Data

Evidence of browse by moose is recorded on the MOOSE BROWSE ARCHITECTURE datasheet.

Moose select certain shrub and tree species for consumption. These species are referred to as preferred species. Preferred browse species includes all common interior Alaska deciduous tree species (paper birch, aspen, and balsam poplar) as well as tall (and some low) willow species. Other tall and low shrub species including alder, rose, soapberry, and dwarf birch are *not* preferred browse species. To measure habitat use based on browse evidence, employ the following modification of the general methodology outlined by Seaton (2002).

Select two individuals of **each** preferred species located closest to the circular plot center point within the 8-m radius plot. For each individual, identify the species and record the estimated plant height. Also record the mature class (whether more or less than 50% of the individual is taller than 3-m), the dead class (whether more or less than 50% of the individual is dead) and assign one of the following architectural classifications:

- **Broomed** – Has been extensively affected by browsing activity:

- *Sapling Type Plants* - The main apical stem has been broken by moose. It is important to look at the history of the plant to ensure that this may have happened 2–10 years before measurement.
- *Bushy Type Plants* - More than half of the current annual growth (CAG) stems arise from lateral stems that were produced as a result of browsing. Look back through stems that are many years old.
- **Browsed** - Has been browsed some in the past but browsing has not significantly affected its growth. Less than half of CAG twigs between 0.0 and 3.0 m arise from lateral stems that were produced from browsing.
- **Unbrowsed** - There is no visible evidence that moose have ever browsed this plant.

Additionally, record whether browsing activity by moose has resulted in one or more broken stems. Moose often break taller stems to reach new growth and leaves. Record whether there is evidence of hare browsing. Hare browse evidence is usually located lower on the plant than moose browse (at the level of winter snow depth or below) and is indicated by a clean diagonal cut in the stem. Moose browse usually has a more horizontal and jagged appearance. Use comments to note evidence of bark stripping by moose and porcupine, lichen utilization by caribou, and any other evidence of habitat utilization by wildlife (ptarmigan, small mammal, squirrel, etc.).

Moose Browse Density

Moose browse density may also be collected utilizing the MOOSE BROWSE ARCHITECTURE DENSITY datasheet. Record the number of individual of plants by species, height class and moose browse architecture (as described above) on the MOOSE BROWSE DENSITY datasheet. Individuals for tall shrubs such as willow are defined as stems that are rooted greater than 10 cm apart. Height classes are defined as 0-0.5m, 0.6-1m, 1.1-3m, 3.1-5m, > 5m. Plants taller than 5m should not be recorded.

Invasive Plant Infestation

To record observations of invasive plants during monitoring projects, use the ALASKA EXOTIC PLANT MANAGEMENT TEAM (EPMT) datasheet (modified for the NPS Alaska Fire Ecology program). Invasive plant infestation is often associated with disturbance, including burned and thinned areas. In order to get an idea of what's coming back in areas affected by fire management decisions, carry several copies of the Alaska Exotic Plant Management Team (EPMT) datasheets to record observations of invasive species. Record a rough estimate of the area infested (buffer), the % cover of the species in the buffer, the current life cycle stage (phenology), the amount of time it would take to remove all individuals from the buffer area, the GPS coordinates indicating where to find the infestation and any comments which might lend insight to the infestation (e.g., type of disturbance(s), health of species individuals, etc.).

It is recommended to carry a copy of the Invasive Species Pocket Guide for Alaska Firefighters (Shepard et al 2018) and/or a list of probable invasive species in the area visited. Additional references include the Invasive Plants of Alaska (AKEPIC 2005) and the USFS Region 10 Forest & Grassland Health webpage (<https://www.fs.usda.gov/main/r10/forest-grasslandhealth/>).

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Datasheets

Plot Data Collection Check List

Unit: _____ Project: _____ Plot ID: _____ Date (M/D/Y): ____/____/____

Protocol/Data Sheet	Check if Data Form Used	Modifications/Comments
Site Description		
General Vegetation Information		
Vegetation Point Intercept		
Tree Density Tally		
Tree Measurements		
Active Layer/Soils		
Burn Severity/Duff Consumption		
Down Woody Debris & Duff Thickness		
Burn Severity - Composite Burn Index (CBI)		
Fuel Moisture Sampling		
Shrub Density by Life Status		
Moose Browse Architecture Data		
Moose Browse Architecture Density		
Invasive Plant Survey		

Site Description

General Site Information:

Unit: _____ Project: _____ Plot ID: _____ Date (M/D/Y): ____/____/____

Field Crew: _____ Plot Markers: _____

Transect Azimuth: _____ (0m to 16m) Transect Slope: _____ % Plot Dimensions: _____

Slope: _____ % Aspect: _____ Deg Declination used: _____ Elevation: _____ ft/m

Soil (circle): Wet Moist Dry Disturbance (circle): Fire Wind Insect Other: _____

Fire Indicators (circle): Burn Snags Burned Stumps Fire Scars Burned Plants Charcoal

Est. Time Since Fire (circle): 0-9 yrs 10-20 yrs 21-50 yrs 51-100 yrs > 100 yrs UNK

Distance to Closest Unburned Trees (m): _____

Species: _____

Treatment/Fire Description:

Plot Type (circle): Wildfire Hazard Fuels RX Control

Treatment phase (circle): Pre-thinning Post-thinning Maintenance thinning

Treatment Year: _____ Pre or Post: _____ (yrs) Type Treatment: _____

OR

Fire Number: _____ Fire Name: _____ Fire Year: _____ Pre or Post: _____ yrs

Latitude/Longitude: GPS Type: _____ GPS Identification: _____ GPS Datum: _____

Description	Waypoint	Latitude (DD.DDDD)	Longitude(DD.DDDD)	GPS Error
		N	W	m/ft
		N	W	m/ft
		N	W	m/ft

Photos - Camera used: _____

Description	Azimuth	Photo Time (military)

Vegetation Class: List two or more dominant species of each lifeform and their % cover within the plot area.

Current Viereck class: _____

Pre-Disturbance Viereck Class: _____

Plot area described: _____

Lifeform	Species 1	% Cover	Species 2	% Cover	Species 3	% Cover	Species 4	% Cover
Tree Sp. (list all spp)								
Tall Shrub Sp.								
Low Shrub Sp.								
Dwarf Shrub Sp.								
Graminoid/Herbaceous Sp.								
Moss/Lichen/Ground Cover								


 Notes on Back of Page

Plot Layout and General Notes: Provide notes and map on relocating or LZ, burn information and other plot notes as needed below.

General Vegetation Information

Park Unit: _____ **Project:** _____ **Plot ID:** _____ **Pre or Post** _____ yrs
Field Date: _____ **Field Crew:** _____ **Plot Dimensions:** 8 m radius

Record plant status (superscript): **D** (dead), **C** (charred), **S** (scorched). Also record if collected (* next to spp. code) or trace (**T** = trace) <1% cover. If tree density and tree measurements are not recorded at the plot, record average ladder fuel height and DBH for tree species. If a single species forms two or more distinct sub-layers or a substantial proportion of species is burned or damaged, list on separate rows (e.g., PIGL-sapling, PIGL-overstory, PIGL-live, PIGL-dead).

Species				Cover Class												
Tree Layer	Common Name	Avg. DBH (cm)	Avg. Ladder Fuel Ht (cm)	Pre-Fire Cover	1-10%	11-20%	21-30%	31-40%	41-50%	51-60%	61-70%	71-80%	81-90%	91-100%	Dead? (Y / N)	Avg. Height (m)
PIGL	White spruce															
PIMA	Black spruce															
POTR5	Aspen															
BEPA	Paper birch															
POBA2	Balsam poplar															
LALA	Larch															
Shrub Layer	Common Name	Seedling	Re-sprout	Pre-Fire Cover	1-10%	11-20%	21-30%	31-40%	41-50%	51-60%	61-70%	71-80%	81-90%	91-100%	Dead? (Y / N)	Avg. Height (m)
ALVIC	Green alder															
SALIX	Unknown willow															
SAGL	Glaucous willow															
SAPU15	Diamond Leaf willow															
SABE2	Bebb willow															
BENA	Dwarf birch															
B EGL	Tall shrub birch															
DAFL3	Shrubby cinquefoil															
LEPAD/LEGR	Labrador tea															
CHCA2	Leatherleaf															
SHCA	Soapberry															
ROAC	Prickly Rose															
VAUL	Blueberry															
VAVI	Lowbush cranberry															
EMNI	Crowberry															
ARRU	Bearberry															
RUCH	Cloudberry															
COCA13	Dwarf dogwood															
LIBO3	Twinflower															

Plot ID: _____ Date: _____

Herbs & Graminoids	Common Name	Seedling	Re-sprout	Pre-Fire Cover	1-10%	11-20%	21-30%	31-40%	41-50%	51-60%	61-70%	71-80%	81-90%	91-100%	Dead? (Y / N)
EQUIS	Unknown Horsetail														
EPAN2	Fireweed														
GELI2	Pumpkinberry														
CABI5	Bigelow's sedge														
CAREX	Unknown Carex														
CACA4	Bluejoint grass														
GRASS	Unknown Grass														
ERVA4	Tussock grass														
Non-vascular	Common Name			Pre-Fire Cover	1-10%	11-20%	21-30%	31-40%	41-50%	51-60%	61-70%	71-80%	81-90%	91-100%	Dead? (Y / N)
MOSS*	Unidentified moss														
SPHAG2	Sphagnum moss														
FMOSS	Unknown feather moss														
HYSP70	Stair-step moss														
PLSC70	Big red stem moss														
CEPU12	Ceratodon moss														
POJU70	Common juniper moss														
AULAC2	Unk. Aulacomnium moss														
MAPO12	Marchantia liverwort														
CLADI3	Cladina unknown														
CLADO3	Cladonia unknown														
LICHEN*	Unknown lichen														
PEAP60	Freckle pelt lichen														
Ground Cover	Common Name			Pre-Fire Cover	1-10%	11-20%	21-30%	31-40%	41-50%	51-60%	61-70%	71-80%	81-90%	901100%	Dead? (Y / N)
LTRNDL	Needle Litter														
LTRH	Leaf Litter														
DUFF	Duff														
1Hr	0 to 0.25 inch														
10Hr	0.25 to 1 inch														
100Hr	1 to 3 inches														
1000Hr	> 3 inches														
DM	Dead Moss														
UD	Upper Duff														
LD	Lower Duff														
MIN	Mineral Soil														
W	Water														
ROCK	Rocks														

Vegetation Point Intercept

Park Unit: _____ Project: _____ Plot ID: _____ Pre or Post _____ yrs

Field Date: _____ Field Crew: _____ Transect: _____

Record substrate and species codes of trees, shrubs, forbs and groundcover intercepted at each 50 cm interval. Record plants tallest to lowest. **Record status** (superscript): **D** (dead), **C** (charred), **S** (scorched).

*=collected

		<i>Tallest</i>						
PNT	Meters	SPP 1	SPP 2	SPP 3	SPP 4	SPP 5	SPP 6	SPP 7
1	0.5							
2	1							
3	1.5							
4	2							
5	2.5							
6	3							
7	3.5							
8	4							
9	4.5							
10	5							
11	5.5							
12	6							
13	6.5							
14	7							
15	7.5							
16	8							
17	8.5							
18	9							
19	9.5							
20	10							
21	10.5							
22	11							
23	11.5							
24	12							
25	12.5							
26	13							
27	13.5							
28	14							
29	14.5							
30	15							
31	15.5							
32	16							

Tree Density Tally

Park Unit: _____ **Project:** _____ **Plot ID:** _____ **Field Date:** _____ **Field Crew:** _____ **Plot Dimensions:** _____

Tally the number of trees taller than 4.5' (1.37-m) by diameter size class, species and status within the 8-m circular plot area. In densely forested stands (with > 15 trees in 4-m radius circular subplot) tally only trees in 4-m radius subplot. Tally trees by live, dead, or if disease or insects are prevalent (record damage code). Dead trees with < 45° angle to ground are not tallied (counted as down woody fuel). For small "layering" trees, pull trees upright to determine if height is > 4.5'. Tally "seedlings" (live trees less than 4.5' tall) by species and life status in three **1-m radius** circular plots at 4-m, 8-m and 12-m on transect. **Resprouts (R):** New growth from older root stock. **Seedlings (S):** New plants from seeds < 10cm tall. **Mature (M):** >10cm tall.

		Tree Counts by DBH (cm)					Seedling <4.5ft 4 M	Seedling <4.5ft 8 M	Seedling <4.5ft 12 M
Tree Species	Status	< 5cm	5.1-10 cm	10.1-15 cm	15.1-23 cm	>23 cm			
Black Spruce (<i>Picea mariana</i>)	LIVE						R	R	R
	Dmg_____						S	S	S
	DEAD						M	M	M
	Dmg_____								
White spruce (<i>Picea glauca</i>)	LIVE						R	R	R
	Dmg_____						S	S	S
	DEAD						M	M	M
	Dmg_____								
Aspen (<i>Populus tremuloides</i>)	LIVE						R	R	R
	Dmg_____						S	S	S
	DEAD						M	M	M
	Dmg_____								
Paper birch (<i>Betula papyrifera</i>)	LIVE						R	R	R
	Dmg_____						S	S	S
	DEAD						M	M	M
	Dmg_____								
Balsam poplar (<i>Populus balsamifera</i>)	LIVE						R	R	R
	Dmg_____						S	S	S
	DEAD						M	M	M
	Dmg_____								
Larch Tamarack (<i>Larix laricina</i>)	LIVE						R	R	R
	Dmg_____						S	S	S
	DEAD						M	M	M
	Dmg_____								

Tree Measurements

Park Unit: _____ **Project:** _____ **Plot ID:** _____ **Pre or Post** _____ **yrs**
Field Date: _____ **Field Crew:** _____ **Plot Dimensions:** _____

Record the following for two live trees (> 4.5 feet tall) of each species and size class observed within the tree density plot. Select trees located within the tree density plot and closest to the plot center point. Record measurements to the nearest tenth (e.g., 4.3 m, 2.2 cm). Note observed tree damage (including fire damage), insects or disease using damage codes where possible. *For deciduous tree species record tree height and DBH only.*

[illegible]

Active Layer/Soils

Park Unit: _____ Project: _____ Plot ID: _____ Field Date: _____ Field Crew: _____ Plot Dimensions: _____

Point	Distance	Active Layer Depth (cm)	Surface Layer Fuel Code	Comment (Permafrost/Rock)	Soil Moisture (%) Depth:	pH	Soil Temp (°C) Depth:	Notes
1	2-m							
2	4-m							
3	6-m							
4	8-m							
5	10-m							
6	12-m							
7	14-m							
8	15-m							

Surface Layer Fuel Codes: LC = lichen, FM = feather moss, SM = sphagnum moss, DM = dead moss, UD = upper duff, LD = lower duff, MIN = mineral, LTRH = Litter herbaceous, LTRNDL = Litter needle litter.

Active Layer Boundary Codes: Permafrost (PF), Rock (R), Seasonal Frost (SF), Unknown (UNK)

Burn Severity/Duff Consumption

Use the burn severity code matrix to determine burn severity for substrates and vegetation. If using pins for duff consumption, pre-fire pins should be pushed in flush with the surface fuels if possible.

Point	Distance	Post-Fire		Pre-fire	Post-fire	
		Burn Severity Code (Substrate)	Burn Severity Code (Vegetation)	Burn Pin above surface (cm) (A)	Burn Pin Exposed (cm) (B)	Burn Depth cm (=B-A)
1	2-m					
2	4-m					
3	6-m					
4	8-m					
5	10-m					
6	12-m					
7	14-m					
8	15-m					

Down Woody Debris & Duff Thickness

Park Unit: _____ **Project:** _____ **Plot ID:** _____ **Pre or Post** _____ **yrs**
Field Date: _____ **Field Crew:** _____ **Transect Length:** _____

Record the number of intercepts of woody fuels by diameter size class along the transect. Record 1-hr (0-1/4") and 10-hr (1/4"-1") fuels from 0 to 6 ft (1.8m) along transect, 100-hr (1"-3") from 0 to 12 ft (3.7m) along transect, and 1000-hr (> 3") from 0 to 52.49 ft (16m). Record the **species, diameter and solid or rotten for 1000-hr fuels >3" diameter**. Measure litter and duff layer thickness at each end of the transect in location off-set by at least 1-m.

	# of intercepts			>3" Diam: Record Diameter (in) and Species (0-53 ft)		Litter and Duff Thickness (cm)			
	0 – 0.25" 1 hr (0-6 ft)	0.25 - 1" 10 hr (0-6 ft)	1 - 3" 100 hr (0-12 ft)	3"+ solid 1000 hr S	3"+ rotten 1000 hr R	Sample site 1	Thickness cm	Sample site 2	Thickness cm
Transect Dir. ____ Slope ____						Litter		Litter	
						Lichen		Lichen	
						Live Moss		Live Moss	
						Dead Moss		Dead Moss	
						Upper Duff		Upper Duff	
	Total:	Total:	Total:			Lower Duff		Lower Duff	

	0 – 0.25" 1 hr	0.25 - 1" 10 hr	1 - 3" 100 hr	3"+ solid 1000 hr S	3"+ rotten 1000 hr R	Sample site 3	Thickness cm	Sample site 4	Thickness cm
	Transect Dir. ____ Slope ____						Litter		Litter
						Lichen		Lichen	
						Live Moss		Live Moss	
						Dead Moss		Dead Moss	
						Upper Duff		Upper Duff	
Total:		Total:	Total:			Lower Duff		Lower Duff	

Definitions & Tally Rules:

- > Downed woody material are dead twigs, branches, stems and boles of trees and shrubs that have fallen and lie on or above the ground.
- > Measure woody material first to avoid disturbing it and biasing your estimates.
- > Do not count dead woody stems and branches still attached to standing live shrubs and trees.
- > If more than 45 degrees and dead, but still attached at the bole it is counted.
- > Do not tally any particle having a central axis that coincides perfectly with the sampling plane.
- > If the sampling plane intersects a curved piece more than once, tally each intersection.
- > For rotten logs that have fallen apart, try to estimate its original diameter.
- > Tally uprooted stumps and roots not encased in dirt. Do not tally undisturbed stumps.

Composite Burn Index (CBI) Data Sheet (AK 2020)

FFI -- BURN SEVERITY -- COMPOSITE BURN INDEX

PD - Abridged		Examiners:		Fire Name:	
Administrative Unit		Project Unit		Macro Plot	
Field Date mmddyyyy	/ /	Fire Date mmyyyy	/	GPS Type	
Plot Aspect		Plot % Slope		Elevation (ft)	
Plot Diameter (m)		Latitude		GPS Datum	
Camera Used		Longitude		GPS Error (ft)	
Number of Plot Photos		Plot Photo Time			

CBI - Long Form	% Understory Burned =	% Overstory Burned =					
STRATA RATING FACTORS	BURN SEVERITY SCALE						FACTOR SCORES
	No Effect	Low		Moderate		High	
	0.0	0.5	1.0	1.5	2.0	2.5	

A. SUBSTRATES		% Pre-Fire Cover: Tussocks =		% Pre-fire Depth (cm) / Consumed (cm)	
% Pre-Fire Cover: Litter =	Moss/Lichen =	Soil/Rock =	Pre-Fire Depth (cm): Litter =	Duff = *	/ **
Litter/Light Fuel Consumed	Unchanged	--	50% litter	--	100% litter
Duff	Unchanged	--	Light char	--	50% loss deep char
Tussocks/Med. Fuel, 3-8 in.	Unchanged	--	20% consumed	--	40% consumed
Heavy Fuel, > 8 in.	Unchanged	--	10% loss	--	25% loss, deep char
Soil & Rock Cover/Color	Unchanged	--	10% change	--	40% change
Moss/Lichen (CBI_1)	Unchanged	--	Light char	--	50% loss deep char
					Consumed

B. HERBS, LOW SHRUBS AND TREES LESS THAN 1 METER		Species:	
% Pre-Fire Cover =	% Enhanced Growth =		
% Foliage Altered (blk-brn)	Unchanged	--	30%
Frequency % Living	100%	--	90%
Colonizers (includes early successional mosses/liverworts)	Unchanged	--	Low
Spp. Comp. - Rel. Abund.	Unchanged	--	Little change
CBI_1			

C. TALL SHRUBS ≥ 1 METER AND TREES 1 to 2 METERS		Species:	
% Pre-Fire Cover =	% Enhanced Growth =		
% Foliage Altered (blk-brn)	0%	--	20%
Frequency % Living	100%	--	90%
% Change in Cover	Unchanged	--	15%
Spp. Comp. - Rel. Abund.	Unchanged	--	Little change
CBI_1			

D. INTERMEDIATE TREES (SUBCANOPY, POLE-SIZED TREES) 2-8 Meters		Species:	
% Pre-Fire Cover =	Pre-Fire Number Living =	Pre-Fire Number Dead =	
% Green (Unaltered)	100%	--	80%
% Black (Torch)	None	--	5-20%
% Brown (Scorch/Girdle)	None	--	5-20%
% Canopy Mortality	None	--	15%
Char Height	None	--	1.5 m
CBI_1			

E. BIG TREES (UPPER CANOPY, DOMINANT, CODOMINANT TREES) ≥ 8 meters		Species:	
% Pre-Fire Cover =	Pre-Fire Number Living =	Pre-Fire Number Dead =	
% Green (Unaltered)	100%	--	95%
% Black (Torch)	None	--	5-10%
% Brown (Scorch/Girdle)	None	--	5-10%
% Canopy Mortality	None	--	10%
Char Height	None	--	1.8 m
CBI_1			

Post Fire: %Girdled =		%Felled =		% Tree Mortality =	
Comments:		CBI = Sum of Scores / N Rated:		Sum of Scores	N Rated
		Understory (A+B+C)			
		Overstory (D+E)			
		Total Plot (A+B+C+D+E)			

% Estimators: **20 m Plot:** 314 m² 1% = 1x3 m 5% = 3x5 m 10% = 5x6 m *After, Key and Benson 1999, USGS NRMSC, Glacier Field Station.*
30 m Plot: 707 m² 1% = 1x7 m (<2x4 m) 5% = 5x7 m 10% = 7x10 m *Version 4.0 8 27, 2004 (updated 11/26/07 for FFI) (updated for AK 2020)*
 Strata and Factors are defined on the reverse side of this form. See the FIREMON Landscape Assessment, available at <https://www.frames.gov/firemon/home> for more information.

STRATA

Substrates—Inert surface materials of soil, duff, litter, and downed woody fuels. **Herbs, Low Shrubs and Trees**—All grasses + forbs, and shrubs + small trees <3 ft (<1 m). **Tall Shrub and Trees**—Shrubs and trees 3–16 ft (1–5 m) tall. **Intermediate Trees (pole-size, subcanopy)**—Trees between tall shrubs/trees and upper canopy, approximately 4–10 inches (10–25 cm) diameter, and 25–65 ft (8–20 m) tall. May be stratified heights and extend to upper canopy, but crowns receive little direct sunlight. Size is relative to upper canopy and varies by community. If this size is upper canopy, count as intermediate trees. **Big Trees (mature, dominant and co-dominant, upper canopy)**—Larger than intermediate trees, occupy upper canopy, receive direct sunlight; tallest may extend above average big-tree level. **Understory**—Substrates, herbs/low shrubs+trees, tall shrubs+trees. **Overstory**—Intermediate and big trees. **Total Plot, or Overall**—All strata of the plot combined.

GENERAL

Pre-fire exposed soil/rock is considered unburned if there is no sign of overlying substrates or vegetation that burned. Avoid sites with >50% exposed pre-fire soil/rock, see guidelines. **Rehab Site**—Mulch or other does not count, estimate as if that was not present. Planted, growing vegetation can be tallied where appropriate, but not as new colonizers. A specific factor may not be rated if is not relevant, shows inconsequential presence or insignificant indication of severity (write in N/A for not applicable), or when effects are unclear and cannot be reasonably judged (write in UC for uncertain). **Percent Plot Area Burned**—Record the percent surface area (burned substrates and low-growing plants) showing any impact from fire for the 98-ft (30-m) diameter plot, and for the nested 66-ft (20-m) plot, if that is used for the understory. **Prefire Variables**—Report cover (percent area), depth (inches) and density (number of trees) plot-wide as if before fire. Consider burned evidence + unburned areas within plot or nearby; reasonable approximation of prefire conditions. If too difficult to estimate, write in UC for uncertain. **Enhanced Growth Factors**—100 percent + percent productivity above that, judged to be fire-enhanced; regard amount of green biomass in terms of cover, volume and density. If plots show about the same or less productivity than before fire, then enter as not applicable (N/A). If plot shows enhanced growth, then enter the percent productivity that is augmented by fire, with 100 percent being the same postfire productivity as prefire (for example, 200 percent represents double the estimated prefire productivity); write in UC if uncertain.

SUBSTRATE RATING FACTORS (Do not count litter or fuels built up after fire.)

Litter/Light Fuel—Relative amount consumed of leaves, needles, and <3-inches (<7.6-cm) diameter wood on the ground at time of fire. Not new litter-fall. Count litter/light fuel even if it occurs under living plants. **Duff condition**—Relative amount consumed and charring of decomposed organic material lying below the litter. Not fine root mass. Count duff even if it occurs under living plants. **Medium Fuel**—Consumption of down woody fuel between 3–8 inches (7.6–20.3 cm). **Large Fuel**—Loss and charcoal from down woody fuel >8-inch diameter (20.3 cm). Base both classes on change to fuel load. Omit or join as one if either fuel class < 5 percent plot cover, see text. Include stumps in appropriate size class, if relevant. **Soil Cover/Color**—New exposed soil and color change; lightening at moderate to high, ~10 percent red at high severity—overlook ash. Consider soil or rock surface *not* covered by litter, duff or low herbaceous cover less than about 30 cm. If such occurs under taller shrubs and trees, count it.

HERBS, LOW SHRUBS AND TREES LESS THAN 3 FEET (1 METER) RATING FACTORS

Percent Foliage Altered—Only low shrubs and trees (<3 ft), prefire live or dead cover that are newly brown, black or consumed. Ignore resprout. **Frequency Percent Living**—Percent of prefire vegetation that is still alive after fire, based on number plot-wide; survivorship, not cover, not new seedlings. Include unburned as well as burned, resprouting perennial herbs, low shrubs and trees (<3 ft) plot-wide. Include all green vegetation as well as burned plants that have not had enough time to resprout but remain viable. Burned plants may need to be examined for viable growth points. Do not include new plants from seed or suckers. **Colonizers**—Potential dominance 2–3 years postfire of new (native or exotic) plants from seed; includes herbs and tree seedlings, plus aspen or other tree-to-shrub suckers, and nonvascular plants (for example, thistle, fireweed, pokeweed, ferns, moss, fungi, seedlings of lodgepole pine, slash pine, western larch, many weedy spp.). Rate only if spp. response to fire is known. **Species Composition/Relative Abundance**—Change in spp. and/or relative abundance of spp. anticipated 2–3 years postfire. How much does postfire spp. composition resemble prefire stratum? Consider presence of new or absence of old spp., plus how dominance is spread across spp.

TALL SHRUBS AND TREES 3 TO 6.5 FEET (1 TO 2 METERS) RATING FACTORS

Percent Foliage Altered—Percent prefire live-or-dead crown volume (leaves, stems) newly brown, black or consumed. Ignore new resprout; it does *not* lessen the amount of prefire foliage altered. **Frequency Percent Living**—Percent of prefire tall shrubs/trees that are still alive after fire. This is a measure of survivorship based on numbers of individuals. Include unburned as well as burned but viable tall shrubs/trees 3–6.5 ft (1–2 m) tall plot wide; examine growth points for viability if needed. Do not include new plants from seed or suckers. Account for potential mortality that could occur up to 2 years postfire. **Percent Change in Cover**—Overall *decrease* in cover of tall shrubs/trees between 3 and 6.5 ft tall (1 and 2 m), relative to the area occupied by those plants before fire. Count resprouting from plants that burned, plus the unburned plants as cover that lessens the amount of decrease in cover. Do not include suckers or plants newly germinating from seeds. **Species Composition/Relative Abundance**—Change in spp. composition and/or relative abundance of spp. Anticipated 2 to 3 years postfire.

INTERMEDIATE AND BIG TREE RATING FACTORS (COMBINED)

Percent Unaltered (green)—Percent prefire live-or-dead crown volume unaltered by fire. Include new resprout from burned crowns, not from bases. **Percent Black (torch)**—Percent prefire live-or-dead crown volume that actually caught fire (black or consumed stems, leaves). May or may not be viable postfire; resprout from black crowns does not lessen percent black. At high severity, consumption of fine branching is evident. Include deciduous blackened crowns. **Percent Brown (scorch)**—Percent prefire live crown volume affected by scorch or girdle without direct flame contact. Brown is due to proximal heating, where foliage did not catch fire. Includes delayed mortality, insect damage, and brown foliage that has fallen to ground. **Percent Canopy Mortality**—Percent prefire live canopy volume made up by trees killed directly or indirectly by fire within 1–2 years. Proportion of a plot's total once-living canopy lost to dead trees (include insect/disease kill) in relation to total prefire canopy volume. **Char Height**—Mean char height from ground flames averaged over all trees. The mean is halfway between upper and lower heights on a tree. Include unburned (char height = 0) and burned trees *only* when char height is discernable. Do *not* include black from crown fire; enter N/A for most crown fire burns.

RECORD FOR EACH OVERSTORY STRATUM, BUT DO NOT COUNT IN CBI SCORES

Percent Girdled (at root or lower bole)—Percent of trees effectively killed by heat through the lower bark, sufficient to kill cambium around lower boles or buttress roots. Include trees either dead or likely to die within 1–2 years. Do not include trees killed by torch or scorch to crown. May or may not char through bark and into the wood; may have loose sloughing bark in 1–2 years. **Percent Felled (downed)**—Percent live-or-dead trees, that were standing before fire but now are on the ground. Usually from wind throw after fire, they exhibit fresh up-turned root masses, and different charring patterns than trees that were down when fire occurred. **Percent Tree Mortality**—Percent of once living trees on the plot that were killed by the fire, based on number of trees. Suspected insect and disease effects also may be included, if such contributed to killing whole trees relatively soon after fire (for example, within 1–2 years).

RATING ADVICE

Factors that are not applicable or cannot be resolved in a plot are not rated; they are omitted from that plot's composite ratings. Moreover, if there is much uncertainty about how a specific factor should be rated, or whether it is even relevant to the plot, then that factor should be left unrated. Only the number of rated factors is used to compute averages. If a factor is not rated, enter not applicable (N/A) or uncertain (UC) on the CBI data form. Do not just leave the field blank; such factors are not part of the CBI average, but one wants to know whether these factors were actually assessed, and it was decided not to rate them, or just accidentally overlooked and skipped. Zeros, on the other hand, are valid entries and do get averaged into composite scores. Zeros should be used when a rating factor is applicable and exhibits an unburned condition. A zero represents no detected change in an observable factor.

Fuel Moisture Datasheet

Site Name: _____ **Recorders:** _____ **Date:** ____/____/____
Location/Unit: _____ **Fuel Type Sampling (Veg Community):** _____ **Phenology:** _____ **Time:** _____
Latitude (DD): N _____ **Longitude (DD): W** _____ **Datum:** _____
Avg Slope: _____% **Aspect:** _____deg **Elevation :** _____(ft/m) **Nearest RAWS:** _____

[illegible]

Sample Type: Duff, Woody (shrubs), Herb (grass or forbs), Foliar (spruce). **Fuel Codes:** *DUFF*: LM = live moss (feather), DM = dead moss, UD = upper duff, LD = lower duff; *FOLIAR*: PIMA = black spruce, PIGL = white spruce, *WOODY*: BEGL = shrub birch, LEPAD = Labrador tea, VAVI = cranberry, VAUL = blue berry; *HERB*: CACA = blue joint grass, ERVA = Tussock cotton grass, CAREX = Carex sedge. **V/G:** Volumetric or Gravimetric

Shrub Density

Park Unit: _____ **Project:** _____ **Plot ID:** _____ **Pre or Post** _____ **yrs**

Field Date: _____ **Field Crew:** _____ **Plot Dimensions:** _____

Tally all individuals for each tall shrub (alder and tall willow) species within the 4-m or 8-m radius circular plot by life status. Individuals are defined by >10 cm gaps between stems. If individuals are indistinguishable then record the number of tall shrub stems at ground level. Record average shrub height by species.

Mature: More live than dead. **Decadent:** More dead than live.

Shrub Species	Avg. Hgt. (m)	Life Status			
		# Resprout	# Mature	# Decadent	# Dead

Moose Browse Architecture & Herbivory Data

Park Unit: _____ Project: _____ Plot ID: _____ Pre or Post ____ yrs

Field Date: _____ Field Crew: _____ Plot Dimensions: _____

For each preferred species individual within the 8-m or 4-m radius circular plot, select 2 individuals located closest to the plot center point. Record species, mature class, dead class, whether broken by moose, evidence of browse by hares as well as architecture classification based on moose browse evidence. Architecture classes are defined as:

Broomed - *Sapling Type Plants*: The main apical stem has been broken by moose. Look back through the history of the plant, this may have happened 2–10 years before you measured it. *Bushy Type Plants*: More than half of the current annual growth (CAG) stems arise from lateral stems that were produced as a result of browsing.

Browsed - Has been browsed some in the past but browsing has not significantly affected its growth. Less than half of CAG twigs between 0.0 and 3.0 m arise from lateral stems that were produced from browsing.

Unbrowsed - There is no visible evidence that moose have ever browsed this plant.

Note in comments evidence of bark stripping and other evidence of moose or other wildlife use in the area.

Plant #	Species	Ht (m)	Mature Class (taller than 3m)	Dead Class (% dead)	Architecture (extent of moose utilization)	Broken	Hare Browse	Comments
			>50% <50%	>50% <50%	Brmd Brwd Unbrw	Y N	Y N	
			>50% <50%	>50% <50%	Brmd Brwd Unbrw	Y N	Y N	
			>50% <50%	>50% <50%	Brmd Brwd Unbrw	Y N	Y N	
			>50% <50%	>50% <50%	Brmd Brwd Unbrw	Y N	Y N	
			>50% <50%	>50% <50%	Brmd Brwd Unbrw	Y N	Y N	
			>50% <50%	>50% <50%	Brmd Brwd Unbrw	Y N	Y N	
			>50% <50%	>50% <50%	Brmd Brwd Unbrw	Y N	Y N	
			>50% <50%	>50% <50%	Brmd Brwd Unbrw	Y N	Y N	
			>50% <50%	>50% <50%	Brmd Brwd Unbrw	Y N	Y N	
			>50% <50%	>50% <50%	Brmd Brwd Unbrw	Y N	Y N	
			>50% <50%	>50% <50%	Brmd Brwd Unbrw	Y N	Y N	
			>50% <50%	>50% <50%	Brmd Brwd Unbrw	Y N	Y N	
			>50% <50%	>50% <50%	Brmd Brwd Unbrw	Y N	Y N	
			>50% <50%	>50% <50%	Brmd Brwd Unbrw	Y N	Y N	
			>50% <50%	>50% <50%	Brmd Brwd Unbrw	Y N	Y N	

Moose Browse Architecture Density

Park Unit: _____ Project: _____ Plot ID: _____ Page ____ of ____

Pre or Post ____ yrs Field Date: _____ Field Crew: _____ Plot Dimensions: _____

Record the number of individual plants by species, height class and moose browse architecture within the 4- or 8-meter plot radius. Individuals for tall shrubs such as willow are defined as stems that are rooted greater than 10 cm apart.

Broomed: *Sapling Type Plants* - The main apical stem has been broken by moose. Look back through the history of the plant, this may have happened 2–10 years before you measured it. *Bushy Type Plants* - More than half of the current annual growth (CAG) stems arise from lateral stems that were produced as a result of browsing. Look back through stems that are many years old.

Browsed - Has been browsed some in the past but browsing has not significantly affected its growth. Less than half of CAG twigs between 0.0 and 3.0 m arise from lateral stems that were produced from browsing.

Unbrowsed - There is no visible evidence that moose have ever browsed this plant.

Species	Average Height Class*	Unbrowsed	Browsed	Broomed

*Height classes: 0-0.5m, 0.6-1m, 1.1-3m, 3.1-5m, > 5m. Do not record plants over 5m tall.

Alaska Exotic Plant Management Team (EPMT) Datasheet (Modified for NPS Alaska Fire Ecology)

Record instances and coverage of invasive plant species where observed. Record *taxon* (species 4-letter code), *phenology* (life cycle stage), *buffer* (ocular estimate of area of species infestation; defined as the radius of a circle which would encompass all plants), and *control estimate* hours required to hand-pull all individuals in buffer.

Park Unit:				Date:		
Site/Location Description:				Disturbance Type:		
Taxon	Buffer (m)	% Cover (circle one)	Phenology (circle one)	Control Estimate (circle one)	Coordinates	Comments
		1-5% 6-25% 26-50% 51-75% 76-95% 96-100%	Rosette No flower Full flower In seed Senesced	<1 person hour between 1 and 8 person hours > 8 person hours	X: Y:	
		1-5% 6-25% 26-50% 51-75% 76-95% 96-100%	Rosette No flower Full flower In seed Senesced	<1 person hour between 1 and 8 person hours > 8 person hours	X: Y:	
		1-5% 6-25% 26-50% 51-75% 76-95% 96-100%	Rosette No flower Full flower In seed Senesced	<1 person hour between 1 and 8 person hours > 8 person hours	X: Y:	
		1-5% 6-25% 26-50% 51-75% 76-95% 96-100%	Rosette No flower Full flower In seed Senesced	<1 person hour between 1 and 8 person hours > 8 person hours	X: Y:	
		1-5% 6-25% 26-50% 51-75% 76-95% 96-100%	Rosette No flower Full flower In seed Senesced	<1 person hour between 1 and 8 person hours > 8 person hours	X: Y:	

Appendix

Common Species Codes

Code Species Name – Common Name

Trees

PIGL	Picea glauca – White spruce
PIMA	Picea mariana – Black spruce
BEPA	Betula papyrifera – Paper birch
POTR	Populus tremuloides – Aspen
POBA	Populus balsamifera – Balsam poplar

Shrubs

BENA	Betula nana - Dwarf birch
ALNUS	Alnus spp – Alder
LEPAD	Ledum palustre ssp. decumbens – Labrador tea (RHTOS2)
VAUL	Vaccinium uliginosum – blue berry
VAVI	Vaccinium vitis-idaea – lowbush cranberry
SALIX	Willow

Herbaceous and Graminoids

EPAN2	Epilobium angustifolium – Tall Fireweed (CHANA9)
POAL	Polygonum alpinum – Wild rhubarb
MEPA	Mertensia paniculata - Tall blue bells
LIBO3	Linnaea borealis – Twin flower
EQUIS	Equisetum spp – Horsetail
CACA4	Calamagrostis canadensis – Blue joint grass
ERVA4	Eriophorum vaginatum – Cotton tussock sedge

Ground

FMOSS	Feather moss
HYSP70	Hylocomium splendens – Stair step moss
SPHAG2	Sphagnum spp (moss)
LTRH	Leaf Litter
LTNDL	Needle Litter
DUFF	Organic duff
MIN	Mineral soil
1HR, 10HR...	Woody debris by size class

Field Gear List

General	Item	Per Plot
Plot	30 meter tape	1
Plot	Bike flag	1
Plot	Hagloff DME	1
Plot	Chaining pins	2
Plot	Clinometer	1
Plot	Clipboard	2
Plot	Compass	2
Plot	Diameter calipers	1
Plot	Diameter logger's tape, metric	1
Plot	Diameter tape (small), metric	2
Plot	Fuel Diameter measure (go-no-go)	1
Plot	Field vest	1/person
Plot	Folding ruler 1 meter	2
Plot	Hand lens	2
Plot	Paint sticks	2
Plot	Rebar, wooden lathe or other plot markers	2 per plot
Plot	Steel/Aluminum tags w/wire	2 per plot
Plot	Welding rods (duff consumption)	10 per plot
Plot	White board with dry erase marker	1
Duff	Compass saw	1
Duff	Duff containers	40
Duff	Green duff mat	1
Duff	Pruners	1
Duff	Ruler, centimeter	1
Tech	Digital Camera	1
Tech	GPS w/appropriate map coverage downloaded	1
Tech	Laser Range Finder	1
Logistics	BK Radio w/appropriate freqs	1
Logistics	Copies of original Datasheets & Photos of each plot	1 set for each year
Logistics	Datasheet organizer for plot project w/ data sheets	1
Logistics	Maps of plot locations	1
Logistics	Satellite Phone	1
Logistics	Shotgun w/ammo	1
Logistics	InReach	1 (per project)
Personal	Food, Clothing, Shelter	Yes

Tree Crown Measurements

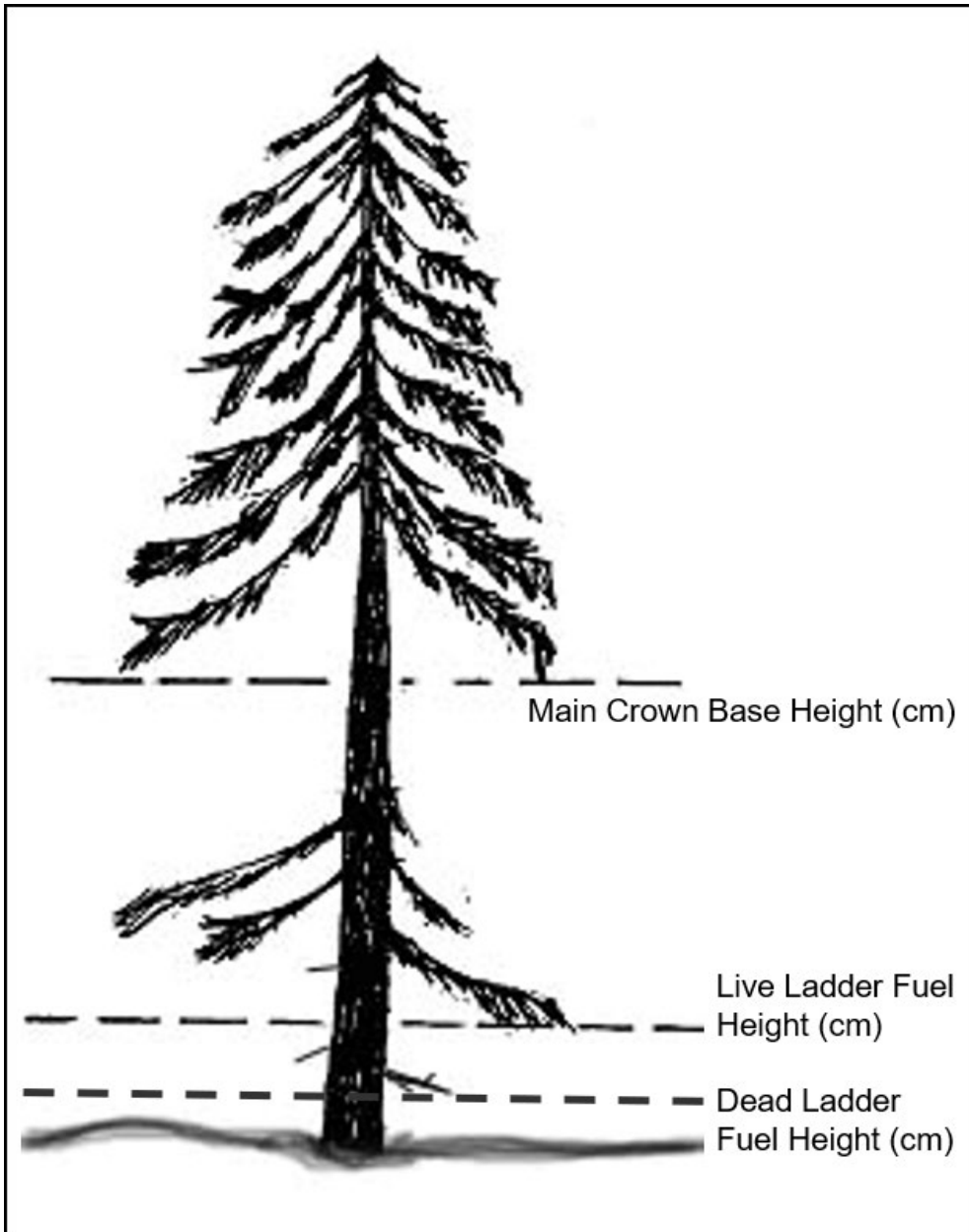


Figure 2. Tree crown and ladder fuel measurements. Figure modified from USFS FMH Manual (2002).

Tree Height Measurements

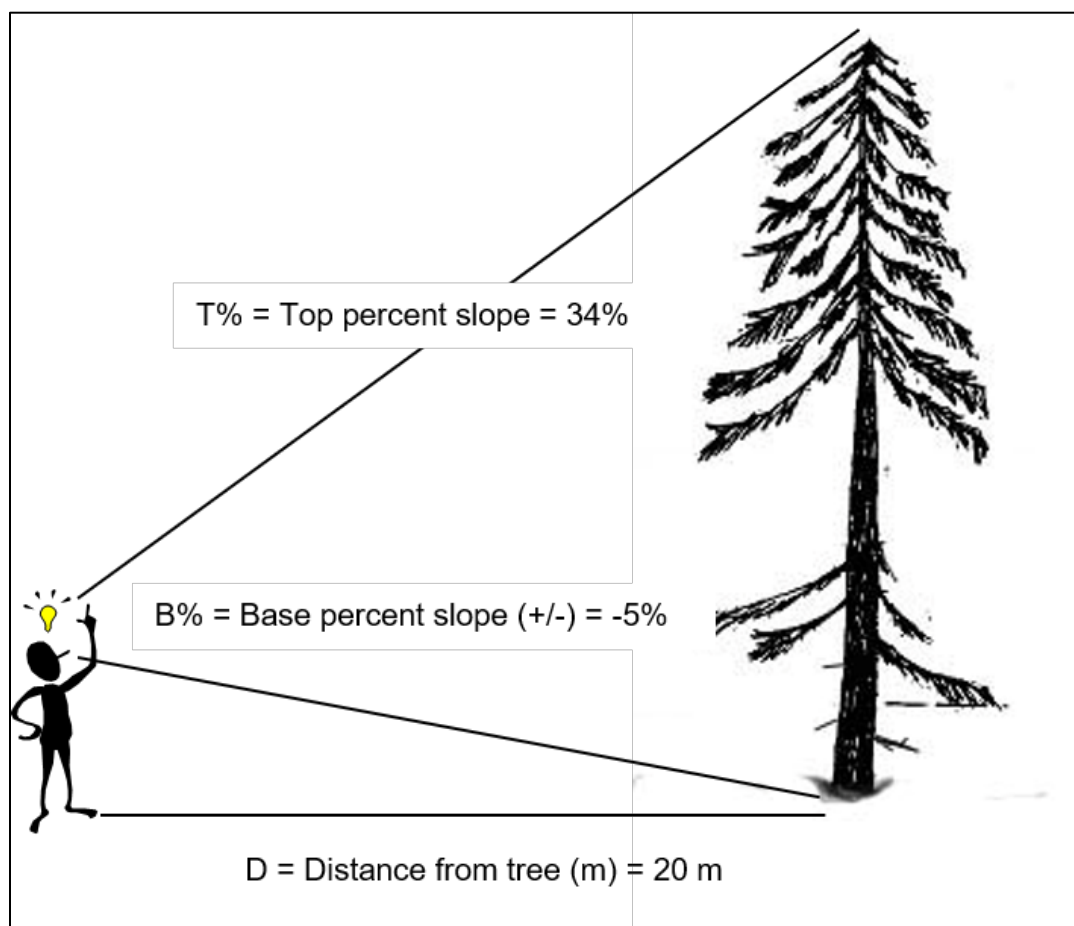


Figure 3. Tree height measurement diagram.

Tree Height Equation: $\text{Height (m)} = D \times (T\% - B\%)$

If the base percent is negative (reading eye-level to tree or on slope above tree DBH), then add B%. If base percent is positive (on slope below tree DBH) then subtract B%. **Example:** $\text{Height} = 20 \text{ m} \times (0.34 + 0.05) = 7.8 \text{ m}$ (Figure 3).

Remember to use percent side of clinometer (right side scale or look for percentage sign at top or bottom of scale) and to move the clinometer up and down, not your head if possible. *Hint:* 10-m and 20-m distances makes easier math, but you must go back far enough to accommodate tree heights.

Damage Codes for Trees

Damage Type	Damage Code	Brief Description
Physical	FORK	Forked top of a tree, multiple primary leaders in a tree crown.
	BROK	Broken tree top.
	DTOP	Upper portion of tree is dead
	BURL	A hard, woody and often rounded outgrowth on a tree.
	DAMG	Mechanical damage to tree
	FIRE	Evidence of fire damage or death.
	LEAN	Tree is leaning.
	MAMM	Damage caused by mammals, such as bear claw marks, porcupine, rabbit or beaver chewing.
	REDB	Red belt, winter desiccation. Foliage and buds killed or faded. May be worse on windward side of tree. New growth is green & normal. Pg. 202 AK I & D
Other	RUST	Spruce needle rust. Current year spruce needles are infected leaving the trees with a distinct orange tinge when the rust is fruiting on the needles. Pg. 129 AK I & D
	BRM	Spruce broom rust. Branches or twig swelling, large burls on main bole or witches' broom (branch proliferation in tree crown). Rust tints needles in the broom yellow/orange. Pg. 146 AK I & D
	GALL	Spruce gall aphids, cause the tree to form conspicuous cone shaped galls on spruce twigs. Dark purple to green initially and then turning brown. Pg. 58 AK I & D
Rots	HRT	Heart rots. <i>Phellinus pini</i> conks are hard and woody, upper surface dark brown, hairy (when young), with concentric ridges and a narrow velvety, light brown margin. Lower surfaces dark brown with pores. Coring shows discoloration of the heartwood, light purplish to gray and later changing to reddish brown. Decay pockets may be empty or filled with a mass of white fibers. Other heart rots would be brown cubicle rots, cores will show brown, yellow crumbly rot. Rots described Pg. 162-193 AK I & D.
	ROOTRT	Tomentosa root rot (<i>Inonotus tomentosus</i>) and Armillaria. Both may have chloritic thin crown, reduced growth, distressed cone crop, resin flow or saturation near root collar. Wind thrown trees lacking major roots. Lose needles oldest to youngest. In Tomentosa roots honeycombed and filled with white mycelium, pink staining. Armillaria has white mycelium and black stringy rhizomorphs under the bark. Rhizomorphs may also be on roots or in soil. Decay in root produces yellow stringy rot w/ fine black lines. Pg. 160 AK I & D
	ROT	Unknown cause of rot, try to record if brown or white rot (Br or W).
Beetles and Bore	BB	Unknown bark beetles, not identifiable as either spruce bark beetle or <i>Ips</i> spp. Describe galleries or collect insects.
	IPS	<i>Ips</i> spp., engraving beetle. Easily confused with spruce bark beetle. They are smaller (1/8 to 1/4 in) with concave wing covers with projections at the rear. Y, H or star shape galleries. Differences from spruce bark beetle; forked egg galleries, lighter (yellow brown to red orange), and finer boring dust, little boring dust in galleries. Pg. 79 AK I & D
	SPB	Spruce bark beetle damage. Spruce trees. Pg. 71-77 AK I & D.
	BORE	Other boring insect damage – e.g., Carpenter ants, Long-horn beetles, wood wasps, ambrosia beetles
	BRNZ	Bronze birch bore damage. Stem swelling on birch or aspen due to larval galleries are winding – 6mm wide filled with boring dust. Adult may feed on foliage. Pg. 94 in AK I & D.
Defoliators	ASLM	Aspen leaf miner. Larvae feeds on leaves of aspen, leaving galleries in the leaves. Pg. 43 in AK I & D.
	BUDW	Spruce bud worm, brown head, with a lighter body and ivory spots. Web new foliage together and feed in web. Pg. 24 AK I & D
	TUSS	Rusty Tussock Moth. Caterpillars (four yellow tussocks of hair on back) consume leaves of trees and shrubs. Large areas of defoliation can occur. Hosts: Willow, birch, spruce and blue berry Pg. 41
	UNKN	Tree is damaged or dead, but cannot determine cause.