United States Department of Agriculture

Forest Service

Pacific Northwest Region

March 2006

Core Data Attributes for Whitebark Pine Surveys

USDA Forest Service
Pacific Northwest Region (R6)
Oregon and Washington

Pacific Northwest Albicaulis Project

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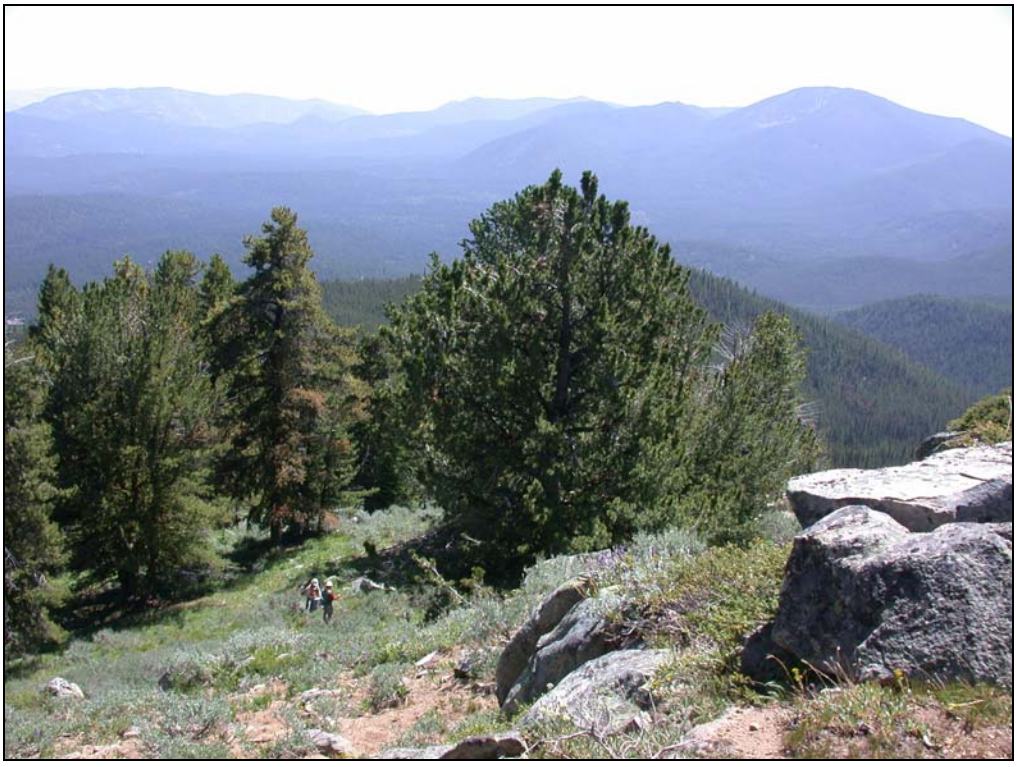

Surveying whitebark pine *(Pinus albicaulis)* on the Okanogan and Wenatchee National Forests.

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Core data attributes for whitebark pine surveys: USDA Forest Service, Pacific Northwest Region (R6), Oregon and Washington

Abstract

This document contains recommendations for core data attributes to be collected in whitebark pine survey and health assessment field activities in the U.S. Department of Agriculture (USDA), Forest Service, Pacific Northwest Region (Region 6), Oregon and Washington. This list of core data attributes applies to whatever type of survey method people choose to use: transect, circular, or other plot type; relevé or random sampling; inventory, long-term monitoring, etc. These core data attributes were developed in an effort to standardize whitebark pine data collection and reporting across the region. They represent the minimum information that should be collected in field surveys intended to assess or monitor the condition of whitebark pine. Other types of data can, of course, also be collected to address additional objectives or to provide more detail. The survey objectives and core data attributes below were identified and in some cases adapted from published methods (see bibliography and references section), from conversations with whitebark pine researchers and field technicians working in Oregon and Washington, and from the author's own field experience.

The **Pacific Northwest Albicaulis Project** of the USDA Forest Service endeavors to support the conservation and restoration of whitebark pine ecosystems in Oregon and Washington through field and laboratory studies, publications, and development of management strategies. For more information on this project, contact Carol Aubry, geneticist, caubry@fs.fed.us.

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March 2006

Acknowledgements

The authors are grateful to the many people involved with whitebark pine throughout its range who provided information, insight, opinions, and advice about whitebark pine data collection and reporting. This group includes forest pathologists, geneticists, ecologists, biologists, botanists, silviculturists, field technicians, and land managers from both the Forest Service and the National Park Service. Many of them also reviewed the first draft of this document and provided constructive suggestions and clarifying comments.

Edited by Mary Carr, CAT Publishing Arts

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Table of contents

Figure 1. Whitebark pine with multiple blister rust infections, including an active code 4 (topkill) blister rust infection on the lower third of the bole.

Introduction

This document contains recommendations for core data attributes to be collected in whitebark pine survey and health assessment field activities in the U.S. Department of Agriculture, Forest Service, Pacific Northwest Region (Region 6), Oregon and Washington. This list of core data attributes applies to whatever type of survey method people choose to use: transect, circular, or other plot type; relevé or random sampling; inventory, long-term monitoring, etc. These core data attributes were developed in an effort to standardize whitebark pine data collection and reporting across the region. They represent the minimum information that should be collected in field surveys intended to assess or monitor the condition of whitebark pine. Other types of data can, of course, also be collected to address additional objectives or to provide more detail.

The most fundamental whitebark pine field activity is a survey is intended to provide a one-time "snapshot" inventory of whitebark pine conditions. The core data attributes presented here will fulfill the objectives of this type of survey. As objectives shift from inventory-type surveys to long-term monitoring, levels of detail, data volume, time commitment, and the need to permanently mark trees and monument sample unit locations are likely to increase. The add-on data attributes presented here are examples of the many additional items that might be included in more detailed surveys or in long-term monitoring. For simplicity, the word "survey" is used throughout this document.

The survey objectives and core data attributes presented here were identified and in some cases adapted from published methods (see Bibliography and references section), from conversations with whitebark pine researchers and field technicians working in Oregon and Washington, and from the author's own field experience. In many cases the core data attributes include recommended units of measure and reporting methods. Since not all surveys will address all the objectives, the core data attributes and a few examples of add-on data attributes are paired with the objective to which they are most pertinent. The first section under "Whitebark pine survey core data attributes" covers basic identification and relocation data for whitebark pine survey sites.

This document contains recommendations for data collection and reporting. It is not a methods manual, and it assumes the reader already has some familiarity with silvicultural terms, basic field work techniques and equipment, and with whitebark pine and white pine blister rust. The Whitebark Pine Ecosystem Foundation (WPEF) has contributed a great deal toward standardizing whitebark pine data collection and reporting. The core data attributes recommended here are similar to those found in their methods manual (Whitebark Pine Ecosystem Foundation 2005), although the insect and blister rust severity codes used here are standard Forest Service codes.

Primary objectives of whitebark pine surveys

I. Describe whitebark pine stand characteristics, landscape and ecological context: location, site attributes, whitebark pine demographics and clump characteristics, other tree and plant species present.

II. Assess health of whitebark pine—blister rust, mountain pine beetle, other damage and disease agents, proportions of live and dead trees, cause of death of dead trees if it can be definitively determined.

III. Describe whitebark pine cone production and regeneration—evidence of current and future cone crops; presence and health of seedlings.

Whitebark pine survey core data attributes

Basic identification data for each survey conducted

- Unique survey site ID.
- Type of survey: transect, plot, etc. Include all pertinent details.
- Date of survey (or revisit if monitoring plot).
- Names of survey crew.
- Administrative unit: Forest and Ranger District.
- Wilderness: indicate whether the site is located within designated wilderness. If the survey is in wilderness, include the name of the wilderness unit.
- Detailed route to survey site: include means of access (drive, hike, horseback, ATV, snowmobile, helicopter, etc.) and time required to reach site.
- Monument installation: if the plot center, first tree, or any other point in the survey area is permanently monumented for relocation purposes, indicate type and location of any monuments installed.
- Unit area of unit surveyed (sq. meters, acres, hectares, etc.)
- Digital photographs of survey unit taken from precisely described locations

Core data attributes

I. Describe whitebark pine stand characteristics and ecological context—location, site characteristics, demographics and clump composition, other tree species present, dominant understory plant species.

Core attributes:

- GPS coordinates for pertinent points in the survey unit. Indicate projection and data used (NAD 1983, Albers is the standard for Forest Service R6). Round coordinate values to nearest whole meter. Record error distance (in meters) if available. If necessary, differentially correct the coordinates using base station GPS data for the area.
- Elevation in meters. Specify source: for example, GPS unit, altimeter, district map, other topographic map.
- Slope: predominant slope for study unit, in whole degrees. Possible range is 0 (flat) to 90 (vertical). Specify source (clinometer, compass, visual estimate).
- Aspect: predominant aspect for study unit, in whole degrees. Possible range is 0 to 359 (use -1 for flat). Also record declination used on compass.
- Diameter at breast height (dbh) by stem for all whitebark pine trees >1.4 m (4.5 ft) tall present in survey unit, in centimeters. OPTIONAL – establish diameter size-class categories, report demographics in terms of size class distribution. (Note: because of the wide range of variability in whitebark pine site conditions, dbh is not a reliable surrogate for tree or stand age when comparing whitebark pine size-class distributions across different stands [King 2005].)
- Clump membership for whitebark pine stems >1.4 m (4.5 ft) tall. Use letters (a,b,c…) to distinguish between different multi-stemmed clumps. Assign one letter to each multi-stemmed clump—for instance, if the first whitebark pine encountered in the

survey is a clump composed of four stems, those trees are numbers 1–4, all in clump **a**. If there are more than 26 clumps, follow clump **z** with clump **aa**, etc. Do not assign clump letters to single trees that are not part of a multiple-stem clump.

- Other tree species present. Estimate total canopy cover for all overstory trees. Estimate overstory tree cover by species (sum of these should add up to total canopy cover).
- Dominant understory plant species. Identify dominant understory plant species.
- Understory cover. Estimate proportions of total understory vegetation cover and bare ground (the sum of these should add up to 100%).

Some add-on attributes:

- Height of each whitebark pine >1.4 m (4.5 ft) tall present in survey unit. Specify units (meters or feet).
- DBH and height for all other trees >1.4 m (4.5 ft) tall present in survey unit.
- Tree crown class (dominance) for all trees 1.4 m (4.5 ft) tall present in survey unit. Examples of classification systems are the Current Vegetation Survey system (Johnson 2001, p.58), and Oliver and Larson (1996) figure 5.3.
- Stand seral stage.
- Plant associations (include reference).
- General substrate type for bare ground (rocky, sandy, pumice, scree, etc.).
- Evidence of recent disturbance (fire, avalanche, etc.).

II. Assess health of whitebark pine – blister rust, mountain pine beetle, other damage and disease agents, proportions of live and dead trees, cause of death of dead trees if it can be definitively determined.

Although the specific emphasis of this document is on whitebark pine, these core attributes are applicable to surveys that also target other five-needle pines. In this case, indicate tree species for each individual five-needle pine for which data are recorded. Results should be reported on a species-by-species basis.

Core attributes:

- Tree status (live or dead) for each whitebark pine tree >1.4 m (4.5 ft) tall observed. At minimum, record live (L) or dead (D). A tree is considered living if it has one or more branches with green foliage. **Report:** percent living = [all living]/[all observed]; percent mortality = [all dead]/[all observed]. OPTIONAL – classify dead trees by how long they appear to have been dead: RD for recent dead, having majority of fine branch structure and bark intact; OD for old dead, having most fine branch structure and much bark missing; XD for very old dead, having only major branches and no bark remaining ("grey ghosts"). Can break down dead component by percentages of RD, OD, XD (for example, percentage of recent dead = [all RD]/[all dead]).
- Cause of death for each dead whitebark pine. Indicate blister rust, mountain pine beetle, or fire if mortality can definitively be attributed to one of these agents. Indicate "unknown" if mortality cannot be confidently attributed to a particular agent. **Report:** percent mortality due to each agent = [all dead by that agent]/[all dead observed]. *Note – given that cause of death is attributed to a specific agent only if the*

field observers are extremely confident about the diagnosis, this is an inherently conservative statistic.

- Proportion of dead crown for each live whitebark pine tree observed. Visually assess each whitebark pine tree >1.4 m (4.5 ft) tall and assign it a value based on the percentage of its crown that is dead, including "flagged" branches (branches with dead needles). Do this within the context of the tree itself. For instance, an open-grown tree on a relatively protected site would be expected to have branches all the way around the bole, while a tree on a windswept ridge would be expected to have few or no branches growing on its windward side. If less than 10% of the leeward branches of a windswept tree are flagged or dead, that tree would merit a 0-10% dead crown rating. For simplicity, record the value ending in 5 that represents the middle of this range – in this case, 5% (see table 1, below). If the tree has a dead top due to blister rust or some other cause, include the topkilled portion of the crown in the dead crown value. **Report:** Report stand range and average; can break down by 10-percent categories.

  Note – proportion of dead crown has caused confusion and spurred the development of a number of rating systems. The simple system presented here is not part of a blister rust severity assessment and does not assume that branch and crown mortality are due to blister rust (compare to Six and Newcomb 2006). This system uses consistently even intervals to assess the proportion of dead crown (compare to WPEF 2005). The goal is to provide a sense of overall individual tree condition at the time of the survey. These tree-by-tree data are most useful for assessing change in individual trees over time in a monitoring situation.

Table 1. Proportion of dead crown ratings

Value	Percent of crown that is dead
5	0-10%
15	11-20%
25	21-30%
35	31-40%
45	41-50%
55	51-60%
65	61-70%
75	71-80%
85	81-90%
95	91-99%

  OPTIONAL – based on closer observation, estimate how much crown mortality can definitively be attributed to blister rust. For instance: total dead crown = 45 (41-50% of crown); dead crown due to blister rust = 35 (31-40% of crown). In this case, approximately 10% of the crown is dead due to other or undetermined causes.

- Occurrence of white pine blister rust on live stems. Use FSVEG blister rust severity codes 1 through 4 (table 2). For each live stem observed, record the code of the most severe infection present. Note whether the canker is active (a) or appears inactive (i). Record "0" for trees without definitive symptoms of blister rust. **Report:** percent blister rust incidence on live stems = [all live stems with code ≠0]/[all live stems observed]. Can also be broken down into individual blister rust codes.

Table 2. FSVEG Damage Agent Severity Ratings for white pine blister rust

Severity	Description
1	Branch infections located greater than 60cm (24in) from bole
2	Branch infections located between 15cm (6in) and 60cm (24in) from bole
3	Bole infections or branch infections located within 15cm (6in) of bole
4	Topkill due to blister rust

Source: Adapted from USDA Forest Service 2005, p.2-305

- Location of most severe blister rust infection. Indicate whether the most severe observed infection is in the bottom (B), middle (M), or top (T) third of the tree as measured from the ground up. (Figure 1 (p.iv) shows an active code 4 canker on the lower third of a whitebark pine tree.)
- Presence of rodent gnawing associated with or as evidence of blister rust infection. Indicate whether there is evidence of rodent gnawing on blister rust cankers. **Report:** percent of live rust-infected whitebark pine trees with evidence of rodent gnawing on blister rust cankers = [all live with rodent gnawing]/[all live with blister rust]. OPTIONAL – record and report separately evidence of rodent gnawing associated with blister rust on dead trees.
- Mountain pine beetle occurrence. Use FSVEG mountain pine beetle severity codes 1 through 6 (table 3). Record "0" for trees without definitive symptoms of mountain pine beetle. **Report:** MPB occurrence = [stems with MPB]/[all stems observed]. Can also be broken down by individual codes. Table 2 contains the FSVEG mountain pine beetle codes (USDA Forest Service 2005). These codes are similar but not identical to the mountain pine beetle condition codes found on p.60 of the Field Procedures for the Current Vegetation Survey (Johnson 2001).

Table 3. FSVEG Damage Agent Severity Ratings for mountain pine beetle

Severity	Description
1	Unsuccessful bole attack: pitchout and beetle brood absent
2	Strip attacks: galleries and brood present
3	Successful current bole attack
4	Topkill *(distinct from topkill due to blister rust)*
5	Successful attack last year
6	Older dead *(only if death can be confidently attributed to mountain pine beetle)*

Source: Adapted from USDA Forest Service 2005, p.2-303

Some optional attributes:

- Missing or dead top: for each whitebark pine tree observed, indicate whether the top is missing or dead. This will help to identify changes in individual trees if the survey area is revisited in the future. It will also help to clarify the "proportion of dead crown" datum. For instance, if a tree's top is missing but all of its remaining branches are live, that tree compels a dead crown value of 5 (0-10 percent), even though an unknown portion of the crown is absent.
- Presence and identity of *Ribes spp.* or other blister rust alternate host plants on or near the survey site: *Castilleja miniata, Pedicularis racemosa* (McDonald et al. 2006).

- Presence of other damaging or mortality agents: bear damage, elk or deer antler rubbing; rodent chewing other than that associated with blister rust cankers; insect damage other than that caused by mountain pine beetle; storm or mechanical damage; avalanche damage; human damage; etc.
- Blister rust evidence on dead whitebark pine stems when it can be definitively identified (whether or not it is considered to be cause of death). **Report:** not typically reported, and should not be confused or combined with blister rust incidence in live stems, which is a different statistic. Can be reported in the explicit context of percent of all stems showing evidence of BR infection = [all stems live or dead with BR code ≠ 0]/[all stems observed].

III. Describe whitebark pine cone production and regeneration: evidence of current and future cone crops; presence and condition of seedlings.

Core attributes:

- Presence of mature cones by stem. "Mature cones" are second-year seed cones that will ripen this summer. Record rough count of cones on each stem (for example, 1-25, 26-50, >50). **Report:** percent of all live stems that have mature cones = [all live with mature cones]/[all live stems encountered]. OPTIONAL – break out by cone count categories.
- Tally of whitebark pine seedlings in plot or transect. Count all whitebark pine seedlings (young trees under 1.4 m (4.5 ft) tall) encountered in survey area. Tally live seedlings by their FSVEG blister rust code. Record dead seedlings by cause of death (BR for blister rust, "other/unknown" for other or unknown cause). Figure 2 is an example of a data table that can be used for this seedling tally. Use one tick mark in the appropriate block to represent each seedling encountered. **Report:** total number live and dead seedlings encountered; percent blister rust incidence on live seedlings = [all live seedlings with BR code ≠ 0]/[all live seedlings observed]; percent seedling mortality = [all dead seedlings]/[all seedlings observed]. Can break down live seedling report by FSVEG code.

Figure 2. Seedling tally data table example

SEEDLING TALLY	LIVE SEEDLINGS without blister rust	LIVE SEEDLINGS with blister rust (FSVEG codes – see table 1)				DEAD SEEDLINGS (cause)	
Height = 1.4 m (4.5 ft) or less	BR code 0 (no rust)	BR 1	BR 2	BR 3	BR 4	Blister rust	Other/ unknown
TALLER: 50 cm (20 in) to 1.4 m (4.5 ft)							
SHORTER: under 50 m (20 in)							

Some optional attributes:

- Presence of first-year cones by stem. "First-year cones" are cones that will ripen next summer. *Note – first-year cones can be extremely hard to spot, particularly in large trees. Also, some trees may have both first- and second-year cones.* **Report:** percent of all live stems that have first-year cones = [all live with first-year cones]/[all live stems encountered].

- Presence of pollen cones by stem. **Report:** percent of all live stems that have pollen cones = [all live with pollen cones]/[all live stems encountered].
- Direct observations of Clark's nutcrackers on site/in vicinity. Estimate number of birds observed, if observations are aural or visual, nutcracker behavior, etc.
- Observations of squirrels and other rodents harvesting whitebark pine cones; observations about squirrel cone middens encountered.
- Evidence of past cone crops by stem: old brown cone scales scattered beneath individual trees; remnants of old cones remaining on branches.

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