Wisconsin State Forests
Continuous Forest Inventory

VOLUME II: FIELD DATA COLLECTION PROCEDURES FOR PHASE 3 INDICATORS

Version 2.0

Wisconsin Department of Natural Resources

Division of Forestry

OCTOBER 2007

11.0 SOIL MEASUREMENTS AND SAMPLING

11.0 INTRODUCTION

The objective of the Phase 3 (P3) Soils Indicator is to assess forest ecosystem health in terms of the physical properties of the soils. The soil resource is a primary component of all terrestrial ecosystems, and any environmental stressor that alters the natural function of the soil has the potential to influence the vitality, species composition, and hydrology of forest ecosystems.

Specifically, soils data are collected on P3 plots to assess :

- the potential for erosion of nutrient-rich top soils and forest floors.
- factors relating to the storage and cycling of nutrients and water.
- the availability of nutrients and water to plants (dependent upon soil structure and texture).

Nutrient and water availability to forest vegetation is dependent on the physical capacity of roots to grow and access nutrients, water, and oxygen from the soil. In addition to playing an important role in plant nutrition, the physical properties of the soil largely determine forest hydrology, particularly with regards to surface and ground water flow. Human activities that result in the destruction of soil aggregates, loss of pore space (compaction), and erosion may increase rates of surface runoff and alter historic patterns of stream flow. In some areas, these changes may result in flooding and/or dewatered streams and can reflect on both the health of aquatic ecosystems and the management and conservation of associated forest and agricultural areas.

Wisconsin State Forests, Continuous Forest Inventory (WisCFI), Soil Measurements and Sampling, Version 2.0 is adapted from the USDA Forest Service Forest Inventory and Analysis (FIA) Northern Region (NRS) field guide version 4.0. NRS FIA version 4.0 is based on the FIA National Core Field Guide, Version 4.0.

- All WisCFI-specific data elements end in “N-WisCFI” (e.g., x.xN-WisCFI).
- [WisCFI field guide electronic file note: National and regional data elements formatted as hidden, strikethrough text are not applicable for WisCFI.]

11.1 SUMMARY OF METHOD

The soil measurement and sampling procedures are divided into two parts: soil erosion and soil compaction. Data collection for soil erosion assessment consists of estimating the percent of bare soil in each subplot. These measurements are combined with data from other sources and used to parameterize established models for erosion potential (RUSLE – Revised Universal Soil Loss Equation, WEPP – Water Erosion Prediction Project). Soil compaction measurements consist of an estimate of the percentage of soil compaction on each subplot along with a description of the type of compaction. Data are recorded using a handheld computer (PDR) with a preloaded data input program.

The physical properties of the soil are assessed through the collection of soil samples. Soil samples are collected from theunderlying mineral soil layers (subplot 2). Soils are sampledby collecting from two depths: 0 to 4 inches and 4 to 8 inches. The texture of each layer is estimated in the field and characterized as organic, loamy, clayey, sandy, or coarse sandy.

11.2 DEFINITIONS

Cryptobiotic crusts - A layer of symbiotic lichens and algae on the soil surface (common in arid regions)

Duff (Humus) - a soil layer dominated by organic material derived from the decomposition of plant and animal litter and deposited on either an organic or a mineral surface. This layer is distinguished from the litter layer in that the original organic material has undergone sufficient decomposition that the source of this material (e.g., individual plant parts) can no longer be identified.

Forest floor - the entire thickness of organic material overlying the mineral soil, consisting of the litter and the duff (humus).

Litter - undecomposed or only partially decomposed organic material that can be readily identified (e.g., plant leaves, twigs, etc.)

Loam - the textural class name for a soil having a moderate amount of sand, silt, and clay.

Mineral soil - a soil consisting predominantly of products derived from the weathering of rocks (e.g., sands, silts, and clays).

Soil erosion - the wearing away of the land surface by running water, wind, ice or other geological agents.

Texture - the relative proportion of sand, silt, and clay in a soil.

11.3 EQUIPMENT AND SUPPLIES

Minimum required equipment is listed below. Field personnel may add equipment as needed to improve efficiency in some areas.

11.3.1 Field Gear Unique to the Soil Indicator

- Retractable measuring tape or ruler graduated in tenths of an inch for measuring soil layer depths.
- Soil compaction, meter, or penetrometer that can measure up to a minimum of 300 psi for measuring soil compaction (specific to WisCFI).
- Garden trowel or hand shovel for sampling forest floor and excavating soil sample hole where soil core sampler cannot be used.
- Small knife with sharp blade for sampling the forest floor layers.
- Pruning shears (very useful in cutting through roots and litter).
- Plastic water bottle for use in hand-texturing soil.
- Small plastic tarp (1 yd x 1 yd) to use as a working surface.
- Cleaning cloths or tissues.

11.3.2 Optional Soils Equipment

- Garden gloves.
- 1-in diameter soil tube probe to take soil samples for hand-texturing.

11.3.3 Required Equipment not Unique to the Soil Indicator:

- Compass for locating sampling points.
- Measuring tape -100 ft loggers tape for measuring distance to sampling locations.

11.6 SOIL EROSION AND COMPACTION

Erosion is defined as the wearing away of the land surface by running water, wind, or ice. Erosion is a natural process that occurs on all non-flat areas of the landscape. However, human

activity (such as timber removal or road-building) can result in accelerated rates of erosion that degrade the soil and reduce the productivity of land. Extensive areas of soil erosion can have a major effect on the aquatic ecosystems associated with forests, recreational opportunities, potable water supplies and the life span of river infrastructure (e.g., dams, levees).

On average, the U. S. loses about 5 billion tons of soil annually to water and wind erosion. As this soil is removed from the landscape, it carries with it all of the nutrients and organic matter that took decades to centuries (or longer) to build up. On human time scales, fertile topsoil is not a renewable resource.

On WisCFI plots, soil erosion potential is estimated using published models, such as the Revised Universal Soil Loss Equation (RUSLE) and the Water Erosion Prediction Project (WEPP). These models are based on factors that represent how climate, soil, topography, and land use affect soil erosion and surface runoff. Generally, these models require the following factors for analysis: percent slope, slope length, precipitation factor, vegetation cover, and litter cover. Some of these factors are collected as part of the P2 mensuration data and other P3 indicators (percent slope and vegetation cover), one factor is obtained from outside sources (precipitation factor), and the remaining factors (% cover, which is given by 100 minus % BARE SOIL, and SOIL TEXTURE) are measured on each subplot as part of the soil indicator.

Estimates of bare soil are made on all subplots. Soil texture is measured at the soil sampling site adjacent to subplot 2.

Compaction refers to a reduction in soil pore space and can be caused by heavy equipment or by repeated passes of light equipment that compress the soil and break down soil aggregates. This compression increases the bulk density and reduces the ability of air and water to move through the soil. These conditions also make it more difficult for plant roots to penetrate the soil and obtain necessary nutrients, oxygen, and water.

In general, compaction tends to be a greater problem on moist soils and on fine-textured soils (clays). These effects can persist for long periods of time and may result in stunted tree growth.

Information about compaction is collected on all subplots that are in a forested condition. Compaction data collected as part of the soil indicator include an estimate of the percent of each subplot affected by compaction and the type(s) of compaction present.

11.6.1 PERCENT COVER OF BARE SOIL

Record a two-digit code indicating the percentage of the subplot that is covered by bare soil (mineral or organic). Fine gravel [0.08-0.20 inch (2-5 mm)] should be considered part of the bare soil. However, do not include large rocks protruding through the soil (e.g., bedrock outcrops) in this category because these are not erodible surfaces. For the purposes of the soil indicator, cryptobiotic crusts are not considered bare soil.

If the subplot includes non-forested areas, multiply the % COVER OF BARE SOIL in the forested part of the subplot by the % of the subplot that is in forested area. For example, if 50% of the subplot is forested and the % COVER OF BARE SOIL of the forested part is 30%, then the % COVER OF BARE SOIL for the entire subplot is 15 %.

When Collected: When any portion of the subplot contains at least one accessible forested condition class
Field Width: 2 digits
Tolerance: +/- 10%
MQO: 75% of the time
Values:

00	Absent	35	31-35%	75	71-75%
01	Trace	40	36-40%	80	76-80%

05	1 to 5%	45	41-45%	85	81-85%
10	6-10%	50	46-50%	90	86-90%
15	11-15%	55	51-55%	95	91-95%
20	16-20%	60	56-60%	99	96-100%
25	21-25%	65	61-65%		
30	26-30%	70	66-70%		

11.6.2 PERCENT COMPACTED AREA ON THE SUBPLOT

Record a two-digit code indicating the percentage of the subplot that exhibits evidence of compaction. Soil compaction is assessed relative to the conditions of adjacent undisturbed soil. Do not include improved roads in your evaluation.

When Collected: When any portion of the subplot contains at least one accessible forested condition class
Field Width: 2 digits
Tolerance: +/- 15%
MQO: 75% of the time
Values:

00	Absent	35	31-35%	75	71-75%
01	Trace	40	36-40%	80	76-80%
05	1 to 5%	45	41-45%	85	81-85%
10	6-10%	50	46-50%	90	86-90%
15	11-15%	55	51-55%	95	91-95%
20	16-20%	60	56-60%	99	96-100%
25	21-25%	65	61-65%		
30	26-30%	70	66-70%		

11.6.3 TYPE OF COMPACTION - RUTTED TRAIL

Type of compaction is a rutted trail. Ruts must be at least 2 inches deep into mineral soil or 6 inches deep from the undisturbed forest litter surface. Record a “1” if this type of compaction is present; record a “0” if it is not present.

When Collected: When PERCENT COMPACTED AREA ON THE SUBPLOT > 00
Field Width: 1 digit
Tolerance: No errors
MQO: 75% of the time
Values:

1	Present
0	Not present

11.6.3.1N-WisCFI NUMBER OF RUTS ON SUBPLOT

Record a two-digit code indicating the number of ruts on subplot. One rut is equal to one wheel track. A rut an elongated depression in a trail or roadway caused by dragged logs or by wheels or tracks of harvesting machinery and is often exacerbated by erosion from uncontrolled storm water runoff. Do not record ruts that are less than 6 inches deep in their entirety (from the original soil surface) or ruts that are less than 5 feet long.

When Collected:
Field Width: 2 digits
Tolerance:
MQO:
Values: 00 to 99

11.6.3.2N-WisCFI LONGEST RUT ON SUBPLOT: TOTAL LENGTH

Record a two-digit code indicating the length (in feet) of the longest rut on subplot.

When Collected:
Field Width: 2 digits
Tolerance:
MQO:
Values: 00 to 99 feet

11.6.3.3N-WisCFI LONGEST RUT ON SUBPLOT: LENGTH THAT EXCEEDS 6 INCHES IN DEPTH

Record a two-digit code indicating the length (in feet) of the portion of the longest rut that exceeds a depth of 6 inches on subplot. The depth should be measured from the original soil surface. If individual lug impressions are visible, measure to the “top” of the lug impression.

When Collected:
Field Width: 2 digits
Tolerance:
MQO:
Values: 00 to 99 feet

11.6.3.4N-WisCFI LONGEST RUT ON SUBPLOT: LENGTH THAT EXCEEDS 10 INCHES IN DEPTH

Record a two-digit code indicating the length (in feet) of the portion of the longest rut that exceeds a depth of 10 inches on subplot. The depth should be measured from the original soil surface. If individual lug impressions are visible, measure to the “top” of the lug impression.

When Collected:
Field Width: 2 digits
Tolerance:
MQO:
Values: 00 to 99 feet

11.6.3.5N-WisCFI LONGEST RUT ON SUBPLOT: MAXIMUM DEPTH FROM ORIGINAL SOIL SURFACE

Record a three-digit code indicating the maximum depth of the longest rut on the subplot. The depth should be measured from the original soil surface. If individual lug impressions are visible, measure to the “top” of the lug impression. Measure the depth in inches.

When Collected:
Field Width: 3 digits
Tolerance:
MQO:
Values: 000 to 999 inches

11.6.3.6N-WisCFI LONGEST RUT ON SUBPLOT: MAXIMUM DEPTH FROM THE TOP OF THE RUT

Record a three-digit code indicating the maximum depth of the longest rut on the subplot. The depth should be measured from the top of the rut. If individual lug impressions are visible, measure to the “top” of the lug impression. Measure the depth in inches.

When Collected:
Field Width: 3 digits
Tolerance:
MQO:
Values: 000 to 999 inches

11.6.3.7N-WisCFI LONGEST RUT ON SUBPLOT: EXTENSIONOF RUT BEYOND SUBPLOT

Record a one-digit code indicating whether the longest rut extends beyond the subplot..

When Collected:
Field Width: 1 digit
Tolerance:
MQO:
Values:

1 Yes (Rut extends beyond subplot)
0 No (Rut does not extend beyond subplot)

11.6.3.8N-WisCFI LONGEST RUT ON SUBPLOT: TYPE OF INFRASTRUCTURE

Record a one-digit code indicating on what part of the infrastructure the rut occurred.

When Collected:
Field Width: 1 digit
Tolerance:
MQO:
Values:

0 Absent
1 Road
2 Landing
3 Primary Skid Trail (3 or more passes of equipment)
4 Secondary Skid Trail (1 or 2 passes of equipment)
5 General Harvest Area
6 Multiple Areas
7 Recreational Trail/Other (explain in plot notes)

11.6.3.9N-WisCFI LOCATION OF LONGEST RUT ON SUBPLOT: LOCATION

Record a one-digit code indicating where the rut occurred.

When Collected:
Field Width: 1 digit
Tolerance:
MQO:
Values:

0 Absent
1 Upland Area (outside of RMZ)
2 Wetland Area (outside of RMZ)
3 Riparian Management Zone (within 100 feet of lakes and perennial streams or within 35 feet of intermittent streams)
4 Multiple Areas

11.6.3.10N-WisCFI LONGEST RUT ON SUBPLOT: SLOPE ORIENTATION

Record a one-digit code indicating the orientation of the slope where the rut occurred.

When Collected:
Field Width: 1 digit
Tolerance:
MQO:
Values:

0 Absent
1 Rut runs up/down the slope
2 Ruts runs across the slope
3 Ruts is on a flat area (slope equals 5% or less)
4 Multiple Areas

11.6.3.11N-WisCFI LONGEST RUT ON SUBPLOT: ACTIVE EROSION

Record a one-digit code indicating whether there is active erosion occurring at the rut.

When Collected:
Field Width: 1 digit
Tolerance:
MQO:
Values:

1 Yes (There is active erosion occurring.)
0 No (There is not active erosion occurring.)

11.6.3.12N-WisCFI LONGEST RUT ON SUBPLOT: ALTERED DRAINAGE

Record a one-digit code indicating whether the drainage patterns were altered as a result of the rut.

When Collected:
Field Width: 1 digit
Tolerance:
MQO:
Values:

1 Yes (The drainage was altered.)
0 No (The drainage was not altered.)

11.6.3.13N-WisCFI LONGEST RUT ON SUBPLOT: CAUSE

Record a one-digit code indicating the apparent cause of the rut.

When Collected:
Field Width: 1 digit
Tolerance:
MQO:
Values:

0 Absent
1 Harvesting equipment
2 ATVs or other off-road vehicles
3 Undetermined cause
4 Multiple causes

11.6.3.14N-WisCFI LONGEST RUT ON SUBPLOT: AGE

Record a one-digit code indicating the approximate age of the rut.

When Collected:
Field Width: 1 digit
Tolerance:
MQO:
Values:

0 Absent
1 Less than 1 week
2 Less than 1 month
3 Less than 3 months
4 More than 3 months
5 Undetermined age

11.6.4 TYPE OF COMPACTION – COMPACTED TRAIL

Type of compaction is a compacted trail (usually the result of many passes of heavy machinery, vehicles, or large animals). Record a “1” if this type of compaction is present; record a “0” if it is not present.

When Collected: When PERCENT COMPACTED AREA ON THE SUBPLOT > 00
Field Width: 1 digit
Tolerance: No errors
MQO: 75% of the time
Values:

1 Present
0 Not present

11.6.5 TYPE OF COMPACTION – COMPACTED AREA

Type of compaction is a compacted area. Examples include the junction areas of skid trails, landing areas, work areas, animal bedding areas, heavily grazed areas, etc. Record a "1" if this type of compaction is present; record a "0" if it is not present.

When Collected: When PERCENT COMPACTED AREA ON THE SUBPLOT > 00
Field Width: 1 digit
Tolerance: No errors
MQO: 75% of the time
Values:

1 Present
0 Not present

11.6.6 TYPE OF COMPACTION – OTHER

Type of compaction is some other form. Record a "1" if this type of compaction is present; record a "0" if it is not present. (An explanation must be entered in the plot notes).

When Collected: When PERCENT COMPACTED AREA ON THE SUBPLOT > 00
Field Width: 1 digit
Tolerance: No errors
MQO: 75% of the time
Values:

1 Present
0 Not present

11.7 SOIL SAMPLE COLLECTION

The chemical and physical properties of the soil are assessed through the collection of soil samples. Soil samples are collected from the underlying mineral soil layers (subplot 2). Mineral and organic soils are sampled by collecting from two depths: 0 to 4 inches and 4 to 8 inches. The texture of each layer is estimated in the field and characterized as organic, loamy, clayey, sandy, or coarse sandy.

Soil samples are collected along soil sampling line adjacent to subplot 2 (Figure 11-1). During the first visit to a plot for soil sampling, soil samples will be collected at the point denoted as Soil Visit #1. On subsequent visits to a plot, soil sampling sites visit #2 or larger will be sampled. The soil sampling sites are spaced at 10-foot intervals alternating on opposite sides of soil sampling site number 1.

The initial sampling point (Soil Visit #1) is located:

- Subplot 2 soil measurement site: 30 feet due south (180^{o}) from the center of subplot 2.

If the soil cannot be sampled at the designated sampling point due to trampling or an obstruction (e.g., boulder, tree, standing water), the sampling point may be relocated to any location within a radius of 5 feet.

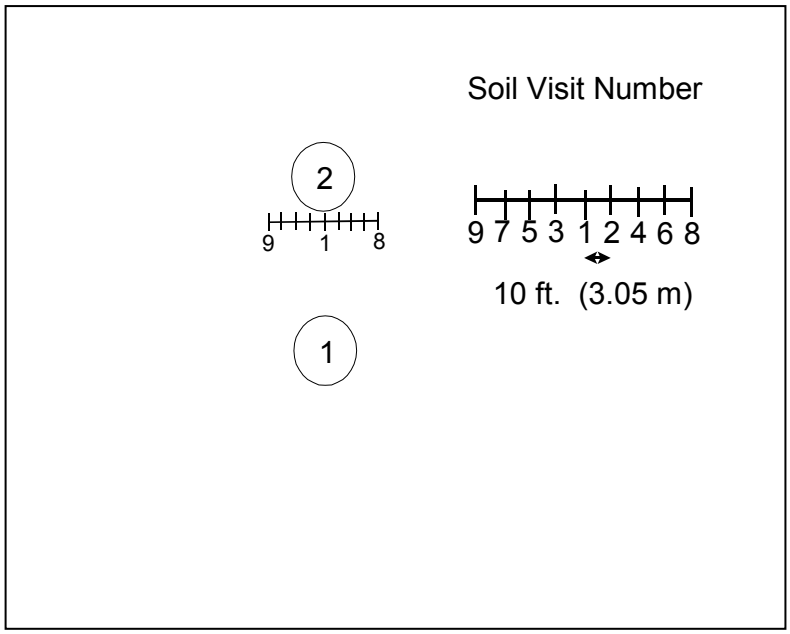

Figure 11-1. Location of soil sampling site

11.7.3 Mineral Soil

Two mineral soil samples 0-4 inch and 4-8 inch are collected from the soil sampling site adjacent to **subplot 2 only**, and are collected if, and only if, the soil sampling site is forested (Figure 11-2).

11.7.4 Regulations Governing Sample Collection (National Historic Preservation Act)

The National Historic Preservation Act of 1966 (as amended) provides for the protection of historical and cultural artifacts. Due to the random placement of the Phase 3 monitoring design, a possibility exists that a Phase 3 plot may be located on a site of prehistoric or historical significance.

If cultural artifacts are encountered on a Phase 3 plot, do **not** take soil samples. Code the site as not sampled on the PDR and record a plot note explaining why soil samples were not taken.

If needed, archeologists or cultural resource specialists in these land management agencies will assist in obtaining permission to sample. Assistance is also available from State Historic Preservation Programs for state and private lands.

11.7.8 SUBPLOT NUMBER

Record the number of the location where the soil sample is being attempted
When Collected: All soil sample locations
Field Width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values: 2

11.7.9 VISIT NUMBER

Record the number of the location where the soil sample is being attempted (Figure 11-1)

When Collected: All soil sample locations
Field Width: 1 digit
Tolerance: No errors

MQO: At least 99% of the time
Values: 1 to 9

11.7.10 SOIL SAMPLE STATUS

Record whether or not a forest floor or mineral soil sample is being collected at the soil sampling location. For both forest floor and mineral samples, it is the condition of the soil sampling sites in the annular plot that determines whether soil samples are collected. Samples are collected if, and only if, the soil sampling site is in a forested condition. In rare instances, the soil sampling site may occur in a forested condition that has not been sampled on the subplots. If this is the case, then use SOIL SAMPLE STATUS code 11 to indicate that a sample has been collected for a forest condition that is not otherwise represented on the plot.

When Collected: All soil sample Field Width: 2 digits
Tolerance: No errors
MQO: At least 99% of the time
Values:

01 Sampled: forest that has been identified as a condition on the plot
02 Not sampled: non-forest

The following are for forest conditions:

03 Not sampled: too rocky to sample
04 Not sampled: water or boggy
05 Not sampled: access denied
06 Not sampled: too dangerous to sample
07 Not sampled: obstruction in sampling area
08 Not sampled: broken or lost equipment
09 Not sampled: other - enter reason in plot notes
11 Sampled: forest that has NOT been identified as a condition on the plot

11.7.11 CONDITION CLASS NUMBER

Record the forested CONDITION CLASS NUMBER that best represents the condition from which the soil sample is being taken. If the condition class for the soil sample is different from any recorded on the 4 subplots, (or macroplots, if used), enter the CONDITION CLASS NUMBER for the most similar forest condition sampled on the plot.

When Collected: Soil sample locations that are being sampled (SOIL SAMPLE STATUS = 1 or 11)
Field Width: 1 digit
Tolerance: No errors
MQO: At least 95% of the time
Values: 1 to 9

11.7.21 SOIL TEXTURE IN THE 0-4 INCH LAYER

Record the code for the soil texture of the 0-4 inch layer. To estimate texture in the field, collect a sample of the soil from the appropriate horizon and moisten it with water to the consistency of modeling clay/wet newspaper; the sample should be wet enough that all of the particles are saturated but excess water does not freely flow from the sample when squeezed. Attempt to roll the sample into a ball. If the soil will not stay in a ball and has a grainy texture, the texture is either sandy or coarse sandy. If the soil does form a ball, squeeze the sample between your fingers and attempt to form a self-supporting ribbon. Samples which form both a ball and a ribbon should be coded as clayey; samples which form a ball but not a ribbon should be coded as loamy.

When Collected: SOIL SAMPLE STATUS = 1 and SUBPLOT NUMBER = 2
Field Width: 1 digit

Tolerance: +/- 1 class
MQO: 80% of the time
Values:

0	Organic
1	Loamy
2	Clayey
3	Sandy
4	Coarse Sand
9	Not measured – make plot note

11.7.22 SOIL TEXTURE IN THE 4-8 INCH LAYER

Record the code for the soil texture of the 4-8 inch layer (see the directions for SOIL TEXTURE IN THE 0-4 INCH LAYER).

When Collected: SOIL SAMPLE STATUS = 1 and SUBPLOT NUMBER = 2
Field Width: 1 digit
Tolerance: +/- 1 class
MQO: 80% of the time
Values:

0	Organic
1	Loamy
2	Clayey
3	Sandy
4	Coarse Sand
9	Not measured – make plot note

11.7.23N-WisCFI SOIL COMPACTION – North

Record the soil compaction (in psi) at a depth of 9 inches using a soil compaction meter, tester or penetrometer.

When Collected:
Field Width: 3 digits
Tolerance: +/- 1 class
MQO: 80% of the time
Values:

000	Reading between 0 to 50
100	Reading between 51 to 150
200	Reading between 151 to 250
300	Reading over 251
999	Not measured, make plot note

11.7.24N-WisCFI SOIL COMPACTION – East

Record the soil compaction (in psi) at a depth of 9 inches using a soil compaction meter, tester or penetrometer.

When Collected:
Field Width: 3 digits
Tolerance: +/- 1 class
MQO: 80% of the time
Values:

000	Reading between 0 to 50
100	Reading between 51 to 150
200	Reading between 151 to 250
300	Reading over 251
999	Not measured, make plot note

11.7.25N-WisCFI SOIL COMPACTION – South

Record the soil compaction (in psi) at a depth of 9 inches using a soil compaction meter, tester or penetrometer.

When Collected:
Field Width: 3 digits
Tolerance: +/- 1 class
MQO: 80% of the time
Values:

000	Reading between 0 to 50
100	Reading between 51 to 150
200	Reading between 151 to 250
300	Reading over 251
999	Not measured, make plot note

11.7.26N-WisCFI SOIL COMPACTION – West

Record the soil compaction (in psi) at a depth of 9 inches using a soil compaction meter, tester or penetrometer.

When Collected:
Field Width: 3 digits
Tolerance: +/- 1 class
MQO: 80% of the time
Values:

000	Reading between 0 to 50
100	Reading between 51 to 150
200	Reading between 151 to 250
300	Reading over 251
999	Not measured, make plot note

11.11 REFERENCES

British Columbia Ministry of Forestry. 1997. Soil conservation surveys guidebook. http://www.for.gov.bc.ca/tasb/legsregs/fpc/fpcguide/SOILSURV/soil-toc.htm

Kern, J.S., M.L. Papp, J.J. Lee, and L.J. Blume. 1988. Soil Sampling Manual for the Direct/Delayed Response Project Mid-Appalachian Soil Survey. U.S. Environmental Protection Agency, Corvallis, OR.

NCASI. 1983. Field Study Program Elements to Assess the Sensitivity of Soils to Acidic Deposition Induced Alterations in Forest Productivity. Technical Bulletin No. 404. National Council of the Paper Industry for Air and Stream Improvement, Inc., New York.

Riitters, K., M. Papp, D. Cassell, and J. Hazard (eds.). 1991. Forest Health Monitoring Plot Design and Logistics Study. U.S. Environmental Protection Agency, Research Triangle Park, NC.

Santiago Declaration. 1995. Criteria and indicators for the conservation and sustainable management of temperate and boreal forests: The Montreal process.

Soil and Water Quality: An Agenda for Agriculture. 1993. Committee on Long-Range Soil and Water Conservation, Board of Agriculture, National Research Council. National Academy Press, Washington, DC.

United Nations Economic Commission For Europe, Convention on Long-range Transboundary Air Pollution. 1994. Manual on Methods and Criteria for Harmonized Sampling, Assessment, Monitoring and Analysis of the Effects of Air Pollution on Forests. 3rd ed.

USDA-Soil Conservation Service. 1992c. Soil Survey Manual. Title 430-V-SSM, U.S. Government Printing Office, Washington, DC.

12.0 CROWNS MEASUREMENTS AND SAMPLING

12.1 OVERVIEW

Crown indicators are designed to be used together. Each indicator comprises a piece of information that can be used individually or as a factor in combination with other indicators. Each variable, alone or in combination with others, adds to the overall rating given each tree. It is important to realize that models are designed to rate trees on how they look, from thriving to almost dead and to help predict future conditions of trees and forest ecosystems.

Crown evaluations, including DIEBACK, and TRANSPARENCY are made on all trees with DBH 5.0 inches or larger.

Two persons make all crown measurements. Individuals should be ½ to 1 tree length from the base of the tree to obtain a good view of the crown. Move away from each other at least 10 feet to take these measurements. A position of 90 degrees to each other from the tree base is ideal (Figure 12.3). When estimates made by two individuals disagree, they should discuss the reasons for their ratings until an agreement is reached, or use the methods below to resolve the situation.

If the numbers for a crown measurement estimated by two crew members do not match, arrive at the final value by: (1) taking an average, if the numbers differ by 10 percent (2 classes) or less; (2) changing positions, if the numbers differ by 15 percent or more and attempting to narrow the range to 10 percent or less if crew members cannot agree; or (3) averaging the two estimates for those trees that actually have different ratings from the two viewing areas (ratings of 30 and 70 would be recorded as 50).

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12.2 CROWN DEFINITIONS

Crown Shape - crown shape is the silhouette of a tree, drawn from branch tip to branch tip, which contains all of a tree’s foliage as it grows in a stand. Exclude abnormally long branches beyond the edge of the crown for this silhouette. Normally, silhouettes are derived from vigorous, open grown trees and tend to be species-specific. For Phase 3 purposes, silhouettes vary with age and spacing. Tree crowns tend to flatten out with age and be more slender when growing in crowded conditions. Crown shape is important when measuring CROWN DENSITY and is used to estimate crown biomass. Crown shape is used as an outline for the sides of the tree.

Crown Top - the crown top is the highest point of a standing tree. Young trees usually have more conical-shaped crowns and the main terminal is the top. Older trees and many hardwoods have globose and flat-topped crowns, where a lateral branch is the highest point. For some measurements the highest live foliage is considered the live crown top. Other measurements include a dead top. Some crown measurements assess how much of the expected crown is present and include broken or missing tops.

Dieback - this is recent mortality of branches with fine twigs, which begins at the terminal portion of a branch and proceeds toward the trunk. Dieback is only considered when it occurs in the upper and outer portions of the tree. When whole branches are dead in the upper crown, without

obvious signs of damage such as breaks or animal injury, assume that the branches died from the terminal portion of the branch. Dead branches in the lower portion of the live crown are assumed to have died from competition and shading. Dead branches in the lower live crown are not considered as part of crown dieback, unless there is continuous dieback from the upper and outer crown down to those branches**.**

Epicormic - shoot growth, from latent or suppressed buds, that arises from old branches, from the trunk or near large branch wounds or breaks. Epicormics remain epicormics until they regain the size of previous branches for trees with no branches 1.0 inch or larger in diameter at the base above the swelling. For trees that had 1.0 inch or larger branches when the epicormics formed, epicormics become branches once they reach 1.0 inch in diameter.

Live Branch - a live branch is any woody lateral growth supporting foliage, and is 1.0 inch or larger in diameter at the base above the swelling where it joins a main stem or larger branch. Small trees or certain tree species greater than 5.0 inches DBH/DRC may have only live twigs which have not yet reached 1.0 inch or larger at the point of attachment. If the death of larger branches is not the cause of these twigs, the twigs are considered branches for these smaller branched trees until the tree matures to a point where twigs have attained 1.0 inch or larger in diameter at the base above the swelling where it joins a main stem or larger branch.

Live Crown Base - the live crown base is an imaginary horizontal line drawn across the trunk from the bottom of the lowest live foliage of the "obvious live crown" for trees and from the lowest live foliage of the lowest twig for saplings. The "obvious live crown" is described as the point on the tree where most live branches/twigs above that point are continuous and typical for a tree species (and/or tree size) on a particular site. Include most crown branches/twigs, but exclude epicormic twigs/sprigs and straggler branches that usually do not contribute much to the tree's growth. The base of the live branch/twig bearing the lowest foliage may be above or below this line.

For trees 5.0 inches DBH/DRC or greater, if any live branch is within 5 feet below this "obvious live crown" line, a new horizontal line is established. Create the new line at the base of live foliage on that branch. Continue this evaluation process until no live branches are found within 5 feet of the foliage of the lowest qualifying branch (Figure 12-1).

Occasionally, all original major crown branches/twigs are dead or broken and many new twigs/sprigs develop. These situations are likely to occur in areas of heavy thinning, commercial clearcuts and severe weather damage:

- Trees that had an "obvious live crown" with live branches now have no crown to measure until the new live twigs become live branches. When these new live branches appear, draw the new live crown base to the live foliage of the lowest live branch that now meets the 5-foot rule.
- Saplings and small trees that had only live twigs should establish the crown base at the base of the live foliage on the new lowest live twig. If no live twigs are present, there is no crown to measure.

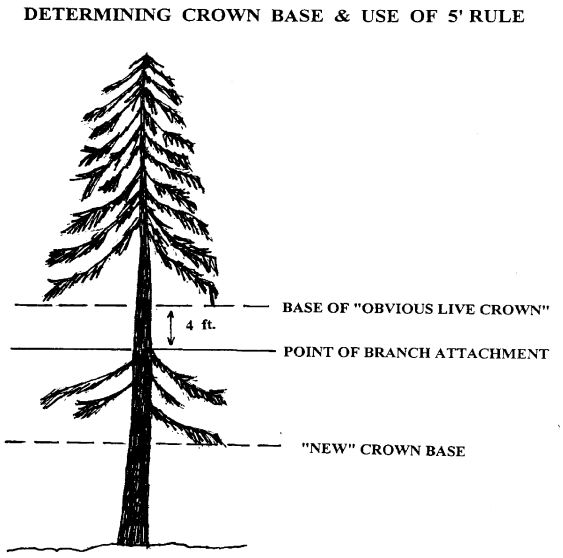


Figure 12-1. Determining the base of the live crown.

Overstory Canopy Zone - the area delineated by the average live crown height determined from the UNCOMPACTED LIVE CROWN RATIO of overstory trees. The bottom of the overstory canopy zone is the average height of the live crown bases. The top of the zone is the average height for the live crown tops.

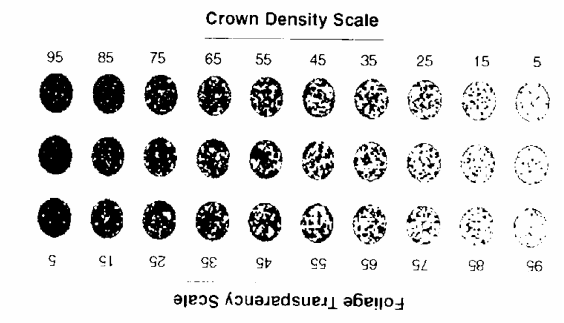
Snag Branch - a dead upper crown branch without twigs or sprigs attached to it. A lower branch on woodland trees such as juniper is not considered a snag branch unless the branch reaches into the upper crown, or reached into the upper crown when the branch was alive. A branch that died due to shading in any crown is not a snag branch.

Sprig - any woody or non-woody lateral growth, without secondary branching, less than 1.0 inch in diameter at the base above the swelling at the point of attachment to a branch or crown stem.

Twig - any woody lateral growth, with secondary branching, less than 1.0 inch in diameter at the base above the swelling at the point of attachment to a branch or crown stem.

12.3 CROWN DENSITY-FOLIAGE TRANSPARENCY CARD

Front



Back

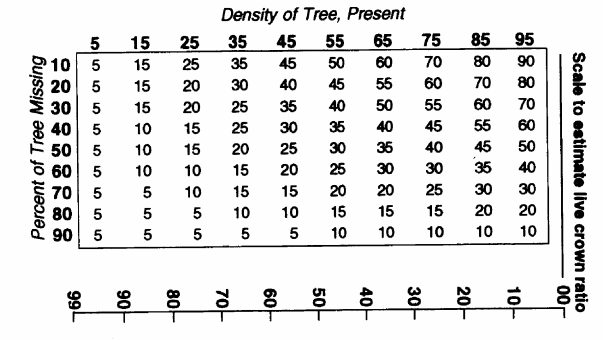


Figure 12-2. Density-Transparency card

The crown density - foliage transparency card (Figure 12-2) should be used as a training aid until crew personnel are comfortable with all ratings. White areas of the card represent skylight visible through the crown area and black areas represent a portion of the tree that is blocking skylight. After training, use the card to calibrate your eyes at the start of each day and rate those trees that do not fit into an obvious class. For FOLIAGE TRANSPARENCY, make sure that "Foliage Transparency" is right-side up.

The back of the crown density - foliage transparency card has a general scale for estimating UNCOMPACTED LIVE CROWN RATIO.

12.4 CROWN RATING PRECAUTIONS

Crews must be especially careful when making evaluations, and pay special attention to certain factors that may affect measurements in the field. These factors include:

- Distance and slope from the tree
- View of the crown
- Climatic conditions
- Heavy defoliation

- Leaning trees
- Trees with no “crown” by definition

Distance and slope from the tree - crews must attempt to stay at least 1/2 to 1 tree length from the tree being evaluated. Some ratings change with proximity to the tree. In some situations, it is impossible to satisfy this step, but the crew should do the best it can in each case. All evaluations are made at grade (same elevation as base of the tree) or up slope from the tree. This may not be possible in all cases but evaluating trees from the down slope side should be avoided.

View of the crown - crew members should evaluate trees when standing at an angle to each other, striving to obtain the best view of the crown. The ideal positions are at 90 degrees to each other on flat terrain (Figure 12-3). If possible, never evaluate the tree from the same position or at 180 degrees. In a thick canopy forest, getting a good perspective of the crown becomes difficult. Overlapping branches, background trees and lack of a good viewing area can cause problems when rating some trees. Crews need to move laterally to search for a good view. Take special care when rating such trees.

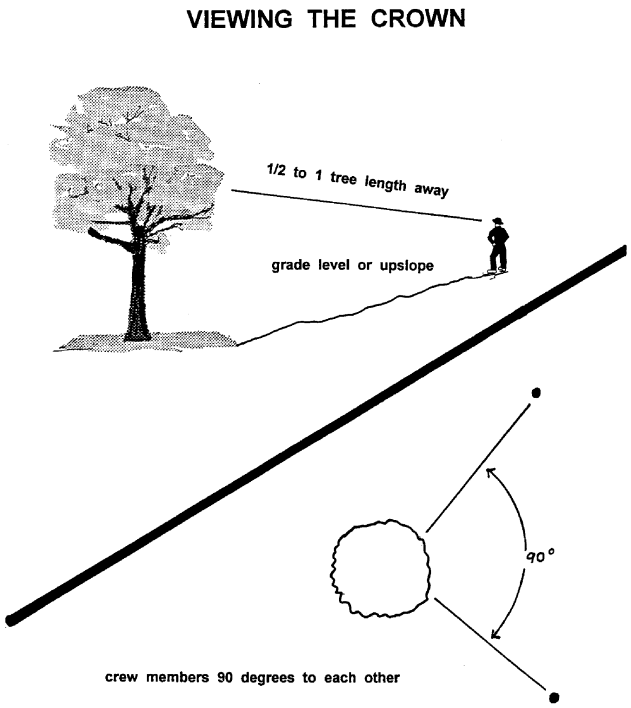


Figure 12-3. Crew positions for viewing crowns.

Climatic conditions - cloudy or overcast skies, fog, rain and poor sun angles may affect the accuracy of crown estimates. Crews need to be especially careful during poor lighting conditions to obtain the best possible view of the crown for the given climate conditions.

Heavy defoliation - during heavy defoliation, CROWN DIEBACK may be overestimated and FOLIAGE TRANSPARENCY may be underestimated due to the difficulty in differentiating dead twigs from defoliated twigs. The use of binoculars may help in separating dead twigs from defoliated twigs.

Leaning trees - so that crown dimensions are measured consistently on both leaning and upright trees, UNCOMPACTED LIVE CROWN RATIO and CROWN DENSITY for leaning and down

trees must be rated in relation to the actual length of the tree bole (as opposed to height above the ground). CROWN POSITION and CROWN LIGHT EXPOSURE should still be estimated relative to the tree's actual location in the canopy. FOLIAGE TRANSPARENCY will rarely be affected by lean angle. Place a note in the PDR TREE NOTES field that the tree is leaning if it is leaning more than 45 degrees from vertical.

Trees with no "crown" by definition (epicormics or sprigs only) -
After a sudden release or damage, a tree may have very dense foliage, but no crown. The following combination of codes is a flag for trees with no crowns:

UNCOMPACTED LIVE CROWN RATIO = 00
CROWN LIGHT EXPOSURE = 0
CROWN POSITION = 3
CROWN DENSITY = 00
CROWN DIEBACK = 99
FOLIAGE TRANSPARENCY = 99

After a sudden release or damage, a sapling may have very dense foliage, but no crown as it only has sprigs. The following combination of codes is a flag for saplings with no crowns:

UNCOMPACTED LIVE CROWN RATIO = 00
CROWN LIGHT EXPOSURE = 0
CROWN POSITION = 3
VIGOR = 3

12.5 UNCOMPACTED LIVE CROWN RATIO

UNCOMPACTED LIVE CROWN RATIO is a percentage determined by dividing the live crown length by the actual tree length (Figure 12-5). UNCOMPACTED LIVE CROWN RATIO for leaning and down trees must be rated in relation to the actual length of the tree bole (as opposed to height above the ground.) Record the UNCOMPACTED LIVE CROWN RATIO to the nearest 1%.

Saplings

Determine sapling UNCOMPACTED LIVE CROWN RATIO by dividing the live crown length by actual tree length, then enter the appropriate code into the PDR. Live crown length is the distance between the top live foliage (dieback and dead branches are not included) and the lowest live foliage on the lowest live twig for saplings. Be sure to eliminate vine foliage as best you can when determining the live crown. The live crown base for saplings is different from trees 5.0 inches DBH/DRC and larger. The 5-foot/1-inch rule does not apply in this case. Do not include sprigs or leaves on the main stem below the lowest live twig (Figure 12-4).

When the two estimates do not agree, follow the guidelines listed at the end of section 12.1 *Overview*.

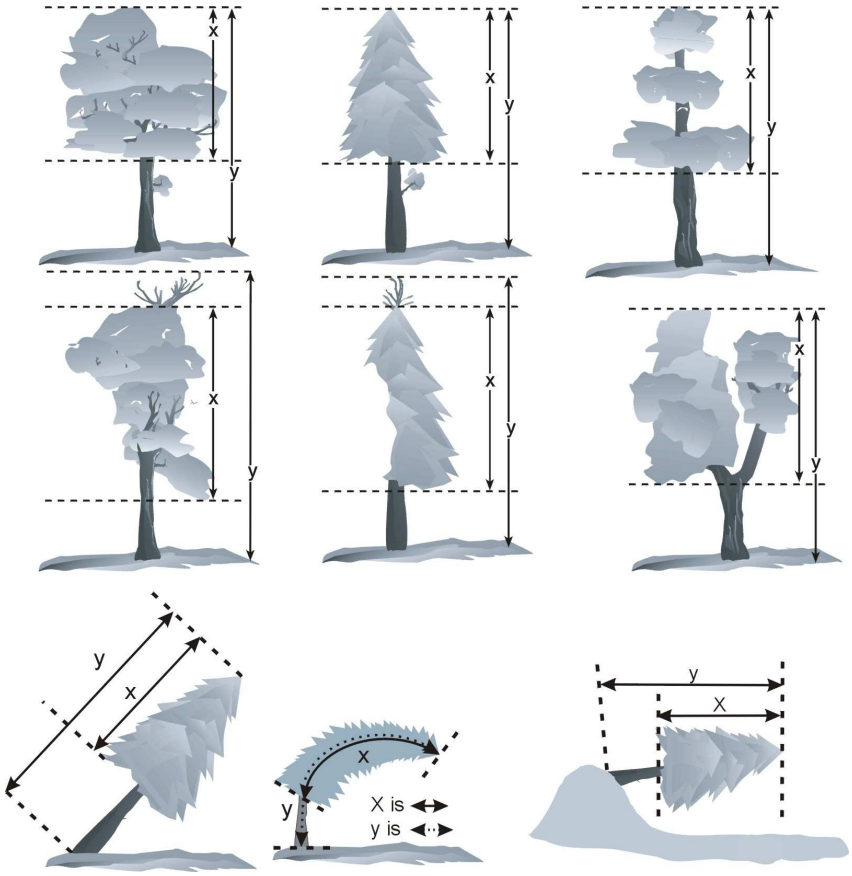


Figure 12-5. UNCOMPACTED LIVE CROWN RATIO examples.

Trees

Live crown length is the distance from the live crown top (dieback in the upper portion of the crown is not part of the live crown) to the "obvious live crown" base (Figure 12-6). Many times there are additional live branches below the "obvious live crown". These branches are only included if they have a basal diameter greater than 1.0 inch and are within 5.0 feet of the base of the obvious live crown (Figure 12-1). The live crown base becomes that point on the main bole perpendicular to the lowest live foliage on the last branch that is included in the live crown. The live crown base is determined by the live foliage and not by the point where a branch intersects with the main bole. Occasionally, small trees or certain species may not have 1.0-inch diameter branches. If this occurs, use the 5.0-foot rule, and apply it to branches that you feel contribute significantly to tree growth.

An individual can use the UNCOMPACTED LIVE CROWN RATIO scale on the back of the crown density - foliage transparency card to help estimate ratios (Figure 12-2). Hold the card in one hand, parallel to the trunk of the tree being evaluated and move the card closer or farther from your eye until the 0 is at the live crown top and the 99 is at the base of the tree where it meets the ground. Then place your finger at the live crown base. A clinometer can also be used to verify the UNCOMPACTED LIVE CROWN RATIO by determining the values of both lengths and determining the ratio of the two values.

When estimates between crew members do not agree, follow the guidelines listed at the end of section 12.1 *Overview*.

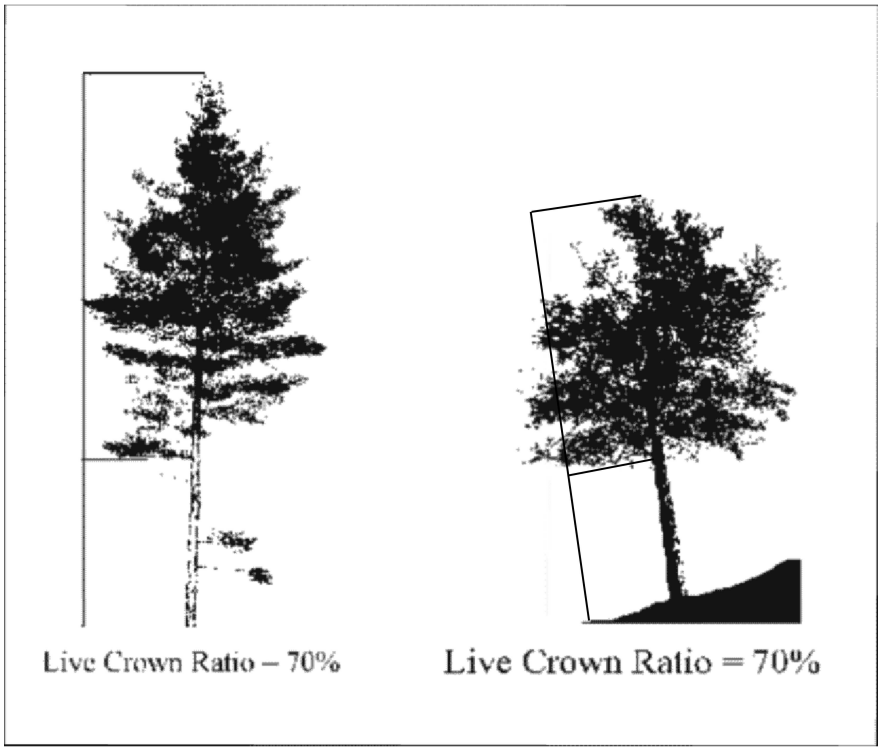


Figure 12-6. UNCOMPACTED LIVE CROWN RATIO outline and rating examples

When collected: All live trees ≥ 1.0 in DBH/DRC
Field width: 2 digits
Tolerance: +/- 10%
MQO: At least 90% of the time
Values: 00 to 99 percent

12.10 CROWN DIEBACK

CROWN DIEBACK estimates reflect the severity of recent stresses on a tree. Estimate CROWN DIEBACK as a percentage of the live crown area, including the dieback area. The crown base should be the same as that used for the UNCOMPACTED LIVE CROWN RATIO estimate. Assume the perimeter of the crown is a two-dimensional outline from branch-tip to branch-tip, excluding snag branches and large holes or gaps in the crown (Figures 12-13 and 12-14).

Project a two-dimensional crown outline, block in the dieback and estimate the dieback area. When two individuals disagree with their estimates, follow the guidelines listed at the end of section 12.1 *Overview*. The estimate is placed into one of 21 percentage classes.

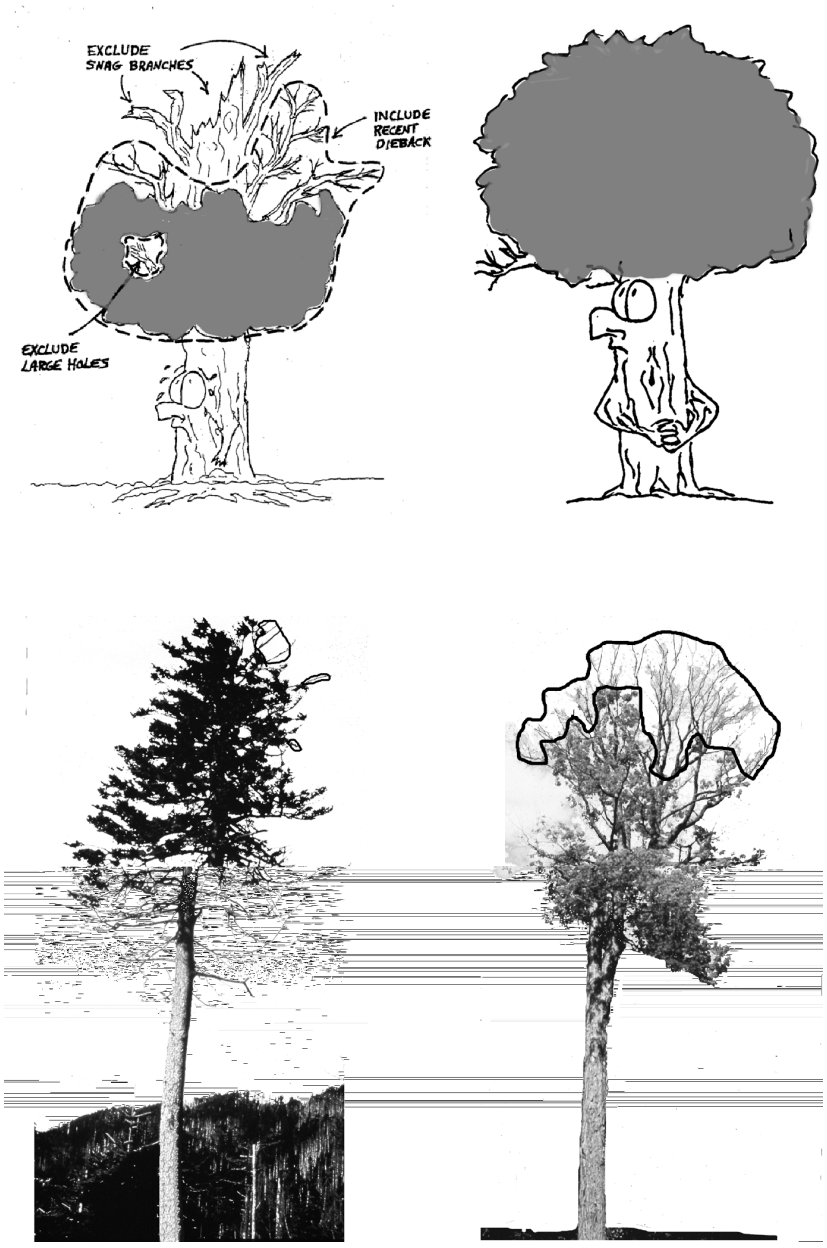


Figure 12-13. CROWN DIEBACK rating outline examples.

Figure 12-14. Dieback outline and rating examples.

When collected: All live trees ≥ 5.0 in DBH/DRC
Field width: 2 digits
Tolerance: +/- 10% (2 classes)
MQO: At least 90% of the time
Values:

Code	Definition	Code	Definition	Code	Definition
00	0%	35	31-35%	70	66-70%
05	1-5%	40	36-40%	75	71-75%
10	6-10%	45	41-45%	80	76-80%
15	11-15%	50	46-50%	85	81-85%
20	16-20%	55	51-55%	90	86-90%
25	21-25%	60	56-60%	95	91-95%
30	26-30%	65	61-65%	99	96-100%

Note: Class code is the percentage of the upper limits of the class, i.e., Code 10 is 6% to 10%, etc.

12.11 FOLIAGE TRANSPARENCY

Foliage transparency is the amount of skylight visible through the live, normally foliated portion (where you see foliage, normal or damaged, or remnants of its recent presence) of the crown. A recently defoliated tree except for one or two live leaves should have a transparency rating of 99 not 0!! (See coding for 'Trees with no crown by definition…' in section 12.4.) Check with binoculars to assess which branches are alive and should have foliage.

Different tree species have a normal range of foliage transparency, which may be more or less than that of other species. Changes in foliage transparency can also occur because of current defoliation or stresses during the current or preceding years.

Estimate FOLIAGE TRANSPARENCY using the crown density - foliage transparency card (Figure 12-2). Exclude vine foliage from the transparency estimate as best you can. Dead branches in the lower live crown, snag branches, crown dieback and missing branches or areas where foliage is expected to be missing are deleted from the estimate (Figure 12-15).

When defoliation is severe, branches alone will screen the light, but you should exclude the branches from the foliage outline and rate the area as if the light was penetrating those branches. For example, an almost completely defoliated dense spruce may have less than 20 percent skylight coming through the crown, but it will be rated as highly transparent because of the missing foliage. Old trees and some hardwood species, have crowns with densely foliated branches that are widely spaced. These spaces between branches should not be included in the FOLIAGE TRANSPARENCY rating. When FOLIAGE TRANSPARENCY in one part of the crown differs from another part, the average FOLIAGE TRANSPARENCY is estimated.

Project a two-dimensional crown outline. Determine the foliated area within the crown outline and estimate the transparency of the normally foliated area.

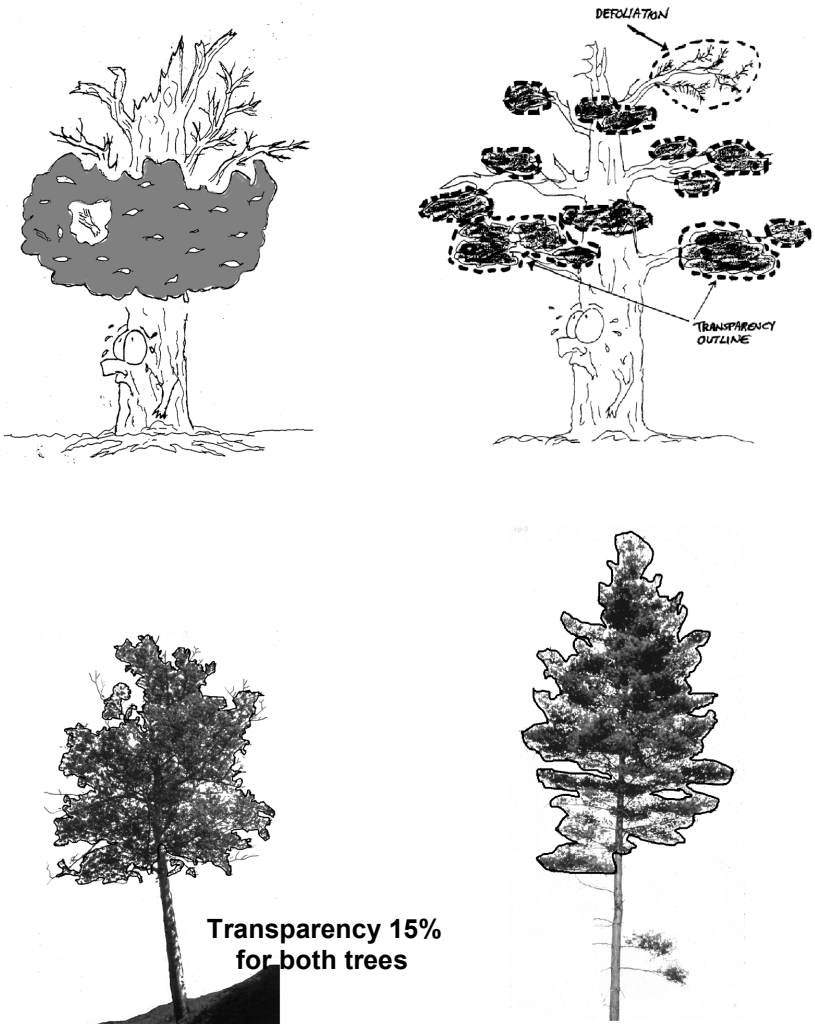


Figure 12-15. FOLIAGE TRANSPARENCY rating outline examples.

When collected: All live trees ≥ 5.0 in DBH/DRC
Field width: 2 digits
Tolerance: +/- 10% (2 classes)
MQO: At least 90% of the time
Values:

Code	Definition	Code	Definition	Code	Definition
00	0%	35	31-35%	70	66-70%
05	1-5%	40	36-40%	75	71-75%
10	6-10%	45	41-45%	80	76-80%
15	11-15%	50	46-50%	85	81-85%
20	16-20%	55	51-55%	90	86-90%
25	21-25%	60	56-60%	95	91-95%
30	26-30%	65	61-65%	99	96-100%

Note: Class code is the percentage of the upper limits of the class, i.e., Code 10 is 6% to 10%, etc.

13.0 VEGETATION DIVERSITY AND STRUCTURE

13.0 INTRODUCTION

The objectives of the Phase 3 (P3) Vegetation Indicator are to measure the type, relative abundance, and vertical position of all trees, shrubs, herbs, grasses, ferns and fern allies within each P3 plot. We use this information to assess forest ecosystem health in terms of diversity and rates of change of community structure for both native and non-native vascular plant species. While individual species can be important indicators of a site's potential productivity, economic value, and wildlife forage and shelter, changes in the composition and spatial arrangement of vascular plants in a forest may indicate the presence of chronic stresses such as discrete site degradation, climate change, and pollution. These stresses can lead to decline or local eradication of sensitive species, as well as increase and dominance of opportunistic species, such as many weedy non-native plants.

Vegetation diversity and structure data can also be used to classify P3 plots by locally defined plant communities or associations, allowing extrapolation of other forest health monitoring results to broader areas.

The accepted technique used by vegetation scientists to sample plant composition and diversity is to install nested plots of different sizes within a given plant community (Mueller-Dombois and Ellenberg 1974, Barbour and others 1987). Multi-scale sampling is necessary because different communities have different spatial patterns of species richness, so a single plot size is an arbitrary sample of species diversity. Sampling at two or more scales provides information about the structure of a plant community and distribution of individual species, which allows better comparison among communities (and forest types), allows us to estimate how many additional species might occur beyond our largest plot size (i.e., were "missed") (Stohlgren and others 1995), and allows us to measure change in composition over time.

Data will be collected by crew members who have been trained and certified in the Vegetation Indicator methods. These crew members are expected to have had previous botanical training; while we can provide some refresher training in local flora, the skills needed to be an effective field vegetation specialist are beyond the scope of what we can provide during a short training period at the beginning of the field season.

Crew members who are not certified in Vegetation Indicator methods may assist the field vegetation specialist by:

1. Sharing CONDITION CLASS number information
2. Assisting with DETAILED NONFOREST LAND USE descriptions
3. Laying out transects
4. Locating quadrat corners
5. Collecting unknown specimens
6. Entering data
7. Aiding in tree identification

Wisconsin State Forests, Continuous Forest Inventory (WisCFI), Vegetation Diversity and Structure, Version 2.0 is adapted from the USDA Forest Service Forest Inventory and Analysis (FIA) Northern Region (NRS) field guide version 4.0. FIA version 4.0 is based on the FIA National Core Field Guide, Version 4.0.

- All WisCFI-specific data elements end in "N-WisCFI" (e.g., x.xN-WisCFI).
- [WisCFI field guide electronic file note: National and regional data elements formatted as hidden, strikethrough text are not applicable for WisCFI.]

13.1 SAMPLE DESIGN

Phase 3 sampling of vegetation is focused on accessible forest condition classes. If the total area of all accessible forest land condition classes is less than 100% on a subplot, vegetation measurements are done only on the portion that is in accessible forest land condition classes. Vegetation Indicator measurements are not done on portions of the plot that are NOT accessible forest land condition classes. Canopy cover estimates are only made for the area within accessible forest condition(s).

Vegetation Indicator data are collected on both subplots of P3 plots or portions of subplots that are accessible forest land. The boundaries of the subplot are 24.0 feet, horizontal distance, from the subplot center. Data are collected on two plot sizes on each subplot: three 3.28 x 3.28 feet (1 m2) “quadrats”, and the 24.0-foot radius subplot (Figure 13-1). From subplot center, the quadrats are located on the right sides of lines at azimuths of 30o, 150o, and 270 o. Ideally, two corners of each quadrat are permanently marked at 15 and 18.3 feet (4.57 and 5.57m), horizontal distance, from the subplot center. (This will vary by region and landowner.)

Total cover of all vegetation foliage in four height layers (0 – 2, > 2 – 6, > 6 – 16, and >16 feet) is estimated on each subplot prior to recording species. Ground variable cover estimates are also recorded on the 24.0-foot radius subplot. Each quadrat is assigned to the dominant condition class on the quadrat, and trampling is assessed.

A species matrix is compiled for each plot as the vegetation specialist visits each sample unit – both quadrats and subplots – on the plot. A species code is recorded when a species is first encountered. When discovered on subsequent sample units within the plot, information is added to the original species record.

On the quadrats where the dominant condition class is accessible forest, species presence/absence data are collected for vascular plants rooted in the quadrat or with overhanging foliage or live material within 6 feet above the ground above the quadrat.

After the quadrats are assessed, a time-constrained search of all species on the subplot is conducted. Total canopy cover of each individual species is estimated on each subplot. There are no height limits for vegetation overhanging the subplot boundary; trees and shrubs that are rooted outside the subplot are included in the record if they overhang the subplot. Most species will have canopy cover in one layer only, in which case the total canopy cover and layer canopy cover will be the same. Species and canopy cover estimates are only made for the area of the subplot in accessible forest condition(s). Boundaries between multiple accessible forest conditions on a subplot are ignored during data collection.

Specimens of all measured plants that cannot be confidently identified to the species level are collected off-plot and submitted to herbaria for subsequent identification. Data are collected by certified vegetation specialists with regional knowledge to provide optimum field identification of plant species at each site.

Quality assurance measurements should be made within 2 weeks of the original plot visit. At the time of next plot measurement cycle, plots should be revisited within 2 weeks of the calendar date of the previous measurement cycle, if at all possible.

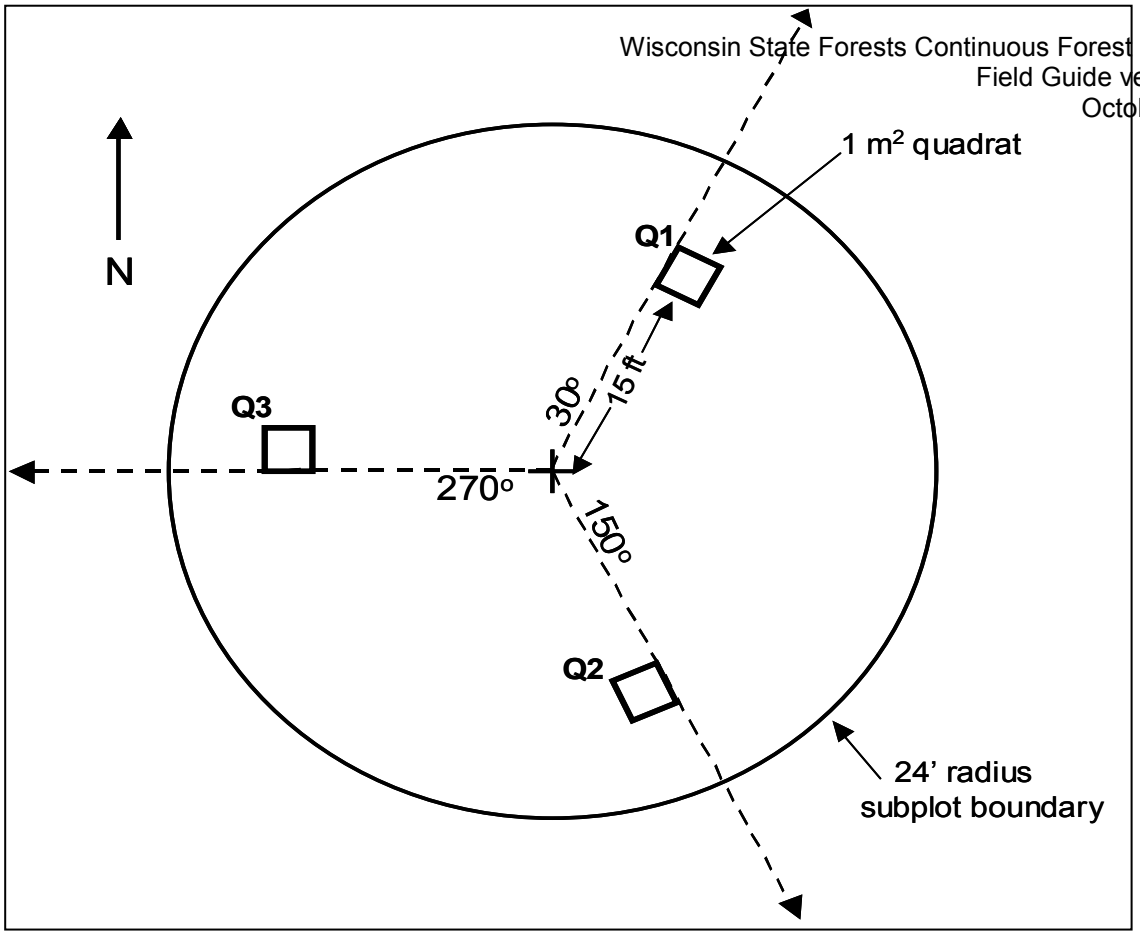


Figure 13-1. Layout of P3 subplot showing location of quadrats and subplot boundary

13.2 SUGGESTED FIELD GEAR UNIQUE TO VEGETATION INDICATOR

- 1-gal plastic bags for unknown plant specimens
- 1-m2 quadrat frame
- Permanent pins/stakes to mark quadrat where allowed, or temporary pin flags
- Carpenters ruler (for height measurements)
- Hand lens
- Pre-numbered labels for unknown plant specimens (provided)
- Envelopes for bulky fruits or nuts
- Local flora keys and species lists
- Digging tool
- Large boxes to store and ship samples
- Newspaper and cardboard
- Plant press
- Access to dissecting scope with illuminator
- Mailing instructions for samples (Region specific)
- Diskettes for sending unknown sample information to herbaria
- PLANTS code dictionary with cross-walk plant names to accepted codes

13.3 PLOT AND VISIT REFERENCE INFORMATION

13.3.1 STATE

Record the unique FIPS (Federal Information Processing Standard) code identifying the State where the plot center is located.

When collected: All plots currently having at least one accessible forest condition
Field width: 2 digits
Tolerance: No errors
MQO: At least 99% of the time
Values: See Appendix 1 in the P2 field guide

13.3.2 COUNTY

Record the unique FIPS (Federal Information Processing Standard) code identifying the County where the plot center is located.

When collected: All plots currently having at least one accessible forest condition
Field width: 3 digits
Tolerance: No errors
MQO: At least 99% of the time
Values: See Appendix 1 in the P2 field guide

13.3.3 PLOT NUMBER

Record the identification number, unique within a county, parish, or borough (survey unit in AK), for each plot. If SAMPLE KIND = 3, the plot number will be assigned by the National Information Management System (NIMS). Use 99999 while in the field for replacement plots.

When collected: All plots currently having at least one accessible forest condition
Field width: 4 digits
Tolerance: No errors
MQO: At least 99% of the time
Values: 0000(0) – 9999(9)

13.3.4 QA STATUS

Record the code corresponding to the type of vegetation measurement conducted.

When collected: All plots currently having at least one accessible forest condition
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values:

1 Standard field production plot
2 Cold Check
3 Reference plot (off grid)
4 Training/Practice plot (off grid)
5 Botched Plot file (disregard during data processing)
6 Blind Check
7 Hot Check (production plot)

13.3.5 VEG CREW TYPE

Record the code corresponding to the type of crew measuring the vegetation diversity and structure.

When collected: All plots currently having at least one accessible forest condition
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values:

1 Regular field crew
2 QA crew (any QA crew member present collecting data)

13.3.6 VEG SAMPLE KIND
Record sample kind.

When collected: All plots
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values:

1	Initial P3 VEG plot establishment
2	Remeasure of previously established P3 VEG plot
3	Replacement P3 VEG plot

13.3.7 VEG VISIT DATE
Record the year, month, and day that the current plot visit was completed as follows:

13.3.7.1 YEAR
Record the year that the plot was completed.

When collected: All plots
Field width: 4 digits
Tolerance: No errors
MQO: At least 99% of the time
Values: > 2005

13.3.7.2 MONTH
Record the month that the plot was completed.

When collected: All plots
Field width: 2 digits
Tolerance: No errors
MQO: At least 99% of the time
Values:

01	January	05	May	09	September
02	February	06	June	10	October
03	March	07	July	11	November
04	April	08	August	12	December

13.3.7.3 DAY
Record the day of the month that the plot was completed.

When collected: All plots
Field width: 2 digits
Tolerance: No errors
MQO: At least 99% of the time
Values: 01 to 31

13.3.8 VEGETATION Specialist CREW NAME
Record the name of the crew member measuring vegetation diversity and structure.

When collected: All plots
Field width: 20 digits
Tolerance: No errors
MQO: At least 99% of the time
Values: Lastname, firstname

13.3.9 VEG PLOT NOTES

Use these fields to record notes pertaining to the entire plot. If the notes apply only to a specific subplot or other specific aspect of the plot, then make that clear in the notes.

When collected: All plots
Field width: 160 alphanumeric characters
Tolerance: N/A
MQO: N/A
Values: English language words, phrases and numbers

13.4 SUBPLOT INFORMATION

13.4.1 SUBPLOT NUMBER

Record the code corresponding to the number of the subplot.

When collected: Every subplot on all plots with at least one accessible forest condition
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values:

1	Center subplot
2	North subplot

13.4.2 VEG SUBPLOT STATUS

Record the code corresponding to how the subplot was sampled, and if not, why not.

When collected: Each subplot
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values:

1 Sampled – at least one accessible forest land condition present
2 Sampled – no accessible forest land condition present on subplot
3 Nonsampled

13.4.3 VEG SUBPLOT NONSAMPLED REASON

For subplots that cannot be sampled, and are wholly or partially within the sampling population (WNDR boundary), record one of the following reasons. Codes 1-4 can be assigned to entire plots or portions of plots that are not sampled. Code 5 is assigned only when the entire plot is affected.

When collected: When Subplot Status=3
Field width: 2 digits
Tolerance: No errors
MQO: At least 99% of the time
Values:

01	Outside .WDNR boundary
03	Hazardous situation
04	Time Limitation
05	Lost data (office use only)
10	Other

13.4.4 PERCENT SUBPLOT AREA ACCESSIBLE FOREST LAND

Record the percent area of the subplot in an accessible forested condition.

When collected: When Subplot Status=1
Field width: 3 digits
Tolerance: +/- 1 class based on the following canopy cover classes: 1-5%, 6-10%, 11-20%, 21-40%, 41-60%, 61-80%, and 81-100%
MQO: 90 % of the time
Values: 001-100.

13.4.5 DETAILED NONFOREST LAND USE

Record the code corresponding to the NONFOREST land use of the portion of the subplot that is not forest. If more than one nonforest land use is present, record the code that best describes the land use occurring closet to subplot center.

When collected: SUBPLOT STATUS = 1, and PERCENT SUBPLOT AREA ACCESSIBLE FOREST LAND < 100%
Field width: 2 digits
Tolerance: No errors
MQO: At least 99% of the time
Values:

- 10 Agriculture
  - 11 Cropland
  - 12 Pasture
  - 13 Idle farmland
  - 14 Orchard
  - 15 Christmas tree plantation
- 20 Rangeland
- 30 Developed
  - 31 Cultural (business, residential, urban buildup)
  - 32 Rights-of-way (improved roads, railway, power lines, canals)
  - 33 Recreation (parks, ski areas, golf courses, etc.)
- 40 Other (beach, desert, noncensus water, marsh, bog)

13.4.6 COMMUNITY DESCRIPTION FOR SPECIMEN LABELS (CORE OPTIONAL)

To fully automate Specimen Label, enter a brief description of the community type to aid the taxonomist in the identification of any specimens collected from this subplot. Community descriptions often describe the dominant overstory species (i.e., Open mixed conifer, closed paper birch, pinyon juniper woodland).

When collected: Optional
Field width: 40 characters
Tolerance: No errors
MQO: At least 99% of the time
Values: English words or phrases that describe plant community

13.4.7 VEG SUBPLOT NOTES

Use these fields to record notes pertaining to the subplot.

When collected: As needed
Field width: 40 alphanumeric characters
Tolerance: N/A
MQO: N/A
Values: English language words, phrases, and numbers

13.5 SUBPLOT TOTAL CANOPY COVER BY LAYER

Estimate the total canopy cover of the foliage of all vascular plants by layer above the ground surface within the accessible forested conditions on the subplot. A rapid canopy cover estimate is made, ignoring overlap among species. It may help to visualize canopy cover by collapsing each layer into a 2-dimension space and using the polygon method. Canopy cover is based on a vertically-projected polygon described by the outline of the foliage, ignoring any normal spaces occurring between the leaves of plants (Daubenmire 1959). If there is no foliage in a layer, enter 0% for that layer. Canopy cover estimates are only made for the area within accessible forest condition(s) and should not include foliage on non-forested portions of the subplot. However, record the percent cover on the forested portion as if the subplot was 100% accessible forest. For example, if cover in a layer is about equal to a circle with a radius of 5.3 ft, enter 5%, as you would for a fully forested subplot, on any partially forested subplot.

13.5.1 SUBPLOT CANOPY COVER LAYER 1 (0 – 2 feet above ground)
Estimate the total canopy cover of the foliage of all vascular plants in Layer 1 within the accessible forested conditions on the subplot. A rapid canopy cover estimate is made, ignoring overlap among species.

When collected: All subplots where SUBPLOT STATUS = 1
Field width: 3 digits
Tolerance: +/- 1 class based on the following canopy cover classes: 1-5%, 6-10%, 11-20%, 21-40%, 41-60%, 61-80%, and 81-100%
MQO: At least 90% of the time
Values: 000-100

13.5.2 SUBPLOT CANOPY COVER LAYER 2 (>2 – 6 ft)
Estimate the total canopy cover of the foliage of all vascular plants in Layer 2 within the accessible forested conditions on the subplot. A rapid canopy cover estimate is made, ignoring overlap among species.

When collected: All subplots where SUBPLOT STATUS = 1
Field width: 3 digits
Tolerance: +/- 1 class based on the following canopy cover classes: 1-5%, 6-10%, 11-20%, 21-40%, 41-60%, 61-80%, and 81-100%
MQO: At least 90% of the time
Values: 000-100

13.5.3 SUBPLOT CANOPY COVER LAYER 3 (>6 – 16 ft)
Estimate the total canopy cover of the foliage of all vascular plants in Layer 3 surface within the accessible forested conditions on the subplot. A rapid canopy cover estimate is made, ignoring overlap among species.

When collected: All subplots where SUBPLOT STATUS = 1
Field width: 3 digits
Tolerance: +/- 1 class based on the following canopy cover classes: 1-5%, 6-10%, 11-20%, 21-40%, 41-60%, 61-80%, and 81-100%
MQO: At least 90% of the time
Values: 000-100

13.5.4 SUBPLOT CANOPY COVER LAYER 4 (> 16 ft)
Estimate the total canopy cover of the foliage of all vascular plants in Layer 4 within the accessible forested conditions on the subplot. A rapid canopy cover estimate is made, ignoring overlap among species.

When collected: All subplots where SUBPLOT STATUS = 1

Field width: 3 digits
Tolerance: +/- 1 class based on the following canopy cover classes: 1-5%, 6-10%, 11-20%, 21-40%, 41-60%, 61-80%, and 81-100%
MQO: At least 90% of the time
Values: 000-100

13.6 SUBPLOT GROUND VARIABLE RECORDS

Assess the cover of ground variables found on the accessible forest portion of the subplot. In areas with thick vegetation, you may opt to complete this section after you have collected the species data and have a better perspective on the ground cover. These describe things in contact with the ground surface and not occupied by tree boles or other vegetation basal area. Multiple ground variables often occur on a subplot. Items must be visible from above. For example, a large rock completely covered with moss would not be coded, but the moss would be. Estimate the cover of each ground variable. Cover is estimated to the nearest 1% for each ground variable.

13.6.2 PERCENT LICHEN COVER
Record the PERCENT LICHEN COVER in the subplot.

When collected: All sampled subplots with SUBPLOT STATUS = 1
Field width: 3 digits
Tolerance: +/- 1 class based on the following cover classes: 1-5%, 6-10%, 11-20%, 21-40%, 41-60%, 61-80%, and 81-100%
MQO: At least 90% of the time
Values: 000-100

13.6.5 PERCENT MOSS COVER
Record the PERCENT MOSS COVER in the subplot. If liverworts occur on the subplot, include them here with mosses.

When collected: All sampled subplots with SUBPLOT STATUS = 1
Field width: 3 digits
Tolerance: +/- 1 class based on the following cover classes: 1-5%, 6-10%, 11-20%, 21-40%, 41-60%, 61-80%, and 81-100%
MQO: At least 90% of the time
Values: 000-100

13.7 QUADRAT DATA

Place the quadrat frame to the right side of the transect line and make sure the corners are lined up at 15 and 18.3 feet from subplot center. Level the quadrat, if necessary, by propping up the quadrat corners. When a quadrat is located on a steep slope the vegetation specialist should be positioned next to or downhill from the quadrat to prevent sliding or falling into the quadrat. In areas of thick vegetation, slide the quadrat sides through the vegetation. Quadrat frames can be made with hinging corners or detachable sections to improve maneuverability.

13.7.1 SUBPLOT NUMBER
Record the code corresponding to the number of the subplot.

When collected: All sampled subplots with SUBPLOT STATUS = 1
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time

Values:

1 Center subplot
2 North subplot

13.7.2 QUADRAT NUMBER

Record the code corresponding to the number of the quadrat.

When collected: Each quadrat
Field width: 1 digits
Tolerance: No errors
MQO: At least 99% of the time
Values:

1 Quadrat on 30
2 Quadrat on 150
3 Quadrat on 270

13.7.3 QUADRAT CONDITION CLASS NUMBER

A CONDITION CLASS number is assigned to each quadrat. If the quadrat straddles a CONDITION CLASS boundary, assign the number for the CONDITION CLASS that occupies the greatest area in the quadrat. Use the CONDITION CLASS number assigned during plot mapping by the mensuration crew.

When collected: Each Quadrat on a sampled subplot with SUBPLOT STATUS = 1
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values: 1-9

13.7.4 QUADRAT STATUS

Record the code corresponding to how the quadrat was sampled. If QUADRAT STATUS is 1 or 3, continue to enter data for the quadrat. If the value entered is 2, 4, or 5, leave the remaining quadrat items blank.

When collected: Each quadrat on a sampled subplot with SUBPLOT STATUS = 1
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values:

1 Quadrat sampled (most of the quadrat is in an accessible forest condition)
2 Quadrat not sampled because most or all of it does not fall in an accessible forested condition class
3 Quadrat sampled, no vascular plants rooted in or overhanging within 6 feet of the ground surface
4 Quadrat not sampled, hazard present on quadrat
5 Quadrat not sampled, other reason – enter in plot notes

13.7.5 TRAMPLING

A trampling code is assigned to each quadrat at the start of vegetation diversity measurements. Trampling is defined as damage to plants or disturbance of the ground layer by humans, livestock, or wildlife.

When collected: QUADRAT STATUS = 1 or 3
Field width: 1 digit
Tolerance: +/- one code
MQO: At least 90% of the time
Values:

1 Low: 0-10% of quadrat trampled: pristine to relatively undisturbed.
2 Moderate: 10-50% of quadrat trampled: trampling by animals or field crew
3 Heavy: >50% of quadrat trampled: hiking trail or heavily grazed.

13.7.6 VEG QUADRAT NOTES
Use these fields to record notes pertaining to the quadrat.

When collected: As needed
Field width: 40 alphanumeric characters
Tolerance: N/A
MQO: N/A
Values: English words, phrases, and numbers

13.8 SPECIES RECORDS

Species data are collected at both the subplot level and the quadrat level for each subplot. A single species list is maintained for the entire plot and updated for specific attributes at each level (quadrat and subplot). Species codes are recorded as each species is discovered for the first time on a given plot. Data are added to the original species' record when the species is encountered on subsequent sample units within the plot. This section describes the data required to uniquely identify each recorded species. Note: It is typically easier to collect quadrat data and quadrat species first, and then return to subplot species. WARNING: changing or deleting a species code will change it or delete it for the entire plot.

13.8.1 PLOT SPECIES LIST

13.8.1.1 SPECIES CODE
Record a code for each vascular plant species found rooted in or overhanging the forested portion of any subplot at any height, or rooted in or overhanging within 6 feet above the quadrat. Species codes must be the standardized codes in the Natural Resource Conservation Service (NRCS) PLANTS database January 2000 version*. Identification to species only is expected. However, if subspecies information is known, enter the appropriate NRCS code.

WisCFI Note: With four exceptions, graminoid species do not require identification and will be recorded with the PLANTS generic code 2GRAM. The four exceptions requiring identification to species are:

PLANTS code	Scientific Name	Common Name
CAPE6	Carex pensylvanica	Pennsylvania sedge
MIVI	Microstegium vimineum	Japanese stiltgrass, Nepalese browntop
PHAR3	Phalaris arundinacea	reed canarygrass
PHAU7	Phragmites australis	common reed

If a plant cannot be identified quickly and confidently, assign a NRCS PLANTS genus or unknown code appropriate to the species. Collect a specimen away from the quadrat unless the species is locally sparse or another SPECIMEN NOT COLLECTED REASON CODE (13.8.1.5) applies. A species is "locally sparse" if 5 or fewer plants are present in the entire plot and immediate surrounding area.

When collected: First time each unique species is discovered on plot
Field width: 10 digits
Tolerance: No errors
MQO: At least 99% of the time
Values: Accepted NRCS species when the species is known, or an accepted NRCS genus or unknown code when the species is not known.

*Species, genus, and unknown codes from this version available from web site: http://socrates.lv-hrc.nevada.edu/fia/ia/IAWeb/IAmain.htm . The list of unknown codes (NRCS "Symbols for unknown plants") is given in section 13.12.

13.8.1.2 UNIQUE SPECIES NUMBER

When any code is entered for the first time on a plot, the UNIQUE SPECIES NUMBER is "1". If more than one unidentified species is discovered that is described by the same genus or unknown code, the next sequential number is assigned. If a recorded unidentified species is encountered again elsewhere on the plot, the vegetation specialist adds information to the species' original record.

When collected: All species records
Field width: 2 digits
Tolerance: No errors
MQO: At least 99% of the time
Values: 1-99, assigned in sequential numbers

13.8.1.3 SPECIMEN OFFICIALLY COLLECTED

Record if a specimen was collected or not for each species, genus or unknown code entered as a new unique species.

When collected: All species records
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values

0	No, a specimen was not collected
1	Yes, a specimen was collected

13.8.1.4 SPECIMEN LABEL NUMBER

Record the label number for the collected specimen. Pre-numbered labels are provided to each vegetation specialist by the regional coordinator.

When collected: SPECIMEN OFFICIALLY COLLECTED = 1 (yes)
Field width: 5 digits
Tolerance: No errors
MQO: At least 99% of the time
Values: 1 to 99999, as pre-printed and assigned by region

13.8.1.5 SPECIMEN NOT COLLECTED REASON CODE

Record the code that describes why a specimen has not been collected.

When collected: An unknown code or genus code is entered and SPECIMEN OFFICIALLY COLLECTED = 0 (no)
Field width: 2 digits
Tolerance: No errors
MQO: At least 99% of the time
Values:

01	Species is locally sparse
02	Species has < 1% canopy cover on the subplot and no mature foliage or reproductive parts are present
03	Hazardous situation
04	Time limitation
05	Already collected with previous entry of genus or unknown code with the same unique species number

06 Specimen collected for immediate/local identification
10 Other (explain in notes)

13.8.1.6 PLOT SPECIES NOTES

Notes may be entered for any species encountered, but are required for each new species that is not identified. Enter text that describes the species. This text may be used in the specimen label and unknown report.

When collected: Required for any new unidentified species encountered on a plot and when SPECIMEN NOT COLLECTED REASON = 10
Field width: Unlimited alphanumeric character field
Tolerance: N/A
MQO: N/A
Values: English language words, phrases, and numbers

13.8.2 QUADRAT SPECIES DATA COLLECTION

13.8.2.1 SPECIES PRESENCE/ABSENCE ON QUADRAT

At each new sampled quadrat (QUADRAT STATUS = 1), record species presence or absence. When a new species is encountered, enter it using the fields described in section 13.8.1.

When collected: For each unique species present on a quadrat with QUADRAT STATUS = 1
Field width: 1 digit
Tolerance: No errors
MQO: At least 90% of the time
Values: Blank or 0 (not present) or 1 (present)

13.8.3 SUBPLOT SPECIES DATA COLLECTION

After completing the three quadrats on a sampled subplot, the vegetation specialist does a search of the entire accessible forest condition area of the subplot, ignoring any condition class boundaries within the accessible forest. Only species rooted in or overhanging accessible forest condition(s) are included. All species recorded on the current subplot's quadrats must be included in canopy cover assessments. The vegetation specialist records abundance for all species, searching for no more than an average of 45 minutes per subplot. Some vegetation specialists find they spend more time on the first subplot, but less time on other subplots because most plants have been identified and coded. Only emergent plants are recorded in wetland forest situations. Epiphytes (Spanish moss, ferns, orchids, mistletoes) are recorded as well as possible as seen from the ground level.

13.8.3.1 SUBPLOT SPECIES TOTAL PERCENT CANOPY COVER

A rapid canopy cover estimate is made for each species occurring within the 24-foot radius subplot. Estimate SUBPLOT SPECIES TOTAL PERCENT CANOPY COVER over the entire forested condition portion of the subplot, ignoring any boundaries between forested condition(s). Canopy cover is based on a vertically-projected polygon described by the outline of the foliage, ignoring any normal spaces occurring between the leaves of plants (Daubenmire 1959). Canopy cover estimates are only made for the area within accessible forest condition(s) and should not include foliage on non-forested portions of the subplot. However, record the percent cover on the forested portion as if the subplot was 100% accessible forest. That is, if total cover for a given species is about equal to a circle with a radius of 5.3 ft, enter 5%, as you would for a fully forested subplot.

For species of moderate cover, it may be easiest to divide the subplots into quarters, estimate canopy cover of each quarter separately, and then add them together. Record a trace (less than 1%) of canopy cover as "t". The following area-cover sizes may be useful in developing estimates for an entirely forested subplot:

Subplot radius = 24.0 feet, Subplot area = 1809 ft^2

Cover	Area (ft^2)	Length of a side of a square(ft)	Radius of circular area(ft)
1%	18	4.3	2.4
3%	54	7.4	4.1
5%	90	9.5	5.3
10%	181	13.4	7.6
20%	362	19	10.7

When collected: Each unique species present on current subplot with SUBPLOT STATUS = 1
Field width: 3 digits
Tolerance: +/- 1 class based on the following canopy cover classes: t, 1-5%, 6-10%, 11-20%, 21-40%, 41-60%, 61-80%, and 81-100%
MQO: At least 90% of the time
Values: t, 001 to 100

13.9 UNKNOWN SPECIES and VOUCHER SPECIMEN COLLECTION

When you encounter a species you cannot identify quickly and confidently using field guides, follow these basic steps:

1. Assign a valid NRCS PLANTS Genus or Unknown CODE and appropriate UNIQUE SPECIES NUMBER.
2. Record if a specimen was collected or not in SPECIMEN COLLECTED.
3. When a specimen is collected, enter a SPECIMEN LABEL NUMBER. Place the pre-printed label with the corresponding label number in the bag with the specimen.
4. If no specimen is collected, record a NOT COLLECTED REASON CODE.
5. Describe any newly encountered unknown species in SPECIES NOTES.
6. Record the quadrat occurrence or canopy cover estimate for the sample unit where the plant was encountered, as for any identified species. (see sections 13.8 or 13.9 for more detailed instructions).

Specimen labels with complete information can be generated automatically from downloaded data if a printer is available. Documentation of the unknown on Specimen Labels and Unknown Reports (replacing Unknown spreadsheets) is explained below, along with instructions for handling specimens.

13.9.1 FIELD SPECIMEN LABEL

Each vegetation specialist will be issued a set of printed, pre-numbered labels to track unknown specimens (Figure 13-2). Information to be completed by hand in the field is optional, but may include date, unknown code, unique species number and crew name.

Label Number:1
Date: 8/06/03
Unknown Code: ACANT2
Unique Species Nbr: 1
Veg Spec. crew: John Doe

Figure 13-2. Example of field label for unknown specimen.

13.9.2 OFFICIAL SPECIMEN LABEL

Official specimen labels are printed from plot data and accompany the unknown (or voucher) specimen as it is pressed, dried, and submitted for further identification (Figure 13.3). Information and variables included on Official Specimen Labels are listed in Table 13.1. Labels will not

include sensitive plot identification data – the unique specimen label number is sufficient identification for each specimen.

Specimen Voucher

Label Number: 21 **Resolved Species Code:**

Resolved scientific name:

Resolved by (name):

Date Collected: 6/22/2005

Unknown Code: 2GRAM **Unique Species Nbr:** 7

Field collected scientific name:

Collected by: John Doe

State: State name **County:** County name

Community type(s) where found: bottomland, old stripmine
ridgetop with atv trl, stripped yrs ago moist bottom

Species Notes: delicate, hairy joints

Figure 13-3. Example of official specimen label for unknown specimen.

13.9.3 UNKNOWN REPORTS

For any unknown plant species encountered, the species is recorded in an **Unknown Report** (replacing the separately maintained Unknown Spreadsheet). The Unknown Report is generated from downloaded plot data. Each Region must train the vegetation specialists if they opt for maintaining unknown spreadsheets as Excel[1] files. The Unknown Spreadsheet contains the fields for variables listed in Table 13.1:

Table 13.1 Summary of Variables for Official Specimen labels and Unknown Reports

Variable	Official Specimen Label	Unknown Report	Source
SPECIMEN Label NBR	X	X	13.8.1.4; Preprinted by Region for each VEG crew
Genus or Unknown code	X	X	13.8.1.1 (As assigned by VEG crew)
UNIQUE SPECIES NBR	X	X	13.8.1.2
VEG spec. crew name	X	X	13.3.8
Field collected scientific name	X	X	Scientific name of species as collected
P2 Plot Number	-	X	13.3.3
State name	(descriptor*)	(descriptor)	13.3.1
County name	(descriptor)	(descriptor)	13.3.2
Community type(s) where found	X	X	13.4.6 or text entered by VEG crew

[1] The use of trade or firm names in this publication is for reader information only and does not imply endorsement by the U.S. Department of Agriculture of any product or service.

Date (Collected)	X	X	13.3.7
Description (of plant)	X	X	13.8.1.6; PLOT SPECIES NOTES
Resolved Species Code	X	X	NRCS code entered by identifier
Resolved Scientific Name	X	X	Scientific Name of corresponding NRCS code
Resolved by name	X	X	Name of person identifying the species

*Descriptor used, i.e., State and County NAMES, rather than FIPS code so that information has meaning to independent botanist or herbarium making the identification.

** NRCS PLANTS CODE and scientific name entry to label is highly recommended if specimen is kept for future reference.

13.9.4 SPECIMEN COLLECTION AND HANDLING

A good rule of thumb for when to collect unknown specimens is "when in doubt, ***collect!***" Specimens of all plants present in the quadrats and subplots that cannot be quickly and confidently identified to species should be collected ***away from quadrats*** and **off of the subplot**, if possible. If fewer than 5 of the unknown plants are present DO NOT COLLECT (see section 13.8.1).

Use a digging tool to extract the entire plant, including any underground portions, flowers, fruits, and leaves. If the plant is abundant, collection of two samples will increase the likelihood of a good specimen. All specimens must be labeled, pressed, and dried for shipping and subsequent identification by the vegetation specialist, cooperating herbarium or specialist.

Collected unknown specimens should be transported in the field and from the field in the 1 and/or 2 gallon zip-lock bags provided. Only one species and label may be placed in a single bag. Acceptable methods of transporting collected specimens include:

- Use a 3-hole-punch to punch holes in the bottom of your bags prior to traveling in the field. Place the punched bags into a 2-inch 3-ring binder with the zip-lock portion facing outward. Plants can then be placed with pre-printed, numbered labels into the bag directly in the binder. This method prevents crumpling, tearing, and destroying the specimen during transportation.
- Use a 1-hole-punch to punch a hole in the one upper corner of each bag. The hole should be placed in such a manner that it cannot easily be torn. Place the bags on an aluminum carabineer (available at drug stores) or on heavy twine and fasten to your field vest or backpack. Be careful to seal the plants and labels securely inside the bags to prevent accidental loss.

Pressing specimens

- Each specimen representing a unique species should be placed individually inside a single layer of folded newsprint. Each specimen is to be accompanied by its corresponding unknown specimen label. Even small plant specimens are to be pressed individually. Large plant specimens may be folded in a "v", "z", or "w" arrangement to fit on a single newsprint page. Arrange the specimen so that at least one upper and one lower leaf surface is exposed. Plants may be trimmed to reduce bulk, so long as all diagnostic parts are included. Diagnostic portions include stem sections, petioles, leaves, roots, flowers, and fruits. Bulky fruits or nuts may be stored separately in a paper envelope that is taped to the newsprint and is accompanied by an identical copy of the specimen's unknown label. Unknown codes can be written on the outside of the folded newspaper to aid sorting as specimens are processed.
- Stack the specimens in their individual newsprint sleeves between two pieces of cardboard. Bind the cardboard and plants together using a piece of twine or flat cloth ribbon wrapped around the length and width of the cardboard bundle. For mailing numerous specimens, several bundles may be used. Place all bundles inside a cardboard box for shipping.

Unknown specimens are to be packaged and shipped at the end of every work week. Exceptions will be made when extended field excursions prevent the vegetation specialist from reaching a post office.

All packaged specimens are to be accompanied by the following:

- Name and address to which final identifications are to be mailed
- One paper and one digital copy of the Unknown Spreadsheet

13.10 REFERENCES

Barbour, M.G., J.H. Burk, and W.D. Pitts. 1987. Terrestrial plant ecology. Menlo Park, CA; Benjamin/Cummings Pub. Co.

Daubenmire, R. 1959. A canopy-coverage method of vegetational analysis. Northwest Science 33(1): 43-64.

Mueller-Dombois, D.; Ellenberg, H. 1974. Aims and methods of vegetation ecology. New York: Wiley & Sons.

Stapanian, M.A.; Sundberg, S.D.; Baumgardner, G.A.; Liston, A. 1998. Alien species composition and associations with anthropogenic disturbance in North American forests. Plant Ecology 139: 49-62.

Stohlgren, T.J.; Falkner, M.B.; Schell, L.D. 1995. A modified-Whittaker nested vegetation sampling method. Vegetatio 117: 113-121.

Stohlgren, T.J.; Rimar, K.A.; Stolte, K.W. *submitted.* Monitoring native and exotic plant diversity in the national forests of the United States. Biodiversity and Conservation XX: xx-xx.

13.12 CODES FOR UNKNOWN PLANTS

Code	Common Name
2FERN	Fern or Fern Ally
2FORB	Forb (herbaceous, not grass nor grasslike)
2FA	Forb, annual
2FB	Forb, biennial
2FD	Forb, dicot
2FDA	Forb, dicot, annual
2FDB	Forb, dicot, biennial
2FDP	Forb, dicot, perennial
2FM	Forb, monocot
2FMA	Forb, monocot, annual
2FMB	Forb, monocot, biennial
2FMP	Forb, monocot, perennial
2FP	Forb, perennial
2FS	Forb, succulent
2FSA	Forb, succulent, annual
2FSB	Forb, succulent, biennial
2FSP	Forb, succulent, perennial
2GRAM	Graminoid (grass or grasslike)
2GA	Grass, annual
2GB	Grass, biennial
2GP	Grass, perennial
2GW	Grass, woody (bamboo, etc.)
2GL	Grasslike (not a true grass)
2GLA	Grasslike, annual
2GLB	Grasslike, biennial
2GLP	Grasslike, perennial
2PLANT	Plant
2SHRUB	Shrub (>.5m)
2SB	Shrub, broadleaf
2SD	Shrub, deciduous
2SDB	Shrub, deciduous, broadleaf
2SDBD	Shrub, deciduous, broadleaf, dicot
2SDBM	Shrub, deciduous, broadleaf, monocot
2SDN	Shrub, deciduous, needleleaf
2SE	Shrub, evergreen
2SEB	Shrub, evergreen, broadleaf
2SEBD	Shrub, evergreen, broadleaf, dicot
2SEBM	Shrub, evergreen, broadleaf, monocot
2SEN	Shrub, evergreen, needleleaf
2SN	Shrub, needleleaf (coniferous)
2SS	Shrub, succulent
2SSL	Shrub, succulent, leaf
2SSS	Shrub, succulent, stem
2SUBS	Subshrub (<.5m)
2SSB	Subshrub, broadleaf
2SSD	Subshrub, deciduous
2SSDB	Subshrub, deciduous, broadleaf
2SSDBD	Subshrub, deciduous, broadleaf, dicot
2SSDBM	Subshrub, deciduous, broadleaf, monocot
2SSDN	Subshrub, deciduous, needleleaf
2SSE	Subshrub, evergreen
2SSEB	Subshrub, evergreen, broadleaf
2SSEBD	Subshrub, evergreen, broadleaf, dicot
2SSEBM	Subshrub, evergreen, broadleaf, monocot
2SSEN	Subshrub, evergreen, needleleaf
2SSN	Subshrub, needleleaf (coniferous)
2SSS2	Subshrub, succulent
2SSSL	Subshrub, succulent, leaf
2SSSS	Subshrub, succulent, stem
2TREE	Tree
2TB	Tree, broadleaf
2TD	Tree, deciduous
2TDB	Tree, deciduous, broadleaf
2TDBD	Tree, deciduous, broadleaf, dicot
2TDBM	Tree, deciduous, broadleaf, monocot
2TDN	Tree, deciduous, needleleaf
2TE	Tree, evergreen
2TEB	Tree, evergreen, broadleaf
2TEBD	Tree, evergreen, broadleaf, dicot
2TEBM	Tree, evergreen, broadleaf, monocot
2TEN	Tree, evergreen, needleleaf
2TN	Tree, needleleaf (coniferous)
2TS	Tree, succulent
2TSL	Tree, succulent, leaf
2TSS	Tree, succulent, stem
2VH	Vine, herbaceous
2VHA	Vine, herbaceous, annual
2VHD	Vine, herbaceous, dicot
2VHDA	Vine, herbaceous, dicot, annual
2VHDP	Vine, herbaceous, dicot, perennial
2VHM	Vine, herbaceous, monocot
2VHMA	Vine, herbaceous, monocot, annual
2VHMP	Vine, herbaceous, monocot, perennial
2VHP	Vine, herbaceous, perennial
2VHS	Vine, herbaceous, succulent
2VHSA	Vine, herbaceous, succulent, annual
2VHSP	Vine, herbaceous, succulent, perennial
2VW	Vine, woody

2VWD	Vine, woody, deciduous
2VWDD	Vine, woody, deciduous, dicot
2VWDM	Vine, woody, deciduous, monocot
2VWE	Vine, woody, evergreen

2VWED	Vine, woody, evergreen, dicot
2VWEM	Vine, woody, evergreen, monocot

13.13 P3 VEG DATA SHEETS

State:	Year:	VEG Plot Notes:		
County:	Month			
Plot Number:	Day:			
VEG Sample Kind:				
VEG Crew Name:				
VEG QA Status:				
VEG Crew Type:				
	Subplot 1	**Subplot 2**	**Subplot 3**	**Subplot 4**
VEG Subplot status				
VEG Subplot Non-sample reason				
Percent Subplot Area in Accessible Forest Condition(s)				
Nonforest Land Use				
Total Canopy Cover by Layer in Accessible Forest Condition(s)				
1 (0-2)				
2 (>2-6)				
3 (>6-16)				
4 (>16+)				
Subplot Ground Variable Cover in Accessible Forest Condition(s)				
Cryptobiotic crust				
Lichen				
Moss				

VEG Crew Name(s):		Qd1	Qd2	Qd3	VEG Subplot Notes:
	Quadrat status				
Year: Month: Day:	Quad Cond Class #				
	Trampling (1-3)				
Subplot:					

Species Code	Unique Sp Number	Specimen Collected? (1) Label Number	Specimen Collected? (0) Not Collected Reason	Plot Species Notes	Present/Absent Qd1	Present/Absent Qd2	Present/Absent Qd3	Sp Total Cover

14.0 DOWN WOODY MATERIALS MEASUREMENTS AND SAMPLING

14.0 INTRODUCTION

Down woody materials (DWM) are an important component of forest ecosystems across the country. DWM is dead material on the ground in various stages of decay. Wildlife biologists, ecologists, mycologists, foresters, and fuels specialists are some of the people interested in DWM because it helps describe the:

- Quality and status of wildlife habitats.
- Structural diversity within a forest.
- Fuel loading and fire behavior.
- Carbon sequestration – the amount of carbon tied up in dead wood.
- Storage and cycling of nutrients and water – important for site productivity.

Down woody components and fuels estimated by the WisCFI program are: coarse woody, litter, and duff depth.

DWM is only sampled in accessible forest conditions intersected by the transect. If a transect crosses a nonforest condition, the boundaries of the condition are recorded (see section 14.3) but no DWM or fuels measurements are taken along this portion of the transect. The majority of DWM in the inventory is sampled using the line intersect sampling method (also called planar intercept method). In this method, transects are established, and individual pieces of CWD are tallied if the central axis of the piece is intersected by the plane of the transect. In addition, each piece must meet specified dimensions and other criteria before being selected for tally. Special procedures apply when a CWD piece lays across a condition class boundary (section 14.2). Transects will be used to sample CWD when crews are able to see and measure individual pieces.

The line intersect method is not practical for sampling CWD when it is part of machine-piled windrows or slash piles, or part of log "jumbles" at the bottom of steep-sided ravines. In these situations, individual pieces are impractical to tally separately and are labeled as “residue piles”. A different sampling method is used to tally and measure CWD residue piles (see section 14.8, Sampling Residue Piles).

Wisconsin State Forests, Continuous Forest Inventory (WisCFI), Down Woody Materials Measurements and Sampling, Version 2.0 is adapted from the USDA Forest Service Forest Inventory and Analysis (FIA) Northern Region (NRS) field guide version 4.0 and the FIA National Core Optional Down Woody Materials Lite Protocols Proposal (August, 2006). NRS FIA version 4.0 is based on the FIA National Core Field Guide, Version 4.0.

- All WisCFI-specific data elements end in “N-WisCFI” (e.g., x.xN-WisCFI).
- [WisCFI field guide electronic file note: National and regional data elements formatted as hidden, strikethrough text are not applicable for WisCFI.]

14.1 DEFINITION OF DOWN WOODY MATERIALS

CWD – In this inventory, CWD includes downed, dead tree and shrub boles, large limbs, and other woody pieces that are severed from their original source of growth and on the ground. CWD also includes dead trees (either self-supported by roots, severed from roots, or uprooted) that are leaning > 45 degrees from vertical. Also included are non-machine processed round wood such as fence posts and cabin logs. For multi-stemmed woodland trees such as juniper, only tally stems that are dead, detached, and on the ground; or dead and leaning > 45 degrees from vertical.

CWD does not include:

1. Woody pieces < 3.0 inches in diameter at the point of intersection with the transect.
2. Dead trees leaning 0 to 45 degrees from vertical.
3. Dead shrubs, self-supported by their roots.
4. Trees showing any sign of life.
5. Stumps that are rooted in the ground (i.e., not uprooted).
6. Dead foliage, bark or other non-woody pieces that are not an integral part of a bole or limb. (Bark attached to a portion of a piece is an integral part).
7. Roots or main bole below the root collar.

14.2 LOCATING AND ESTABLISHING LINE TRANSECTS

Transects are established on each subplot if the subplot center is accessible (i.e., not census water, access denied, or hazardous), and there is at least one forest land condition class mapped within the 24.0-foot radius subplot (CONDITION CLASS STATUS = 1). Transects begin at the subplot center and extend 24.0 feet to the edge of the subplot. The locations of condition class boundaries are recorded along the transect. It is extremely important to lay out the transect in a straight line to avoid biasing the selection of pieces and to allow the remeasurement of transect lines and tally pieces for future change detection.

Transect lines should be marked with a pin or small piece of flagging at the end of the line (24.0 feet, horizontal distance) to help the QA staff identify the path of the transect during the check-plot procedure. Because the tolerance for the transect azimuth is +/- 2 degrees, the line might have been laid down in a slightly different direction from the check-plot crew. This could affect the location of diameter measurements for CWD pieces as well as identifying whether a CWD piece is a valid tally piece. It is also helpful to mark the point where the FWD transect begins (14 feet, slope distance).

14.2.1 CWD TRANSECTS

Three transects are established that originate at the subplot center and extend out 24.0 feet horizontal distance (the radius of the subplot). The transects are established at azimuths of 30, 150 and 270 degrees on subplots 1 and 2(Figure 14-1). This transect configuration was chosen to avoid sampling bias on sloped land, where it is possible that CWD may be oriented in one direction. This configuration of transects should pick up CWD logs that are lying parallel to the slope, perpendicular to the slope, and across slope.

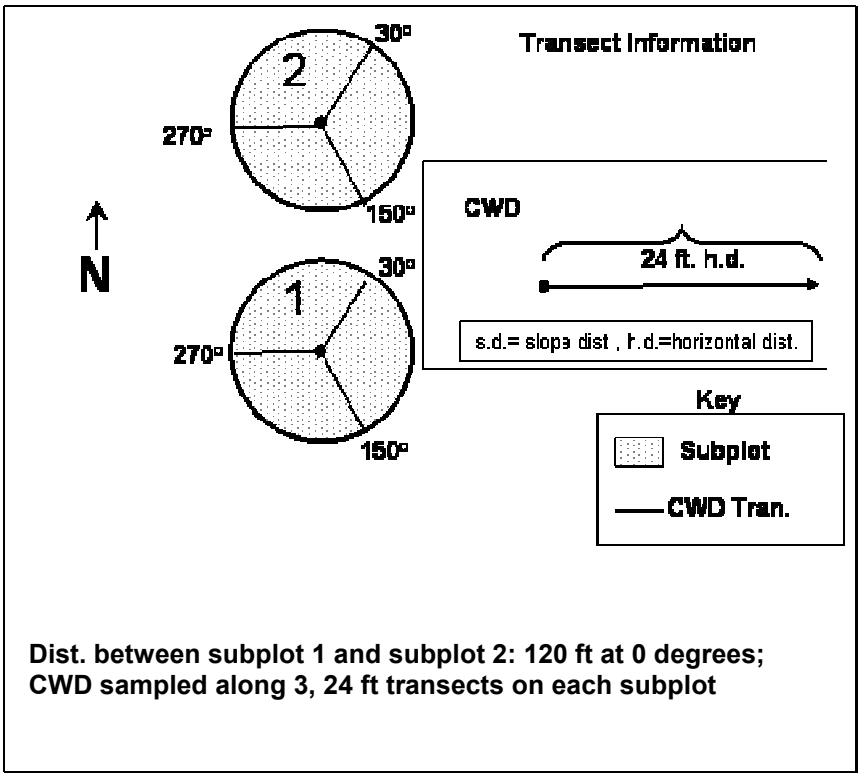


Figure 14-1. Plot layout for sampling CWD.

14.3 TRANSECT LINE SEGMENTING

Transect lines are segmented to determine the length of transect that occurs within each mapped condition class intersecting the line. A segment is a length of transect that is in one condition. Segments are identified by recording the BEGINNING DISTANCE and ENDING DISTANCE of the slope from subplot center out to the end of the subplot. In the office, the segmenting data will be combined with CWD distances to determine which condition class each piece falls in (condition classes are not assigned to CWD pieces in the field). If more than one condition is found on the FWD transects, the segmenting information recorded here will provide the length of transect in each condition.

Starting at the subplot center and working towards the fixed radius plot boundary, each segment of transect line in a different condition class is delineated and recorded as a separate record. On each record, the BEGINNING DISTANCE and ENDING DISTANCE of the slope are recorded for each condition class encountered. The first record for each transect will have a BEGINNING DISTANCE of 0 feet. If only one condition class occurs on the transect line, only one segment is recorded. The transect must extend a total of 24.0 feet horizontal distance. If the entire 24.0-foot subplot is nonforest, enter codes for SUBPLOT NUMBER, TRANSECT, CONDITION CLASS NUMBER, followed by zeros in the remaining fields.

On subplots where a transect intersects a boundary between condition classes, the transect continues across the boundary into the adjacent class (Figure 14-2). Although DWM is only sampled in accessible forest conditions, all CONDITION CLASS BOUNDARIES (BEGINNING DISTANCE and ENDING DISTANCE) are recorded on each transect.

Individual pieces of DWM intersected by a transect are tallied or counted if they meet the tally rules for CWD or FWD specified in the sections that follow. It is expected that the majority of FWD transects will be in one condition, but if the condition class changes along the transect, a count is recorded for each condition. Again, the segmenting data recorded here will identify which condition class is associated with each count.

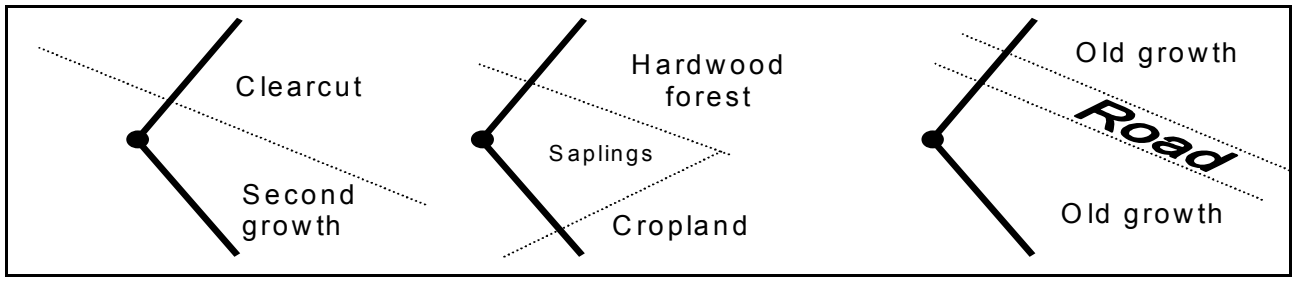


Figure 14-2. Transects are installed across condition class boundaries.

14.3.1 SUBPLOT NUMBER

Record the code indicating the subplot center from which the transect originates.

When collected: All tally segments
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values: 1 to 2

1 Center subplot
2 North subplot

14.3.2 TRANSECT

Record the code indicating the transect on which a condition class is being delineated. The three transects used are 30 degrees, 150 degrees, and 270 degrees. These transects, when being installed, have a tolerance of +/- 2 degrees.

When Collected: All tally segments
Field width: 3 digits
Tolerance: No errors
MQO: At least 99% of the time
Values:

030 Transect extends 30 degrees from subplot center
150 Transect extends 150 degrees from subplot center
270 Transect extends 270 degrees from subplot center

14.3.3 CONDITION CLASS NUMBER

Record the code indicating the number of the condition class for the transect segment. Use the same code assigned to the condition class on the subplot or elsewhere on the plot. The first segment recorded for each transect will have the same CONDITION CLASS NUMBER as assigned to the subplot center.

When collected: All tally segments
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values: 1 to 9

14.3.4 BEGINNING DISTANCE

Record the location (using slope distance) on the transect line where the transect intersects the boundary with the adjacent condition class nearer to the subplot center. The first record for each transect will have a BEGINNING DISTANCE of 00.0 ft. Each subsequent record will have a BEGINNING DISTANCE equal to the ENDING DISTANCE of the previous record. Measure to the nearest 0.1 ft.

When collected: All tally segments
Field width: 3 digits
Tolerance: +/- 1.0 ft
MQO: At least 95% of the time
Values: 00.0 to 99.9

14.3.5 SLOPE PERCENT

Record the code indicating the average slope percent along the transect within the condition class being segmented. When only one condition class is present on a transect, slope percent is the average slope percent along the entire transect. Measure to the nearest 5%.

When collected: All tally segments
Field width: 3 digits
Tolerance: +/- 10%
MQO: At least 90% of the time
Values: 005 to 155

14.3.6 ENDING DISTANCE

Record the location (using slope distance) on the transect line where the transect exits the condition class being delineated and intersects the boundary with a different condition class further away from the subplot center. If no other condition classes are encountered, record the location (using slope distance) of the end of the transect line. Measure to the nearest 0.1 foot.

When collected: All tally segments
Field width: 3 digits
Tolerance: +/- 1.0 ft
MQO: At least 95% of the time
Values: 00.1 to 99.9

14.4 SAMPLING METHODS FOR COARSE WOODY DEBRIS (CWD)

14.4.1 TALLY RULES FOR COARSE WOODY DEBRIS (CWD)

1. Coarse woody debris (CWD) is sampled in accessible forest land conditions only. Tally a piece if its central longitudinal axis intersects the transect, and the condition class is accessible forest land at the point of intersection (Figure 14-3). The entire piece is assigned to this condition.

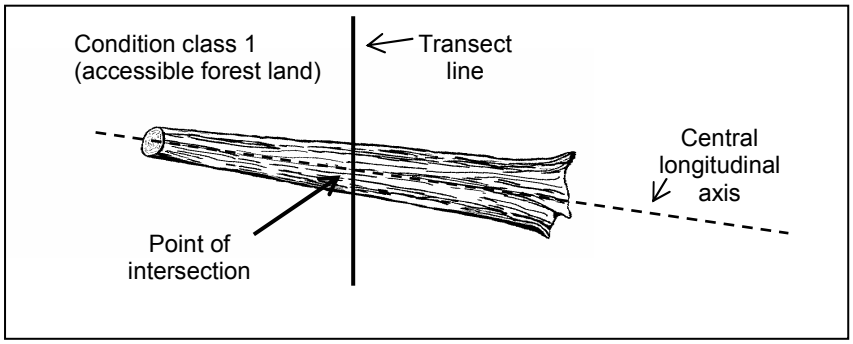


Figure 14-3. Tally rules for CWD.

2. Tally dead trees and tall stumps that are leaning > 45 degrees from vertical. Do not tally live trees or standing dead trees and stumps that are still upright and leaning < 45 degrees from vertical. Follow the same rules for down trees as outlined in section 5.0 'Tree and Sapling Data' from the P2 field guide. Most CWD will be laying on the ground.

3. The minimum length of any tally piece is 3.0 feet. When CWD pieces are close to 3 feet total length measure the length to the nearest 0.1 foot to determine if it is >3.0 feet.

4. Decay class of the piece determines whether or not the piece is tallied (see section 14.4.3.4).

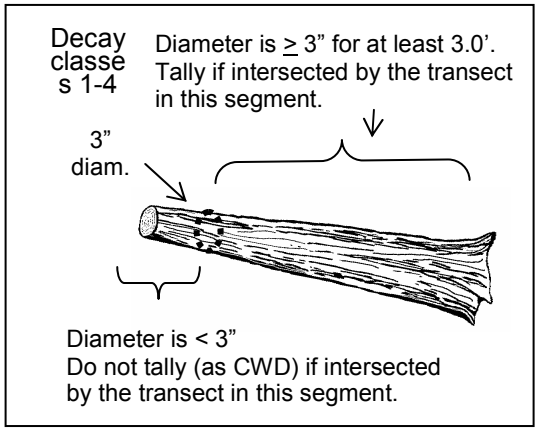


Figure 14-4. CWD tally rules for decay classes 1-4.

- For decay classes 1 to 4: tally a piece if it is > 3.0 inches in diameter at the point of intersection with the transect. The piece must be > 3.0 feet in length and > 3.0 inches or more in diameter along that length. If the intersect diameter is close to 3.0 inches, measure the diameter to the nearest 0.1 inch to determine if the piece qualifies (Figure 14-4).
- For decay class 5: tally a piece if it is > 5.0 inches in diameter at the point of intersection and > 5.0 inches high from the ground. The piece must be > 3.0 feet in length and > 5.0 inches or more in diameter along that length. The reason for treating decay class 5 pieces differently is because they are difficult to identify, especially when heavily decomposed. Only pieces that still have some shape and log form are tallied—humps of decomposed wood that are becoming part of the duff layer are not tallied.

5. Tally pieces created by natural causes (examples: natural breakage or uprooting) or by human activities such as cutting only if not systematically machine-piled. Do not record pieces that are part of machine-piled slash piles or windrows, or that are part of a log "jumble" at the

bottom of a steep-sided ravine in which individual pieces are impractical to tally separately. Instead, sample these piles according to instructions in section 14.8 'Sampling Residue Piles'. A slash pile or windrow consists of broken logs, limbs, and other vegetative debris.

6. Tally a piece only if the point of intersection occurs above the ground. If one end of a piece is buried in the litter, duff, or mineral soil, the piece ends at the point where it is no longer visible.

7. If the central longitudinal axis of a piece is intersected more than once on a transect line or if it is intersected by two transect lines, tally the piece each time it is intersected (uncommon situation, see Figure 14-5).

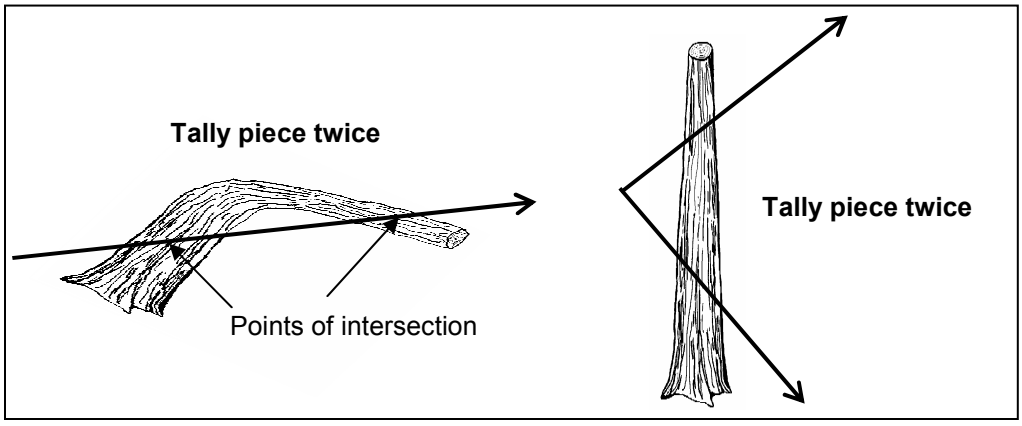


Figure 14-5. CWD tally rules: intersections.

8. Tally a piece only once if the subplot center falls directly on the central longitudinal axis of the piece. Tally the piece on the 30 degree transect(subplots 2 and 3) or the 150 degree transect (subplots 1 and 4) and record the CWD Distance as 001.

9. If a piece is fractured across its diameter or length, and would pull apart at the fracture if pulled from either end or sides, treat it as two separate pieces. If judged that it would not pull apart, tally as one piece. Tally only the piece intersected by the transect line.

10. Do not tally a piece if it intersects the transect on the root side of the root collar. Do not tally roots.

11. When the transect crosses a forked down tree bole or large branch connected to a down tree, tally each qualifying piece separately. To be tallied, each individual piece must meet the minimum diameter and length requirements.

12. In the case of forked trees, consider the "main bole" to be the piece with the largest diameter at the fork. Variables for this fork such as DECAY CLASS should pertain to the entire main bole. For smaller forks or branches connected to a main bole (even if the main bole is not a tally piece), variables pertain only to that portion of the piece up to the point where it attaches to the main bole (see Figure 14-6).

13. If a transect intersects a nonforest condition (e.g., a road), CWD is not tallied in the nonforest condition.

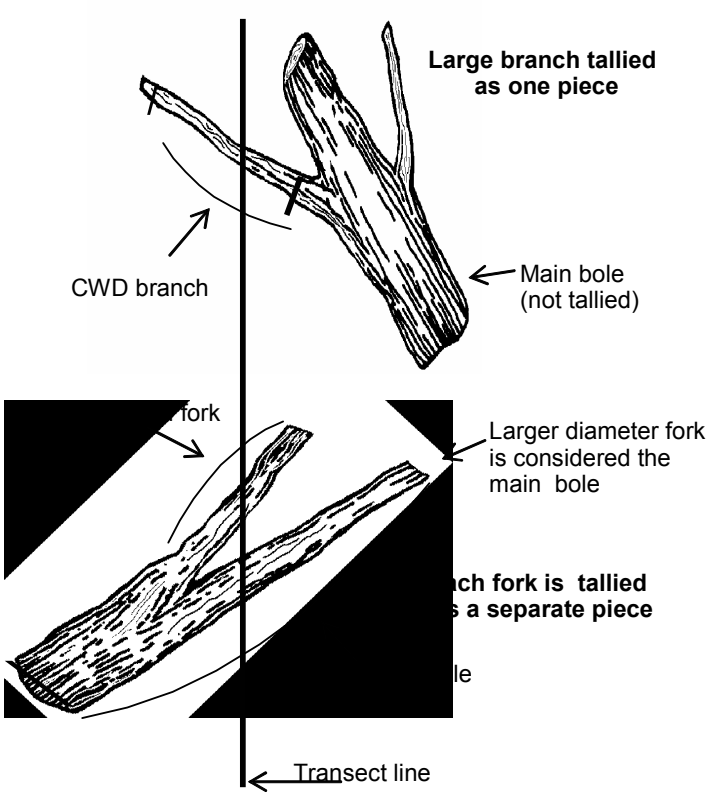


Figure 14-6 CWD rules for forked pieces.

14.4.2 MARKING CWD

Marking CWD is optional. Marked CWD is an aid to future crews returning to the plot for a QA check or to remeasure the plot at the next remeasurement period. Nails can be used to mark the location of the point of intersection, if the piece is in decay class 1, 2, or 3. Position the nail on top of the piece, and if possible, drive the nail into the piece so that about 1 inch of the nail is left exposed. Stop driving the nail if the next blow means breaking the piece or seriously disturbing the location of the piece. Please see section 14.3 Transect Line Segmenting, for information on the required marking of the transect line.

14.4.3 RECORDING PROCEDURES for CWD

The tolerance for the total number of pieces (> 3 inches, transect diameter) tallied across all transects on the plot is : +/- 2 piece or +/- 5%, whichever is greater for the plot. Note: always round up to a whole piece count when using the 5% option.

14.4.3.1 SUBPLOT NUMBER

Record the code indicating the number of the subplot center from which the transect originates.

When collected: All tally pieces
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values: 1 to 2

1	Center subplot
2	North subplot

14.4.3.2 TRANSECT

Record the code indicating the azimuth of the transect on which the piece is sampled.

When Collected: All tally pieces
Field width: 3 digits
Tolerance: No errors
MQO: At least 99% of the time
Values:

030 Transect extends 30 degrees from subplot center
150 Transect extends 150 degrees from subplot center
270 Transect extends 270 degrees from subplot center

14.4.3.3 CWD SLOPE DISTANCE

Record the code indicating the slope distance from the subplot center to the point where the transect intersects the longitudinal center of the piece. If two or more pieces have the same slope distances, record the top piece first. Measure and record to the nearest 0.1 feet. CWD SLOPE DISTANCE is an important item because it will be used to assign the CWD piece to a condition class by comparing the recorded distance to the piece with the recorded BEGINNING DISTANCE and ENDING DISTANCE to the condition class boundary. CWD SLOPE DISTANCE is also used to locate the piece for QA and remeasurement in future inventories.

When Collected: All tally pieces
Field width: 3 digits
Tolerance: +/- 1.0 ft
MQO: At least 90% of the time
Values: 00.1 to 99.9

14.4.3.4 CWD DECAY CLASS

Record a 1-digit code indicating the decay class of the piece. Code the decay class which predominates along the length of the piece. Use the guide below to determine CWD DECAY CLASS.

When Collected: All tally pieces
Field width: 1 digit
Tolerance: +/- 1 class
MQO: At least 90% of the time
Values:

Decay Class	Structural Integrity	Texture of Rotten Portions	Color of Wood	Invading Roots	Branches and Twigs
1	Sound, freshly fallen, intact logs	Intact, no rot; conks of stem decay absent	Original color	Absent	If branches are present, fine twigs are still attached and have tight bark
2	Sound	Mostly intact; sapwood partly soft (starting to decay) but can't be pulled apart by hand	Original color	Absent	If branches are present, many fine twigs are gone and remaining fine twigs have peeling bark
3	Heartwood sound; piece supports its own weight	Hard, large pieces; sapwood can be pulled apart by hand or sapwood absent	Reddish-brown or original color	Sapwood only	Branch stubs will not pull out
4	Heartwood rotten;	Soft, small blocky	Reddish or	Through	Branch stubs pull out

	piece does not support its own weight, but maintains its shape	pieces; a metal pin can be pushed into heartwood	light brown	-out	
5	None, piece no longer maintains its shape, it spreads out on ground	Soft; powdery when dry	Red-brown to dark brown	Through -out	Branch stubs and pitch pockets have usually rotted down

Note: CWD DECAY CLASS 5 pieces can be difficult to identify because they often blend into the duff and litter layers. They must still resemble a log, therefore, the first tally rule is that they must be > 5.0 inches in diameter, ≥ 5.0 inches from the surface of the ground, and at least 3.0 feet long. Decomposed logs that are slightly elevated 'humps' on the ground are not tallied.

CWD DECAY CLASS: The chart above was developed primarily for Douglas-fir in the Pacific Northwest. At the present time, there are no other charts available to use to describe decay classes for other species or locations. Concentrate on the structural integrity and texture when estimating a decay class for CWD logs.

If a log is case hardened (hard, intact outer sapwood shell) but the heartwood is rotten, code this log as a CWD DECAY CLASS 2 with a HOLLOW PIECE code of 1. CWD DECAY CLASS 1 should be reserved for 'freshly fallen' logs that are completely intact (i.e., recent windfalls, or harvest).

14.4.3.5 SPECIES

Record the code indicating the species of the piece. Species codes are the same as those used in P2 (see Appendix 3 of the P2 field guide). Because CWD includes the tally of large shrub boles and woody vines, enter a code of '0001' for SPECIES if the tally piece is a shrub or vine.

Species identification may be uncertain for some pieces. The piece's bark (either attached or sloughed and laying beside the piece), branching pattern (if the branches are still present), or heartwood smell (particularly if cedars, Douglas-fir, or western hemlock) may provide clues. On remeasurement plots, see what tree species were tallied in past inventories. One way to distinguish hardwoods from softwoods is by the type of decay present. Hardwoods usually have a white or grayish stringy rot, while softwoods usually have a reddish-brown blocky rot. If it is not possible to identify the species, attempt to estimate if it is softwood or hardwood. Enter code 0299 for unknown dead conifer or 0998 for unknown dead hardwood.

When Collected: CWD DECAY CLASS = 1 to 4
Field width: 4 digits
Tolerance: No errors
MQO: At least 80% of the time
Values: See species codes in Appendix 3 of the P2 field guide.

14.4.3.6 DIAMETERS

The diameter is most commonly measured by holding a tape above the log, at a position perpendicular to the length. It is useful to carry a steel carpenters retracting tape to measure diameters. Other methods include wrapping a tape around the bole if possible, holding a straight-edge ruler above the piece, or using calipers.

For pieces that are not round in cross-section because of missing chunks of wood or "settling" due to decay, measure the diameter in two directions and take an average. Estimate the longest and shortest axis of the cross-section ("A" and "B" in Figure 14-8), and enter the average in the diameter field.

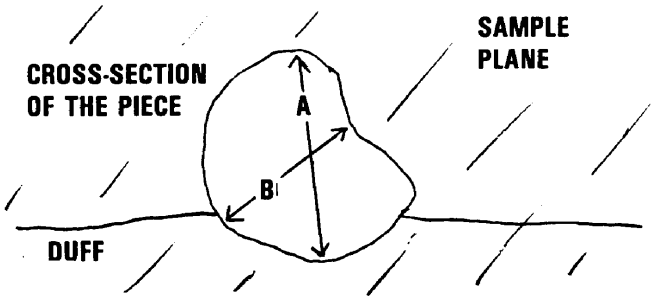


Figure 14-8. Estimating the diameter of pieces that are not round in cross-section.

If the transect intersects the log at the decayed or splintered end (Figure 14-9) (i.e., the portion where we do not consider it part of the log because it is falling apart), record the diameter at this location as the intersect diameter. If the splintered end appears to be two separate pieces (i.e., a major split located just at the end) – in this situation treat it as one log and take a diameter around the end (take two measurements if it is odd shaped).

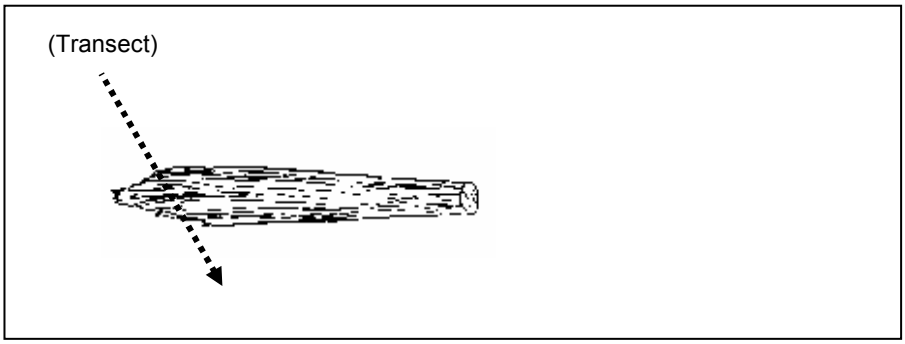


Figure 14-9. Example of decayed end intersecting the transect

14.4.3.6.1 DIAMETER AT POINT OF INTERSECTION

Record the code indicating the piece's diameter at the point where the transect intersects the longitudinal center of the piece. If the diameter is close to 3 inches, measure the diameter to the nearest 0.1 inch to determine if the piece is actually >3.0 inches and a valid tally piece. The diameter is recorded to the nearest inch.

When Collected: All tally pieces
Field width: 3 digits
Tolerance: Pieces < 20.0 in diameter: +/- 3 in; Pieces > 20.0 in diameter: +/- 20%
MQO: At least 90% of the time
Values: 003 to 200

14.4.3.8 IS THE PIECE HOLLOW?

Record the code indicating whether or not the piece is hollow (see Figure 14-10).

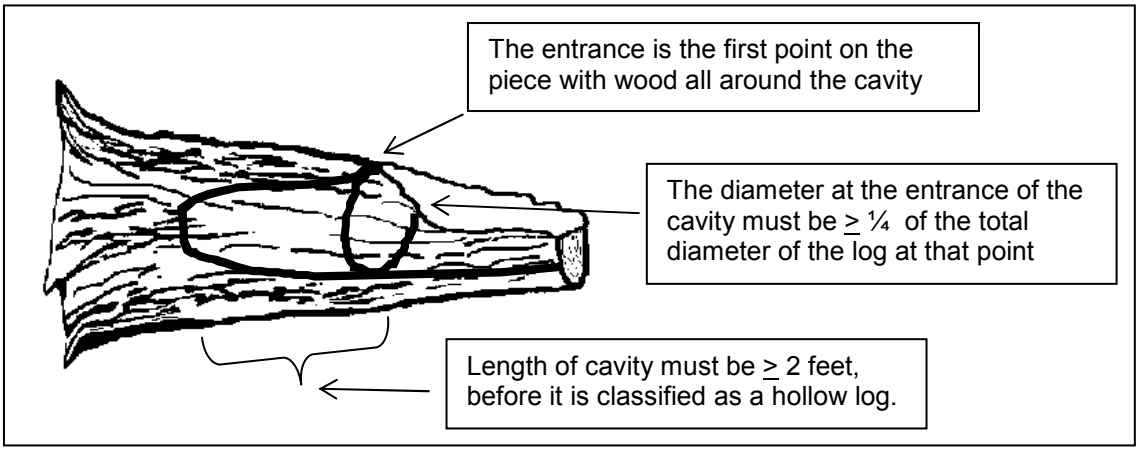


Figure 14-10. Determining if the piece is hollow.

When Collected: CWD DECAY CLASS = 1 to 4
Field width: 1 digit
Tolerance: No errors
MQO: At least 90% of the time
Values:

Y A piece is considered hollow if a cavity extends at least 2 feet along the central longitudinal axis of the piece, and the diameter of the entrance to the cavity is at least 1/4 of the diameter of the piece where the entrance occurs. The entrance occurs at the point where the circumference of the cavity is whole -- the point where wood is present completely around the circumference of the cavity. The length of the cavity begins at this point.

N Does not meet criteria for being a hollow log

14.4.3.9 CWD HISTORY

Record the code that indicates whether or not the piece of CWD is on the ground as a result of harvesting operations or as a result of natural circumstances. One objective of this item is to identify those pieces that are considered logging residue. If the piece appears to have fallen to the ground as a result of natural causes such as decomposition or windfall, enter a code of 1. This category would include blown out tops, snapped off boles, wind-fallen trees on clearcut edges, and trees that basically collapsed and fell over due to decomposition.

If the piece is on the ground as a result of recent (since last annual remeasurement; if the plot is new, the time between the panel remeasurements) harvesting activity, either because the tree was cut down with a chainsaw (or other device) or pushed over by harvesting equipment (bulldozer), enter a code of 2. A code of 2 would be considered logging residue (usually you are in the middle of a recent clearcut).

If the piece is on the ground as a result of older (more than 15 years) harvesting activity, enter a code of 3. This would be a situation where you tally an old decomposing log that has a sawn end – if it appears that the log was cut and left on site, then enter a code of “3”.

If a piece is on the ground as a result of incidental harvest (such as a standing tree was cut for firewood or small clearing), enter a code of “4”. Incidental harvest involves a few trees and is not a part of a major organized harvesting operation.

If the crew cannot decide the history of the CWD log, classify it as “unknown”, and give it a code of “5”.

When Collected: CWD DECAY CLASS = 1 to 4
Field width: 1 digit
Tolerance: No errors
MQO: At least 90% of the time
Values:

1 CWD piece is on the ground as a result of natural causes
2 CWD piece is on the ground as a result of major recent harvest activity (<= 15 yrs old)
3 CWD piece is on the ground as a result of older harvest activity (> 15 yrs old)
4 CWD piece is on the ground as a result of an incidental harvest (such as firewood cutting)
5 Exact Reason Unknown

14.6 DUFF AND LITTER DEPTH MEASUREMENTS

Depth measurements are sampled in accessible forest land conditions. The depth of the duff layer and litter layer are important components of fire models used to estimate fire behavior, fire spread, fire effects, and smoke production. These measurements are taken at the 24-foot slope location on each transect. An average depth will be calculated in the office and stored with other information about the condition class on the plot. If a residue pile, log, rock, or other obstruction intersects the transect at the 24-ft slope location, do not measure the duff or litter depth.

14.6.1 DEFINITIONS

Litter - the layer of freshly fallen leaves, needles, twigs (< 0.25 inch in diameter), cones, detached bark chunks, dead moss, dead lichens, detached small chunks of rotted wood, dead herbaceous stems, and flower parts (detached and not upright). Litter is the loose plant material found on the top surface of the forest floor. Little decomposition has begun in this layer.

Litter is flash fuel – so think about it as the loose material that is exposed to the air, capable of igniting quickly and carrying a fire across the surface of the forest floor.

Litter does not include bark that is still attached to a down log, or rotten chunks of wood that are still inside a decaying log or log end (i.e., if a decayed log end has a lot of rotten cubes or pieces laying on a log surface and exposed to air, they are considered part of the log and not litter – fire would burn differently if it hit a pile of rotten punky wood chips, cradled by the unrotted sapwood shell). If these rotten chunks have spilled out to the ground and are actually on the ground surface, then they would be included in the litter layer.

Litter does not include animal manure.

Duff - the layer just below litter. It consists of decomposing leaves and other organic material. You should see no recognizable plant parts, the duff layer is usually dark decomposed organic matter. When moss is present, the top of the duff layer is just below the green portion of the moss. The bottom of this layer is the point where mineral soil (A horizon) begins.

14.6.2 OVERVIEW OF MEASUREMENTS

Depth measurements will be taken at the 24-foot (slope distance) location on each transect. If a log, rock or other obstruction occurs at the sample location, do not measure duff or litter depth, regardless of what is on top of the obstruction.

The DUFF AND LITTER SAMPLE variable has options for indicating if duff and litter were measured at each sample location. The default value for this variable is 1, indicating that two variables were measured (duff and litter). A value of 2 is entered if neither of the two (duff and litter) were sampled (i.e., submerged part of plot).

14.6.2.1 DUFF AND LITTER

The duff layer is the organic material layer between the A-horizon (or uppermost soil mineral horizon) and the litter layer. The duff is a soil layer dominated by organic material derived from the decomposition of plant and animal litter (pine straw, leaves, twigs, etc) and deposited on either an organic or a mineral surface. This layer is distinguished from the litter layer in that the original organic material has undergone sufficient decomposition that the source of this material (e.g., individual plant parts) can no longer be identified. Litter is defined as undecomposed or only partially decomposed organic material that can be readily identified (e.g., plant leaves, twigs, etc.). As a general rule, duff depth should rarely exceed a few inches. Crews should be absolutely sure they are measuring deep duff depths, instead of mineral soil layers or parts of the litter layer. Duff can easily weigh more than 6 times that of litter. If unsure of the bottom of the duff layer, crews should feel the texture of the suspect material in their hand. Rub the soil between your fingers. Does it crumble (duff) or feel more like modeling clay (mineral).

Carefully expose a shallow profile of the forest floor by digging out an area at the sample point using a knife, hatchet, or other tool. Estimate the depth of each layer with a ruler to the nearest 0.1 inch. If there is a log, rock, or other obstruction on the surface at the sample point, do not measure the litter or duff depth (record DUFF AND LITTER = 2) ; a value of 99.9 will be entered by the TALLY program for each depth.

As you dig the hole for this measurement, if you encounter a rock, root, or buried log – stop the depth measurement at this point.

The height of the litter should be measured at the top of the loose material located at the sample point on the transect. Try to preserve the conditions of this location by walking around this point, so the QA staff will measure the same height as the original crew.

14.6.3 SUBPLOT NUMBER

Record the code indicating the number of the subplot center from which the transect originates.

When collected: All tally segments
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values: 1 to 2

1	Center subplot
2	North subplot

14.6.4 TRANSECT

Record the code indicating the azimuth of the transect.

When collected: All tally segments
Field width: 3 digits
Tolerance: No errors
MQO: At least 99% of the time
Values:

030	Transect extends 30 degrees from subplot center
150	Transect extends 150 degrees from subplot center
270	Transect extends 270 degrees from subplot center

14.6.5 DUFF AND LITTER SAMPLE

Record the code indicating if the depth of the duff and litter layer was measured.

When collected: At 24.0 ft on each transect
Field width: 1 digit
Tolerance: No errors

MQO: At least 99% of the time
Values:

1 All sampled: Duff, litter
2 Nothing sampled; Duff and litter are not sampled

14.6.6 DUFF DEPTH

Record the code indicating the depth of the duff layer to the nearest 0.1 inch.

When collected: At 24.0 ft on each transect
Field width: 3 digits
Tolerance: +/- 0.5 inch
MQO: At least 90% of the time
Values: 00.0 to 99.9

14.6.7 LITTER DEPTH

Record the code indicating the depth of the litter layer to the nearest 0.1 inch.

When collected: At 24.0 ft on each transect
Field width: 3 digits
Tolerance: +/- 0.5 inch
MQO: At least 90% of the time
Values: 00.0 to 99.9

14.8 SAMPLING RESIDUE PILES

The line transect method is not practical when sampling CWD within piles and windrows. Piles and windrows will be located and sampled on the subplot plot, regardless of whether they intersect a transect.

Piles and windrows created directly by human activity and log piles at the bottom of steep-sided ravines in which individual pieces are impossible to tally separately, are more efficiently sampled by using the following instructions. However, loose CWD in piles created by wind throw, landslides, fires, and other natural causes should be tallied using line transects unless it is physically impossible to measure the pieces in the natural pile.

For a pile to be tallied on a subplot that contains forest land, all of the following criteria must be met (Figure 14-11):

- The pile's center must be within 24.0 horizontal feet of subplot center,
- The pile's center must be in an accessible forest land condition class, and
- The pile contains pieces of CWD > 3 inches diameter that would be impossible to tally separately.

Use the PILE DENSITY variable to estimate the percent of the pile that contains woody material > 3 inches. The pile is assigned to the condition class in which the pile center lies.

Apply the following steps to determine the center of a pile or windrow:

1. Determine the longest axis of a pile.
2. Determine the midpoint of this axis.
3. Project a line through this midpoint that is perpendicular to the axis determined in step 1.
4. Determine the midpoint of the segment of this projected line that crosses the pile.
5. This is the center of the pile.

Piles that cross the 24.0-foot fixed-radius subplot boundary: If the center of a pile is within 24.0 horizontal feet of subplot center, tally the pile, recording the dimensions of the entire pile even if

part of the pile is beyond 24.0 feet. If the center of a pile is more than 24.0 horizontal feet of subplot center, do not tally the pile or any portion of the pile.

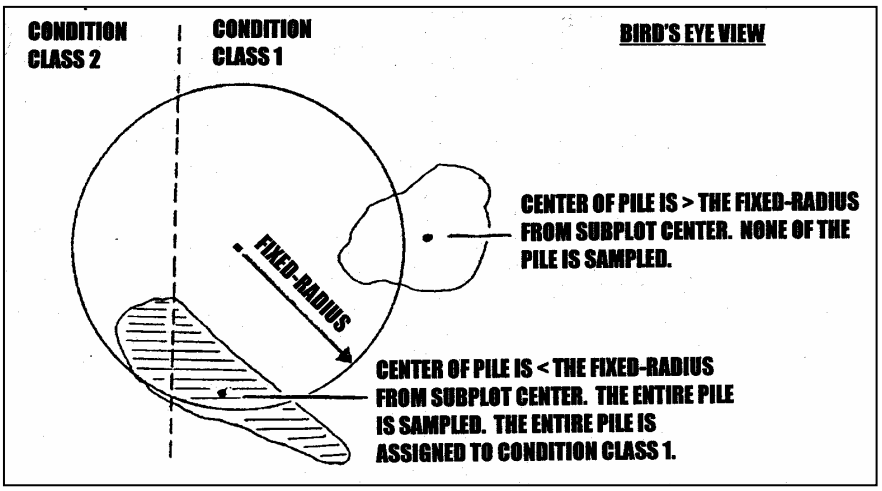


Figure 14-11. Residue pile selection examples.

14.8.1 SUBPLOT NUMBER
Record the code indicating the subplot number.

When collected: Record for all sampled residue piles
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values: 1 to 2
1 Center subplot
2 North subplot

14.8.2 CONDITION CLASS
Record the code indicating the number of the condition class to which the pile is assigned.

When collected: Record for all sampled residue piles
Field Width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values: 1 to 9

14.8.3 PILE AZIMUTH
Record the code indicating the azimuth from the subplot center to the pile. This azimuth centers on the pile so that it can be relocated. Use 360 for north.

When collected: All sampled residue piles
Field width: 3 digits
Tolerance: +/- 10
MQO: At least 90% of the time
Values: 001 to 360

14.8.4 PILE SHAPE
Record the code indicating the shape of the pile. Determine which of the four shapes diagrammed in Figure 14-12 most resembles the pile and record the dimensions. Pile

dimensions should be ocularly smoothed out when making estimates. Average the unevenness of protruding pieces.

When collected: All sampled residue piles
Field width: 1 digit
Tolerance: No errors
MQO: At least 90% of the time
Values: 1 to 4

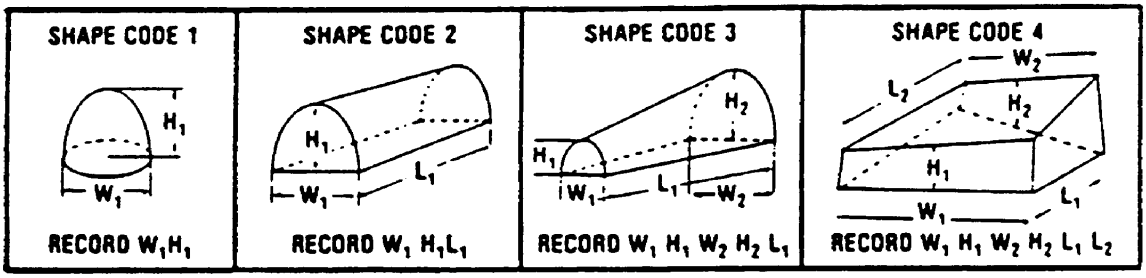


Figure 14-12. PILE SHAPE codes (Hardy 1996).

14.8.5 PILE LENGTH 1
Record the code indicating the length of the sides of the pile. Estimate to the nearest foot. PILE LENGTH 1 may often equal PILE LENGTH 2.

When collected: All sampled residue piles and PILE SHAPE = 2, 3, 4
Field width: 2 digits
Tolerance: +/- 10%
MQO: At least 90% of the time
Values: 01 to 99

14.8.6 PILE LENGTH 2
Record the code indicating the length of the sides of the pile. Estimate to the nearest foot. PILE LENGTH 1 may often equal PILE LENGTH 2.

When collected: All sampled residue piles and PILE SHAPE = 4
Field width: 2 digits
Tolerance: +/- 10%
MQO: At least 90% of the time
Values: 01 to 99

14.8.7 PILE WIDTH 1
Record the code indicating the width of the sides of the pile. Estimate to the nearest foot. PILE WIDTH 1 may often equal PILE WIDTH 2.

When collected: All sampled residue piles, and PILE SHAPE = 1, 2, 3, 4
Field width: 2 digits
Tolerance: +/- 10%
MQO: At least 90% of the time
Values: 01 to 99

14.8.8 PILE WIDTH 2
Record the code indicating the width of the sides of the pile. Estimate to the nearest foot. PILE WIDTH 1 may often equal PILE WIDTH 2.

When collected: All sampled residue piles, and PILE SHAPE = 3, 4
Field width: 2 digits
Tolerance: +/- 10%
MQO: At least 90% of the time
Values: 01 to 99

14.8.9 PILE HEIGHT 1

Record the code indicating the height of either end of the pile. Estimate to the nearest foot. PILE HEIGHT 1 may often equal PILE HEIGHT 2.

When collected: All sampled residue piles, and PILE SHAPE = 1, 2, 3, 4
Field width: 2 digits
Tolerance: +/- 10%
MQO: At least 90% of the time
Values: 01 to 99

14.8.10 PILE HEIGHT 2

Record the code indicating the height of either end of the pile. Estimate to the nearest foot. PILE HEIGHT 1 may often equal PILE HEIGHT 2.

When collected: All sampled residue piles, and PILE SHAPE = 3, 4
Field width: 2 digits
Tolerance: +/- 10%
MQO: At least 90% of the time
Values: 01 to 99

14.8.11 PILE DENSITY

Record the code estimating the percent of the pile that consists of wood. Use the PILE DENSITY variable to estimate the percent of the pile that contains woody material > 3 inches. Air, soil, rock, plants, etc, should be factored out of the estimate. Estimate to the nearest 10 percent.

When collected: All sampled residue piles
Field width: 2 digits
Tolerance: +/- 20%
MQO: At least 75% of the time
Values:

00	Absent
01	Trace (< 1% cover)
10	1 – 10%
20	11-20%
30	21-30%
….	
90	81-90%
99	91-100%

14.10 DATA SHEET

DWM Combined Data Form

Date **Crew** **Plot Identification:**

Transect Segment Data						Duff and Litter Depths			
Sub plot	Transect AZ	Condition	Dist Start	Dist End	Slope	Subplot	Samp.	Duff	Litter
xx	xxx	x	xxx.y (ft)	xxx.y (ft)	xxx (%)	Transect	x	xx.y (in)	xx.y (in)
						1,30			
						1,150			
						1,270			
						2,30			
						2,150			
						2,270			

History	
1	Natural
4	Firewood
5	Unknown

CWD Form							
Sub Plot	Transect AZ	Dist	Species	Tran. Dia	Decay	Hollow	History
xx	xxx (deg)	xx.y (ft)	xxx	xxx (in)	x	x	x

Residue Pile										
Sub Plot	Condition	Azimuth	Shape	Length 1	Length 2	Width 1	Width 2	Height 1	Height 2	Density
xx	xx (%)	xxx (deg)	x	xx (ft)	xx (ft)	xx (ft)	xx (ft)	xx (ft)	xx (ft)	xx (%)

15.0 WisCFI FOREST HABITAT TYPE IDENTIFICATION

Each forested condition class will receive a habitat type designation and completed data sheet with species list. If two or more forested condition classes occur within a plot, then a separate data sheet and habitat type designation must be completed for each condition class.

Data to collect and enter on each data collection sheet:

- WI CFI plot number and condition class
- Property and County names
- Name(s) of person(s) collecting data and identifying habitat type
- Date data collected
- Forest cover type – predominant tree species
- Habitat type name (abbreviation) and habitat type CFI code

The habitat type should be identified on site using the appropriate field guide(s). Habitat type computer software can be used for consideration and verification.

- Identification (ID) method
  - ID methods: 1 – on site, 2 – extrapolated, 3 – undefined
- For each species present, estimate and record canopy coverage class.

For trees, separate seedlings (trees <1 inch DBH) from larger trees and record coverage separately.
Important species not listed on data sheet can be added on the front or back of the data sheet.

- Coverage classes: 1, <1% - present; 2, 1-5% - common; 3, 6-25% - well represented; 4, >25% - abundant
- Notes can be added on the back of the data sheet

Area to evaluate, collect species list, and identify habitat type:

- On, around, and between subplots, *as long as condition class and habitat type remain relatively constant*. Boundaries (subplot, plot, search area) should be considered soft – precise distance measures are not necessary – site and vegetation homogeneity/heterogeneity should guide the evaluation.
  The normal search area forms an ellipse around the CFI plot, extending about 48 feet from plot and subplot center points – see first diagram.
  If additional area is required for evaluation to identify the habitat type and collect a complete species list, and the habitat type (site) appears to remain constant, then the search area can be expanded to an area approximately one acre in size – this expanded search area can be generally defined as a circle with a 120 foot radius around plot center – see second diagram. When data is collected by this standard method, a “1” (on site) should be entered in the “ID Method” box on the data sheet.
- If unable to determine the habitat type of the condition class on site because of a lack of diagnostic vegetation, then the search may be expanded to a larger area, adjacent stand, or nearby stand (may be a different cover type) if you believe that the habitat type remains constant. If this method of habitat type determination is used, then a “2” (extrapolated) should be entered in the “ID Method” box on the data sheet. On the back of the data sheet describe the reason for extrapolation, location of data collection, and key stand characteristics where data was collected.

In the case where more than one habitat type exists within a condition class, then:

- If one habitat type is predominant, occurring on >50% of the subplot(s) condition class area, then the predominant habitat type will be recorded with the species list from that portion of the stand and site. Note the situation on the back of the data sheet (draw diagram if possible).

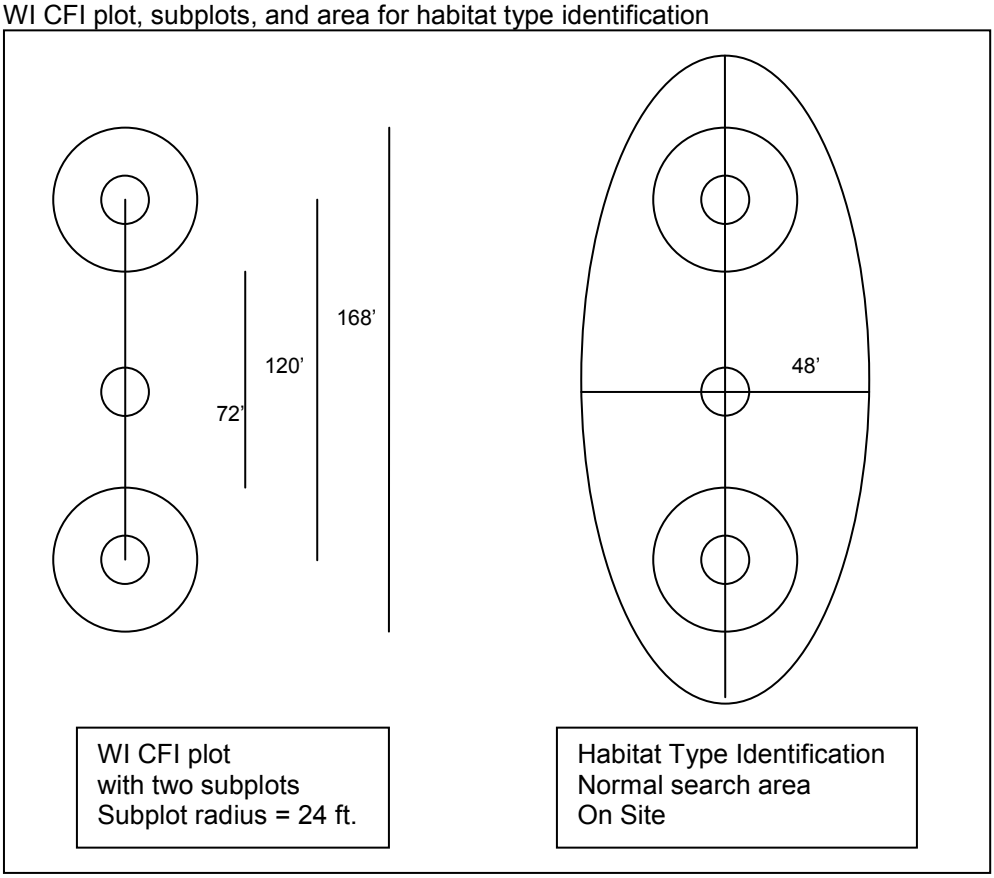
- If no single habitat type is predominant (>50%) on the subplot(s), then an undefined name and code will be applied. In this case, the "Undefined – Plot too complex" designation will be used.

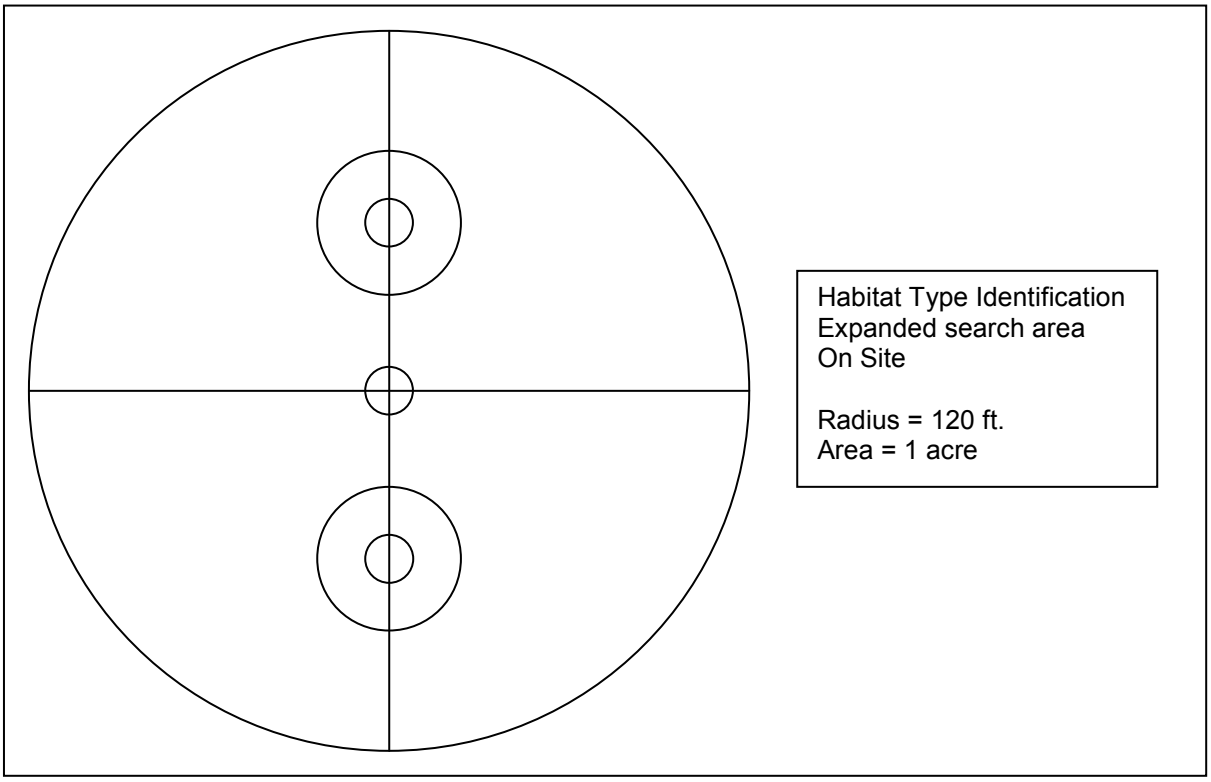
Always attempt to identify the habitat type. In some cases, a habitat type cannot be identified either on site or by extrapolation. In such cases, the habitat type will be undefined. If conditions exist that make habitat type determination highly uncertain, then enter "undefined" and specify the reason in the "Habitat Type" box on the data sheet. In the "Habitat Type Code" box, enter the appropriate code for undefined – reason. Appropriate codes are 93-100. Try to be as specific as possible as to the reason when selecting an undefined designation and code. In the "ID Method" box, enter "3" (undefined). When the habitat type is undefined, the species list does not need to be completed.

Standard field equipment is required (e.g. map, compass, distance tape, clip board, pencil, etc.). Equipment specific to habitat type data collection and identification:

- CFI plot information – plot no., location, layout, condition classes, etc.
- Habitat type identification and data collection guidelines
- Habitat type data collection data sheet
- List of forest habitat types and habitat type CFI codes
- Habitat type guide(s)
  - *A Guide to Forest Communities and Habitat Types of Northern Wisconsin*, second edition, 2002
  - *A Guide to Forest Communities and Habitat Types of Central and Southern Wisconsin*, 1996
- Habitat type software – can be field or office based (handheld, laptop, or desktop)
  - *Wisconsin Forest Habitat Type Program*, 2004
- Plant identification guide(s) (e.g. *Newcomb's Wildflower Guide*, 1977)

WI CFI plot, subplots, and area for habitat type identification





Forest Habitat Type List and WI CFI Codes

Habitat Type Name	CFI Code	Habitat Type Group #	Habitat Type Group Name and Abbreviation
PQE	1	1	N. Very Dry to Dry
PQG	2	1	N VD-D
PQGCe	3	1	
PArV	4	1	
PArV-U	5	1	
PArVAo	6	1	
QAp	7	1	
PArVAm	8	2	N. Dry to Dry-mesic
PArVAa	9	2	N D-DM
PArVAa-Vb	10	2	
PArVAa-Po	11	2	
PArVPo	12	2	
AVVb	13	3	N. Dry-mesic
AVCl	14	3	N DM
TFAa	15	3	
AVDe	16	3	
AVb-V	17	3	
ACl	18	3	
AVb	19	3	
AAt	20	3	
ATFPo	21	3	
AFVb	22	4	N. Mesic
ATM	23	4	N M
ATFSt	24	4	
ATFD	25	4	
AAs	26	4	
ATD	27	4	
ATDH	28	4	
AHVb	29	4	
AFAd	30	4	
AFAl	31	4	
ACaCi	32	4	
AOCa	33	4	
AH	34	4	
AHl	35	5	N. Mesic to Wet-mesic
ACal	36	5	N M-WM
ASal	37	5	
ATAtOn	38	5	
ASnMi	39	5	
AAtRp	40	5	
TMC	41	5	
ArAbCo	42	5	
ArAbSn	43	5	

ArVRp	44	5	
ArAbVCo	45	5	
ArAbVC	46	5	
Forest Lowland North	90	6	N. Wet-mesic to Wet (N WM-W)
PVGy	51	7	S. Dry
PEu	52	7	S D
PArVHa	50	7	
PVCr	53	7	
PVG	54	7	
ArDe-V	55	8	S. Dry-mesic
ArDe	56	8	S DM
AQVb-Gr	57	8	
ArCi	58	8	
ArCi-Ph	59	8	
AArVb	60	8	
AArL	61	8	
ATiDe-Ha	62	9	S. Dry-mesic to Mesic
ATiDe	63	9	S DM-M
ATiDe-As	64	9	
ATiFrCi	65	9	
ATiFrVb	66	9	
AFrDe	67	9	
AFrDeO	68	9	
ATiDe(Pr)	69	10	S. Dry-mesic to Mesic (phase)
ATiCr(O)	70	10	S DM-M(p)
ATiCr(As)	71	10	
ATiFrVb(Cr)	72	10	
AFrDe(Vb)	73	10	
ATTr	74	11	S. Mesic
AFTD	75	11	S M
ATiSa-De	76	11	
ATiSa	77	11	
ATiFrCa	78	11	
ATiCa-La	79	11	
ATiCa	80	11	
ATiCa-Al	81	11	
ATiH	82	11	
AFH	83	11	
AFAs	84	11	
AFAs-O	85	11	
ATiAs(De)	86	12	S. Mesic (phase)
ATiFrCa(O)	87	12	S M(p)
PArVRh	49	13	S. Mesic to Wet-mesic
Wetmesic South	91	13	S M-WM
Forest Lowland South	92	14	S. Wet-mesic to Wet (S WM-W)
Undefined habitat type (other)	93	15	No habitat type identified

		(undefined)
Undefined - Lack of diagnostics (other)	94	15
Undefined - Plantation (lack diagnostics)	95	15
Undefined - Clearcut (lack diagnostics)	96	15
Undefined - Grazed (lack diagnostics)	97	15
Undefined - Disturbed (lack diagnostics)	98	15
Undefined - Plot too complex	99	15
Undefined - Not done / No data	100	15

WI CFI - Forest Habitat Type Data Collection Sheet

CFI Plot No.: **Condition Class:**
Property: **County:**
Collected by: **Date:**

Habitat Type: **Cover Type:**
Habitat Type Code: **ID Method:**

ID Method: **1** - on site; **2** - extrapolated; **3** - undefined

Coverage Classes: **1**, <1% - present; **2**, 1-5% - common; **3**, 6-25% - well represented; **4**, >25% - abundant

	Acer spicatum		Crataegus spp.		Lycopodium annotinum		Rubus flagellaris
	Achillea millefolium		Cryptotaenia can.		Lycopodium clavatum		Rubus hispidus
	Actaea spp.		Cuscuta gronovii		Lycopodium comp.		Rubus parviflorus
	Adiantum pedatum		Cypripedium acaule		Lycopodium lucidulum		Rubus pubescens
	Agrimonia spp.		Desmodium glutinosum		Lycopodium obscurum		Rubus spp.
	Allium tricoccum		Desmodium nudiflorum		Lycopus uniflorus		Rudbeckia laciniata
	Alnus rugosa		Diervilla lonicera		Lysimachia ciliata		Salix spp.
	Amelanchier spp.		Dioscorea villosa		Lysimachia quadrifolia		Sambucus canadensis
	Amorpha canescens		Dirca palustris		Maianthemum can.		Sambucus pubens
	Amphicarpa bracteata		Dryopteris disjuncta		Matteuccia struth.		Sanguinaria canadensis
	Andromeda glauco.		Dryopteris phegopteris		Medeola virginiana		Sanicula spp.
	Anemone quinquefolia		Dryopteris spinulosa		Melampyrum lineare		Sarracenia purpurea
	Anemone virginiana		Dryopteris thelypteris		Menispermum can.		Scutellaria lateriflora
	Apocynum andro.		Epifagus virginiana		Mitchella repens		Sium suave
	Aquilegia canadensis		Epigaea repens		Mitella diphylla		Smilacina racemosa
	Aralia nudicaulis		Equisetum spp.		Mitella nuda		Smilacina stellata
	Aralia racemosa		Eupatorium rugosum		Monarda fistulosa		Smilacina trifolia
	Arctostaphylos uva-ursi		Euphorbia corollata		Monotropa uniflora		Smilax herbacea
	Arenaria lateriflora		Fragaria spp.		Nemopanthus mucro.		Smilax tamnoides
	Arisaema atrorubens		Galium aparine		Onoclea sensibilis		Solanum dulcamara
	Arisaema dracontium		Galium asprellum		Osmorhiza claytoni		Solidago flexicaulis
	Aronia melanocarpa		Galium boreale		Osmunda cinnamomea		Sorbus spp.
	Asarum canadense		Galium spp.		Osmunda claytoniana		Stachys tenuifolia
	Aster macrophyllus		Galium triflorum		Osmunda regalis		Staphylea trifolia
	Athyrium filix-femina		Gaultheria hispidula		Oxalis montana		Streptopus roseus
	Betula pumila		Gaultheria procumbens		Parthenocissus quinq.		Symplocarpus foetidus
	Boehmeria cylindrica		Gaylussacia baccata		Pedicularis canadensis		Teucrium canadense
	Botrychium virginianum		Geranium maculatum		Petasites palmatus		Thalictrum dasycarpum
	Caltha palustris		Geum spp		Phryma leptostachya		Thalictrum dioicum
	Campanula rotundifolia		Habenaria spp.		Physostegia virginiana		Toxicodendron vernix
	Caulophyllum thalic.		Hamamelis virginiana		Pilea pumila		Trientalis borealis
	Ceanothus americanus		Helianthus spp.		Podophyllum peltatum		Trillium spp.
	Cephalanthus occi.		Hepatica acutiloba		Polemonium reptans		Triosteum aurantiacum
	Chamaedaphne caly.		Hepatica americana		Polygala paucifolia		Urtica spp
	Chimaphilla umbellata		Heracleum maximum		Polygonatum pub.		Uvularia grandiflora
	Cicuta maculata		Hydrophyllum virginia.		Potentilla spp		Uvularia sessifolia
	Circaea spp.		Ilex verticillata		Prenanthes alba		Vaccinium ang./myrt.
	Cladonia rang./mit.		Impatiens capensis		Prunus pennsylvanica		Vaccinium macrocarpa
	Clintonia borealis		Iris versicolor		Prunus virginiana		Vaccinium oxycoccus

	Comptonia peregrina		Kalmia polifolia		Pteridium aquilinum		Viburnum acerifolium
	Coptis groenlandica		Laportea canadensis		Ranunculus spp		Viburnum lentago
	Cornus alternifolia		Lathyrus/Vicia spp.		Rhamnus alnifolia		Viburnum raf.
	Cornus amomum		Ledum groenlandicum		Rhus radicans		Viburnum trilobum
	Cornus canadensis		Linnaea borealis		Ribes spp.		Viola canadensis
	Cornus racemosa		Lobelia cardinalis		Rosa spp.		Viola pub./penn.
	Cornus rugosa		Lonicera canadensis				Vitis riparia
	Cornus stolonifera		Lonicera spp.				Waldsteinia fragarioides
	Corylus americana		Lupinus perennis				Xanthoxylum amer.
	Corylus cornuta						

	Moss/Grass/Sedge	SE	Trees	Sap+
	Mosses (other)		Abies balsamea	
	Feather mosses		Acer negundo	
	Sphagnum mosses		Acer rubrum	
			Acer saccharinum	
	Grasses & Sedges		Acer saccharum	
	Carex spp.		Betula allghaniensis	
	Carex pensylvanica		Betula nigra	
	Cinna spp.		Betula papyrifera	
	Elymus spp.		Carpinus caroliniana	
	Eriophorum spp.		Carya cordiformis	
	Leersia spp.		Carya ovata	
	Muhlenbergia spp.		Celtis occidentalis	
			Fagus grandifolia	
			Fraxinus amer./penn.	
			Fraxinus nigra	
			Juglans cinerea	
			Juglans nigra	
			Larix laricina	
			Ostrya virginiana	
			Picea glauca	
			Picea mariana	
			Pinus banksiana	
			Pinus resinosa	
			Pinus strobus	
			Populus balsamifera	
			Populus deltoides	
			Populus grandidentata	
			Populus tremuloides	
			Prunus serotina	
			Quercus alba	
			Quercus bicolor	
			Quercus ellipsoidalis	
			Quercus macrocarpa	
			Quercus rubra	

			Quercus velutina	
			Salix nigra	
			Thuja occidentalis	
			Tilia americana	
			Tsuga canadensis	
			Ulmus spp.	
SE = seedling, **SAP+** = sapling and larger				

Appendix 1+N+WisCFI. State, Unit, County FIPS codes and State Forest Property codes

State		Unit	County		Unit	County cont'd.	
55	WI	3	001	Adams	3	073	Marathon
		2	003	Ashland	1	075	Marinette
		2	005	Barron	3	077	Marquette
		2	007	Bayfield	1	078	Menominee
		5	009	Brown	5	079	Milwaukee
		4	011	Buffalo	3	081	Monroe
		2	013	Burnett	1	083	Oconto
		5	015	Calumet	1	085	Oneida
		3	017	Chippewa	5	087	Outagamie
		3	019	Clark	5	089	Ozaukee
		5	021	Columbia	4	091	Pepin
		4	023	Crawford	4	093	Pierce
		5	025	Dane	2	095	Polk
		5	027	Dodge	3	097	Portage
		5	029	Door	2	099	Price
		2	031	Douglas	5	101	Racine
		4	033	Dunn	4	103	Richland
		3	035	Eau Claire	5	105	Rock
		1	037	Florence	2	107	Rusk
		5	039	Fond du La	4	109	St. Croix
		1	041	Forest	4	111	Sauk
		4	043	Grant	2	113	Sawyer
		5	045	Green	1	115	Shawano
		5	047	Green Lake	5	117	Sheboygan
		4	049	Iowa	2	119	Taylor
		2	051	Iron	4	121	Trempealeau
		3	053	Jackson	4	123	Vernon
		5	055	Jefferson	1	125	Vilas
		3	057	Juneau	5	127	Walworth
		5	059	Kenosha	2	129	Washburn
		5	061	Kewaunee	5	131	Washington
		4	063	La Crosse	5	133	Waukesha
		4	065	Lafayette	3	135	Waupaca
		1	067	Langlade	3	137	Waushara
		1	069	Lincoln	5	139	Winnebago
		5	071	Manitowoc	3	141	Wood

State Forest Property Codes

American Legion State Forest	4475
Black River State Forest	2777
Brule River State Forest	1674
Coulee Experimental Forest	3213
Flambeau River State Forest	5873
Governor Knowles State Forest	4979
Kettle Moraine State Forest – NU	6717
Kettle Moraine State Forest – SU	6813
Northern Highland State Forest	6476
Peshtigo River State Forest	3810
Point Beach State Forest	3672

Appendix 3+N. FIA Tree Species Codes

This list includes all tree species tallied in the Continental U.S. – modified for the North. Species that have an "X" in the *Core* column are tallied in all regions. All other species on the list are "core optional". The North tallies all *Core* and "core optional" species.

NRS Note: Not all tree species are listed in this table that may occur in the North. If not listed,tree species are tallied using species code 0999. The use of code 0999 requires a tree NOTE with the species identified. Dead trees are coded in the following order of identification hierarchy: Species code, Genus code, 0299 or 0998, or 0999.

Core	FIA	PLANTS00	Common Name	Genus	Species
	0010	ABIES	Fir spp.	Abies	spp.
X	0012	ABBA	balsam fir	Abies	balsamea
X	0015	ABCO	white fir	Abies	concolor
X	0016	ABFR	Fraser fir	Abies	fraseri
	0040	CHAMA4	cedar spp.	Chamaecyparis	spp.
X	0043	CHTH2	Atlantic white-cedar	Chamaecyparis	thyoides
	0057	JUNIP	redcedar, juniper spp.	Juniperus	spp.
X	0061	JUAS	Ashe juniper	Juniperus	ashei
X	0068	JUVI	eastern redcedar	Juniperus	virginiana
	0070	LARIX	larch spp.	Larix	spp.
X	0071	LALA	tamarack (native)	Larix	laricina
	0090	PICEA	spruce spp.	Picea	spp.
X	0091	PIAB	Norway spruce	Picea	abies
X	0094	PIGL	white spruce	Picea	glauca
X	0095	PIMA	black spruce	Picea	mariana
X	0096	PIPU	blue spruce	Picea	pungens
X	0097	PIRU	red spruce	Picea	rubens
	0100	PINUS	pine spp.	Pinus	spp.
X	0105	PIBA2	jack pine	Pinus	banksiana
X	0108	PICO	lodgepole pine	Pinus	contorta
X	0110	PIEC2	shortleaf pine	Pinus	echinata
X	0113	PIFL2	limber pine	Pinus	flexilis
X	0122	PIPO	ponderosa pine	Pinus	ponderosa
X	0123	PIPU5	Table Mountain pine	Pinus	pungens
X	0125	PIRE	red pine	Pinus	resinosa
X	0126	PIRI	pitch pine	Pinus	rigida
X	0128	PISE	pond pine	Pinus	serotina
X	0129	PIST	eastern white pine	Pinus	strobus

Core	FIA	PLANTS00	Common Name	Genus	Species
X	0130	PISY	Scotch pine	Pinus	sylvestris
X	0131	PITA	loblolly pine	Pinus	taeda
X	0132	PIVI2	Virginia pine	Pinus	virginiana
X	0136	PINI	Austrian pine	Pinus	nigra
	0200	PSEUD7	Douglas-fir spp.	Pseudotsuga	spp.
X	0202	PSME	Douglas-fir	Pseudotsuga	menziesii
	0220	TAXOD	cypress spp.	Taxodium	spp.
X	0221	TADI2	baldcypress	Taxodium	distichum
X	0222	TAAS	pondcypress	Taxodium	ascendens
	0230	TAXUS	yew spp.	Taxus	spp.
	0240	THUJA	Thuja spp.	Thuja	spp.
X	0241	THOC2	northern white-cedar	Thuja	occidentalis
	0260	TSUGA	hemlock spp.	Tsuga	spp.
X	0261	TSCA	eastern hemlock	Tsuga	canadensis
X	0299	2TE	unknown dead conifer	Tree	evergreen
	0310	ACER	maple spp.	Acer	spp.
X	0313	ACNE2	boxelder	Acer	negundo
X	0314	ACNI5	black maple	Acer	nigrum
X	0315	ACPE	striped maple	Acer	pensylvanicum
X	0316	ACRU	red maple	Acer	rubrum
X	0317	ACSA2	silver maple	Acer	saccharinum
X	0318	ACSA3	sugar maple	Acer	saccharum
	0319	ACSP2	mountain maple	Acer	spicatum
	0320	ACPL	Norway maple	Acer	platanoides
	0321	ACGL	Rocky Mountain maple	Acer	glabrum
	0330	AESCU	buckeye, horsechestnut spp.	Aesculus	spp.
X	0331	AEGL	Ohio buckeye	Aesculus	glabra
X	0332	AEFL	yellow buckeye	Aesculus	flava
	0336	AEPA	red buckeye	Aesculus	pavia
X	0341	AIAL	ailanthus	Ailanthus	altissima
X	0345	ALJU	mimosa/silktree	Albizia	julibrissin
	0350	ALNUS	alder spp.	Alnus	spp.
X	0355	ALGL2	European alder	Alnus	glutinosa
	0356	AMELA	serviceberry spp.	Amelanchier	spp.
	0357	AMAR3	common serviceberry	Amelanchier	arborea

Core	FIA	PLANTS00	Common Name	Genus	Species
	0358	AMSA	roundleaf serviceberry	Amelanchier	sanguinea
X	0367	ASTR	pawpaw	Asimina	triloba
	0370	BETUL	birch spp.	Betula	spp.
X	0371	BEAL2	yellow birch	Betula	alleghaniensis
X	0372	BELE	sweet birch	Betula	lenta
X	0373	BENI	river birch	Betula	nigra
X	0374	BEOC2	water birch	Betula	occidentalis
X	0375	BEPA	paper birch	Betula	papyrifera
X	0379	BEPO	gray birch	Betula	populifolia
X	0391	CACA18	American hornbeam, musclewood	Carpinus	caroliniana
	0400	CARYA	hickory spp.	Carya	spp.
X	0401	CAAQ2	water hickory	Carya	aquatica
X	0402	CACO15	bitternut hickory	Carya	cordiformis
X	0403	CAGL8	pignut hickory	Carya	glabra
X	0404	CAIL2	pecan	Carya	illinoinensis
X	0405	CALA21	shellbark hickory	Carya	laciniosa
X	0407	CAOV2	shagbark hickory	Carya	ovata
X	0408	CATE9	black hickory	Carya	texana
X	0409	CAAL27	mockernut hickory	Carya	alba
X	0410	CAPA24	sand hickory	Carya	pallida
X	0412	CAOV3	red hickory	Carya	ovalis
	0420	CASTA	chestnut spp.	Castanea	spp.
	0421	CADE12	American chestnut	Castanea	dentata
X	0422	CAPU9	Allegheny chinkapin	Castanea	pumila
	0423	CAPUO	Ozark chinkapin	Castanea	pumila var. ozarkensis
X	0424	CAMO83	Chinese chestnut	Castanea	mollissima
	0450	CATAL	catalpa spp.	Catalpa	spp.
X	0451	CABI8	southern catalpa	Catalpa	bignonioides
X	0452	CASP8	northern catalpa	Catalpa	speciosa
	0460	CELTI	hackberry spp.	Celtis	spp.
X	0461	CELA	sugarberry	Celtis	laevigata
X	0462	CEOC	hackberry	Celtis	occidentalis
	0463	CELAR	netleaf hackberry	Celtis	laevigata var. reticulata
X	0471	CECA4	eastern redbud	Cercis	canadensis

Core	FIA	PLANTS00	Common Name	Genus	Species
X	0481	CLKE	yellowwood	Cladrastis	kentukea
	0490	CORNU	dogwood spp.	Cornus	spp.
X	0491	COFL2	flowering dogwood	Cornus	florida
	0500	CRATA	hawthorn spp.	Crataegus	spp.
	0501	CRCR2	cockspur hawthorn	Crataegus	crus-galli
	0502	CRMO2	downy hawthorn	Crataegus	mollis
	0503	CRBR3	Brainerd hawthorn	Crataegus	brainerdii
	0504	CRCA	pear hawthorn	Crataegus	calpodendron
	0505	CRCH	fireberry hawthorn	Crataegus	chrysocarpa
	0506	CRDI	broadleaf hawthorn	Crataegus	dilatata
	0507	CRFL	fanleaf hawthorn	Crataegus	flabellata
	0508	CRMO3	oneseed hawthorn	Crataegus	monogyna
	0509	CRPE	scarlet hawthorn	Crataegus	pedicellata
	5091	CRPH	Washington hawthorn	Crataegus	phaenopyrum
	5092	CRSU5	fleshy hawthorn	Crataegus	succulenta
	5093	CRUN	dwarf hawthorn	Crataegus	uniflora
	0520	DIOSP	persimmon spp.	Diospyros	spp.
X	0521	DIVI5	common persimmon	Diospyros	virginiana
X	0531	FAGR	American beech	Fagus	grandifolia
	0540	FRAXI	ash spp.	Fraxinus	spp.
X	0541	FRAM2	white ash	Fraxinus	americana
X	0543	FRNI	black ash	Fraxinus	nigra
X	0544	FRPE	green ash	Fraxinus	pennsylvanica
X	0545	FRPR	pumpkin ash	Fraxinus	profunda
X	0546	FRQU	blue ash	Fraxinus	quadrangulata
	0550	GLEDI	locust spp.	Gleditsia	spp.
X	0551	GLAQ	waterlocust	Gleditsia	aquatica
X	0552	GLTR	honeylocust	Gleditsia	triacanthos
X	0561	GIBI2	Ginkgo, maidenhair tree	Ginkgo	biloba
X	0571	GYDI	Kentucky coffeetree	Gymnocladus	dioicus
	0580	HALES	silverbell spp.	Halesia	spp.
X	0591	ILOP	American holly	Ilex	opaca
	0600	JUGLA	walnut spp.	Juglans	spp.
X	0601	JUCI	butternut	Juglans	cinerea
X	0602	JUNI	black walnut	Juglans	nigra
	0605	JUMI	Texas walnut	Juglans	microcarpa

Core	FIA	PLANTS00	Common Name	Genus	Species
X	0611	LIST2	sweetgum	Liquidambar	styraciflua
X	0621	LITU	yellow-poplar	Liriodendron	tulipifera
X	0641	MAPO	Osage-orange	Maclura	pomifera
	0650	MAGNO	magnolia spp.	Magnolia	spp.
X	0651	MAAC	cucumbertree	Magnolia	acuminata
X	0652	MAGR4	southern magnolia	Magnolia	grandiflora
X	0653	MAVI2	sweetbay	Magnolia	virginiana
X	0654	MAMA2	bigleaf magnolia	Magnolia	macrophylla
X	0655	MAFR	mountain magnolia, Fraser magnolia	Magnolia	fraseri
X	0658	MATR	umbrella magnolia	Magnolia	tripetala
	0660	MALUS	apple spp.	Malus	spp.
X	0662	MAAN3	southern crabapple	Malus	angustifolia
X	0663	MACO5	sweet crabapple	Malus	coronaria
X	0664	MAIO	prairie crabapple	Malus	ioensis
	0680	MORUS	mulberry spp.	Morus	spp.
X	0681	MOAL	white mulberry	Morus	alba
X	0682	MORU2	red mulberry	Morus	rubra
X	0684	MONI	black mulberry	Morus	nigra
	0690	NYSSA	tupelo spp.	Nyssa	spp.
X	0691	NYAQ2	water tupelo	Nyssa	aquatica
X	0693	NYSY	blackgum	Nyssa	sylvatica
X	0694	NYBI	swamp tupelo	Nyssa	biflora
X	0701	OSVI	eastern hophornbeam	Ostrya	virginiana
X	0711	OXAR	sourwood	Oxydendrum	arboreum
X	0712	PATO2	paulownia, empress-tree	Paulownia	tomentosa
	0720	PERSE	bay spp.	Persea	spp.
X	0722	PLAQ	water-elm, planertree	Planera	aquatica
	0729	PLATA	sycamore spp.	Platanus	spp.
X	0731	PLOC	American sycamore	Platanus	occidentalis
	0740	POPUL	cottonwood and poplar spp.	Populus	spp.
X	0741	POBA2	balsam poplar	Populus	balsamifera
X	0742	PODE3	eastern cottonwood	Populus	deltoides
X	0743	POGR4	bigtooth aspen	Populus	grandidentata
X	0744	POHE4	swamp cottonwood	Populus	heterophylla

Core	FIA	PLANTS00	Common Name	Genus	Species
X	0745	PODEM	plains cottonwood	Populus	deltoides ssp. monilifera
X	0746	POTR5	quaking aspen	Populus	tremuloides
X	0747	POBAT	black cottonwood	Populus	balsamifera ssp. trichocarpa
X	0749	POAN3	narrowleaf cottonwood	Populus	angustifolia
X	0752	POAL7	silver poplar	Populus	alba
X	0753	PONI	Lombardy poplar	Populus	nigra
	0760	PRUNU	cherry and plum spp.	Prunus	spp.
	0761	PRPE2	pin cherry	Prunus	pensylvanica
X	0762	PRSE2	black cherry	Prunus	serotina
	0763	PRVI	common chokecherry	Prunus	virginiana
	0764	PRPE3	peach	Prunus	persica
X	0765	PRNI	Canada plum	Prunus	nigra
X	0766	PRAM	American plum	Prunus	americana
	0769	PRAL5	Allegheny plum	Prunus	alleghaniensis
	0770	PRAN3	Chickasaw plum	Prunus	angustifolia
X	0771	PRAV	sweet cherry (domesticated)	Prunus	avium
	0772	PRCE	sour cherry (domesticated)	Prunus	cerasus
	0773	PRDO	European plum (domesticated)	Prunus	domestica
	0774	PRMA	Mahaleb plum (domesticated)	Prunus	mahaleb
	0800	QUERC	oak – deciduous spp.	Quercus	spp.
X	0802	QUAL	white oak	Quercus	alba
X	0804	QUBI	swamp white oak	Quercus	bicolor
X	0806	QUCO2	scarlet oak	Quercus	coccinea
X	0809	QUEL	northern pin oak	Quercus	ellipsoidalis
X	0812	QUFA	southern red oak	Quercus	falcata
X	0813	QUPA5	cherrybark oak	Quercus	pagoda
X	0816	QUIL	scrub oak	Quercus	ilicifolia
X	0817	QUIM	shingle oak	Quercus	imbricaria
X	0820	QULA3	laurel oak	Quercus	laurifolia
X	0822	QULY	overcup oak	Quercus	lyrata
X	0823	QUMA2	bur oak	Quercus	macrocarpa
X	0824	QUMA3	blackjack oak	Quercus	marilandica

Core	FIA	PLANTS00	Common Name	Genus	Species
X	0825	QUMI	swamp chestnut oak	Quercus	michauxii
X	0826	QUMU	chinkapin oak	Quercus	muehlenbergii
X	0827	QUNI	water oak	Quercus	nigra
X	0828	QUBU2	Nuttall oak	Quercus	buckleyi
X	0830	QUPA2	pin oak	Quercus	palustris
X	0831	QUPH	willow oak	Quercus	phellos
X	0832	QUPR2	chestnut oak	Quercus	prinus
X	0833	QURU	northern red oak	Quercus	rubra
X	0834	QUSH	Shumard's oak	Quercus	shumardii
X	0835	QUST	post oak	Quercus	stellata
X	0837	QUVE	black oak	Quercus	velutina
X	0840	QUMA6	dwarf post oak	Quercus	margarettiae
	0845	QUPR	dwarf chinkapin oak	Quercus	prinoides
X	0901	ROPS	black locust	Robinia	pseudoacacia
	0919	SASAD	western soapberry	Sapindus	saponaria var. drummondii
	0920	SALIX	willow spp.	Salix	spp.
	0921	SAAM2	peachleaf willow	Salix	amygdaloides
	0922	SANI	black willow	Salix	nigra
	0923	SABE2	Bebb willow	Salix	bebbiana
X	0925	SACA5	coastal plain willow	Salix	caroliniana
X	0926	SAPY	balsam willow	Salix	pyrifolia
	0927	SAAL2	white willow	Salix	alba
X	0929	SASE10	weeping willow	Salix	sepulcralis
X	0931	SAAL5	sassafras	Sassafras	albidum
	0934	SORBU	mountain ash spp.	Sorbus	spp.
	0935	SOAM3	American mountain ash	Sorbus	americana
X	0936	SOAU	European mountain ash	Sorbus	aucuparia
X	0937	SODE3	northern mountain ash	Sorbus	decora
	0950	TILIA	basswood spp.	Tilia	spp.
X	0951	TIAM	American basswood	Tilia	americana
	0952	TIAMH	white basswood	Tilia	americana var. heterophylla
	0953	TIAMC	Carolina basswood	Tilia	americana var. caroliniana
	0970	ULMUS	elm spp.	Ulmus	spp.
X	0971	ULAL	winged elm	Ulmus	alata

Core	FIA	PLANTS00	Common Name	Genus	Species
X	0972	ULAM	American elm	Ulmus	americana
X	0973	ULCR	cedar elm	Ulmus	crassifolia
X	0974	ULPU	Siberian elm	Ulmus	pumila
X	0975	ULRU	slippery elm	Ulmus	rubra
X	0976	ULSE	September elm	Ulmus	serotina
X	0977	ULTH	rock elm	Ulmus	thomasii
	0991	TAMAR2	saltcedar	Tamarix	spp.
X	0993	MEAZ	chinaberry	Melia	azedarach
X	0996	COOB2	smoketree	Cotinus	obovatus
	0997	ELAN	Russian-olive	Elaeagnus	angustifolia
X	0998	2TB	unknown dead hardwood	Tree	broadleaf
X	0999	2TREE	other, or unknown live tree	Tree	unknown