
“Anyone who establishes a permanent plot should recognize that he or she hereby assumes responsibility for furnishing workers with a complete picture of conditions on the plot at the time of its establishment. Not only must each plot be properly marked and all measures be in near perfect order, but all notes and records must be complete. Otherwise, the plots may fail to yield the desired results and those who in later years become responsible for their care and for the analysis of the data, may be led to serious mistakes.”

[U.S. Department of Agriculture, Forest Service 1935.]

Note to User: URBAN FIA Field Guide 7.1 is based on the National CORE Field Guide, Version 7.1. Data elements are national CORE unless indicated as follows:

- National CORE data elements that end in “+U” (e.g., x.x+U) have had values, codes, or text added, changed, or adjusted from the CORE program. Any additional URBAN FIA text for a national CORE data element is hi-lighted or shown as an “Urban Note.”

- All URBAN FIA data elements end in “U” (e.g., x.xU). The text for an URBAN FIA data element is not hi-lighted and does not have a corresponding variable in CORE.

NRS Note: NRS FIA Field Guide Version 7.2 Ground Truth Plots is based on the National Core FIA Field Guide Version 7.2 and URBAN FIA Field Guide 7.1; with the exception of Soil Measurements and Sampling, and Crowns Measurements and Sampling data elements and procedures, which are based on the National Core Field Guide Version 5.1. All data elements are national unless indicated as follows:

- National data elements that end in “+N” or “+GT” (e.g., x.x+N) have had values, codes, or text added, changed, or adjusted from the CORE program*. Any additional regional text for a national CORE data element is hi-lighted or shown as a “NRS Note.”

- All regional data elements end in “N” or “N-GT” (e.g., x.xN). The text for a regional data element is not hi-lighted and does not have a corresponding variable in CORE.

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*All national data elements with added regional values/codes must be collapsed back to existing national standards by the Information Group unless supported by NIMS. National CORE data elements retain their national CORE field guide data element / variable number but may not retain their national CORE field guide location or sequence within the guide.

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### 1.14 INTRODUCTION

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INTRODUCTION

This document describes the standards, codes, methods, and definitions for Forest Inventory and Analysis (FIA) field data items. The objective is to describe CORE FIA Image-based Change Estimation (ICE) Ground Truth and Nonforest Tree Inventory field procedures that are consistent and uniform across all FIA units. This CORE is Image-based Change Estimation (ICE) Ground Truth and Nonforest Tree Inventory guide will serve as the framework for regional FIA programs; individual programs may add regional variables that support their CORE program, but may not change or add to the nationally CORE Image-based Change Estimation (ICE) Ground Truth and Nonforest Tree Inventory requirements. Unless otherwise noted, the items in this field guide are considered CORE Image-based Change Estimation (ICE) Ground Truth and Nonforest Tree Inventory, that is, the information will be collected by all FIA units as specified. Items or codes specified as CORE Image-based Change Estimation (ICE) Ground Truth and Nonforest Tree Inventory OPTIONAL are not required by individual units; however, if the item is collected or coded, it will be done as specified in this field guide. It is expected that on average all items in this guide (Volume 1 of the FIA field methods guide) can be measured by a one or two-person field crew in less than one day, including travel time to and from the plot. Image-based Change Estimation (ICE) Ground Truth and Nonforest Tree Inventory plots will be referred to as Ground Truth plots throughout the field procedures. Ground Truth variables that are optional are referred to as Ground Truth OPTIONAL.
The FIA program is in transition, changing in response to legislation and new customer demands. One of these demands is for increased consistency, which this field guide begins to address. Another change was the merger of the FIA program with the field plot component of the Forest Health Monitoring (FHM) program’s Detection Monitoring. A systematic grid was established that includes some, but not all former FIA plots. This grid contains the Phase 2 plots, the annual survey plots that are designed for measurement on a rotation such that a portion of the plots are measured each year. The rotation length varies by region. The former FHM Detection Monitoring field plots are the Phase 3 plots, a subset of the Phase 2 plots. The same basic plot and sampling designs are used on all the plots.

The focus of Volume I is on data that are collected in the field on all Phase 2 plots in the FIA sample. The methods in Volume I are also used on Phase 3 plots except when specifically noted otherwise in the methods text. Volume II of the series describes an additional, expanded suite of data collected on the Phase 3 subset of plots. Volume II contains methods for the following indicators: ozone bioindicator plants; lichen communities; soils (physical and chemical characteristics); crown condition; and vegetation diversity and structure. Note that the down woody materials field procedures are now included only in Volume I. Volume III of the series (in preparation) will document the office procedures including data elements measured in the office, data from other sources that are merged into the FIA database, and CORE compilation and analysis algorithms. When complete, the three-volume set will describe the CORE FIA program field data, all of which are measured consistently across the country.

Field Guide Layout
Each section of the field guide corresponds to one of the following sections:

0 General Description
1 Plot Level Data
2 Condition Class
3 Subplot Information
4 Boundary References
5 Tree Measurements and Sapling Data
6 Seedling Data
7 Site Tree Information
8-P2+ Phase 2 (P2) Vegetation Profile (core optional)
9-P2+ Invasive Plants
10-P2+ Down Woody Materials
11U Non-Tally Trees
22-P2+ Soil Measurements and Sampling
23-P2+ Crowns Measurements and Sampling
26N-GT ICE GROUND TRUTH (Image-based Change Estimation)

National URBAN FIA Field Guide is referred to as URBAN FIA
Regional URBAN FIA Field Guide is referred to as URBAN FIA and Regional items are highlighted.
National CORE Field Guide is referred to as CORE
Regional CORE Field Guide is referred to as CORE and Regional items are highlighted.

Each section begins with a general overview of the data elements collected at that level and background necessary to prepare field crews for data collection. Descriptions of data elements follow in this format:
DATA ELEMENT NAME -- <brief variable description>

When collected: <when data element is recorded>

Field width: <X digits>

Tolerance: <range of measurement that is acceptable>

MQO: <measurement quality objective>

Values: <legal values for coded variables>

Data elements, descriptions of when to collect the data elements, field width, tolerances, MQO’s, and values, apply to both Phase 2 plots (formerly called FIA plots) and Phase 3 plots (formerly called FHM Detection Monitoring plots) unless specifically noted. Field width designates the number of columns (or spaces) needed to properly record the data element.

**NRS Note:** Some regional data items are described in the field guide but do not require any data entry. These variables are "hidden" variables that are required for regional programming and/or logic checks on collected data items. Data items that require a field entry have an associated PDR (Personal Data Recorder) prompt. Some of these items may be auto-filled (i.e., downloaded values).

Tolerances may be stated in +/- terms or number of classes for ordered categorical data elements (e.g., +/- 2 classes); in absolute terms for some continuous variables (e.g., +/- 0.2 inches); or in terms of percent of the value of the data element (e.g., +/- 10 percent of the value). For some data elements, no errors are tolerated (e.g., PLOT NUMBER).

**NRS Note:** Some CORE variable tolerances have been tightened to comply with regional requirements.

MQO’s state the percentage of time that the collected data are required to be within tolerance. Percentage of time within tolerance is generally expressed as "at least X percent of the time," meaning that crews are expected to be within tolerance at least X percent of the time.

PLOT NOTES will be available on every PDR screen for ease in recording notes.

**Units of Measure**

The field guide will use ENGLISH units as the measurement system.

**Plot Dimensions:**
Subplot:

Radius = 24 feet
Area = 1,809.56 square feet or approximately 0.04 acre or approximately 1/24 acre

Microplot:

Radius = 6.8 feet
Area = 145.27 square feet or approximately 0.003 acre or approximately 1/300 acre

Ground Truth 118:

Radius = 118.0 feet
Area = 43,743.54 square feet or approximately 1 acre

Ground Truth 144:

Radius = 144.0 feet
Area = 63,144.07 square feet or approximately 1.5 acre

ICE Points:

ICE 1 = FIA Plot Center
ICE 2 = 137 feet at 34 degrees
ICE 3 = 137 feet at 124 degrees
ICE 4 = 137 feet at 214 degrees
ICE 5 = 137 feet at 304 degrees

Macroplot:

Radius = 58.9 feet
Area = 10,899 square feet or 0.25 acre (ac) or 1/4 acre

Annular plot:

Radius = from 24.0 feet to 58.9 feet
Area = 9088.4 square feet or approximately 0.21 acre or 5/24 acre

The distance between subplot centers is 120.0 feet horizontal.

The minimum area needed to qualify as accessible forest land is 1.0 acre.

The minimum width to qualify as accessible forest land is 120 ft.
Tree Limiting Dimensions:

- breast height: 4.5 ft
- stump height: 1.0 ft
- merchantable top: 4.0 in DOB
- merchantable top for woodland: 1.5 in DOB
- minimum conifer seedling length: 0.5 ft
- minimum hardwood seedling length: 1.0 ft
- seedling/sapling DBH/DRC break: 1.0 in DOB
- sapling/tree DBH/DRC break: 5.0 in DOB

0.0+N+GT

**GENERAL DESCRIPTION**

The CORE Ground Truth field plot consists of four subplots approximately 1/24 acre in size with a radius of 24.0 feet as well as a 118.0 feet radius circle used for identifying trees within the acre around plot center. The center subplot is subplot 1. Subplots 2, 3, and 4 are located 120.0 feet horizontal (+/− 7 feet) at azimuths of 360, 120, and 240 degrees from the center of subplot 1, respectively (see Figure 1+N). Throughout this field guide, the use of the word ‘plot’ refers to the entire set of four subplots. ‘Plot center’ is defined as the center of subplot 1. As a CORE OPTION, the field plot may also include macroplots that are ¼ acre in size with a radius of 58.9 feet; each macroplot center coincides with the subplot’s center. Macroplots are numbered in the same way as subplots.

If the macroplots are not installed, the subplots are used to collect data on trees with a diameter (at breast height, DBH, or at root collar, DRC) of 5.0 inches or greater. If the macroplots are installed, then subplots are used to collect data on trees from a diameter 5.0 inches to the breakpoint diameter and the macroplot is used to collect data on trees with diameter greater than the breakpoint diameter.

**NRS Note:** Macroplots are not installed in the North and all reference to a macroplot has been shaded out or removed for this regional guide.

Each subplot contains a microplot of approximately 1/300 acre in size with a radius of 6.8 feet. The center of the microplot is microplot offset 90 degrees and 12.0 feet horizontal (+/− 1 foot) from each subplot center. Microplots are numbered in the same way as subplots. Microplots are used to select and collect data on saplings (DBH/DRC of 1.0 inch through 4.9 inches) and seedlings (DBH/DRC less than 1.0 inch in diameter and greater than or equal to 0.5 foot in length [conifers] or greater than or equal to 1.0 foot in length [hardwoods]).

As a CORE OPTION for a Phase 2 plot that is not part of the Phase 3 subset, data for one or more of the Phase 3 indicators may be collected on the plot. If a region exercises the option to collect one or more Phase 3 indicator(s) on a Phase 2 only plot, the entire suite of measurements for the particular indicator(s) described in the appropriate chapter must be collected for the data for that indicator to be core optional.

Each unit may choose which Phase 3 indicators to collect as core optional on a Phase 2 plot that is not a Phase 3 plot. They may choose no indicators, all indicators or a subset. If they choose to collect data for a Phase 3 indicator, all the procedures for the indicator must be followed for that indicator to be considered core optional (data in the National Information Management System [NIMS]). If a subset of measurements for an indicator are collected, that is considered a regional enhancement and the data will be in the regional database.
Macroplots may be used to provide a better sample of rare population elements, such as very large trees.

The annular plot may be used for destructive sampling such as collecting soil samples. Also the term annular plot will be used for instructions in the field guide, for example, instructions on numbering trees when the macroplots are installed.

**NRS Note:** Annular plots are not installed in the North for P2 and all reference to an annular plot has been shaded out or removed for this regional guide.

Data are collected on field plots at the following levels:

<table>
<thead>
<tr>
<th>Level</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plot</td>
<td>Data that describe the entire cluster of four subplots.</td>
</tr>
<tr>
<td>Subplot</td>
<td>Data that describe a single subplot of a cluster.</td>
</tr>
<tr>
<td>Ground Truth 118</td>
<td>A 118 foot radius circle centered around plot center that is used to determine if certain items of interest are located within this circle.</td>
</tr>
<tr>
<td>Ground Truth 144</td>
<td>A 144 foot radius circle that is used to determine if change has occurred. This circle is used during measurement of Sample Kind 2 plots.</td>
</tr>
<tr>
<td>ICE Points</td>
<td>Locations, 1-5, where Land Use and Land Cover are defined for the ICE project.</td>
</tr>
<tr>
<td>Condition Class</td>
<td>A discrete combination of landscape attributes that describe the environment on all or part of the plot. These attributes include CONDITION CLASS STATUS, RESERVED STATUS, OWNER GROUP, FOREST TYPE, STAND SIZE CLASS, REGENERATION STATUS, and TREE DENSITY.</td>
</tr>
<tr>
<td>Boundary</td>
<td>An approximate description of the demarcation line between two condition classes that occur on a single subplot, microplot, or macroplot. There is no boundary recorded when the demarcation occurs beyond the fixed-radius plots.</td>
</tr>
<tr>
<td>Tree</td>
<td>Data describing saplings with a diameter 1.0 inch through 4.9 inches, and trees with diameter greater than or equal to 5.0 inches.</td>
</tr>
<tr>
<td>Seedling</td>
<td>Data describing trees with a diameter less than 1.0 inch and greater than or equal to 0.5 foot in length (conifers) or greater than or equal to 1.0 foot in length (hardwoods).</td>
</tr>
<tr>
<td>Site Tree</td>
<td>Data describing site index trees.</td>
</tr>
</tbody>
</table>
Plot Setup

Plots will be established according to the regional guidelines of each FIA unit (See Regional Appendix A for plot establishment and/or relocation procedures). When the crew cannot occupy the plot center because safety hazards exist, or the plot center is inaccessible or out of the sample, the crew should check the other subplots. If any subplot centers can be occupied and are in the sample, the subplots that can be occupied should be established and sampled following normal procedures. When a subplot center or microplot center cannot be occupied, no data will be collected from that subplot or microplot; instead, the entire subplot or microplot should be classified according to the condition preventing occupancy.

The following table provided can assist in locating subplot 2-4 from a subplot other than subplot 1.

<table>
<thead>
<tr>
<th>Subplot Numbers</th>
<th>Azimuth degrees</th>
<th>Backsight</th>
<th>Distance feet</th>
</tr>
</thead>
<tbody>
<tr>
<td>From</td>
<td>Azimuth</td>
<td>To</td>
<td>Backsight</td>
</tr>
<tr>
<td>2</td>
<td>150</td>
<td>330</td>
<td>207.8</td>
</tr>
<tr>
<td>2</td>
<td>210</td>
<td>030</td>
<td>207.8</td>
</tr>
<tr>
<td>3</td>
<td>270</td>
<td>090</td>
<td>207.8</td>
</tr>
</tbody>
</table>

If a subplot was installed incorrectly at the previous visit, the current crew should remeasure the subplot in its present location and contact the field supervisor. In cases where individual subplots are lost (cannot be relocated), use the following procedures:
Assign the appropriate present CONDITION CLASS STATUS Code(s) to the new subplot (usually CONDITION CLASS STATUS = 1 or 2).

Assign PRESENT TREE STATUS = 0 and RECONCILE = 7 to all downloaded trees (i.e., incorrectly tallied at the previous survey).

Assign PRESENT TREE STATUS = 1 or 2 and RECONCILE codes 3 or 4 (i.e., missed live or missed dead) to all trees on the new subplot.

Assign the next TREE RECORD NUMBER for all new trees.

0.2 Plot Integrity
Each FIA unit is responsible for minimizing damage to current or prospective sample trees and for specifying how these trees are monumented for remeasurement. The following field procedures are permitted:

- Scribing and nailing tags on witness trees so that subplot centers can be relocated.
- Boring trees for age on subplots and macroplots to determine tree age, site index, stand age, or for other reasons. **Not applicable in the North.**
- Nailing and tagging trees on microplots, subplots, and macroplots so that these trees can be identified and relocated efficiently and positively at times of remeasurement.
- Nailing, scribing, or painting microplot, subplot, and macroplot trees so that the point of diameter measurement can be accurately relocated and remeasured.

All other potentially damaging procedures that may erode subplot integrity are prohibited. The following practices are specifically prohibited:

- Boring and scribing some specific tree species that are known to be negatively affected (e.g., the initiation of infection or callusing).
- Boring trees for age on subplots to determine tree age, site index, stand age, or for other reasons.
- Chopping vines from tally trees. When possible, vines should be pried off trunks to enable accurate measurement. If this is not possible, alternative tools (calipers, biltmore sticks) should be used. **NRS Note: The use of alternative tools is not applicable.**
- **Toppling of dead trees or saplings.**

Note: Avoid becoming part of the problem! There is a risk that field crews walking into plot locations could pick up seeds along roadsides or other patches of invasive plants and spread them through the forest and on to the plot. Be aware of the vegetation you are traveling through and consider stopping and removing seeds from boots and clothing before entering uninvaded lands, particularly remote areas that are rarely visited.

**NRS Note:** A primary responsibility of FIA data collectors is to keep the FIA plot sample unbiased and it is the policy of NRS FIA to NOT release plot locations or in general any information collected or observed on a plot that may influence a landowner's decision on how they manage the area where an FIA plot resides. This includes both public and private plot ownerships and the discovery of any invasive plant or insect, or endangered species observed or tallied on plot. The following list of dos and don’ts may help with how you interact with landowners while accessing FIA plot locations:

**Dos:**
• Protect the integrity of the FIA plot sample and don’t bias the sample

• Be honest and cooperative when a landowner specifically asks a direct question about what you observed while on their property, but avoid directing them directly to the plot area which would bias the sample.

• If a landowner wants to accompany you to the plot area while you’re collecting the data, you should comply with that request. It’s their property.

• If you discover an invasive pest such as emerald ash borer or Asian longhorn beetle, pass this on to your direct supervisor or your Contracting Officer Representative. FIA has provided information to USFS State and Private Forestry on the general location of an observed pest. Exact location and coordinates are kept confidential.

• If a landowner requests a copy of the plot data, explain that the data collected on their property was not designed to be useful or descriptive on the scale of an individual landowner or single plot location. FIA plot samples are designed for larger scale inventories at the county, state or national level. If they insist or it’s a necessity to gain access, you can provide the plot data or a summary of the plot data, but not the GPS coordinates.

Don’ts:

• Do not provide coordinates of plot locations. If copies of the plot data sheets are provided to the landowner, please be sure to remove these coordinates.

• Do not provide forest management or forest pest management advice. You can direct any landowner to contact their county, state, or cooperative forester for forest management or forest pest advice.

0.3U+N Plot Monumentation

Record two witness objects on the subplot. Microplot WITNESS OBJECTs are required whenever subplot center cannot be accessed and whenever there is a concern that the next crew may have a problem locating the microplot. Ideally, permanent objects within 100 ft. and as close to the subplot /microplot center as possible should be selected. These objects could be, but are not limited to, utility poles, mail boxes, or the corner of a building. When permanent objects are not available use the next best available options, which could be live trees. If no witness objects are present, include other features that may help the next crew locate the plot on the plot cluster diagram and install a Starting Point (SP) / Reference Point (RP) according to regional guidelines. Include additional notes in the PLOT NOTES section if needed. In urban areas talk to the landowner in regards to marking trees with paint, markers, scribes, or other means. In some cases owners may allow the base of a tree to be marked if the mark is out of view.

NRS NOTE: Location correction for SK 1 plots - If the ground location is clearly not the point depicted by the “X” on the image (as demonstrated by obvious features on the image), and the correct location can be determined on the ground, install the plot in the correct location. If there are no clear features on the image, or if there are but it is NOT obvious that the plot location should be adjusted, leave the plot location as it was established through standard plot instillation procedures. The office provided coordinates override the traditional photo work course to sample and the “X” on the image overrides the Coordinates in terms of accurately establishing PC on a SK 1 install. This is only done on a SK 1 when it is obvious that the location determined by chaining azimuth and distance does not agree with the location on the photo or image provided.

0.3.1U MONUMENT TYPE [MOTY]

Record the code to indicate what MONUMENT TYPE is being described.
When Collected: Two subplot Witness Objects, OR a Starting Point (SP) / Reference Point (RP) when no Witness Objects are possible, per occupied plot that contains an URBAN CONDITION STATUS 2, 3, or 4. Plots that contain at least one URBAN CONDITION STATUS 1 are monumented based on Regional CORE standards. Microplot Witness Objects as needed.

(URBAN OPTIONAL) Install 3 witness objects for accessible plots. One Starting Point (SP) / Reference Point (RP) on field plots where data is collected without physical access to the plot area. Install 2 subplot Witness Objects for each OFFSET point visited, or passed through, on plots where the subplot center cannot be occupied.

Field width: 1 digit
Tolerance: No tolerance
MQO: At least 99% of the time
Values:
1 Starting Point (SP) / Reference Point (RP)
2 Witness Object
3 No Witness Object available

0.3.2U MONUMENT NUMBER [MO#]
Record the MONUMENT NUMBER for the monument being described. Each plot may have up to eleven monuments, including a Starting Point (SP) / Reference Point (RP) tree. Start with the Starting Point (SP) / Reference Point (RP) if there is one, followed by the subplot and then continue with the microplots in a clockwise manner starting with microplot 11.

When Collected: MONUMENT TYPE 1, 2
Field width: 2 digits
Tolerance: No tolerance
MQO: At least 99% of the time
Values: 1-11

0.3.3U+GT SUBPLOT / MICROPLLOT NUMBER [S/M#]
Record the code to indicate which SUBPLOT OR MICROPLOT is being monumented.

When Collected: Record for each MONUMENT TYPE 1 or 2
Field width: 2 digits
Tolerance: No tolerance
MQO: At least 99% of the time
Values:
01 Subplot (PC)
02 Subplot 2
03 Subplot 3
04 Subplot 4
11 Subplot 1 Microplot
21 Subplot 2 Microplot
31 Subplot 3 Microplot
41 Subplot 4 Microplot

0.3.4U+GT SUBPLOT / MICROPLLOT OFFSET POINT [OFFPT]
Record the code to indicate which OFFSET POINT is being monumented.
When Collected: Record for each MONUMENT TYPE 1 or 2
Field width: 3 digits
Tolerance: No tolerance
MQO: At least 99% of the time
Values:

1 subplot 1
2 subplot 2
3 subplot 3
4 subplot 4
110 Subplot 1 microplot
21 Subplot 2 microplot
31 Subplot 3 microplot
41 Subplot 4 microplot

0.3.5U+N WITNESS OBJECT / SP / RP TYPE [WTYPE]
Indicate the type of reference used to monument the SUBPLOT / MICRO PLOT. Choose a Witness Object that is most likely to still be present when the plot is remeasured in the future, for example, a sewer drain is more likely to be present than a street sign. Items in bold are preferred when possible (i.e. 4 fire hydrant, 10 sewer/storm cover, 11 sewer/storm drain).

When Collected: Record for each MONUMENT TYPE 1 or 2
Field width: 2 digits
Tolerance: No tolerance
MQO: At least 99% of the time
Values:

1 Tally species (Only use trees if no other viable options are available)
2 Corner of House/Building (the front side of a home is preferable to the rear, as additions are often added to the rear.)
3 Electric Meter
4 Fire Hydrant
5 Gas Meter
6 Mailbox
7 Fence Post
8 Street Sign
9 Utility Pole
10 Sewer/Storm Cover
11 Sewer/Storm Drain
12 Street Lamp
13 Sprinkler Box
14 Utility Box
99 Other Object

0.3.6U WITNESS OBJECT / SP / RP SPECIES [WSPP]
Indicate the species used as a monument.
When Collected: Record for WITNESS OBJECT / SP / RP TYPE=1
Field width: 4 digits
Tolerance: No tolerance
MQO: At least 99% of the time
Values: See Appendix 3+N and Appendix 3BU+N

0.3.7U  OBJECT DESCRIPTION [DESC]
Describe the reference used to monument the SUBPLOT / MICRO PLOT. Be as descriptive as needed. For example, if there is more than one Fence Post in the area, state that it is the third post south of the driveway (Ctr. E on the PDR).

When Collected: Record for WITNESS OBJECT / SP / RP TYPE 2-12
Field width: 240 characters
Tolerance: No tolerance
MQO: At least 99% of the time
Values: Letters, numbers, and special characters

0.3.8U  MONUMENT AZIMUTH [AZM]
MONUMENT TYPE = 1 record the MONUMENT AZIMUTH from the Starting Point (SP) / Reference Point (RP) to the center of the subplot / microplot center or their corresponding OFFSET POINT.

MONUMENT TYPE = 2 Record the MONUMENT AZIMUTH from subplot / microplot center or their corresponding OFFSET POINT to the center of the WITNESS OBJECT / SP / RP TYPE.

Record the AZIMUTH to the nearest degree. Use 360 for north.

When Collected: Record for MONUMENT TYPE 1 or 2
Field width: 3 digits
Tolerance: +/- 10 degrees
MQO: At least 90% of the time
Values: 001 to 360

0.3.9U  MONUMENT HORIZONTAL DISTANCE [HDIS]
Record the measured HORIZONTAL DISTANCE, to the nearest 0.1 foot, from the center (or corner if monumenting a building) of the MONUMENT TYPE to the corresponding subplot / microplot center or their corresponding OFFSET POINT depending on which is being monumented.

When Collected: Record for MONUMENT TYPE 1 or 2
Field width: 5 digits (xxxx.y)
Tolerance: Monument Type 1: +/- 33.0 ft
Monument Type 2: 000.1 ft. to 0139.9 ft.: +/- 1.0 ft.
0140.0 ft. to 0500.0 ft.: +/- 2.0 ft.
0500.1 ft. to 0999.9 ft.: +/- 3.0 ft.
MQO: Monument Type 1: 99% of the time
Monument Type 2: At least 90% of the time
Values: Monument Type 1: 0000.1 ft. to 9999.9 ft.
Monument Type 2: 0000.1 ft to 0999.9 ft.

0.3.10U MONUMENT DBH / DRC [DBH]
Record the MONUMENT DBH / DRC when a tree is used as a monument.
When Collected: WITNESS OBJECT / SP / RP TYPE = 1
Field width: 4 digits (xxx.y)
Tolerance: +/- 0.1 inch per 20.0 inch increment of measured diameter
For woodland species: +/- 0.2 inch per stem
MQO: At least 95% of the time.
Values: 001.0 to 999.9

0.4U+G GPS Starting Point Variables Not Collected in Ground Truth

0.5N Plot Data Security
All collected data are considered SENSITIVE MATERIAL and are private! NRS-FIA must safeguard all the data to best of our ability. Do not give out any information about specific plots or landowners unless authorization has been given from St. Paul or Newtown Square. Landowners are allowed access to plot data collected on their property. Plot information can be given to the owner of the property, but guidelines need to be followed.

You CAN

- Show the landowner the plot packet, including the image
- Allow the landowner to accompany you to the plot location
- Offer to have a copy of the image mailed to the landowner, if they initiate the request
- Provide a summary of the information collected to the landowner

You SHOULD NOT

- Give the landowner any materials with coordinates, plot numbers, or the X marking the location
- Offer to provide extra information unless asked
- Suggest management practices in any summary information you provide

EXPLANATION

When attempting to gain permission on a plot, feel free to show the landowner the image that is in the plot packet. This will help them get an idea as to where the plot is located and help to confirm that the plot is located on their property.

If the landowner requests any of the current plot packet, including the image, do not provide them with it. Legally, we cannot provide the coordinates, plot number, or the exact location on the image to a landowner. Instead, offer to have a copy of the image mailed to them and indicate it will take a few days. This image will not contain an 'X' that marks the plot center. If the landowner needs the general location indicated, a circle (~5 acres in size) can be added at the crew’s request.

If the landowner requests to accompany you onto the plot, this is fine to allow them to do so. It is essential that you brief them that they SHOULD NOT manage the area any differently than the rest of their property. We are tracking how the resources are being utilized and any special treatment to the area will result in miss-information being reported.

If a landowner requests a follow-up report on what we encountered on plot, we are allowed to provide this as well. Make sure the landowner is aware that the data we collect is on a limited area and likely will not represent their land as a whole. Do your best to summarize the information
that was collected on plot with a write-up. DO NOT give them any management suggestions for the property.

If a landowner requests other documents or publications, do your best to fulfill this request at the field level. The response time for them to receive information will be much quicker when completed by a field crew member. If the request needs to be filled by St. Paul, it will likely be quite some time before they receive a packet. The exception to this will be if a copy of the image is requested. This request will be fulfilled in a timely manner.

Please do not make a habit of offering any of the above services. Leave it up to the landowner to make the request before an offer of information is given. It is our job to provide information to the customers, but the resources and time to provide these items is limited.

Requests for plot locations from GPS coordinates, photo images and maps and PLOT NUMBER are to be directed through St. Paul or Newtown Square. It is a federal offence to intentionally release this data. If the landowner specifically requests the GPS coordinates, forward the request to Newtown Square.

NRS-FIA has partnerships with other public agencies and other organizations. Many times, we are allowed to share information with these different partners. Prior to releasing any plot information verify with St. Paul or Newtown Square that the requestor has entered into a Memorandum of Understanding (MOU) with the Forest Service. This MOU serves to outline the conditions under which the Forest Service will release plot locations to partners who are actively engaged in implementing or forwarding the Forest Service mission through work or research, and the protections imposed to insure continued privacy and confidentiality of the personal information released.

It is everyone’s responsibility to keep the data safe and secure in order to ensure access to plots in the future. NRS-FIA must maintain a working relationship with our partners and ensuring the security of plot data is one way to achieve that goal.

0.6N Wilderness (Reserved) Areas

Servicewide Agreement O9-SA-FIA01 is in effect as of September 21, 2009 for WILDERNESS AND WILD AND SCENIC RIVERS (WWSR). This Servicewide Agreement (SA) provides special provisions for conducting FIA inventories in Wilderness areas on the National Forest System. The special provisions from this document have been noted in this field guide where it concerns plot establishment, diameter measurements, stand age and site index. Other provisions from the SA are as follows:

- At least one week prior to commencement of field operations, FIA will furnish the designated WWSR Wilderness Manager with the following information:
  - Names of key personnel involved and their titles.
  - Number of personnel per party.
  - Dates and locations of field work within Wilderness boundaries.
  - Cellular telephone numbers used by all inventory crews in lieu of radio frequencies and call names and numbers.
- This agreement does not authorize any entry upon, or activities within, any lands not under the jurisdiction of the WWSR Wilderness Manager, including private in holdings within National Forest boundaries. Such activities must be coordinated and authorized prior to entry, through the respective agency or owner.
Field personnel must carry an approved research permit at all times when engaged in data collection activities in Wilderness. This permit shall only apply to the timeframe and content of the approved project plan of work.

Measuring and recording methods in Wilderness areas must be sensitive to the generally undisturbed character of these areas and leave as few signs of disturbance as possible. It is important to be able to relocate plots, subplots, and trees measured during the inventory. In Wilderness areas, less visible markings are always appropriate. Detailed, concise sketches and notes will make subsequent relocation easier.

- Identifying tags/nails - Marking tags/nails should be used minimally, painted an approved color, and face away from obvious trails and roads. Tags and nails may only be used at the base of the reference tree. All other tally trees are marked with a nail only at the base. Thin barked trees should not have nails placed in them as there is potential for disease or death.
- Flagging - Any flagging used to facilitate entry and exit from the plot area will be removed upon completion of the plot measurements.
- Painting/Scribing - This practice will not be used to monument the plot, identify witness trees, or to mark breast height.

Specimen Collection

- No personal flora or fauna collection is permitted on Wilderness lands. Collections are for scientific or educational purposes only, dedicated to public benefit, and may not be used for personal or commercial profit. All collections for scientific purposes must be approved by the WWSR Wilderness Manager.
- No archeological or vertebrate paleontological materials may be collected. Upon location of any historical or archeological remains field work will cease and the site shall be reported immediately to the local WWSR Wilderness Manager. No disturbance of such a site is permitted.

Site Condition

- All refuse associated with field operations shall be removed from Wilderness lands and the site of any data collection or encampment shall be returned to the condition in which it was found, except as authorized by the project work plan.
- Soil disturbance is prohibited, except as specifically authorized in the mutually agreed upon project work plan.
- Temporary markers, such as flagging, may not remain in place for more than one week when study teams are not present on a site. Paint, or similar semi-permanent markers, may not be applied to rocks, plants, or other natural surfaces.

Wildlife Interaction

- Harassment, hazing, or other disturbance of wildlife is prohibited.
- Problem encounters with wildlife, including any experienced or observed incidents of wildlife obtaining food or garbage from humans, shall be reported promptly to the WWSR Wilderness Manager. All food and garbage will be stored in a sealed containers approved by the local WWSR Wilderness Manager. Field personnel will make all reasonable efforts to prevent wildlife from obtaining food or garbage from humans.

National Parks have similar requirements. Permits are required for any research work completed within the park. FIA has a national agreement to use tags and nails. Do not paint or scribe in a National Park.
0.7N Border States Not Collected in Ground Truth
1.0+GT PLOT LEVEL DATA

All variables listed in Section 1.0 are collected on plots with containing at least one accessible forest land, accessible nonforest land, noncensus water, or census water condition (URBAN / GROUND TRUTH PLOT STATUS = 1 - 3) and all Nonforest/Nonsampled plots (URBAN / GROUND TRUTH PLOT STATUS = 2 or URBAN / GROUND TRUTH PLOT STATUS = 3 - 4). In general, plot level data apply to the entire plot and they are recorded from the center of subplot 1. A plot is considered nonforest if no part of it is currently located in forest land (URBAN / GROUND TRUTH CONDITION CLASS STATUS = 1). A plot is nonsampled if the entire plot is not sampled for one of the reasons listed in URBAN / GROUND TRUTH PLOT NONSAMPLED REASON.

If a forest plot has been converted to nonforest or becomes a nonsampled plot, the previous data are reconciled and an attempt is made to visit the plot during the next inventory. If a nonforest plot becomes forest or access is gained to a previously nonsampled plot, a new forest ground plot is installed. All nonforest and nonsampled plots are visited if there is any reasonable chance that they might include some forest land condition class.

Trees on previously forest land plots will be reconciled during data processing. There is a distinction between plots that have been clearcut, and plots that have been converted to another land use. A clearcut plot is considered to be forest land until it is actively converted to another land use. Additional information concerning land use classifications is contained in Section 2.3.

1.0.1 CYCLE [CYCL]

This variable represents the number of times a state has been inventoried (includes periodic and annual). In the annual inventory, a cycle is the completion of all sub-cycles.

When collected: All plots
Field width: 2 digits
Tolerance: N/A
MQO: N/A
Values: Downloaded value and preprinted on plot location sheet (See also Appendix J)

1.0.2 SUB-CYCLE [SUBC]

This variable identifies the sub-panels that are being inventoried. In the annual forest inventory, a sub-cycle is the completion of 14 sub-panels (five year cycle length) or 10 sub-panels (seven year cycle length) in a year.

When collected: All plots
Field width: 1 digit
Tolerance: N/A
MQO: N/A
Values: Downloaded value and preprinted on plot location sheet (See also Appendix J)

1.1 STATE [ST]

Record the unique FIPS (Federal Information Processing Standard) code identifying the State where the plot center is located.
1.1.1N UNIT [UNIT]
Record the unique code identifying the inventory unit where the plot center is located.

When collected: All plots
Field width: 2 digits
Tolerance: No errors
MQO: At least 99% of the time
Values: See Appendix 1 (Downloaded value and preprinted on plot location sheet)

1.2+N COUNTY [CNTY]
Record the unique FIPS (Federal Information Processing Standard) code identifying the county, parish, or borough (or unit in AK) where the plot center is located.

When collected: All plots
Field width: 4 digits
Tolerance: No errors
MQO: At least 99% of the time
Values: See Appendix 1 (Downloaded value and preprinted on plot location sheet)

1.3+N PLOT NUMBER [PLT#]
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).

NRS Note: Contact the St. Paul office to obtain a replacement PLOT NUMBER when SAMPLE KIND = 3. Two electronic data files will be required in this case. One with the original number defined as a Lost Plot and one with the new number defined as a Replacement Plot.

When collected: All plots
Field width: 5 digits
Tolerance: No errors
MQO: At least 99% of the time
Values: 00001 to 99999 (Downloaded value and preprinted on plot location sheet)

1.4+N+GT URBAN / GROUND TRUTH PLOT STATUS [UGT STAT]
Record the code that describes the sampling status of the plot. In cases where a plot is accessible - Denied or Hazardous land, record URBAN / GROUND TRUTH PLOT STATUS = 4.
When collected: All plots
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 on plot
2. Sampled – no accessible forest but at least one accessible nonforest land condition present on plot
3. Sampled -- possibility of forest land no accessible forest or nonforest land condition present on subplot, i.e. subplot is either census and / or noncensus water
4. Nonsampled -- possibility of forest land

1.5N NONFOREST SAMPLING STATUS Not Collected in Ground Truth

1.6 NONFOREST PLOT STATUS Not Collected in NRS Not Collected in Ground Truth

1.7U+GT URBAN / GROUND TRUTH PLOT NONSAMPLED REASON [UGT REAS]
For entire plots that cannot be sampled, record one of the following reasons.

When collected: When URBAN / GROUND TRUTH PLOT STATUS = 3.4
Field width: 2 digits
Tolerance: No errors
MQO: At least 99% of the time

Values:
01. Outside U.S. boundary – Entire plot is outside of the U.S. border.
02. Denied access – Access to the entire plot is denied by the legal owner, or by the owner of the only reasonable route to the plot. Because a denied-access plot can become accessible in the future, it remains in the sample and is re-examined at the next occasion to determine if access is available.
03. Hazardous – Entire plot cannot be accessed because of a hazard or danger, for example cliffs, quarries, strip mines, illegal substance plantations, high water, etc. Although most hazards will not change over time, a hazardous plot remains in the sample and is re-examined at the next occasion to determine if the hazard is still present.
05. Lost data – Plot data file was discovered to be corrupt after a panel was completed and submitted for processing. This code is applied at the time of processing after notification to the units. This code is for office use only. Not Collected in NRS
06. Lost plot – Entire plot cannot be found. Whenever this code is assigned, a replacement plot is required. The plot that is lost is assigned SAMPLE KIND = 2 and URBAN / GROUND TRUTH PLOT NONSAMPLED REASON = 6. The replacement plot is assigned SAMPLE KIND = 3.
07. Wrong location – Previous plot can be found, but its placement is beyond the tolerance limits for plot location. Whenever this code is assigned, a replacement plot is required. The plot being relocated is assigned SAMPLE KIND = 2 and NONSAMPLED REASON = 7. Its replacement plot is assigned SAMPLE KIND = 3. Not Collected in NRS
08. Skipped visit – Entire plot skipped. Used for plots that are not completed prior to the time a panel is finished and submitted for processing. This code is for office use only. Not Collected in NRS
09. Dropped intensified plot - Intensified plot dropped due to a change in grid density. This code used only by units engaged in intensification. This code is for office use only. Not Collected in NRS
10 Other – Entire plot not sampled due to a reason other than one of the specific reasons already listed. A field note is required to describe the situation.

11 Ocean – Plot falls in ocean water below mean high tide line.

1.8 NONFOREST PLOT NONSAMPLED REASON

Not Collected in NRS
Not Collected in Ground Truth

1.9+N SUBPLOTS EXAMINED [EXAM]

Record the number of subplots examined. By default, PLOT STATUS = 1 plots have all 4 subplots examined.

NRS Note: Each state has up to 25 nonforest QA/QC PI and potentially a QA/QC SPECIAL plot that require a field visit to confirm if the Prefield photo interpretation was properly determined in the office. These plots cannot be coded as 1. These plots require on-site field verification. (See Regional Appendix A for additional information.)

When collected: All plots
Field width: 1 digit
Tolerance: No errors
MQO: At least 90% of the time

Values:

1 Only subplot 1 center condition examined and all other subplots assumed (inferred) to be the same – Utilized during Photo Interpretation in office from photos, maps, etc.

4 All four subplots fully described (no assumptions/inferences) – on site field verification. Subplot center does not need to be occupied.

1.10+N+GT SAMPLE KIND [SK]

Record the code that describes the kind of plot being installed.

NRS Note: When a plot is being located over a previous established plot (DA, Haz, or Skipped Visit), the plot center of subplot 1 will be established over the previous established plot center. (See Regional Appendix C for special instructions.)
When collected: All plots
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values: *(Downloaded value and preprinted on plot location sheet)*

1. **Initial plot establishment** - the initial establishment and sampling of a national design plot (FIA Field Guide versions 1.1 and higher). SAMPLE KIND 1 is assigned under the following circumstances:
   - Initial activation of a panel or subpanel
   - Reactivation of a panel or subpanel that was previously dropped
   - Resampling of established plots that were not sampled at the previous visit *(URBAN / GROUND TRUTH PLOT STATUS = 4 and PLOT NONSAMPLED REASON = 02 or 03 from the previous annual inventory cycle)*

2. **Remeasurement** – remeasurement of a national design plot that was sampled at the previous annual inventory cycle.

3. **Replacement plot** - a replacement plot for a previously established plot. Assign SAMPLE KIND = 3 if a plot is re-installed at a location other than the original location (i.e., plots that have been lost, moved, or otherwise replaced). Note that replacement plots require a separate plot file for the replaced plot. Replaced plots are assigned SAMPLE KIND = 2, URBAN / GROUND TRUTH PLOT STATUS = 4, and the appropriate URBAN / GROUND TRUTH PLOT NONSAMPLED REASON code. The plot number for the new (replacement) plot is assigned by NIMS. Contact the St. Paul office for a new plot number.

### 1.10.1 PHASE

This variable indicates the type of plot that is being completed. Phase 2 (P2) represents all plots from the base grid. Phase 3 (P3) plots are a subset of Phase 2. Phase 3 plots were previously identified and known as FHM plots. P2+ is a combination of P2 and P3 where a "lite" version of P3 data are collected. P3 plots are the same as P2+ but add soils sampling. REGEN LITE are the same as P2+ without crowns and DWM.

When collected: All plots
Field width: 1 digit
Tolerance: N/A
MQO: N/A
Values: 2 or 3 (downloaded “hidden” value and preprinted on plot location sheet only)

### 1.11 PREVIOUS PLOT NUMBER [PRV#]

Record the identification number for the plot that is being replaced.
When collected: When SAMPLE KIND = 3
Field width: 5 digits
Tolerance: No errors
MQO: At least 99% of the time
Values: 00001 to 99999

1.12 +N FIELD GUIDE VERSION
Record the version number of the National Core Field Guide that was used to collect the data on this plot. FIELD GUIDE VERSION will be used to match collected data to the proper version of the field guide.

NRS Note: This variable is auto coded as a downloaded "hidden" variable within the MIDAS PDR Application.

When collected: All plots
Field width: 2 digits (x.y)
Tolerance: No errors
MQO: At least 99% of the time
Values: 7.2

1.13 +N Current and Previous Date
Record the year, month, and day that the current plot visit was completed as described in 1.13.1 – 1.13.3+N. Previous plot year and month for all remeasurement plots are downloaded/hidden variables used for logic checks in Condition and Tree data.

1.13.1 YEAR [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: ≥ 2003

1.13.2 MONTH [MONT]
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:

<table>
<thead>
<tr>
<th>Month</th>
<th>Day</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td>01</td>
</tr>
<tr>
<td>February</td>
<td>02</td>
</tr>
<tr>
<td>March</td>
<td>03</td>
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<td>April</td>
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<td>September</td>
<td>09</td>
</tr>
<tr>
<td>October</td>
<td>10</td>
</tr>
<tr>
<td>November</td>
<td>11</td>
</tr>
<tr>
<td>December</td>
<td>12</td>
</tr>
</tbody>
</table>

1.13.3 DAY [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

1.13.4N PREVIOUS YEAR [PYEAR]
The year that the plot was previously completed is used as a logic check for recorded condition and tree data.

When collected: All plots
Field width: 4 digits
Tolerance: N/A
MQO: N/A
Values: Downloaded “hidden” value and preprinted on plot location sheet

1.13.5N PREVIOUS MONTH [PMON]
The month that the plot was previously completed is used as a logic check for recorded condition and tree data.

When collected: All plots
Field width: 2 digits
Tolerance: N/A
MQO: N/A
Values: Downloaded “hidden” value and preprinted on plot location sheet

1.13.6N PREVIOUS DAY [PDAY] Not Collected in NRS CORE
The day that the plot was previously completed is used as a logic check for recorded condition and tree data.

When collected: All urban plots
Field width: 2 digits
Tolerance: No errors
MQO: At least 99% of the time
Values: Downloaded “hidden” value and preprinted on plot location sheet

1.14 DECLINATION (CORE OPTIONAL) Not Collected in NRS

1.15 +U+N+GT HORIZONTAL DISTANCE TO IMPROVED ROAD [RDIS]
Record the straight-line distance from plot center (subplot 1) to the nearest improved road. An improved road is a road of any width that is maintained as evidenced by pavement, gravel, grading, ditching, and/or other improvements. A private drive, farm lane, or access road that meets the qualifications for an improved road is considered an improved road unless it is within a developed area (GTNFLU 300 series). NRS Note: Improved roads should not have advanced rutting, old washouts, old fallen trees, vegetation, etc. that inhibits regular vehicular travel.
When collected: All plots with either one accessible forest land condition class (URBAN/GROUND TRUTH PLOT STATUS = 1) or one accessible nonforest land condition class when nonforest is field-measured (PLOT STATUS = 2 and NONFOREST SAMPLING STATUS = 1 and NONFOREST PLOT STATUS =1)

Field width: 1 digit
Tolerance: No errors
MQO: At least 90% of the time

Values:
1. 100 ft or less – 1.5 chains or less
2. 101 to 300 ft – 1.5 chains to 4.55 chains
3. 301 to 500 ft – 4.55 chains to 7.58 chains
4. 501 to 1000 ft – 7.58 chains to 15.2 chains
5. 1001 ft to 1/2 mile – 15.2 chains to 40 chains
6. 1/2 to 1 mile – 40 chains to 80 chains
7. 1 to 3 miles – 80 chains to 240 chains
8. 3 to 5 miles – 240 chains to 400 chains
9. Greater than 5 miles – greater than 400 chains

1.16 U+N+GT WATER ON PLOT [WTYP]

Record the water source that has the greatest impact on the area within the accessible forest/nonforest land portion of any of the four subplots. The coding hierarchy is listed in order from large permanent water to temporary water (too small to qualify as noncensus water). This variable can be used for recreation, wildlife, hydrology, and timber availability studies. Do not tally this variable for water that is already defined as a separate Noncensus or Census Water Condition. This variable is intended to indicate the presence of water that has not already been defined as its own separate condition.
When collected: All plots with either at least one accessible forest land condition class (URBAN \_GROUNDF TRUTH PLOT STATUS = 1) or one accessible nonforest land condition class when nonforest is field-measured (PLOT STATUS = 2 and NONFOREST SAMPLING STATUS = 1 and NONFOREST PLOT STATUS = 1)

Field width: 1 digit
Tolerance: No errors
MQO: At least 90% of the time

Values:

0  None – no water sources within the accessible forest/nonforest land
1  Permanent streams or ponds too small to qualify as noncensus water
2  Permanent water in the form of deep swamps, bogs, marshes without standing trees present and less than 1.0 ac in size, or forested swamps, bogs or marshes classified as accessible forest land with standing trees
3  Ditch/canal – human-made channels used as a means of moving water, such as irrigation or drainage which are too small to qualify as noncensus water
4  Temporary streams
5  Flood zones – evidence of flooding when bodies of water exceed their natural banks
9  Other temporary water – specify in plot notes (includes Springs)

1.17 QA STATUS [QAST]

Record the code to indicate the type of plot data collected, using the following codes:

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

Values:

1  Standard production plot
2  Cold check
3  Reference plot (off grid)
4  Certification/practice plot (off grid)
5  Botched plot file (disregard during data processing)
6  Blind check
7  Hot check (production plot)

1.18 CREW NUMBER [CRW1, CRW2, CRW3, CRW4, CRW5]

Record up to 5 crew numbers as assigned to the field crew; always record the crew leader first. The first 2 digits are for the responsible unit’s station number (NRS = 24xxx, SRS = 33xxx, RMRS = 22xxx, and PNW = 26xxx).

When collected: All plots
Field Width: 6 digits
Tolerance: No errors
MQO: At least 99% of the time

Values:

NRS  240001 – 249999
SRS  330001 – 339999
RMRS  220001 – 229999
PNW  260001 – 269999

1.18.1 UN-GT QA SCORE [QASC] (URBAN OPTIONAL)

Record the QA score to the nearest tenth of a percent when URBAN / GROUNDF TRUTH PLOT STATUS is 1 (Sampled – at least one accessible forest land condition), 2 (Sampled – no
accessible forest land but at least one nonforest condition), or 3 (Sampled - no accessible forest
or nonforest condition) present on plot and QA STATUS is 2 (cold check) or 6 (blind check). (See
Regional Appendix C for additional information about PI and Special plot designation.)

When collected: Plots with URBAN PLOT STATUS = 1 - 3 and QA STATUS = 2 or 6.
Field width: 4 digits
Tolerance: No errors
MQO: At least 99% of the time
Values: 000.0 to 100.0

1.18.1.1 UN-GT, QA SCORE CREW NUMBER [PROD1, PROD2, PROD3, PROD4, PROD5] (URBAN
OPTIONAL)

Record up to 5 crew numbers as assigned to the production field crews associated with the QA
SCORE, always record the crew leader first. The first 2 digits are for the responsible unit's station
number (NRS – 24xxxx, SRS – 33xxxx, RMRS – 22xxxx, and PNW – 26xxxx).

When collected: Plots with URBAN / GROUND TRUTH, PLOT STATUS = 1 - 3 and QA STATUS
= 2 or 6.
Field Width: 6 digits
Tolerance: No errors
MQO: At least 99% of the time
Values:

NRS 240001 – 249999
SRS 330001 – 339999
RMRS 220001 – 229999
PNW 260001 – 269999

1.18.2 ONE OR TWO PERSON PLOT [CRSZ]

Enter a code which indicates that the plot could be completed with either a one person crew or
with a two person crew. As a guideline, consider what can be completed safely by an average
crewmember or crew.

When collected: All plots where Plot Status (STAT) = 1, or 2, or 3
Field width: 1 digit
Tolerance: N/A
MQO: N/A
Values:

1 Could be completed by a one person crew
2 Should be completed by a two person crew

1.18.3N PLOT SEASON [SEAS]

Enter the code reflecting the best time of year to access and complete this plot. If there are no
hindrances (e.g., water, vegetation, remoteness) for completing this plot at any time of year, enter
code 3. Do not base your assessment on whether or not the plot is chosen for P2+, P3, PA
Regeneration.
When collected: All plots where Plot Status (STAT) =1, 2, or 3
Field width: 1 digit  
Tolerance: N/A  
MQO: N/A  
Values:  
1 Winter  
2 Summer  
3 Anytime

1.18.4N TRAINING PLOT [TRAN]
Indicate whether the plot is completed by a crew with a new Federal crew member. Plots coded as 1 “training plot” will typically take more time to complete due to explaining, defining, and demonstrating how to collect FIA plot data. Supervisory approval is required in order to code 1 “training plot” outside the normal window allowed for training a new Federal crew member.

When collected: All plots  
Field width: 1 digit  
Tolerance: N/A  
MQO: N/A  
Values:  
0 Standard production plot  
1 Training plot

1.18.5N DENIED ACCESS REASON [DARE]
Record the method by which a plot was Denied Access. Choose from the following codes. If more than one method applies, choose the last method you used in the attempt to obtain permission.

When collected: When PLOT STATUS = 3 (Nonsampled with possibility of forest land present) and PLOT NONSAMPLED REASON = 2 (Denied access).
Field width: 1 digit  
Tolerance: No errors  
MQO: At least 99% of the time  
Values:  
1 In person  
2 On phone  
3 Letter with NO phone number available  
4 Letter WITH phone number available  
5 Unable to contact – NO phone number and didn’t respond to letter  
6 Unable to contact – WITH phone number and didn’t respond to letter  
7 Insufficient public information – NO phone number, letters returned as undeliverable

1.19+N GPS Coordinates
Use a global positioning system (GPS) unit to determine the plot coordinates and elevation of all field-visited plot locations even if GPS has been used to locate the plot in the past.

NRS Note: Every attempt should be made to collect GPS data at plot center. If it is not possible to collect GPS data at plot center, attempt to compute an offset location to PC (see Offset instructions in Appendix G). If this too is not possible, and GPS data is not collected, do not enter either the previous coordinates or the PI coordinates from the plotsheet into the data recorder.

The procedures to enter data into the data recorder when GPS coordinates are not taken are as follows (much of the GPS screen should be left blank):
Enter 'GPS Unit' as '0' (GPS coordinates not collected)
Delete the downloaded value for 'GPS Datum' (DATM)
Delete the downloaded value for 'Coordinate System' (CSYS)
Leave all other data item blank

For the standard field plots, if coordinates were not collected, a PLOT NOTE must be entered in the MIDAS PDR Application and on the plotsheet. If it is a QAQC-PI plot, a note is not necessary.

1.19.1 GPS Unit Settings, Datum, and Coordinate System
Consult the GPS unit operating manual or other regional instructions to ensure that the GPS unit internal settings, including Datum and Coordinate system, are correctly configured. Each FIA unit will use the NAD83 Datum to collect coordinates.

Each FIA unit will determine which coordinate system to use. Regions using a Geographic system will collect coordinates in Degrees, Minutes, and Seconds of Latitude and Longitude; the regions using the UTM coordinate system will collect UTM Easting, Northing, and Zone.

1.19.2 Collecting Readings
Critical GPS settings such as maximum PDOP, maximum EHE, minimum satellite elevation, minimum SNR, and number of readings to average will be determined by each region based on recommendations from the Mobile Geospatial Technology Advisory Group (MGTAG) where available. These may be collected in a file for post-processing or may be averaged by the GPS unit.

NRS Note: Most NRS-FIA Allegros are loaded with LANDMARK CE software and are accompanied with an EMTAC/RIGHTWAY/QSTARZ GPS receiver. When using a combination of the two, the LANDMARK CE software will allow a coordinates file to be created on the Allegro that can auto-populate the MIDAS Starting Point or Plot Center GPS screens. Once the LANDMARK CE software has completed it averaging process, navigate to either the MIDAS Starting Point or Plot Center GPS screen and Click on Ctrl+K. This will auto-populate the point data into their respective fields.

Soon after arriving at plot center, use the GPS unit to attempt to collect coordinates. If suitable positions cannot be obtained, try again before leaving the plot center.

If it is still not possible to get suitable coordinates from plot center, attempt to obtain them from a location within 200 feet of plot center. Obtain the azimuth and horizontal distance from the "offset" location to plot center. If LANDMARK CE software is used, use the offset function to compute the coordinates of the plot center. If another type of GPS unit is used, record the azimuth and horizontal distance as described in Sections 1.19.14 and 1.19.15.

Coordinates may be collected further away than 200 feet from the plot center if a laser measuring device is used to determine the horizontal distance from the "offset" location to plot center. Again, if LANDMARK CE software is used, use the offset function to compute the coordinates of the plot center. If another type of GPS unit is used, record the azimuth and horizontal distance as described in Sections 1.19.14 and 1.19.15.

NRS Note: Latitude and Longitude are collected for all new starting points (SP) where a course to plot is being established for the first time. This SP data are recorded on the plot location sheet and the data recorder. See Regional Appendix A for required PDR SP variables.
Coordinates not collected by automatic means shall be manually double-entered into the data recorder.

1.19.3+N GPS UNIT [UNIT]
Record the kind of GPS unit used to collect coordinates. If suitable coordinates cannot be obtained, record 0.

NRS Note: If GPS coordinates cannot be collected for any reason, enter code 0 for GPS UNIT. The remaining GPS variables for PC are not recorded. The regional SP coordinates will not be required either but should be transferred from previous plotsheet if present and valid. (See Regional Appendix A for required PDR SP variables.)

When collected: All field visited plots
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values:
0  GPS coordinates not collected
2  Models capable of field-averaging
3  Models capable of producing files that can be post-processed
4  Models not capable of field-averaging or post-processing

1.19.4 GPS SERIAL NUMBER [GPS#]
Record the last six digits of the serial number on the GPS unit used.

When collected: When GPS UNIT > 0
Field width: 6 digits
Tolerance: No errors
MQO: At least 99% of the time
Values: 000001 to 999999

1.19.5+N GPS ENTRY METHOD [METH]
Identify the method used to record GPS data. If GPS data are manually entered, record 0. If GPS data are transferred electronically from the GPS receiver to the data recorder, record 1.

Upon entering a 1 the following variables are automatically populated in accordance with the GPS receiver setup in 1.19.1 (coordinates LATITUDE, LONGITUDE or UTM, GPS ELEVATION, GPS ERROR, and NUMBER OF READINGS). All other GPS variables must be populated via manual key-entry.

NRS Note: GPS ENTRY METHOD is auto-populated in the PDR MIDAS Application as read-only. If the data is transferred electronically it will populate a ‘1’ in this field. If any auto-populated GPS data is keypunched, even after being transferred, a ‘0’ will be populated for GPS ENTRY METHOD.
When Collected: GPS UNIT > 0  
Field width: 1 digit  
Tolerance: No errors  
MQO: at least 99% of the time  
Values:  
0  GPS data manually entered  
1  GPS data electronically transferred

1.19.6 GPS DATUM [DATM]  
Record the acronym indicating the map datum that the GPS coordinates are collected in (i.e., the map datum selected on the GPS unit to display the coordinates).  

When collected: When GPS UNIT > 0  
Field width: 5 characters (cccn)  
Tolerance: No errors  
MQO: At least 99% of the time  
Values: NAD83 North American Datum of 1983

1.19.7+N COORDINATE SYSTEM [COORS]  
Record a code indicating the type of coordinate system used to obtain readings.  

NRS Note: The geographic coordinate system value 1 will be displayed on GPS screen as a Download Value.  

When collected: When GPS UNIT > 0  
Field width: 1 digit  
Tolerance: No errors  
MQO: At least 99% of the time  
Values:  
1  Geographic coordinate system  
2  UTM coordinate system

NRS Note: The former procedure of collecting latitude and longitude as degrees and decimal minutes is no longer applicable. Coordinates will now by collected as degrees, minutes and seconds for latitude and longitude at both SP and PC.  

Example: 41° 38.1306 degrees and decimal minutes is converted to degrees minutes and decimal seconds as:  

41°  
.1306 X 60 = 7.836 or 07.84"  

41° 38’ 07.84"  

1.19.8+N Latitude  
Record the latitude of the plot center to the nearest hundredth second, as determined by GPS.  

NRS Note: On a remeasurement annual plot (SK 2), latitude at PC is remeasured even if the previous value is satisfactory for plot relocation.
Note: The following can be customized at the region level (e.g., decimal minutes to the nearest thousandth) as long as the final results recorded are within the specified tolerance to the nearest hundredth of a second or +/- 1.01 ft.

1.19.8.1 LATITUDE DEGREES [NDEG]
Record the latitude degrees of the plot center as determined by GPS.

When collected: When COORDINATE SYSTEM = 1
Field width: 3 digits (1st digit is + or -, last 2 digits are numeric)
Tolerance: When GPS ENTRY METHOD = 0, No errors in data entry
When GPS ENTRY METHOD = 1, not applicable
MQO: When GPS ENTRY METHOD = 0, at least 99% of the time
When GPS ENTRY METHOD = 1, not applicable
Values: 0–90

1.19.8.2 LATITUDE MINUTES [NMIN]
Record the latitude minutes of the plot center as determined by GPS.

When collected: When COORDINATE SYSTEM = 1
Field width: 2 digits
Tolerance: When GPS ENTRY METHOD = 0, No errors in data entry
When GPS ENTRY METHOD = 1, not applicable
MQO: When GPS ENTRY METHOD = 0, at least 99% of the time
When GPS ENTRY METHOD = 1, not applicable
Values: 0–59

1.19.8.3 LATITUDE SECONDS [NSEC]
Record the latitude decimal seconds of the plot center to the nearest hundredth place as determined by GPS.

When collected: When COORDINATE SYSTEM = 1
Field width: 4 digits
Tolerance: When GPS ENTRY METHOD = 0, No errors in data entry
When GPS ENTRY METHOD = 1, not applicable
MQO: When GPS ENTRY METHOD = 0, at least 99% of the time
When GPS ENTRY METHOD = 1, not applicable
Values: 0.00 – 59.99

1.19.9 Longitude
Record the longitude of the plot center, to the nearest hundredth second, as determined by GPS.

NRS Note: On a remeasurement annual plot (SK 2), longitude at PC is remeasured even if the previous value is satisfactory for plot relocation.

Note: The following can be customized at the region level (e.g., decimal minutes to the nearest thousandth) as long as the final results recorded are within the specified tolerance to the nearest hundredth of a second or +/- 1.01 ft.

1.19.9.1 LONGITUDE DEGREES [WDEG]
Record the longitude degrees of the plot center as determined by GPS.
When collected: When COORDINATE SYSTEM = 1
Field width: 4 digits (1st digit is + or -, last 3 digits are numeric)
Tolerance: When GPS ENTRY METHOD = 0, No errors in data entry
When GPS ENTRY METHOD = 1, not applicable
MQO: When GPS ENTRY METHOD = 0, at least 99% of the time
When GPS ENTRY METHOD = 1, not applicable
Values: 1-180

1.19.9.2 LONGITUDE MINUTES [WMIN]
Record the longitude minutes of the plot center as determined by GPS.

When collected: When COORDINATE SYSTEM = 1
Field width: 2 digits
Tolerance: When GPS ENTRY METHOD = 0, No errors in data entry
When GPS ENTRY METHOD = 1, not applicable
MQO: When GPS ENTRY METHOD = 0, at least 99% of the time
When GPS ENTRY METHOD = 1, not applicable
Values: 0 – 59

1.19.9.3 LONGITUDE SECONDS [WSEC]
Record the longitude decimal seconds of the plot center to the nearest hundredth place as determined by GPS.

When collected: When COORDINATE SYSTEM = 1
Field width: 4 digits
Tolerance: When GPS ENTRY METHOD = 0, No errors in data entry
When GPS ENTRY METHOD = 1, not applicable
MQO: When GPS ENTRY METHOD = 0, at least 99% of the time
When GPS ENTRY METHOD = 1, not applicable
Values: 0.00 – 59.99

1.19.10 UTM ZONE Not Collected in NRS

1.19.11 EASTING (X) UTM Not Collected in NRS

1.19.12 NORTTHING (Y) UTM Not Collected in NRS

NRS Note: The following variables, pertaining to the correction for “offset”, are used only if the recorded latitude and longitude coordinates do not relate to the plot center and require post correction at the regional office. In the North, most GPS units have program software utilities to calculate plot center coordinates if azimuth and distance are known to plot center.

1.19.13 N Correction for “Offset” Location
As described in Section 1.19.2, coordinates may be collected at a location other than the plot center (an “offset” location). If the GPS unit (including LANDMARK CE software) is capable of calculating plot center coordinates then AZIMUTH TO PLOT CENTER and DISTANCE TO PLOT CENTER both equal 000.

1.19.14 AZIMUTH TO PLOT CENTER [AZM]
Record the azimuth from the location where coordinates were collected to actual plot center. If coordinates are collected at plot center or are corrected in the field to plot center, record 000.
When collected: When GPS UNIT = 2, 3 or 4  
Field width: 3 digits  
Tolerance: +/- 3 degrees  
MQO: At least 99% of the time  
Values:  
000 when coordinates are collected at plot center  
001 to 360 when coordinates are not collected at plot center

1.19.15 DISTANCE TO PLOT CENTER \[\text{DIST}\]  
Record the horizontal distance in feet from the location where coordinates were collected to the actual plot center. If coordinates are collected at plot center or are corrected in the field to plot center, record 000. As described in Section 1.19.2, if a laser range finder is used to determine DISTANCE TO PLOT CENTER, offset locations may be up to 999 feet from the plot center. If a range finder is not used, the offset location must be within 200 feet.

When collected: When GPS UNIT = 2, 3 or 4  
Field width: 3 digits  
Tolerance: +/- 6 ft  
MQO: At least 99% of the time  
Values:  
000 when coordinates are collected at plot center  
001 to 200 when a Laser range finder is not used to determine distance  
001 to 999 when a Laser range finder is used to determine distance

1.19.15.1 N \[\text{CDIF}\] COORDINATE DIFFERENCE  
This variable indicates the difference, in feet, between the historical coordinates downloaded into the Historical file and the coordinates that have been entered during the current visit. It is calculated and auto-populated once the current coordinates are entered.

When collected: When GPS UNIT = 2, 3 or 4  
Field width: 6 digits  
Tolerance:  
MQO:  
Values: 0-999999

1.19.16 N \[\text{ELEV}\] GPS ELEVATION  
Record the elevation above mean sea level of the plot center, in feet, as determined by GPS.

NRS Note: If GPS coordinates are collected at different location other than PC, no data will be entered into GPS ELEVATION.

When collected: When GPS UNIT = 2 or 4  
Field width: 6 digits (1st digit is + or -, last 5 digits are numeric)  
Tolerance: No errors  
MQO: At least 99% of the time  
Values: -00100 to +20000

<table>
<thead>
<tr>
<th>State</th>
<th>Highest Point</th>
<th>Elevation</th>
<th>Lowest Point</th>
<th>Elevation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connecticut</td>
<td>Mt. Frissel – S slope</td>
<td>2,380</td>
<td>Long Island Sound</td>
<td>Sea level</td>
</tr>
<tr>
<td>Delaware</td>
<td>Ebright Azimuth</td>
<td>448</td>
<td>Atlantic Ocean</td>
<td>Sea level</td>
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<tr>
<td>D.C.</td>
<td>Tenleytown at Reno Reservoir</td>
<td>410</td>
<td>Potomac River</td>
<td>1</td>
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<tr>
<td>Illinois</td>
<td>Charles Mound</td>
<td>1,235</td>
<td>Mississippi River</td>
<td>279</td>
</tr>
<tr>
<td>State</td>
<td>Highest Point</td>
<td>Elevation</td>
<td>Lowest Point</td>
<td>Elevation</td>
</tr>
<tr>
<td>------------</td>
<td>--------------------</td>
<td>-----------</td>
<td>-----------------</td>
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<tr>
<td>Indiana</td>
<td>Hoosier Hill Point</td>
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<td>Ohio River</td>
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<td>Iowa</td>
<td>Hawkeye Point</td>
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<td>Kansas</td>
<td>Sunflower</td>
<td>4,039</td>
<td>Verdigris River</td>
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<td>Mt. Katahdin</td>
<td>5,267</td>
<td>Atlantic Ocean</td>
<td>Sea level</td>
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<tr>
<td>Maryland</td>
<td>Backbone Mt.</td>
<td>3,360</td>
<td>Atlantic Ocean</td>
<td>Sea level</td>
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<tr>
<td>Massachusetts</td>
<td>Mt. Greylock</td>
<td>3,487</td>
<td>Atlantic Ocean</td>
<td>Sea level</td>
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<tr>
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<td>Mt. Arvon</td>
<td>1,979</td>
<td>Lake Erie</td>
<td>572</td>
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<tr>
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<td>Eagle Mt.</td>
<td>2,301</td>
<td>Lake Superior</td>
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<td>Missouri</td>
<td>Taum Sauk Mt.</td>
<td>1,772</td>
<td>St. Francis River</td>
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<td>Panorama Point</td>
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<td>Missouri River</td>
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<tr>
<td>New Hampshire</td>
<td>Mt. Washington</td>
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<td>Sea level</td>
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<td>1,803</td>
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<tr>
<td>New York</td>
<td>Mt. Marcy</td>
<td>5,344</td>
<td>Atlantic Ocean</td>
<td>Sea level</td>
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<tr>
<td>North Dakota</td>
<td>White Butte</td>
<td>3,506</td>
<td>Red River</td>
<td>750</td>
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<tr>
<td>Ohio</td>
<td>Campbell Hill</td>
<td>1,549</td>
<td>Ohio River</td>
<td>455</td>
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<tr>
<td>Pennsylvania</td>
<td>Mt. Davis</td>
<td>3,213</td>
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<tr>
<td>Rhode Island</td>
<td>Jerimoth Hill</td>
<td>812</td>
<td>Atlantic Ocean</td>
<td>Sea level</td>
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<tr>
<td>South Dakota</td>
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<td>7,242</td>
<td>Big Stone Lake</td>
<td>966</td>
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<tr>
<td>Vermont</td>
<td>Mt. Mansfield</td>
<td>4,393</td>
<td>Lake Champlain</td>
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<tr>
<td>West Virginia</td>
<td>Spruce Knob</td>
<td>4,861</td>
<td>Potomac River</td>
<td>240</td>
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<tr>
<td>Wisconsin</td>
<td>Timms Hill</td>
<td>1,951</td>
<td>Lake Michigan</td>
<td>579</td>
</tr>
</tbody>
</table>

1.19.17 GPS ERROR [ERRS]
Record the EHE error as shown on the GPS unit to the nearest foot up to 999 feet.

When collected: When GPS UNIT = 2
Field width: 3 digits
Tolerance: No errors
MQO: At least 99% of the time
Values: 000 - 999

1.19.17.1N GPS PDOP [PDOP]
Record the Position Dilution of Precision (PDOP) value as shown on the LANDMARK CE software to the nearest tenth. When averaging, the software requires a minimum amount of precision to determine whether or not to ignore a positional measurement. The recorded PDOP measures the overall accuracy of measurements.

Note: If the GPS UNIT does not display this value, enter 0.0.

When collected: When GPS UNIT = 2
Field width: 2 digits (x.y)
Tolerance: No errors
MQO: At least 99% of the time
Values: 0.0, 0.1 to 8.0

1.19.18 NUMBER OF READINGS [READ]
Record a 3-digit code indicating how many readings were averaged by the GPS unit to calculate the plot coordinates.
When collected: When GPS UNIT = 2
Field width: 3 digits
Tolerance: No errors
MQO: At least 99% of the time
Values: 001 to 999

1.19.19 GPS FILE NAME (CORE OPTIONAL) Not Collected in URBAN / GROUND TRUTH FIA Not Collected in NRS

1.20 MACROPLOT BREAKPOINT DIAMETER (CORE OPTIONAL) Not Collected in URBAN / GROUND TRUTH FIA Not Collected in NRS

1.21 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. Others may find this information helpful when checking or processing the plot data, or even when re-establishing the plot during the next inventory cycle. The value of good notes cannot be overemphasized.

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

1.21.1 N_GT SAFETY [SAFE]
Identify the presence of any safety concern(s) for future crew reference that were encountered during landowner contact, on route to the plot, and on the plot. A note is required to list the safety concern(s). Include detailed notes to ensure that individuals that may visit the site in the future are aware of the safety concerns(s) and any safety tips for future crews. At remeasurement, remeasure crews should realize conditions may have changed or previous crew may have missed a safety concern. Always be diligent for your own safety.

The Plot/Condition could still be measured despite the concern. It will be up to each individual crew to determine the level of caution necessary to justify completing the Plot/Condition or coding the Plot/Condition as Hazardous or Denied Access.

When collected: All plots. If CONDITION NONSAMPLED REASON = 3 then SAFETY = 1 is required
Field width: One digit
Tolerance: No errors
MQO: At least 99% of the time
Values:
  0 No safety concern
  1 Safety Concern(s) Present (Ctrl-E to note the specific concern)

Potential safety concerns include but are not limited to:

- Poor SPOT or cellular reception was noticed in normal work pattern and was concern due to plot area.
- Hazardous terrain, e.g. cliff or extreme slope
• Temporary natural conditions such as high water, weather/wind, fire, snow, frozen ground, etc. (Note – If unable to complete plot safely with temporary natural condition, should postpone plot completion until after temporary natural condition has passed)

• Heavy equipment in use including quarry, strip mine, mountain-top-removal, fracking, forestry, or other land development

• Ammunitions testing ground, firing range, buried explosives

• Violent, abusive, or threatening individual, landowner

• Violent, abusive, or threatening individual, non-landowner, incidental contact

• Aggressive domestic animal

• Aggressive wild animal, insects

• Marijuana plantation, mobile or clandestine drug or alcohol production site

• Noxious plants causing phytophotodermatitis, e.g. wild parsley, giant hogweed (plant families include Umbelliferae, Rutaceae, Moraceae, and Leguminosae)

1.21.1.1 \textbf{N-GT SAFETY DESCRIPTION [SDESC]}

A detailed note for future crew reference describing safety concerns related to access and completion of the plot.

When collected: SAFETY = 1
Field width: 2000 characters
Tolerance: No errors
MQO: At least 99% of the time
Values: English words or phrases that describe safety concerns on the plot.

1.22 \textbf{P2+ and PA Regen-GT} P2 Vegetation Sampling Options – Plot-Level Variables

The following options are set by the inventory unit prior to field season and are not set by field crews upon arriving at a plot. Therefore, each unit can customize the PDR program to automatically fill these variables. These variables are included to aid data management and allow various units to be compared appropriately.

1.22.1 \textbf{P2+ and PA Regen-GT} P2 VEGETATION SAMPLING STATUS

This plot-level variable determines whether P2 Vegetation data will be recorded on the plot, and the land condition class(es) on which it will be recorded. The code used will be determined by regional needs. If P2 VEGETATION SAMPLING STATUS = 0, no further data collection is required within this field guide section.

When collected: All plots
Field width: 1 digit
MQO: No errors
Tolerances: At least 99% of the time
Values:
2 P2 Vegetation data collected on all accessible nonforest land conditions
(NONFOREST CONDITION CLASS STATUS = 2)

1.22.2 \textbf{P2+ and PA Regen-GT} LEVEL OF DETAIL

This plot-level variable determines whether data are collected for Vegetation Structure only or for Species Composition as well. If LEVEL OF DETAIL = 3, then a tree species could be recorded twice, but it would have two different SPECIES GROWTH HABITS (see 8.6.1).
When collected: When P2 VEGETATION SAMPLING STATUS = 1 or 2
Field width: 1 digit
MQO: No errors
Tolerances: At least 99% of the time
Values:
1. Collect data for Vegetation Structure only; total aerial canopy cover and canopy cover by layer for tally tree species (all sizes), non-tally tree species (all sizes), shrubs/subshrubs/woody vines, forbs, and graminoids.

1.23. INVASIVE PLANT SAMPLING STATUS (Plot-level variable)
Determined whether invasive plant data will be recorded on the plot and the land class(es) on which it will be recorded.

When collected: All plots
Field width: 1 digit
MQO: At least 99% of the time
Values:
2. Invasive plant data collected on all accessible land conditions (URBAN/GROUND TRUTH CONDITION CLASS STATUS = 1, or NONFOREST CONDITION CLASS STATUS = 2, 3, and 4)

1.24. INVASIVE PLANT SPECIMEN COLLECTION RULE (Plot-level variable)
Downloaded code to indicate if collection of specimens of unknown invasive species is required.

When collected: Downloaded on all plots where INVASIVE PLANT SAMPLING STATUS = 1 or 2
Field width: 1 digit
MQO: At least 99% of the time
Values:
1. FIA unit requires specimen collection for invasive plants
0. FIA unit does not require specimen collection for invasive plants

1.25. Plot-Level Variables for DWM Protocol
The codes in this section define the type of variables and transect configuration used for measuring DWM. The variables will help define the design of previously-collected data and directly feed into compilation of expansion factors for measured DWM. These variables are predefined for an inventory and generally will be downloaded to the PDR.

1.25.1. DWAM SAMPLING STATUS (BASE)
Record the code that describes whether DWM data will be recorded and which variables will be recorded. If code = 0, no further data collection is required within this manual section.
When collected: All plots
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time

Values:
1. BASE biomass DWM variables collected on measured land conditions
   (CONDITION CLASS STATUS = 1 or NONFOREST CONDITION CLASS
   STATUS = 2).

1.25.2 P2+GT DWM NUMBER OF SUBPLOTS (BASE)
Identify the number of subplots on which DWM is measured. When DWM SAMPLING STATUS = 1 or 2, number of subplots = 4. When DWM SAMPLING STATUS = 3, value can range from 1 to 4.

When collected: All plots where DWM SAMPLING STATUS > 0
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values: 1 to 4

1.25.3 P2+GT DWM NUMBER OF TRANSECTS ON SUBPLOT (BASE)
Identify the number of transects per subplot on which DWM is measured. A “transect” is defined as a line starting from subplot center and ending at or beyond the subplot boundary. When DWM SAMPLING STATUS = 1, number of transects per subplot = 2. When DWM SAMPLING STATUS = 2, number of transects per subplot = 2 or 3. When DWM SAMPLING STATUS = 3, value can range from 1 to 3.

When collected: All plots where DWM SAMPLING STATUS > 0
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values: 1 to 3

1.25.4 P2+GT DWM TRANSECT LENGTH (BASE)
Identifies the length of each transect on which DWM is measured. The minimum transect length when DWM SAMPLING STATUS = 0 is 24.0 feet, measured to the nearest 0.1 foot. On plots where the core-optional condition classes are defined and measured on the macroplot, transect length can extend into the 58.9 foot macroplot. When DWM SAMPLING STATUS = 1 or 2, transect length equals 24 feet or 58.9 feet; when DWM SAMPLING STATUS = 3, the length can be some specified value between 24 feet and 58.9 feet (if conditions are mapped on the macroplot).

When collected: All plots where DWM SAMPLING STATUS > 0
Field width: 3 digits (xx.y)
Tolerance: +/- 1 ft
MQO: At least 95% of the time
Values: 24.0 to 58.9 feet

1.25.5 P2+GT DWM SUBPLOT LIST (BASE)
Identifies the subplots on which DWM is measured. When DWM SAMPLING STATUS = 1 or 2, subplots = 1234. When DWM SAMPLING STATUS = 3, value can range from 1000 to 4000.
When collected:
Field width:
Tolerance:
MQO:
Values: 1000 to 4000

1.25.6. **P2+-GT** DWM NOTES (BASE)

Use these fields to record notes pertaining to the Down Woody Materials indicator. 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 where DWM SAMPLING STATUS >0, as needed
Field width: Unlimited alphanumeric character field
Tolerance: N/A
MQO: N/A
Values: English language words, phrases and numbers

1.26. **N-P2+ and PA Regen+GT** BROWSE IMPACT [BRWS] (Plot-level variable)

BROWSE IMPACT refers to the consumption of tender shoots, twigs, and leaves of trees and shrubs used by ungulates for food. Estimate the amount of browsing pressure exerted on regeneration [by deer, elk, feral hogs, livestock, and moose]. The assessment considers the amount of browse pressure, which is a function of ungulate density and available food sources. Evaluation of browse impact requires diligence in considering variables that vary from plot to plot, such as the amount of sunlight reaching the forest floor, food preferences of local ungulate populations, availability of plants that ungulates eat, proximity of other food sources (e.g. cropland), density of competing understory vegetation, disturbance history, and other variables.

Record the browse impact on the area within the accessible forest land portion of the four subplots.

When Collected: All plots with at least one accessible forest land or nonforest land condition class (GROUND TRUTH PLOT STATUS = 1 or 2) and with at least one subplot sampled for Advance Regeneration (REGENERATION MICROPLOT STATUS = 1).
Field width: 1 digit
Tolerance: +/- 1 class
MQO: At least 90% of the time

Values:
1 Very Low: Plot is inside a well-maintained exclosure.
2 Low: Minimal browsing observed or vigorous seedlings present and of varied height (no well-maintained exclosure present). Herbaceous plants are present and they are able to flower and fruit.
3 Moderate: Browsing evidence observed but not common. Seedlings are common but with limited variability in height. Stump sprouts are heavily browsed or not evident. Herbaceous plants show a lack of or inhibited flowering and fruiting. There is little or no evidence of browsing on non-preferred plants.
4 High: Browsing evidence common on preferred vegetation. Preferred seedlings and herbaceous plants are rare or absent. Non-preferred plants show some evidence of herbivory and browse-resistant vegetation is limited in height growth. A browse line is beginning to be visible.
5 Very High: Browsing evidence is omnipresent. Non-preferred and browse-resistant plants show signs of heavy repeated browsing. A browse line is obvious.

1.27N-GT ... Tree Resource

1.27.1N-GT ... TREE RESOURCE 1
Record if there are live seedlings, saplings and/or trees visible within the 118 foot radius circle. Complete a quick visual check of the circle. It may be necessary to measure the distance to individual trees that are near the circle boundary. It is not necessary to search for seedlings that are not readily visible. The center of Subplot 1 is the center of the 118 foot radius circle. See Figure 2GT.

If the plot is Sampled but Subplot 1 is Nonsampled due to being denied access or hazardous, use imagery and estimation to determine if trees are present within the 118 foot radius circle.

Record all Values that are present within the 118 foot radius circle.
Figure 2GT. 117 foot circle not properly depicted from this figure.
When collected: All Plots
Field width:
Tolerance: No errors
MQO: At least 99% of the time
Values:  

0  No seedlings, saplings, or trees present
1  Forestland (meeting definition and size requirements, including afforestation)
2  Treed inclusion (small block of trees that don’t meet the size requirements for forestland)
3  Windbreak / Shelterbelt (less than 120 feet wide)
4  Wide Windbreak / Shelterbelt (greater than 120 feet wide)
5  Riparian buffer
6  Wooded strip
7  Wooded fence row
8  Scattered or isolated established tree/s (include established saplings on poor sites)
9  Scattered or isolated encroaching seedlings and/or saplings - must have at least one coded out of 2-8 in order for 9 to be coded
10  Pasture with trees
11  Eastern red cedar/Rocky Mountain juniper present within a block of trees
12  Eastern red cedar/Rocky Mountain juniper present in a scattered or isolated fashion- must have code 8 or 9 coded in order for 11 to be coded

1.27.2N-GT TREE RESOURCE 2
Follow procedures described for TREE RESOURCE 1

When collected: All Plots
Field width:
Tolerance: No errors
MQO: At least 99% of the time
Values: See 1.27.1GT

1.27.3N-GT TREE RESOURCE 3
Follow procedures described for TREE RESOURCE 1

When collected: All Plots
Field width:
Tolerance: No errors
MQO: At least 99% of the time
Values: See 1.27.1GT

1.27.4N-GT TREE RESOURCE 4
Follow procedures described for TREE RESOURCE 1

When collected: All Plots
Field width:
Tolerance: No errors
MQO: At least 99% of the time
Values: See 1.27.1GT

1.27.5N-GT ORIENTATION OF WINDBREAK/SHELTERBELT
Record the primary orientation of each independent windbreak/shelterbelt that intersects, or is located within, the 118 foot radius circle. For independent windbreaks/shelterbelts that form an ‘L’
or a ‘T’, record the primary orientation for the longest stretch. If the windbreak/shelterbelt is curved, take into consideration the optimal wind direction that would be impeded in order to protect the leeward side of the windbreak/shelterbelt. Then record the orientation that is perpendicular to the wind for the curved windbreak/shelterbelt.

When collected: TREE RESOURCE = 3 or 4  
Field width: 1 digit  
Tolerance: No errors  
MQO: At least 99% of the time  
Values:  
1 North/South  
2 Northeast/Southwest  
3 East/West  
4 Northwest/Southeast

1.27.6N-GT DISTANCE TO NEAREST TREE OUTSIDE FOREST  
Record the distance, to the nearest foot, from plot center to the pith of the nearest live tree, 1 inch or greater, on the condition outside of Forestland within the 118 foot radius circle.

If the plot is Sampled but plot center is in a Nonsampled condition due to being denied access or hazardous, use imagery and estimation to determine if plot center is Nonforest and has a tree within 118 feet. If those requirements are met, estimate the distance to the closest tree to plot center.

When collected: TREE RESOURCE = 2-12 and Condition #1 URBAN / GROUND TRUTH CONDITION CLASS STATUS ≠ 1  
Field width: 3 digit  
Tolerance: No errors  
MQO: At least 99% of the time  
Values: 001-118

1.27.7N-GT TREE DENSITY  
For all plots where plot center is not forested, record the number of live seedlings, saplings, and/or trees that are visible outside of Forestland within the 118 foot radius circle.

The center of Subplot 1 is the center of the 118 foot radius circle. Complete a quick visual check of the circle. It may be necessary to measure the distance to individual trees that are near the circle boundary. It is not necessary to search for seedlings that are not readily visible.

If the plot is Sampled but plot center is in a Nonsampled condition due to being denied access or hazardous, use imagery and estimation to determine if plot center is Nonforest and if there is at least one tree within 118 feet. If those requirements are met, estimate the number of live seedlings, saplings, and/or trees that are present in what would be the Nonforest conditions.
When collected: Condition #1 URBAN / GROUND TRUTH CONDITION CLASS STATUS ≠ 1
Field width: 2 digit
Tolerance: No errors
MQO: At least 99% of the time

Values:

0 No seedlings, saplings, or trees present
1 1 to 4 seedlings, saplings, or trees present
5 5 to 10 seedlings, saplings, and/or trees present
11 11 to 25 seedlings, saplings, and/or trees present
25 Greater than 25 seedlings, saplings, and/or trees present

1.27.8N-GT TREE DENSITY IN WINDBREAKS/SHELTERBELTS

For all plots where plot center is not forested, record the number of live seedlings, saplings, and/or trees that are located in a windbreak/shelterbelt that intersects the 118 foot radius circle.

The center of Subplot 1 is the center of the 118 foot radius circle. Complete a quick visual check of the circle. It may be necessary to measure the distance to individual windbreaks/shelterbelts that are near the circle boundary. It is not necessary to search for seedlings that are not readily visible within the windbreak/shelterbelt.

If the plot is Sampled but plot center is in a Nonsampled condition due to being denied access or hazardous, use imagery and estimation to determine if plot center is Nonforest and if there is a windbreak/shelterbelt within 118 feet. If those requirements are met, estimate the number of live seedlings, saplings, and/or trees that are present in what would be the nonforest windbreaks/shelterbelts.

When collected: Condition #1 URBAN / GROUND TRUTH CONDITION CLASS STATUS ≠ 1
Field width: 2 digit
Tolerance: No errors
MQO: At least 99% of the time

Values:

0 No Windbreak / Shelterbelt present
1 1 to 4 seedlings, saplings, or trees present within a Windbreak / Shelterbelt
5 5 to 10 seedlings, saplings, and/or trees present within a Windbreak / Shelterbelt
11 11 to 25 seedlings, saplings, and/or trees present within a Windbreak / Shelterbelt
25 Greater than 25 seedlings, saplings, and/or trees present within a Windbreak / Shelterbelt

1.27.9N-GT TREE DENSITY OUTSIDE WINDBREAKS/SHELTERBELTS

For all plots where plot center is not forested, record the number of live seedlings, saplings, and/or trees that are visible outside of Forestland within the 118 foot radius circle and not located in a windbreak/shelterbelt or a forested condition.

The center of Subplot 1 is the center of the 118 foot radius circle. Complete a quick visual check of the circle. It may be necessary to measure the distance to individual trees that are near the circle boundary. It is not necessary to search for seedlings that are not readily visible.

If the plot is Sampled but plot center is in a Nonsampled condition due to being denied access or hazardous, use imagery and estimation to determine if plot center is Nonforest and if there is at least one tree within 118 feet. If those requirements are met, estimate the number of live seedlings, saplings, and/or trees that are present in what would be the Nonforest conditions and outside of the windbreaks/shelterbelts.
When collected: Condition #1 URBAN / GROUND TRUTH CONDITION CLASS STATUS ≠ 1
Field width: 2 digit
Tolerance: No errors
MQO: At least 99% of the time
Values:
0 No seedlings, saplings, or trees present
1 1 to 4 seedlings, saplings, or trees present outside a Windbreak / Shelterbelt
5 5 to 10 seedlings, saplings, and/or trees present outside a Windbreak / Shelterbelt
11 11 to 25 seedlings, saplings, and/or trees present outside a Windbreak / Shelterbelt
25 Greater than 25 seedlings, saplings, and/or trees present outside a Windbreak / Shelterbelt

1.27.10N-GT ... TREE DENSITY OF EASTERN REDCEDAR
For all plots where plot center is not forested, record the number of live eastern redcedar seedlings (erc), saplings, and/or trees that are visible outside of Forestland within the 118 foot radius circle.

The center of Subplot 1 is the center of the 118 foot radius circle. Complete a quick visual check of the circle. It may be necessary to measure the distance to individual erc that are near the circle boundary. It is not necessary to search for erc seedlings that are not readily visible.

If the plot is Sampled but plot center is in a Nonsampled condition due to being denied access or hazardous, use imagery and estimation to determine if plot center is Nonforest and if there is at least one erc within 118 feet. If those requirements are met, estimate the number of live erc seedlings, saplings, and/or trees that are present in what would be the Nonforest conditions.

When collected: Condition #1 URBAN / GROUND TRUTH CONDITION CLASS STATUS ≠ 1
Field width: 2 digit
Tolerance: No errors
MQO: At least 99% of the time
Values:
0 No erc seedlings, saplings, or trees present
1 1 to 4 erc seedlings, saplings, or trees present
5 5 to 10 erc seedlings, saplings, and/or trees present
11 11 to 25 erc seedlings, saplings, and/or trees present
25 Greater than 25 erc seedlings, saplings, and/or trees present

1.27.11N-GT ... TREE DENSITY OF EASTERN REDCEDAR IN WINDBREAKS/SHELTERBELTS
For all plots where plot center is not forested, record the number of live eastern redcedar (erc) seedlings, saplings, and/or trees that are located in a windbreak/shelterbelt that intersects the 118 foot radius circle.

The center of Subplot 1 is the center of the 118 foot radius circle. Complete a quick visual check of the circle. It may be necessary to measure the distance to individual windbreaks/shelterbelts that are near the circle boundary. It is not necessary to search for erc seedlings that are not readily visible within the windbreak/shelterbelt.

If the plot is Sampled but plot center is in a Nonsampled condition due to being denied access or hazardous, use imagery and estimation to determine if plot center is Nonforest and if there is a windbreak/shelterbelt within 118 feet. If those requirements are met, estimate the number of live erc seedlings, saplings, and/or trees that are present in what would be the nonforest windbreaks/shelterbelts.
When collected: Condition #1 URBAN / GROUND TRUTH CONDITION CLASS STATUS ≠ 1
Field width: 2 digit
Tolerance: No errors
MQO: At least 99% of the time
Values:
0  No erc present in a Windbreak / Shelterbelt
1  1 to 4 erc seedlings, saplings, or trees present within a Windbreak / Shelterbelt
5  5 to 10 erc seedlings, saplings, and/or trees present within a Windbreak / Shelterbelt
11 11 to 25 erc seedlings, saplings, and/or trees present within a Windbreak / Shelterbelt
25 Greater than 25 erc seedlings, saplings, and/or trees present within a Windbreak / Shelterbelt

1.27.12N-GT  TREE DENSITY OF EASTERN REDCEDAR OUTSIDE WINDBREAKS/SHELTERBELTS
For all plots where plot center is not forested, record the number of live eastern redcedar (erc) seedlings, saplings, and/or trees that are visible outside of Forestland within the 118 foot radius circle and not located in a windbreak/shelterbelt.

The center of Subplot 1 is the center of the 118 foot radius circle. Complete a quick visual check of the circle. It may be necessary to measure the distance to individual erc trees that are near the circle boundary. It is not necessary to search for erc seedlings that are not readily visible.

If the plot is Sampled but plot center is in a Nonsampled condition due to being denied access or hazardous, use imagery and estimation to determine if plot center is Nonforest and if there is at least one erc tree within 118 feet. If those requirements are met, estimate the number of live erc seedlings, saplings, and/or trees that are present in what would be the Nonforest conditions and outside of the windbreaks/shelterbelts.

When collected: Condition #1 URBAN / GROUND TRUTH CONDITION CLASS STATUS ≠ 1
Field width: 2 digit
Tolerance: No errors
MQO: At least 99% of the time
Values:
0  No erc seedlings, saplings, or trees present
1  1 to 4 erc seedlings, saplings, or trees present outside a Windbreak / Shelterbelt
5  5 to 10 erc seedlings, saplings, and/or trees present outside a Windbreak / Shelterbelt
11 11 to 25 erc seedlings, saplings, and/or trees present outside a Windbreak / Shelterbelt
25 Greater than 25 erc seedlings, saplings, and/or trees present outside a Windbreak / Shelterbelt
2.0 CONDITION CLASS
The Ground Truth Forest Inventory and Analysis (FIA) plot is a cluster of four subplots in a fixed pattern. Subplots are never reconfigured or moved in order to confine them to a single condition class; a plot may straddle more than one condition class. Every plot samples at least one condition class: the condition class present at plot center (the center of subplot 1).

2.1 Determination of Condition Class

2.1.1 U+N+GT Step 1: Delineate the plot area by URBAN / GROUND TRUTH CONDITION CLASS STATUS
The first attribute considered when defining a condition class is URBAN / GROUND TRUTH CONDITION CLASS STATUS. The area sampled by a plot is assigned to condition classes based upon the following differences in URBAN / GROUND TRUTH CONDITION CLASS STATUS:

1. Accessible forest land
2. Accessible Nonforest land
3. Noncensus water
4. Census water
5. Nonsampled possibility of forest land

The population of interest is subdivided into domains of interest defined by URBAN / GROUND TRUTH CONDITION CLASS STATUS. Accessible forest and Accessible Nonforest land are further subdivided by a distinct set of additional attributes. In the FIA Urban Ground Truth inventory, all lands are of interest.

2.1.2 Step 2: Further subdivide Accessible Forest Land by 6 delineation variables
Any condition class sampled as accessible forest land must be further subdivided, in order of listed priority, into smaller condition classes if distinct, contrasting condition classes are present because of variation in any of the following attributes within the sampled area:

1. URBAN / GROUND TRUTH RESERVED STATUS
2. URBAN / GROUND TRUTH OWNER GROUP
3. FOREST TYPE
4. STAND SIZE CLASS
5. REGENERATION STATUS
6. TREE DENSITY

At time of re-inventory, one additional attribute, PRESENT NONFOREST LAND USE, is used to define new condition classes if the sampled area on a plot has changed from accessible forest land to nonforest land (Note: see Section 2.5.29 +N). This allows tracking of land use changes without requiring mapping of all nonforest land condition classes on all plots.

No other attribute shall be the basis for recognizing contrasting accessible forest land condition classes. For each condition class recognized, several “ancillary attributes” that help describe the condition will be collected, but will not be used for delineation purposes (see Section 2.3.1 U+GT).
2.1.3 Non-Urban GT

Step 3: When inventorying Nonforest Land, delineate accessible Nonforest Land by 3 delineation variables:

Further subdivide accessible Nonforest Land by 3 delineation variables "Not Collected in NRS CORE"

2.2 Condition Class Status Definitions

2.2.1 Accessible Forest Land

The GROUND TRUTH project will not record any data items within Accessible Forest Land. Accessible Forest Land will be identified, delineated, and recorded in the Condition section. A Canopy Cover Check may be required to determine if an area is forested. Multiple forested conditions may be defined and recorded. ICE points will still be collected in forested conditions.

Land that is within the population of interest, is accessible, is on a subplot that can be occupied at subplot center, can safely be visited, and meets the following criteria:

Forest land has at least 10 percent canopy cover of live tally tree species of any size or has had at least 10 percent canopy cover of live tally species in the past, based on the presence of stumps, snags, or other evidence. Additionally, the condition is not subject to nonforest use(s) that specifically intended to prevent normal tree regeneration and succession, such as regular mowing, intensive grazing, or recreation activities. USE THE REGIONAL CORE SPECIES LIST WHEN DETERMINING CANOPY COVER IN REGARDS TO DEFINING FOREST LAND – NOT THE URBAN FIA SPECIES LIST.

In contrast to regular mowing, chaining treatments (as well as prescribed burns or timber stand improvements for intensively managed wildlife areas) are recognized as long-term periodic or one-time treatments. Although the intent of chaining may be permanent removal of trees, reoccupation is common in the absence of additional treatments and sometimes the treatment does not remove enough to reduce canopy cover below the threshold of forest land. As a result, only live canopy cover should be considered in areas that have been chained; missing (dead or removed) canopy cover is not considered in the forest land call.

In the cases of land on which either forest is encroaching on adjacent nonforest land, or the land that was previously under a nonforest land use (e.g., agriculture, non forested marsh or mining) is reverting to forest naturally, only the live cover criterion applies.

NRS Note: When evaluating a condition for the 10% canopy cover threshold required for forest land:

- Evaluate the condition based on observations on the day the plot is visited without taking into account how the land may be used in the future.
- Exclude from consideration any missing canopy cover (LIVE PLUS MISSING CANOPY COVER) that resulted from the most recent land use conversion.
  - Example pond: A beaver dams up a creek killing a stand of timber and creating a STATUS 3 pond. When the dam falls apart, the pond drains and the area starts to revert back to forest - do not count the trees that died as a result of the conversion to the pond.
- The Primary land use must be forest.
  - Example yard: The primary land use of a maintained backyard with canopy cover of 90% would be STATUS 2 nonforest / developed. All canopy cover originating from this area would not count towards the forest land threshold.
When dual land uses are present in the condition only consider live canopy cover. Such areas exist where regeneration or the overall lifespan of the potential forested condition is limited by the fact that there are two competing land uses present.

- Example grazing: A potential forested condition that is heavily grazed by domestic animals. In such a case the presence of the animals may increase tree mortality or prevent successful natural regeneration after tree mortality or harvest.

- Example water levels: The mean high water mark associated with some bodies of water may fluctuate from year to year or even decade to decade depending on rain fall or various activities such as dams. In such cases during periods of low water a forest might get established one year only to be flooded out a few years later.

- Example wildlife management: An area is managed for grouse habitat through the use of various forms of timber stand improvement (TSI) or prescribed fire.

In the case of deliberate afforestation – human-assisted conversion of other land use / land cover to forest land -- there must be at least 150 established trees per acre (all sizes combined) to qualify as forest land. Land that has been afforested at a density of less than 150 trees per acre is not considered forest land (see Nonforest Land below). If the condition experiences regeneration failure or is otherwise reduced to less than 150 survivors per acre after the time of planting / seeding but prior to achieving 10 percent canopy cover, then the condition should not be classified forest land.

To qualify as forest land, the prospective condition must be at least 1.0 acre in size and 120.0 feet wide measured stem-to-stem from the outer-most edge. Forested strips must be 120.0 feet wide for a continuous length of at least 363.0 feet in order to meet the acre threshold. Forested strips that do not meet these requirements are classified as part of the adjacent nonforest land.

NRS Note: See Section 2.4+U+GT for more guidance dealing with strips less than 120 feet wide.

When a forest land condition encroaches into a nonforest land condition, the border between forest and nonforest is often a gradual change in tree cover with no clear and abrupt boundary. In addition, it may be difficult to determine exactly where the forested area meets the minimum cover criteria and where it does not. For these situations, determine where the land clearly meets the 10 percent minimum canopy cover, and where it clearly is less than required cover; divide the zone between these points in half, and determine the side of the zone on which the subplot center is located. Classify the condition class of the subplot based on this line (Figure 3), using the class criteria above.
Figure 3. Example of classifying the condition class of the subplot in a transition zone with forest/nonforest encroachment.

For example, at measurement time 1, a clear and distinct boundary existed between the forest and nonforest land condition classes. At time 2, however, there now exists a zone of regeneration or small-diameter trees between the previous forest condition and where the nonforest clearly remains. If the zone of encroachment is clearly forest where it meets the nonforest, classify the entire zone as forest. If the zone is clearly nonforest up to the original stand, call it all nonforest. If the encroachment or transition zone is not clearly stocked where it meets the nonforest, determine where it is clearly forest and where it is clearly nonforest; divide this zone in half, and classify the entire subplot based on which side of the line the subplot center falls.

Treated strips – Occasionally, crews will come across plantations of trees, in which rows of trees alternate with strips of vegetation that have been bulldozed, mowed, tilled, treated with herbicide, or crushed. Because these strip treatments are conducted to optimize growth or to release the stand, the areas are considered forest land, and the treatment is considered a timber stand improvement operation. Do not confuse these practices with similar treatments on nonforest lands such as yards or Rights-of-way. Contact with the landowner may help determine the intent of a treatment.

Indistinct boundary due to the condition minimum-width definition – Do not subdivide subplots where a condition class may change due only to the forest vs. nonforest minimum width (120.0
feet) definition. Although the point where the definition changes from forest to nonforest creates an invisible “line” between conditions, this definitional boundary is not distinct and obvious. See Figure 4 and Figure 5. Where the point of the definition change occurs on the subplot, determine only if the subplot center is on the forest or nonforest side of that approximate boundary, and classify the entire subplot based on the condition of the subplot center. If the boundary crosses through the center of the subplot, classify the subplot as the condition it most resembles. If the boundary occurs between subplots, classify each subplot based on its relation to the definitional boundary.

Urban / Ground Truth NRS Note: The definitional boundary concepts described in Figure 4 and Figure 5 are not limited to Forest / Nonforest boundaries; they apply to any two conditions.

Figure 4. Forest condition narrows within a nonforest land condition. Examine the location of the subplot center in reference to the approximate line where the forest narrows to 120.0 ft wide. In this example, the entire subplot is classified as forest.

Figure 5. Nonforest land condition narrows within a forest condition. Examine the location of the subplot center in reference to the approximate line where the nonforest narrows to 120.0 ft wide. In this example, the entire subplot is classified as forest.

2.2.2\text{\textregistered}U+N\text{\textregistered}GT Accessible Nonforest Land
Land that has less than 10 percent canopy cover of tally tree species of any size (live + missing) and, in the case of afforested land, fewer than 150 established trees per acre; OR land that has
sufficient canopy cover or stems, but is classified as nonforest land use (see criteria and size requirements under section 2.5.29, GT, PRESENT URBAN / GROUND TRUTH NONFOREST LAND USE). Nonforest includes areas that have sufficient cover or live stems to meet the Forest Land definition, but do not meet the dimensional requirements. All conditions not meeting the requirements of forest land will be assigned a PRESENT URBAN / GROUND TRUTH NONFOREST LAND USE code.

**NRS Note:** Commercial cranberry bogs and concrete ponds/raceways associated with fish hatcheries and sewage treatment facilities are considered CONDITION CLASS STATUS = 2. They should NOT be coded STATUS 3 or 4. Earthen fish hatcheries or sewage treatment ponds will be considered under STATUS 3 or 4 if they meet minimum size requirements.

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**Figure 5.aN.** Neither the pond nor the grass can independently qualify as a Status 1, 3, or 4 but combined together they are an acre in size. Since Nonforest Land is defined as any land (at least 120’ and an acre in size) within the sample that does not meet the definitions of Accessible Forest Land, Noncensus Water, or Census water, the white area is defined as Status 2 (Nonforest Land).

If the combined area of the pond and grass were < 1 acre in size, the white area would be considered an inclusion within the forestland and be classified as Status 1 (Accessible Forest Land).
Figure 5.bN. The above figure displays the delineation of the plot area on the left and the assigned Condition Class of the same plot area on the right. The small pond does not qualify as a Status 1, 3, or 4 but shares a 120' boundary with the road and cropland. This shared 120' boundary allows the area of the pond to be combined with the road and cropland. In which case, the pond, the road, and the cropland are classified as Status 2 (Nonforest Land).

If the small pond did not share this 120’ shared boundary with the road and cropland the small pond would be considered an inclusion within forestland and be classified as Status 1 (Accessible Forest Land).
Figure 5.cN. A questionable area, in this case nonstocked grass, falls between two defined conditions. The entire questionable area is defined at PC by whichever existing status is closest. Once it is defined at PC all subplots that fall within the questionable area are assigned the same condition.
Figure 5.dN. Where the hayfield is too small to stand alone as its own condition, that area would be defined by the condition status nearest PC, provided the hayfield shares at least a 120 ft. boundary with that condition. If the hayfield does not share a 120 ft. boundary the adjacent condition, it will be considered an inclusion within the surrounding condition.

2.2.3 +N Noncensus Water
Lakes, reservoirs, ponds, and similar bodies of water 1.0 acre to 4.5 acres in size. Rivers, streams, canals, etc., 30.0 feet to 200 feet wide.

NRS Note: Non-linear Noncensus and Census water must maintain a minimum width of 120 ft.

2.2.4 +N Census Water
Lakes, reservoirs, ponds, and similar bodies of water 4.5 acres in size and larger; and rivers, streams, canals, etc., more than 200 feet wide (1990 U.S. Census definition).

NRS Note: The minimum required dimensions for Condition Class Status 3 and 4 are measured to the mean high water mark and these minimum dimensions must be maintained over the entirety of the condition.

2.2.5 +U+N+GT Nonsampled, possibility of forest
See section 2.4.3 +U+GT URBAN / GROUND TRUTH CONDITION NONSAMPLED REASON for descriptions of land that qualifies as nonsampled. In cases where a condition is access-denied or hazardous land use, but obviously contains no forest or nonforest land, record URBAN / GROUND TRUTH CONDITION CLASS STATUS = 2, 3 or 4 as long as it can be confirmed that there are no trees or land above the mean high water line on the plot. In cases where a condition is an access-denied or hazardous land use and has the possibility of forest, URBAN / GROUND...
TRUTH CONDITION CLASS STATUS 1, 2, or URBAN / GROUND TRUTH CONDITION CLASS STATUS 3, 4 with the possibility of trees and or land above the mean high-water line; record URBAN / GROUND TRUTH CONDITION CLASS STATUS = 5.

NRS Note: Reference Section 2.1.1, NRS Note, when determining if a separate condition is defined under these guidelines.

Guidance on plots that might otherwise be nonsampled (hazardous or DA):

- If trees are present, or if you can’t tell if trees are present, and you can’t occupy the plot, the plot is processed as nonsampled.

- If you get close enough to the plot to tell there are no trees AND you can get close enough to accurately measure ALL of the other aspects of data collection. Complete and process the plot based on your visual inspection. In such a case the only monumentation required will be installing a SP / RP, GPS, and Course to Sample information.

- If you get close enough to the plot to tell there are no trees but can NOT get close enough to accurately measure ALL of the other aspects of data collection. Complete and process the plot as nonsampled.

  If you cannot get close enough to the plot to accurately measure ALL aspects of data collection you may make calls based on what you see on the image ONLY if there is no vegetation present, such cases may be where the plot falls entirely within water, a building, or on an impermeable surface. In such a case the only monumentation required will be installing a SP / RP, GPS, and Course to Sample information.

2.2.5 U+N+GT Nonsampled, possibility of forest

See section 2.4.3 U+GT URBAN / GROUND TRUTH CONDITION NONSAMPLED REASON for descriptions of land that qualifies as nonsampled. In cases where a condition is access-denied or hazardous land use, but obviously contains no forest or nonforest land, record URBAN / GROUND TRUTH CONDITION CLASS STATUS = 2, 3 or 4, as long as it can be confirmed that there are no trees or land above the mean high-water line on the plot. In cases where a condition is an access-denied or hazardous land use and has the possibility of forest, URBAN / GROUND TRUTH CONDITION CLASS STATUS 1, 2, or URBAN / GROUND TRUTH CONDITION CLASS STATUS 3, 4 with the possibility of trees and or land above the mean high-water line; record URBAN / GROUND TRUTH CONDITION CLASS STATUS = 5.

NRS Note: Reference Section 2.1.1, NRS Note, when determining if a separate condition is defined under these guidelines.

Guidance on plots that might otherwise be nonsampled (hazardous or DA):

- If trees are present, or if you can’t tell if trees are present, and you can’t occupy the plot, the plot is processed as nonsampled.

- If you get close enough to the plot to tell there are no trees AND you can get close enough to accurately measure ALL of the other aspects of data collection. Complete and process the plot based on your visual inspection. In such a case the only monumentation required will be installing a SP / RP, GPS, and Course to Sample information.

- If you get close enough to the plot to tell there are no trees but can NOT get close enough to accurately measure ALL of the other aspects of data collection. Complete and process the plot as nonsampled.

  If you cannot get close enough to the plot to accurately measure ALL aspects of data collection you may make calls based on what you see on the image ONLY if there is no vegetation present, such cases may be where the plot falls entirely
within water, a building, or on an impermeable surface. In such a case the only monumentation required will be installing a SP / RP, GPS, and Course to Sample information.

2.3 Condition Class Attributes

<table>
<thead>
<tr>
<th>CONDITION CLASS NUMBER</th>
<th>A classification for URBAN / GROUND TRUTH CONDITION CLASS STATUS are required for every condition class sampled on a plot.</th>
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<tbody>
<tr>
<td>2.3.1 <strong>U+N+GT</strong> Forest Land For each condition class classified as accessible forest land, a classification is required for each of the following attributes:</td>
<td></td>
</tr>
<tr>
<td>Attributes where a change causes a separate condition class</td>
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</tr>
<tr>
<td>2.5.1 <strong>U+GT</strong> URBAN / GROUND TRUTH RESERVED STATUS</td>
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<tr>
<td>2.5.2 <strong>U+GT</strong> URBAN / GROUND TRUTH OWNER GROUP</td>
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</tr>
<tr>
<td>2.5.3 <strong>U+GT</strong> FOREST TYPE Not Collected in Ground Truth</td>
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<tr>
<td>2.5.4 <strong>U+GT</strong> STAND SIZE CLASS Not Collected in Ground Truth</td>
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<tr>
<td>2.5.5 <strong>U+GT</strong> REGENERATION STATUS</td>
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<tr>
<td>2.5.6 <strong>U+GT</strong> TREE DENSITY Not Collected in Ground Truth</td>
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<tr>
<td>Ancillary – changes do not delineate a new condition class</td>
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<td>2.5.7 <strong>U+GT</strong> URBAN / GROUND TRUTH OWNER CLASS</td>
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<td>2.5.16 <strong>U+GT</strong> DISTURBANCE YEAR (1 per disturbance) Not Collected in Ground Truth</td>
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<td>2.5.21 <strong>U+GT</strong> TREATMENT (up to 3 coded) Not Collected in Ground Truth</td>
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<td>2.5.22 <strong>U+GT</strong> TREATMENT YEAR (1 per treatment) Not Collected in Ground Truth</td>
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<td>2.5.28 <strong>U+GT</strong> LAND COVER CLASS</td>
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<td>2.5.29 <strong>U+GT</strong> PRESENT NONFOREST LAND USE (for the first CONDITION CLASS STATUS encountered as well as any additional IF the area was converted from accessible forest land condition class to nonforest land since last inventory).</td>
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<td>2.5.31 <strong>U+GT</strong> LIVE CANOPY COVER</td>
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<tr>
<td>2.5.36 <strong>U+GT</strong> CHAINING CODE</td>
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</table>
NRS Note: PRESENT NONFOREST LAND USE is recorded on all plots that are either entirely nonforest or contain both a forested and a nonforested condition.

2.3.2 +U+GT  URBAN / GROUND TRUTH Nonforest Land Not Collected in NRS CORE

For each condition class classified as nonforest land, a classification is required for each of the following attributes:

Attributes where a change causes a separate condition class

2.5.1 +U+GT  URBAN / GROUND TRUTH RESERVED STATUS
2.5.2 +U+GT  URBAN / GROUND TRUTH OWNER GROUP
2.5.29 +U+GT  PRESENT URBAN / GROUND TRUTH NONFOREST LAND USE

Ancillary - changes do not delineate a new condition class

2.5.7 +U+GT  URBAN / GROUND TRUTH OWNER CLASS
2.5.12  RESERVED AREA NAME
2.5.15 +N  DISTURBANCE (up to 3 coded) Not Collected in URBAN / GROUND TRUTH FIA Nonforest Land
2.5.16  DISTURBANCE YEAR (1 per disturbance) Not Collected in URBAN / GROUND TRUTH FIA Nonforest Land
2.5.21 +N  TREATMENT (up to 3 coded) Not Collected in URBAN / GROUND TRUTH FIA Nonforest Land
2.5.22  TREATMENT YEAR (1 per treatment) Not Collected in URBAN / GROUND TRUTH FIA Nonforest Land
2.5.27 +N  PHYSIOGRAPHIC CLASS Not Collected in URBAN / GROUND TRUTH FIA Nonforest Land
2.5.28 +N  LAND COVER CLASS
2.5.29.1 UGT  TREE LAND USE
2.5.30 +U+GT  URBAN / GROUND TRUTH CANOPY COVER SAMPLE METHOD
2.5.31 +N+GT  LIVE CANOPY COVER
2.5.32 +N+GT  LIVE PLUS MISSING CANOPY COVER
2.5.33 +N+GT  CURRENT AFFORESTATION CODE
2.5.34 +N+GT  PREVIOUS AFFORESTATION CODE
2.5.35 +N  TOTAL STEMS
2.5.36 +GT  CHAINING CODE

2.4 +U+N-GT  Delineating Condition Classes Differing In Condition Class Status:

The first step in delineating condition classes is to recognize differences in CONDITION CLASS STATUS. The most common difference is adjacent accessible forest land and nonforest land. Adjacent accessible forest land and nonforest land condition classes are recognized only if each of the two prospective condition classes is at least 1.0 acre in size, and each is at least 120.0 feet in width. These size and width minimums apply to both accessible forest land and nonforest land.

Within an accessible forest land condition class, unimproved roads, rock outcrops, and natural nonforest openings less than 1.0 acre in size and less than 120.0 feet in width are considered forest land and are not delineated and classified as a separate nonforest land condition class.

Within a nonforest land condition class, forested areas or linear strips of trees less than 1.0 acre in size and less than 120.0 feet in width are considered part of the nonforest land condition class and are considered inclusions and tallied in accordance with section 5.

Within noncensus and census water condition classes, forested areas or linear strips of trees less than 1.0 acre in size and less than 120.0 feet in width are considered part of the water condition class and tallied in accordance with section 5.
Five exceptions to these size and width requirements apply:

2.4.0.1 Developed nonforest land condition: human-caused nonforest land condition classes such as homes or cabins that are less than 1.0 acre in size and 120.0 feet in width and are surrounded by forest land. There are three kinds of developed nonforest land conditions that do not have to meet area or width requirements (Figure 6).

2.4.0.1.1a Improved roads: paved roads, gravel roads, or improved dirt roads regularly maintained for long-term continuing use. Unimproved traces and roads created for skidding logs are not considered improved road

![Diagram of a switchback road. All the cross-hatched area is forest and the improved road is a nonforest condition.](image)

Figure 6. Example of a switchback road. All the cross-hatched area is forest and the improved road is a nonforest condition.

**NRS Note:** Improved roads may contain restricted access such as gates or berms. Indications that roads are NOT regularly maintained may include long-term evidence of unrepaired gullies, washouts, deep ruts, blowdowns, or the establishment of vegetation on the road bed that would restrict normal vehicle traffic.

2.4.0.1.2b Maintained rights-of-way: corridors created for railroads, power lines, gas lines, and canals that are periodically treated to limit the establishment and growth of trees and shrubs.

**NRS Note:** Rights-of-way that do not exclude other existing nonforest land uses such as cropland or pasture shall not be classified as rights-of-way. A power line that crosses a pasture at least 1 acre in size and 120 feet in width would be classified as pasture because there is no maintenance under the power line to preclude the existence of the pasture. Similarly, if a power line passes through accessible forestland, but is not maintained, the power line would not be recognized as a nonforest Condition Status because it does not preclude the existence of the accessible forestland.

Trees that are growing into live power lines create an unsafe work environment and must be considered as part of a hazardous condition.

2.4.0.1.3c Developments: structures and the maintained area next to a structure, all less than 1.0 acre in size and surrounded by forest land. Examples of developments are houses or trailers on very small lots, communication installations in a small cleared area within forest land, and barns and sheds.
NRS Note: Intense human activity such as developed campgrounds would be considered nonforest. However, recreation trails used for snowmobiling, skiing, biking, or hiking would be considered an inclusion in the surrounding condition unless the trail is considered highly developed as evidenced by permanent surfacing with concrete, asphalt, structural wood, crushed stone or a similar substance throughout. Shooting lanes and other areas cleared in association with hunting are also considered an inclusion in the surrounding condition.

NRS Note: Improved roads, R.O.W., and noncensus water that are less than 120.0 feet in width do not necessarily break up a forest condition that are between "switchbacks" as shown in Figure 6. Other regional variations of the “switchback” rule can be found in Regional Appendix C. In other situations as shown in Figure 7.b+N, where there is an improved R.O.W, development or noncensus water, a strip of forest land may have minimum width of 30.0 feet and minimum length of 120.0 feet as long as there is “qualifying” accessible forest land that lies across from the nonforest strip. Since the forest strip cannot be delineated as its own condition, the condition variables are determined from the “qualifying” accessible forest land.

Figure 6.aN. Example of nonforest and forest strips when the nonforest strip is developed (e.g., R.O.W or areas with structures), or noncensus water. Otherwise, see Figure 7.b+N.
Figure 6.bN. Two forest strips exist on either side of a R.O.W. The R.O.W is its own condition, however, a developed condition can be jumped if less than 120.0 ft in width. The width or the R.O.W cannot be used to measure the overall width of the forest. If the combined forest strips measure to be at least 120 ft in width and 363 ft in length, then the combined strips can be defined as accessible forest land.

Figure 6.cN. Two forest strips exist on either side of noncensus water. The noncensus water is its own condition, however, noncensus water can be jumped if less than 120.0 ft in width. The width of the noncensus water cannot be used to measure the overall width of
the forest. If the combined forest strips measure to be at least 120 ft in width and 363 ft in length, then the combined strips can be defined as accessible forest land.

NRS Note: The preceding two illustrations show a procedure to combine two forest strips in order to achieve the minimum width and acreage for accessible forestland. This is in contrast to Figure 6.aN which shows accessible forest land (i.e., 1 acre and 120.0 ft) adjacent to the nonforest "developed" strip or noncensus water. In both figures, the width of the nonforest condition is not used to measure overall width since these represent a separate CONDITION CLASS STATUS. As in Figure 6.aN, a forest strip must be at least 30.0 feet in width. Strips of trees less than 30.0 feet in width are treated as inclusions of the adjacent nonforest condition when the adjacent condition is nonforest. Strips of trees less than 30.0 feet in width are treated as inclusions in the adjacent forested condition when the adjacent condition is accessible forestland. This also holds true if the adjacent forest land is of a different forest type than the strip.

![Diagram](image)

**Figure 6.dN.** **Figure 6.eN.**

NRS Note: In Figure 6.dN and Figure 6.eN the target area for the jumping rule does not need to be distinct from any other area that qualifies as accessible forestland without the use of the jumping rule. As long as the target area is at least 30 ft. by 120 ft., the jumping rule may be applied even if portions of this area are incorporated into adjacent defined accessible forestland.

2.4.0.2 Distinct, alternating strips of forest and nonforest land:
this situation occurs when a plot or subplot samples a condition class that is less than 1.0 acre in size and less than 120.0 feet in width. The condition class is one of a series of parallel strips of forest and nonforest land in which none of the strips meet the minimum width requirement. This exception applies only to nonforest land conditions that are not listed under #1, e.g., improved roads, maintained rights-of-way, and developments.

2.4.0.2.1a Many small intermingled strips:
For many small intermingled strips, determine the total area that the intermingled strips occupy, and classify according to the CONDITION CLASS STATUS (forest land or nonforest land) that occupies the greater area. If the area of intermingled strips is so large or indistinct as to make a total area determination impractical, then classify the sample as forest land.
See Figure 7.aN.

![Diagram of forest and nonforest land strips]

**Figure 7.aN.** Entire plot area consists of strips of forest and nonforest land. None of the strips meets the 120 ft minimum width to qualify as a separate land use and the nonforest strips are not developed nonforest conditions. In this example, the entire area is classified as forest since the sum of the areas occupied by the forest land use exceeds the sum of the nonforested area in this example.

2.4.0.2.2  **Two alternating strips:**
For two alternating strips of forest and nonforest between two qualifying areas of nonforest land and forest land, see Figure 7.b+N. Figure 7.b+N delineates the boundary between the forest and nonforest land condition classes for four different examples. The plot center defines the plot condition for all strips covered by the arrow. Any subplot that falls in the alternating strips uses the rule. Any subplot that falls in assigned nonforest / forest is assigned that type. Again, this exception applies only to nonforest land conditions that are not listed under number 1, e.g., improved roads, maintained rights-of-way, and developments. If either strip of land is less than 30.0 feet wide, then the strip is treated as inclusion of the surrounding or adjacent condition. Note: The nonforest strip in Figure 7.b+N is not "developed" as described in Exception 1 and shown in . See Regional Appendix C for more regional Figure 7.b+N illustrations.
Figure 7.b+N. Example of alternating strips of forested and nonforested conditions (that is neither a developed feature as indicated in “Exception 1” nor linear noncensus). PC is the plot center (center of subplot 1) and the strips are treated as either F or NF based on this location.
Figure 7.cN. When determining the acreage of a strip in order to qualify for Figure 7.b+N do not include associated areas that are not part of the strip. Neither of the strips meet the size requirements for Figure 7.b+N. In such cases the area of the largest strip will dictate what both strips are classified as; in this case they are treated as NF.
Figure 7.dN. In cases where there are two strips, only one of which meets the size requirements under Figure 7.b+N, the smaller strip will be considered an inclusion within the surrounding condition. Therefore Figure 7.b+N does not apply. In this case the 25 ft. strip is considered forest.
Figure 7.eN. The preceding is a summary describing when to use which rules when dealing with strips of various dimensions.

2.4.0.3 The 120.0-foot minimum width for delineation does not apply when a corner angle is 90 degrees or greater (Figure 8).

Figure 8. Illustration of the 90 degree corner rule. The dotted lines do not create nonforest land conditions.

2.4.0.4 Linear water features: natural water features that are linear in shape such as streams and rivers. A linear water feature must meet the definition for census or noncensus water to be nonforest area. Therefore, a linear water feature must be at least 30.0 feet wide and cover at least 1.0 acre. The width of a linear water feature is measured across its channel between points on either side up to which water prevents the establishment and survival of trees. To determine whether a linear water feature
qualifies as nonforest, rely on all available information on hand such as aerial photos, topographic maps, past survey land calls, and ocular estimates at the current survey visit. Linear water features that do not meet the definition for census or noncensus water should be classified as forest land only if bounded by forest land on both shores. Crews are NOT expected to measure the length of a linear water feature to determine if it meets the 1.0 acre requirement; use professional judgment and common sense on any linear water feature.

**NRS Note:** Linear water features must also cover 1 acre while maintaining the 30.0 foot width requirement.

![Diagram](image.png)

**Figure 8.aN.** Although dimensional requirements for bodies of water and linear features are distinct, there may be instances where a linear Noncensus Water feature (or narrow finger of a body of water) feeds into a body of Census or Noncensus Water. In these cases, the linear feature will be mapped only if it meets the 1 acre size requirement, excluding any acreage that otherwise would qualify as Census or Noncensus water for the body. Specifically, only the acreage between the 30' minimum width for linear features and the 120' minimum width for bodies of water would be considered.

If the minimum acreage is not met, the linear feature (or narrow finger of a body of water) is considered part of the adjacent Nonforest condition. In a similar context, if Accessible Forestland boarders both sides of the linear feature that does not meet the minimum acreage; the linear feature is considered part of the surrounding Forestland.

2.4.0.5 **Nonsampled conditions**

are delineated as a separate condition class regardless of size.

2.4.1 **CONDITION CLASS NUMBER [CON#]**

On a plot, assign and record a number for each condition class. The condition class at plot center (the center of subplot 1) is designated condition class 1. Other condition classes are assigned
numbers sequentially at the time each condition class is delineated on a subplot following the standard numeric progression through the four points and proceed clockwise on individual subplots.

NRS Note: On remeasurement plots, conditions are renumbered to reflect current conditions (i.e., CONDITION CLASS = 1 always represents subplot 1’s plot center).

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

2.4.2 \( \text{U} + \text{N} + \text{GT} \) URBAN / GROUND TRUTH CONDITION CLASS STATUS [UGTC DST]

Record the code that describes the sampling status of the condition class. The instructions in Sections 2.3 and 2.4 apply when delineating condition classes that differ by URBAN / GROUND TRUTH CONDITION CLASS STATUS. In situations where a condition is denied access or hazardous, but obviously contains no forest or nonforest land, record URBAN / GROUND TRUTH CONDITION CLASS STATUS = 2, 3 or 4 as long as it can be confirmed that there are NO trees or dry land above the mean high-water line on the plot. In cases where a condition is an access-denied or hazardous land use and has the possibility of forest, an URBAN / GROUND TRUTH CONDITION CLASS STATUS 1 or 2, or the possibility of a 3 or 4 with the potential to contain trees and or land above the mean high-water line record URBAN / GROUND TRUTH CONDITION CLASS STATUS = 5.

NRS Note: Reference Section 2.1.1, NRS Note, when determining if a separate condition is defined under these guidelines.

NRS Note: When defining conditions on subplots that include a nonsampled condition, see Split Subplot procedures in Regional Appendix C.

When collected: All condition classes
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values:
1 Accessible forest land
2 Accessible Nonforest land
3 Noncensus water
4 Census water
5 Nonsampled -- possibility of forest land

2.4.3 \( \text{U} + \text{N} + \text{GT} \) URBAN / GROUND TRUTH CONDITION NONSAMPLED REASON [UGTREAS]

For portions of plots that cannot be sampled (URBAN / GROUND TRUTH CONDITION CLASS STATUS = 5), record one of the following reasons.

When collected: When URBAN / GROUND TRUTH CONDITION CLASS STATUS = 5
Field width: 2 digits
Tolerance: No errors
MQO: At least 99% of the time
Values:
01 Outside U.S. boundary – Assign this code to condition classes beyond the U.S. border.
Denied access area – Any area within the sampled area of a plot to which access is denied by the legal owner, or to which an owner of the only reasonable route to the plot denies access. There are no minimum area or width requirements for a condition class delineated by denied access. Because a denied-access condition can become accessible in the future, it remains in the sample and is re-examined at the next occasion to determine if access is available. See section 2.2+U. GT. Nonsampled prior to using both the Denied Access or Hazardous Situation codes.

NRS Note: If a denied access or hazardous plot can be ground-truthed as nonforest from adjacent accessible property, code the plot nonforest.

NRS Note: If a denied access or hazardous subplot can be ground-truthed as nonforest from an adjacent accessible property, code the subplot as nonforest, provided accessible forestland exists on one of the subplots.

Hazardous situation – Any area within the sampled area on plot that cannot be accessed because of a hazard or danger, for example cliffs, quarries, strip mines, illegal substance plantations, temporary high water, etc. Although the hazard is not likely to change over time, a hazardous condition remains in the sample and is re-examined at the next occasion to determine if the hazard is still present. There are no minimum size or width requirements for a condition class delineated by a hazardous condition. See section 2.2+GT. Nonsampled prior to using both the Denied Access or Hazardous Situation codes.

NRS Note: Reference note above.

Lost data – Plot data file was discovered to be corrupt after a panel was completed and submitted for processing. Used for the single condition that is required for this plot. Applied at the time of processing and used only in conjunction with PLOT NONSAMPLED REASON code 05. This code is for office use only. Not Collected in NRS

Lost plot – Entire plot cannot be found. Used for the single condition that is required for this plot. Used only in conjunction with URBAN / GROUND TRUTH PLOT NONSAMPLED REASON code 06. Can be either generated by the data recorder or in the office. Not Collected in NRS

Wrong location – Previous plot can be found, but its placement is beyond the tolerance limits for plot location. Used for the single condition that is required for this plot. Used only in conjunction with PLOT NONSAMPLED REASON code 07. Can be either generated by the data recorder or in the office. Not Collected in NRS

Skipped visit – Entire plot skipped. Used for the single condition that is required for this plot. Applied at the time of processing and used only in conjunction with PLOT NONSAMPLED REASON code 08. This code is for office use only. Not Collected in NRS

Dropped intensified plot – Used for the single condition that is required for this plot. Used only by units engaged in intensification. Applied at the time of processing and used only in conjunction with PLOT NONSAMPLED REASON code 09. This code is for office use only. Not Collected in NRS

Other – This code is used whenever a condition class is not sampled due to a reason other than one of the specific reasons listed. A field note is required to describe the situation.

NRS Note: When a potentially forested portion of a subplot cannot be measured because the subplot center falls under a building, the entire subplot should be classified as a CONDITION CLASS STATUS = 5 with a CONDITION NONSAMPLED REASON code = 10.

Ocean – Condition falls in ocean water below mean high tide line.
2.4.4 NONFOREST CONDITION CLASS STATUS Not Collected in Ground Truth Not Collected in NRS

2.4.5 NONFOREST CONDITION NONSAMPLED REASON Not Collected in Ground Truth Not Collected in NRS

2.5a+N Delineating Condition Classes within Accessible Forest Land
Accessible forest land is subdivided into condition classes that are based on differences in URBAN / GROUND TRUTH RESERVED STATUS, URBAN / GROUND TRUTH OWNER GROUP, FOREST TYPE, STAND SIZE CLASS, REGENERATION STATUS, and TREE DENSITY. Section 2.1 applies when delineating contrasting forest condition classes. Specific criteria apply for each of the six attributes and are documented by attribute in 2.5.1+U+GT to 2.5.6. “Stands” are defined by plurality of stocking for all live trees, saplings, and seedlings that are not overtopped.

NRS Note: Throughout Field Guide 7.2 the word stocking is used to describe the stands relative basal area and tree distribution. DO NOT confuse this with previous field guide’s “stocking guidelines.”

Additionally, each separate forest condition class recognized within accessible forest land must be at least 1.0 acre in size and at least 120.0 feet in width. If prospective contrasting forest land condition classes do not each meet these minimum size and width requirements, the most similar prospective conditions should be combined until these minimums are attained.

No other attribute shall be the basis for recognizing contrasting condition classes within accessible forest land. For each condition class recognized, many “ancillary attributes” that help describe the condition will be collected, but will not be used for delineation purposes (see Sections 2.5.7 to 2.5.36+U+GT).

General instructions for delineating condition classes within accessible forest lands:

2.5.0.1 Distinct boundary within a macroplot (if applicable), subplot, or microplot
Separate condition classes ARE recognized if, within a subplot, two (or more) distinctly different condition classes are present and delineated by a distinct, abrupt boundary. The boundary is referenced; see Section 4.0+U+GT.

2.5.0.2 Indistinct boundary within a subplot
Separate condition classes are NOT recognized if the prospective condition classes abut along an indistinct transition zone, rather than on an abrupt, obvious boundary. Only one condition is recognized, and the subplot is classified entirely as the condition it most resembles.

Example: The four subplots all sample only accessible forest land. Subplots 1, 3, and 4 sample what is clearly a stand of large-diameter trees. Subplot 2 falls in the middle of a stand-size transition zone. In the zone, the large-diameter stand phases into a sapling stand.

Subplot 2 must not be divided into two condition classes on the basis of stand size. Instead, it is treated entirely as part of the large-diameter condition class or is assigned entirely to a new condition class that is classified as a seedling-sapling stand. The latter occurs only if the crew thinks the entire subplot is more like a stand of seedlings-saplings than a stand of large-diameter trees; then the boundary between the large- and small-diameter stands is assumed to occur between and not on the subplots.
2.5.0.3 A boundary or transition zone between fixed-radius subplots that sample distinctly different condition classes

Separate condition classes are recognized and recorded when a valid attribute obviously differs between two fixed-radius subplots, but a distinct boundary or indistinct transition zone exists outside the sampled (fixed-radius) area of the subplots. In such cases, a boundary, if present, is not referenced.

Example: The northernmost subplot (2) samples entirely accessible forest land. The other three subplots, 1, 3, and 4, fall clearly in a nonforest meadow. Between subplot 1 and 2 is a transition zone; the number of trees present goes from none to what clearly represents forest land. Two condition classes are sampled: accessible forest land sampled on subplot 2, and nonforest land sampled on the other subplots.

2.5.0.4 Riparian forest area

A riparian forest area is defined as a forest area between 30.0 and 120.0 feet wide, and 1.0 acre or more in size, cumulative, and adjacent to but not necessarily present on both sides of a naturally occurring or artificially created body of water or watercourse with continuous or intermittent flow. Riparian forest areas may be associated with but not limited to streams, rivers, lakes, sloughs, seeps, springs, marsh, bogs, beaver ponds, sink holes, cypress domes and ponds, man-made ditches and canals. Such associated areas may or may not contain trees. If such associated areas do contain 10% canopy cover and are > 30’ and < 120’ in width and are an acre in size they can also be called a riparian condition (see ). This does not prevent a 2nd riparian zone associated with this water. A riparian forest area must be associated “within forest” and contain at least one distinct and obvious change in a condition class delineation attribute from its adjacent accessible forest land condition class. Figure 10 to Figure 15 provide examples of when to delineate riparian forest area as a separate condition class. In these figures, forest type “A” qualifies as its own condition (> 120. feet and > 1 acre). The riparian area represented by forest type “B” qualifies as its own condition if the area is between 30.0 and 120.0 feet and is > 1 acre. In addition, see Riparian Flowchart.

NRS Note: When determining if a potential riparian area exists, exclude from consideration any acreage of that potential riparian condition that already qualifies as a distinct condition without the use of the riparian rule. (See Figure 9.aN.) When considering if a potential riparian area meets minimum size requirements, do not included acreages beyond 120 ft. of the water. These areas beyond 120’ may later be included with the riparian condition if one is defined.
Figure 9.aN. The 1 acre block of Red Maple qualifies as a unique condition separate from the surrounding accessible forestland and therefore the acreage associated with the Red Maple condition cannot be included with any other area under consideration for a separate condition under the riparian rules. Consequently, the 30’ x 90’ Red Maple area does not meet the 1 acre riparian size requirement. It is considered an inclusion within the Red Oak condition.

Note: When the width of forest adjacent to a body of water or water course is between 120.0 feet and 150.0 feet and the width of the riparian forest is at least 30.0 feet wide, the rules for identifying the non-riparian forest (at least 30.0 feet but less than 120.0 feet) need to be modified. The non-riparian forest can be between 30.0 feet and 120.0 feet and mapped as a separate condition as long as it meets the criteria for delineating a separate condition class, otherwise it will be an inclusion in the riparian forest condition class.
Figure 9bN. Riparian forest containing two distinct forest conditions when the traditional forest land definition is not met. In order to delineate a riparian condition, the accessible forestland must initially be at least 120 ft. in width. Once subdivided, the remaining accessible forestland must be at least 30 ft. in width and 1 acre in size. The riparian condition must be at least 30 ft. in width, but less than 120 ft. in width, and must also be at least one acre in size. The two resulting conditions must maintain a common border for the entire length of the riparian condition.

<table>
<thead>
<tr>
<th>CDST 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Woods between 30-120’, &gt;1 acre</td>
</tr>
<tr>
<td>Riparian woods between 30-120’, &gt;1 acre</td>
</tr>
<tr>
<td>Water</td>
</tr>
<tr>
<td>CDST 2</td>
</tr>
</tbody>
</table>
Figure 9.cN. The riparian rule allows for the delineation of a condition that is between 30 ft. and 120 ft. in width and one acre in size. Although the remaining accessible forestland can be as small as 30 ft. in width and one acre in size, there is no provision for subdividing the remaining accessible forestland into non-riparian conditions less than 120 ft. in width and one acre in size. In this example, the “Woods Between 30-120’” cannot be subdivided from the non-riparian accessible forestland and therefore cannot be defined as a separate condition.
Figure 9.dN. In the case of a forested swamp, the swamp can be considered a riparian area, assuming it meets the minimum riparian requirements. In addition, a second riparian condition may also be defined so long as it is adjacent to a water source, even if that source is incorporated within another riparian condition. In this example, three conditions can be defined.

NRS Note: Riparian areas and their associated forest land both need to be at least 1 acre in size individually. Riparian areas may not be delineated if their associated non-riparian forest is less than 30.0 feet wide. If the associated non-riparian forest is between 30’ and 120’ wide, at least one acre must be adjacent to the riparian forest in order to implement the riparian rule.
Figure 9.eN. The areas labeled A and B both exceed the 120’ riparian width limitation. The Red Maple area beyond 120’ from the water may not be considered when determining if the riparian area meets the minimum size requirement. If it is determined the Red Maple area within 120’ of the water meets the minimum size requirements, the area exceeding 120’ is included in the riparian condition if it is at least 120’ wide. Once the riparian area is defined as a separate condition; Area ‘A’, which is ≥120’ wide, is included within the Red Maple condition. In contrast, Area ‘B’, which is < 120’ wide, must be considered an inclusion within the surrounding Red Oak condition.
Figure 10. Forest type B is a separate condition class (riparian) if the band of it is between 30.0 feet and 120.0 feet wide, and is ≥ 1.0 acre in size.

Figure 11. If the stream is < 30.0 feet wide, forest type B is a separate condition class (riparian) if the sum of the two widths of the bands, including the stream falls between 30.0 feet and 120.0 feet wide, and is ≥ 1.0 acre in size.

Figure 12. Forest type B is a separate condition class (riparian) if the band of it is between 30.0 feet and 120.0 feet wide, and is ≥ 1.0 acre in size.

Figure 13. Forest type B is a separate condition class (riparian) if the band of it is between 30.0 feet and 120.0 feet wide, and is ≥ 1.0 acre in size.

Figure 14. If the stream is > 30.0 feet wide, forest type B is a separate condition class (riparian) if either of the two widths of the bands falls between 30.0 feet and 120.0 feet wide and is ≥ 1.0 acre in size.

Figure 15. In a nonforested area, a band of forest type B that is < 120.0 feet wide is NOT considered a riparian area. It is not a separate condition class at all.
Figure 15.aN. Riparian Delineation Flowchart.

2.5.1 +U+GT URBAN / GROUND TRUTH RESERVED STATUS [UGTRESV]

Record the code that identifies the reserved designation for the condition. Reserved land is withdrawn by law(s) prohibiting the management of land for the production of wood products (not merely controlling or prohibiting wood-harvesting methods). Such authority is vested in a public agency or department, and supersedes rights of ownership. The prohibition against management for wood products cannot be changed through decision of the land manager (management agency) or through a change in land management personnel, but rather is permanent in nature.

NRS Note: RESERVED STATUS is coded as 0 for all private land (OWNER GROUP = 40) regardless of conservation easements that may restrict harvesting. All public land requires documentation in PLOT NOTES of RESERVED STATUS in the data recorder. This designation removes the associated forest into noncommercial forest land. See Appendix 12 for additional instructions about documentation procedures for reserved public land.

Ownership and the name (designation) of an area are critical for determining reserved status. All private lands (OWNER GROUP = 40) are considered not reserved (due to difficulty in determining legal status); this includes in-holdings, where they can be identified. FIA has adopted a default national list of federal land designations which are considered reserved (see Appendix 12). All federally-owned lands managed by the National Park Service or Fish and Wildlife Service (OWNER CLASS = 21 or 23) are considered reserved. Some lands owned by State or local governments are considered reserved, even in the absence of specific laws covering them, if the agency mandate for that land designation precludes management to produce wood products (e.g., most State Parks). In the absence of State-specific lists of reserved areas, any State or local government land area that includes “park”, “wilderness”, “wild river”, “reserve”, or “preserve” in the name is by default considered reserved. There are less common designations that are not on the CORE list and units may add exceptions to the list for specific areas that are managed under different legal guidance than is usual for that designation. All designations must be
documented using the RESERVED AREA NAME field. Note that harvest can occur in reserved areas, for example for restoration, safety, or recreation.

For the URBAN FIA / GROUND TRUTH inventory, nonforest areas, as well as census and noncensus water conditions, are reserved if forest lands in the same designated area are considered reserved, or if the area would be considered reserved if forestland was present.

When collected: CORE: URBAN / GROUND TRUTH CONDITION CLASS STATUS = 1, 2, 3, 4
CORE OPTIONAL: All condition classes
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values:
  0 Not reserved
  1 Reserved

2.5.2 U+GT URBAN / GROUND TRUTH OWNER GROUP [UGTOWNG]
Record the URBAN / GROUND TRUTH OWNER GROUP code identifying the ownership (or the managing Agency for public lands) of the land in the condition class. Conditions will be delineated based on changes in URBAN / GROUND TRUTH OWNER GROUP only; separate conditions due to changes in URBAN / GROUND TRUTH OWNER GROUP are recognized only where differences can be clearly identified on the ground when visiting the plot. Assume all census and noncensus water conditions are state and local government unless they clearly fall with in federal land or are clearly marked as private.

When collected: CORE: URBAN / GROUND TRUTH CONDITION CLASS STATUS = 1, 2, 5
CORE OPTIONAL: All condition classes
Field width: 2 digits
Tolerance: No errors
MQO: At least 99% of the time
Values:
  10 Forest Service
  20 Other Federal
  30 State and Local Government
  40 Private

2.5.3 Forest Type [FTYP] Not Collected in Ground Truth

2.5.4 Stand Size Class [STSZ] Not Collected in Ground Truth

2.5.5 REGENERATION STATUS [REGN]
Record the code that best describes the artificial regeneration that occurred in the condition.

NRS Note: Artificial regeneration must be at least 1 acre and at least 120.0 feet in width.

NRS Note: Underplanting is considered artificial regeneration.
When collected: All accessible forest land condition classes (URBAN / GROUND TRUTH CONDITION CLASS STATUS = 1, 2, 3, 4)

Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time

Values:
0 Natural – present stand shows no clear evidence of artificial regeneration. Includes unplanted, recently cut lands
1 Artificial – present stand shows clear evidence of artificial regeneration

The instructions in section 2.1 and 2.4 apply when delineating, within accessible forest land, contrasting conditions based on differences in REGENERATION STATUS.

For a forest land condition to be delineated and/or classified as artificially regenerated, the condition must show distinct evidence of planting or seeding. If it is difficult to determine whether or not a stand has been planted or seeded, then use code 0. If no distinct boundary exists within the sampled (fixed-radius) area on any subplot, then do not recognize separate conditions. In many regions of the West, trees are not planted in rows, and planted stands do not differ in physical appearance from natural conditions. In these cases, there is no need to differentiate conditions based on regeneration status.

Note: Plot records or verbal evidence from landowner is acceptable for determining regeneration status.

2.5.6 TREE DENSITY [DENS] Not Collected in Ground Truth

Ancillary (Non-Delineating) Variables

2.5.13 ARTIFICIAL REGENERATION SPECIES [SOSP] Not Collected in Ground Truth

2.5.14+N STAND AGE [SAGE] Not Collected in Ground Truth

2.5.14.1N-GT WINDBREAK/SHELTERBELT PLANTED OR REMOVED [WBPR]

Record if there is evidence that a windbreak/shelterbelt has been planted or removed, both partially or fully, on the defined nonforest condition. This is a condition level variable and is not limited to the area within the 118 foot radius circle. If it can be determined that a windbreak/shelterbelt has been added or removed anywhere in the defined condition then this variable will be coded.

To qualify as a partial removal, either a section at least 25 feet long where all linear rows have been removed or complete row/s must be removed from the windbreak/shelterbelt. Individual trees removed throughout would not qualify for this variable.

Both ground observation and aerial photo interpretation are allowed when determining if a windbreak/shelterbelt has been planted or removed from the landscape.

For initial plot establishment (SAMPLE KIND = 1 or 3), the windbreak/shelterbelt planting or removal must be within the last 5 years. For remeasured plots, only recognize windbreak/shelterbelt planting or removals that have occurred since the previous inventory.
When collected: URBAN / GROUND TRUTH CONDITION CLASS STATUS = 2
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values:

0  No evidence a windbreak/shelterbelt has been planted or removed
1  A windbreak/shelterbelt has been planted
2  A portion of a windbreak/shelterbelt has been removed without replacement
3  A complete windbreak/shelterbelt has been removed without replacement
4  A portion of a windbreak/shelterbelt has been removed and has been replaced with newly planted trees
5  A complete windbreak/shelterbelt has been removed and has been replaced with newly planted trees

2.5.14.2N-GT. PRIMARY FUNCTION OF TREES [FTR1]
Record the most evident function of the trees for each Condition. For example a tree planting around a farmstead would have the farmstead windbreak as the primary function. A tree planting in a field that parallels a county road would have the primary function as field windbreak. Function 01-06 have a higher priority than remaining codes and are often listed as the primary function.

When collected: URBAN / GROUND TRUTH CONDITION CLASS STATUS = 1, 2, 3, 4
Field width: 2 digits
MQO:
Values:

00  No trees present on the Condition
01  Farmstead or Ranch headquarters windbreak: Planted or natural growing trees in an organized area within 300 feet of farm or ranch buildings that are providing wind or snow protection. Owner is expected to provide some type of management for establishment or cleanup/replacement if the trees are damaged. Valid with areas that meet the definition of Accessible Forestland as long as the defined function above is meet.
02  Field windbreak: Planted or natural growing trees forming a uniform and dense continuous protection at least 100 feet long next to a cultivated or previously cultivated agricultural field. These windbreaks give wind protection for crops, reduce soil erosion and drift snow across the fields. Owner is expected to provide some type of management for establishment or cleanup/replacement if the trees are damaged. Valid with areas that meet the definition of Accessible Forestland as long as the defined function above is meet.
03  Livestock windbreak: Planted or natural growing trees forming protection for livestock (pens or in a pasture areas). Owner is expected to provide some type of management for establishment or cleanup/replacement if the trees are damaged. Valid with areas that meet the definition of Accessible Forestland as long as the defined function above is meet.
04  Living snowfence: Planted or natural growing trees along and parallel a road or transportation route on the north or west sides of the road within 300 feet from the edge of the road. Owner is expected to provide some type of management for establishment or cleanup/replacement if the trees are damaged. Valid with areas that meet the definition of Accessible Forestland as long as the defined function above is meet.
05  Rural home acreage protection: Planted or natural growing trees within 300 feet of a home (not farm or ranch) for energy savings, privacy and property identity, usually close to a community or urban area. Valid with areas that meet the definition of Accessible Forestland as long as the defined function above is meet.
06 Wildlife habitat trees: Planted trees (may be in rows or not) or natural growing organized grouping of trees with a diversity of shrubs, deciduous and evergreen trees planted for wildlife. Validation with areas that meet the definition of Accessible Forestland as long as the defined function above is met.

07 Abandoned farmstead: Planted or natural growing trees that at one time gave protection to the farmstead that is now not active. Validation with areas that meet the definition of Accessible Forestland as long as the defined function above is met.

08 Planted riparian forest buffer: Planted trees along a water or other riparian resource. Validation with areas that meet the definition of Accessible Forestland as long as the defined function above is met.

09 Natural riparian forest buffer: Naturally occurring trees along a water or other riparian resource. Validation with areas that meet the definition of Accessible Forestland as long as the defined function above is met.

10 Narrow wooded strip: Natural woodlands not meeting FIA criteria of at least 1 acre and 120 foot wide and 10% density and not along a water resource (riparian forest buffer). Usually extending out from forestland. Codes 1-9 take precedence over this code.

11 Isolated tree resource: Other tree resources, with either a positive or negative influence, in fencelines, out in pastures, road ditches, odd locations and without identifying features of a planned tree planting. These trees do not comprise a consistent, uniform or dense form (at least 100 feet length) for a windbreak determination. Scattered trees out in open areas and without any oriented use. Codes 1-9 take precedence over this code.

12 Forestland: Area meets the definition of Accessible Forestland and is not better defined with the above codes. Codes 1-9 take precedence over this code.

2.5.14.3N-GT SECONDARY FUNCTION OF TREES [FTR2]

Record the secondary function of the trees for each Condition. For example a tree planting around a farmstead would have the farmstead windbreak as the primary function with a secondary benefit as livestock if there are animals on the farmsite or a secondary benefit of wildlife habitat. A tree planting in a field that parallels a county road would have the primary function as field windbreak and a secondary benefit as a living snowfence. Function 01-06 have a higher priority than remaining codes and are often listed as the primary function and the remaining codes would be the secondary function.
When collected: PRIMARY FUNCTION OF TREES = 1 - 10
Field width: 2 digits
MQO:
Values:
01 Farmstead or Ranch headquarters windbreak: Planted or natural growing trees in an organized area within 300 feet of farm or ranch buildings that are providing wind or snow protection. Owner is expected to provide some type of management for establishment or cleanup/replacement if the trees are damaged. Valid with areas that meet the definition of Accessible Forestland as long as the defined function above is meet.
02 Field windbreak: Planted or natural growing trees forming a uniform and dense continuous protection at least 100 feet long next to a cultivated or previously cultivated agricultural field. These windbreaks give wind protection for crops, reduce soil erosion and drift snow across the fields. Owner is expected to provide some type of management for establishment or cleanup/replacement if the trees are damaged. Valid with areas that meet the definition of Accessible Forestland as long as the defined function above is meet.
03 Livestock windbreak: Planted or natural growing trees forming protection for livestock (pens or in a pasture areas). Owner is expected to provide some type of management for establishment or cleanup/replacement if the trees are damaged. Valid with areas that meet the definition of Accessible Forestland as long as the defined function above is meet.
04 Living snowfence: Planted or natural growing trees along and parallel a road or transportation route on the north or west sides of the road within 300 feet from the edge of the road. Owner is expected to provide some type of management for establishment or cleanup/replacement if the trees are damaged. Valid with areas that meet the definition of Accessible Forestland as long as the defined function above is meet.
05 Rural home acreage protection: Planted or natural growing trees within 300 feet of a home (not farm or ranch) for energy savings, privacy and property identity, usually close to a community or urban area. Valid with areas that meet the definition of Accessible Forestland as long as the defined function above is meet.
06 Wildlife habitat trees: Planted trees (may be in rows or not) or natural growing organized grouping of trees with a diversity of shrubs, deciduous and evergreen trees planted for wildlife. Valid with areas that meet the definition of Accessible Forestland as long as the defined function above is meet.
07 Abandoned farmstead: Planted or natural growing trees that at one time gave protection to the farmstead that is now not active. Valid with areas that meet the definition of Accessible Forestland as long as the defined function above is meet.
08 Planted riparian forest buffer: Planted trees along a water or other riparian resource. Valid with areas that meet the definition of Accessible Forestland as long as the defined function above is meet.
09 Natural riparian forest buffer: Naturally occurring trees along a water or other riparian resource. Valid with areas that meet the definition of Accessible Forestland as long as the defined function above is meet.
10 Narrow wooded strip: Natural woodlands not meeting FIA criteria of at least 1 acre and 120 foot wide and 10% density and not along a water resource (riparian forest buffer). Usually extending out from forestland. Codes 1-9 take precedence over this code.

2.5.14N-GT_TREE FUNCTION WIDTH [TRFW]
Record the average width of the tree resource. If the resource has a variable width then record the average width across the length of the resource. The average width can be determined by
measuring multiple widths across the length and calculating the average or measuring a couple representative locations and estimating the average. The imagery can be used to help make the estimation.

This is not to be confused with Accessible Forest Land’s minimum width of 120 feet (see Land Use code 1). This width can be measured from dripline to dripline, plowline to plowline, or fence to fence.

When collected: PRIMARY FUNCTION OF TREES = 1 through 10 (6 is allowed to be NULL)
Field width: 3 digits
Tolerance:
MQO:
Values: 10-200 feet in 10 ft classes

<table>
<thead>
<tr>
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<th>Definition</th>
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<th>Code</th>
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<td>135</td>
<td>131-140</td>
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<td>075</td>
<td>71-80</td>
<td>145</td>
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<td>121-130</td>
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<td>191-200</td>
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</tbody>
</table>

2.5.14.5N-GT... TREE FUNCTION CONDITION [TCON]
Record the category where the majority of the condition description applies. Trees should be observed from 1/8 of a mile distance to determine gaps. Walk or drive the length of the strip of trees for a good assessment. Classify the Function into the category where the majority of the condition description applies.

When collected: PRIMARY FUNCTION OF TREES = 1 through 5
Field width: 1 digit
Tolerance:
MQO:
Values:

1  Good - Meets at least 6 of the attributes listed (one needs to be less than 25% mortality)
2  Fair - Has 4 – 5 of the attributes listed (one needs to be less than 25% mortality)
3  Poor - Has less than 4 of the attributes listed and /or more than 25% mortality

Windbreak Attributes:

- Less than 25% of the trees are dead
- Continuous barrier, no gaps (missing trees)
- 50% density or greater
- No smooth bromegrass or fescue sod present
- Majority of the tree crowns are healthy with less than 25% of the trees showing insect, disease or herbicide damage
- None to very little livestock activity in the planting.
- Tree regeneration is present
• Trees are expected to live another 20 years

2.5.14.6N-GT... TREE FUNCTION AGE [AGE]

Record the average age of the tree function to determine renovation needs.

When collected: and FUNCTION OF TREES = 1 through 5
Field width: 1 digit
Tolerance:
MQO:
Values:
1 less than 25 years
2 25-50 years
3 greater than or equal to 50 years

2.5.15+N DISTURBANCE 1 [DIS1] Not Collected in Ground Truth
2.5.16 DISTURBANCE YEAR 1 [DYR1] Not Collected in Ground Truth
2.5.17 DISTURBANCE 2 [DIS2] Not Collected in Ground Truth
2.5.18 DISTURBANCE YEAR 2 [DYR2] Not Collected in Ground Truth
2.5.19 DISTURBANCE 3 [DIS3] Not Collected in Ground Truth
2.5.20 DISTURBANCE YEAR 3 [DYR3] Not Collected in Ground Truth
2.5.21+N TREATMENT 1 [TRE1] Not Collected in Ground Truth
2.5.22 TREATMENT YEAR 1 [TYR1] Not Collected in Ground Truth
2.5.23 TREATMENT 2 [TRE2] Not Collected in Ground Truth
2.5.24 TREATMENT YEAR 2 [TYR2] Not Collected in Ground Truth
2.5.25 TREATMENT 3 [TRE3] Not Collected in Ground Truth
2.5.26 TREATMENT YEAR 3 [TYR3] Not Collected in Ground Truth
2.5.27+N PHYSIOGRAPHIC CLASS [PHYS] Not Collected in Ground Truth

2.5.37N PRIVATE OWNER INDUSTRIAL STATUS [INDU] Not Collected in Ground Truth

2.5bU Delineating Condition Classes within Accessible Nonforest Land

Accessible Nonforest Land is subdivided into condition classes that are based on differences in URBAN RESERVED STATUS, URBAN OWNER GROUP, and URBAN NONFOREST LAND USE. Specific criteria apply for each of the three attributes and are documented by attribute in Sections 2.5.1+U, 2.5.2+U, and 2.5.29+U.

Additionally, each separate nonforest condition class recognized within accessible nonforest land must be at least 1.0 acre in size and at least 120.0 feet in width. If prospective contrasting nonforest condition classes do not each meet these minimum size and width requirements, the
most similar prospective conditions should be combined until these minimums are attained. The exception is that there is no specific minimum size requirement for the 300 (Developed) series of URBAN NONFOREST LAND USEs other than their shortest dimension must be at least 20 ft. in length. The two exceptions to the 20 ft. minimum dimension rule within the 300 (Developed) series are code 340 (Mining and Wasteland), which must be at least 120 ft. wide and an acre in size and codes 320 (Rights-of-way), 321 (Transportation), and 322 (Utility), which have no minimum dimension.

No other attribute shall be the basis for recognizing contrasting condition classes within accessible nonforest land. For each condition class recognized, many “ancillary attributes” that help describe the condition will be collected, but will not be used for delineation purposes (see Sections 2.5.7+U to 2.5.36.

Record the URBAN NONFOREST LAND USE that describes the land use occurring closest to the ground, for example:

- An elevated highway that exists over a downtown parking lot would be coded as Commercial / Industrial (314), not Transportation (321).
- A Utility line that exists above a developed URBAN NONFOREST LAND USE would be ignored and considered an inclusion within the surrounding condition.

General instructions for delineating condition classes within accessible nonforest land:

- Distinct boundary within a subplot or microplot – Separate condition classes ARE recognized if, within a subplot, two (or more) distinctly different condition classes are present and delineated by a distinct, abrupt boundary. The boundary is referenced; see Section 4.0+U.
- Indistinct boundary within a subplot – Separate condition classes are NOT recognized if the prospective condition classes abut along an indistinct transition zone, rather than on an abrupt, obvious boundary. Only one condition is recognized, and the subplot is classified entirely as the condition it most resembles.

(2.5.1+U URBAN RESERVED STATUS)
(See full data element description in Section 2.5.1+U URBAN RESERVED STATUS)

(2.5.2+U URBAN OWNER GROUP)
(See full data element description in section Section 2.5.2+U URBAN OWNER GROUP)

2.5.29+U+N+GT PRESENT URBAN / GROUND TRUTH NONFOREST LAND USE \[UGT\text{NFLU}\] Record this attribute for every nonforest condition class sampled identified on the plot. Recognizing multiple nonforest conditions on a plot is not required unless conducting a nonforest inventory (NONFOREST SAMPLING STATUS = 1); or when areas that were sampled and classified at last inventory as accessible forest land and are now nonforest or partially nonforest land. For those areas that have changed from forest to nonforest, this variable is used to track land use change. Conversions from forest to nonforest become new nonforest conditions whenever they occur, except when a previously defined nonforest condition has expanded into an adjacent previously defined forest condition. This expanded condition will be captured through boundary changes on respective subplots and does not constitute a new separate condition. Instructions in Sections 2.1 and 2.4 apply. At times an URBAN CONDITION CLASS STATUS 2 condition may be made up of multiple nonforest land uses neither of which meet the minimum size requirement individually. In such cases, record the first URBAN NONFOREST LAND USE encountered. If unable to determine the URBAN NONFOREST LAND USE for a non–sampled condition on the ground make the best call based on the image provided to install the plot.
NRS Note: Guidelines on how to combine areas that are too small to stand alone into combined Nonforest conditions:

- In cases where the first encountered nonforest area is less than an acre and or less than 120 feet in width but is bounded by a single qualifying adjacent nonforest area, the non-forest area is considered an inclusion and the surrounding Land Use will be used to represent the condition.

- Nonforest conditions may consist of multiple nonforest land uses that are less than an acre or less than 120 feet in width. In such cases, the first nonforest land use encountered will be used to represent the condition, assuming the combined areas are 120 feet and an acre.

- In cases where the area encountered is not identifiable as a distinct and specific Nonforest Land Use (an inclusion), the adjacent qualifying Land Use will be used to represent the condition.

- In cases where a wooded strip is too small to be its own condition and it is bordered on each side by two different qualifying distinct and specific Nonforest Land Uses, assign the wooded strip to the condition that PC is closest to.

- In cases where a wooded strip is too small to be its own condition and it is bordered on each side by two different non-qualifying Nonforest Land Uses, assuming the combined areas are 120 feet and an acre, assign the strip of trees a Nonforest Land Use of 40 (Other).

NRS Note: On remeasure plots, two (or more) CONDITION CLASS STATUS 2 conditions will be recorded if an additional, unique, PRESENT NONFOREST LAND USE resulted from the conversion of forest land since the previous sampled visit.

NRS Note: When remeasuring a plot that had multiple CONDITION STATUS 2 conditions defined:

- Combine all previously defined CONDITION STATUS 2 conditions into one condition
- Follow current condition delineation rules to define the combined condition
- If new forest to nonforest conversions have occurred since last sampled visit, multiple CONDITION STATUS 2 conditions can once again be defined
Figure 15.bN. In the subplot on the left, there has been an expansion of an existing nonforest condition since the previous inventory. No distinction is made between the previous and current nonforest conditions. However, in the subplot on the right, a new and distinct nonforest condition exists where there was once accessible forestland. In this case, two nonforest conditions must be defined, distinguished by different Present Nonforest Land Uses.

When collected: **URBAN / GROUND TRUTH, CONDITION CLASS STATUS = 2, 3, 4, 5**
Field width: 2 \( \text{digits} \)
Tolerance: No errors
MQO: At least 99% of the time

Values:
- **100** Agricultural land - Land managed for crops, pasture, or other agricultural use. The area must be at least 1.0 acre in size and 120.0 feet wide (with the exception of windbreak/shelterbelt, which has no minimum width.) If a windbreak or shelterbelt meets the size and definition requirements of accessible forest land, then it is not considered nonforest. A windbreak or shelterbelt can be less than 120.0 feet wide and less than 1 acre. If a windbreak or shelterbelt qualifies and meets the definition of accessible forest land, then it is not considered nonforest. At times a 2 condition may be made up of multiple nonforest land uses, some of which may not be an acre in size. In this case record the first nonforest land use that you encounter, regardless of size. Use the 100 code only for cases not better described by one of the following:
- **110** Cropland - Land utilized for agricultural crops including silage and feed grains; and bare farm fields resulting from cultivation or harvest.
120 Pasture (improved through cultural practices) - Land maintained and used for grazing with canopy cover less than 10 percent in live trees (established seedlings, saplings or larger trees). Exclude occasional large trees with the obvious function of providing shade for livestock, and small single trees or clusters of trees when determining canopy cover (unless they are somewhat homogenous throughout the condition). Evidence of maintenance, besides the degree of grazing, includes condition of fencing, presence of stock ponds or water tanks. Land also may be periodically brush hogged indicated by seedlings 3 to 4 feet in height and basal scars present on trees.

130 Idle farmland - Former cropland or pasture that has not been tended within the last 2 years and that has less than 10 percent canopy cover with live trees, (established seedlings or larger trees) regardless of species. A field that is between crop rotations should NOT be called Idle Farmland.

140 Orchard / Nursery - Land utilized for orchards and nursery stock.

150 Christmas tree plantation

160 Maintained wildlife opening - Land maintained as a permanent opening of primarily herbaceous vegetation within woodland areas to provide food and cover benefits for early successional wildlife species. [Source: USDA NRCS] These may be located on public or private land.

170 Windbreak / Shelterbelt - Windbreaks or shelterbelts are plantings of single or multiple rows of trees or shrubs that are established for environmental purposes. Windbreaks or shelterbelts are generally established to protect or shelter nearby leeward areas from troublesome winds. Such plantings are used to reduce wind erosion, protect growing plants (crops and forage), manage snow, and improve irrigation efficiency. Windbreaks also protect structures and livestock, provide wildlife habitat, improve aesthetics, and provide tree or shrub products. Also, when used as a living screen, windbreaks control views and lessen noise. [Source: USDA NRCS, Windbreak /Shelterbelt Conservation Practice Job Sheet 380, April 1997]

200 Rangeland - Land primarily composed of grasses, forbs, or shrubs. This includes lands vegetated naturally or artificially to provide a plant cover managed like native vegetation and does not meet the definition of pasture. The area must be at least 1.0 acre in size and 120.0 feet wide.

300 Developed - Land used primarily by humans for purposes other than forestry or agriculture. There is no specific minimum size requirement for the 300 (Developed) series of codes other than their shortest dimension must be at least 20 ft. in length. An exception to this rule is code 340 (Mining and wasteland) which must be at least 120 ft. wide and an acre in size. Another exception is code 320 (Rights-of-way) and 322 (Utility) which have no minimum width. In some situations a building may serve multiple land uses, such as a commercial store front on the first floor with residential units on the second floor. In such cases assign the land use that produces the most pedestrian “foot traffic”. Use the 300 code only for land not better described by one of the following:

310 Cultural: business (industrial/commercial), residential, and other places of intense human activity. Use the 310 code only for land not better described by one of the following:

311 Residential: Free standing structures and related green space serving one to four families each.
312 Multi-family residential: Structures containing more than four units each. A block of attached one-four family structures would be considered Multi-family residential. A residential complex consisting of many separate one-four family structure and related green space would be also considered Multi-family residential.

313 Institutional: Schools, hospitals/medical complexes, colleges, religious buildings, government buildings, etc., and related green space. However, small islands of trees in a maintained landscape would be considered Institutional.

314 Commercial/Industrial: In addition to standard commercial and industrial land uses related green space, outdoor storage/staging areas, and parking lots in downtown areas that are not connected with institutional or residential use are also included. Home businesses, such as day care, tax preparation, hair styling, etc. that are run out of Residential buildings are considered Commercial.

316 Cemetery. This category includes associated access roads, buildings and green space (maintained and unmaintained) while excluding obvious public roads which would be considered Rights-of-Ways.

320 Rights-of-way: improved roads, railway, powerlines, maintained canal.

A canal that qualifies as census or noncensus water is coded as CONDITION CLASS STATUS 3 or 4.

An improved road that specifically serves a Developed area such as a residence, parking lot, campground, or a cemetery is considered a part of that greater Developed NFLU, and is not delineated as a Right-of-Way so long as it remains within that Developed land use. Once that road departs from the specific Developed land use, it may be considered a Right-of-Way. Improved roads that are adjacent to Developed Nonforest areas, but do not uniquely serve those areas are considered rights-of-way and are not incorporated into the greater Developed condition, unless it’s bounded (on both sides) by accessible forest land.

An alley or alleyway is NOT delineated and mapped as a R.O.W. and is included in its surrounding condition. An alley is defined as a narrow lane, path, or passage way, for pedestrians or vehicles, which usually runs between or behind buildings, and in some cases provides access to the rear of lots or buildings.

Consider the area between the road edge and the far side of the sidewalk as part of the R.O.W. In cases where there is no sidewalk present look to the following ranked locations to determine the R.O.W. boundary:

- Signs of periodic vegetation manipulation associated with the roadway
- A clear change in ownership between public and private
- The far side the drainage ditch associated with the road

Use code 320 for land not better described by the following:

321 Transportation: limited access roadway (highways with on-off ramps), railway or airport and related green space.

322 Utility: power lines, pipelines, maintained levees and flood control channels.

All maintained utility Rights-of-Way are coded as such when they occur within Forestland (URBAN CONDITION STATUS 1). However, if a utility right-of-way extends into a developed land use (the 300 series codes), the developed land use takes precedence. For example, a power line may run over a Multi-Family Residential land use, in this case code it as Multi-Family Residential.
Recreation: parks, Skiing, golf courses, campgrounds, playing fields, athletic, sports tracks, etc. These are areas where persons participate in sports and outdoor activities. This code excludes complexes such as professional football stadiums, such areas would be considered Commercial / Industrial.

Use code 330 for land not better described by the following:

331 Park: Parks take on many forms but normally include "park," "wilderness," "wild river," "reserve," or "preserve" in their names and are normally publicly owned and are always open to the public. This land use includes associated access roads, buildings and green space (maintained and unmaintained) while excluding obvious public roads which would be considered Rights-of-Ways.

332 Golf courses. This category includes associated access roads, buildings and green space (maintained and unmaintained) while excluding obvious public roads which would be considered Rights-of-Ways.

340 Mining and wasteland

Note: Code 340 must be at least 1 acre in size and 120.0 feet in width. Surface mining, gravel pits, dumps, landfills or reclaimed mining areas that are at least 1 acre and 120.0 feet in width. Note: Reclaimed mining areas are not always nonforest. Some trees such as black locust readily adapt to reclaimed areas. If the 10% canopy cover requirement is met, the land is considered forest land. The field crew will make the decision of whether the land is productive or unproductive. Reclaimed mine areas should remain in this land use until either the 10% canopy cover threshold is met for accessible forest land or another nonforest land use applies. NRS Note: Code 34 must be at least 1 acre in size and 120.0 feet in width.

400 Other - Land parcels greater than 1.0 acre in size and greater than 120.0 feet wide, which do not fall into one of the uses described above. At times an URBAN CONDITION CLASS STATUS 2 condition may be made up of multiple nonforest land uses, some of which may not be an acre in size. In this case record the first nonforest land use that you encounter, regardless of size. Examples include undeveloped beaches, barren land (rock, sand), marshes, bogs, ice, and snow. Use the 400 code only for cases not better described by one of the following:

410 Nonvegetated

420 Wetland - Areas subjected to periodic tidal flooding or other areas where water is present for extended periods during the growing season and for longer periods during the non-growing season. Water usually comes from rainfall, snowmelt, a rising water table, groundwater seepage, or incoming tides. Water may be present on the surface of wetlands for varying periods, as in flooded or ponded wetlands, or it may simply keep the underlying soils saturated near the surface with no surface water present. Wetlands include bogs, marshes, salt marshes, swamps, meadows and fens. [Source: Tiner]

Bogs are not always nonforest. Some tree species such as black spruce can adapt to bog conditions. If the 10% canopy cover requirement is met, the land is considered forest land.

Swamps are not always nonforest. Some tree species readily adapt to the swamp conditions. If the 10% canopy cover requirement is met, the land is considered forest land. Drained beaver ponds that are not stocked are included in this category.

430 Beach - Sandy or pebbly shore associated with an ocean or lake.

450 Nonforest-Chaparral
900  All URBAN CONDITION CLASS STATUS = 3, 4 (Noncensus and Census Water) conditions.
910  URBAN CONDITION CLASS STATUS = 5 (Nonsampled when the area that was not sampled had the potential to be forest land).

The following are regional definitions developed for both national and regional sub-codes. Use these codes in conjunction with CONDITION CLASS STATUS 2.

11 – CROPLAND

Land utilized for agricultural crops including silage and feed grains; and bare farm fields resulting from cultivation or harvest.

12 – IMPROVED / MAINTAINED PASTURE

Land maintained and used and for grazing with canopy cover less than 10 percent in live trees (established seedlings, saplings or larger trees), except that occasional large trees with the obvious function of providing shade for livestock, and small single trees or clusters should be ignored when determining canopy cover (unless they are somewhat homogenous throughout the condition). Evidence of maintenance, besides the degree of grazing, includes condition of fencing, presence of stock ponds or water tanks. Land also may be periodically brush hogged indicated by seedlings 3 to 4 feet in height and basal scars present on trees.

13 – IDLE FARMLAND

Former cropland or pasture that has not been tended within the last 2 years and that has less than 10 percent canopy cover with live trees, (established seedlings or larger trees) regardless of species. A field that is between crop rotations should NOT be called Idle Farmland.

14 – ORCHARD/NURSERY

Land utilized for orchards and nursery stock.

15 – CHRISTMAS TREE PLANTATION

Active Christmas tree plantation must show signs of annual shearing. Record tree species used in the plantation in the PLOT NOTES. If an inclusion of maintained Christmas trees are located within forest land treat them as crops and do not tally them.

16 – MAINTAINED WILDLIFE OPENING

Land maintained as a permanent opening of primarily herbaceous vegetation within woodland areas to provide food and cover benefits for early successional wildlife species. [Source: USDA NRCS] These may be located on public or private land.

17 – WINDBREAK/SHELTERBELT

Windbreaks or shelterbelts are plantings of single or multiple rows of trees or shrubs that are established for environmental purposes. Windbreaks or shelterbelts are generally established to protect or shelter nearby leeward areas from troublesome winds. Such plantings are used to
reduce wind erosion, protect growing plants (crops and forage), manage snow, and improve irrigation efficiency. Windbreaks also protect structures and livestock, provide wildlife habitat, improve aesthetics, and provide tree or shrub products. Also, when used as a living screen, windbreaks control views and lessen noise. [Source: USDA NRCS, Windbreak /Shelterbelt Conservation Practice Job Sheet 380, April 1997]

31 – CULTURAL

Cultural includes multiple family housing – More than one family household per structure, for example, condominiums, townhouses, row houses and apartment buildings. Single family housing – One family or person per structure. Industrial/commercial – Supply yards, parking lots, shopping centers, factories, etc.

32 – RIGHTS-OF-WAY

Highways, improved roads, railroads, airports, pipelines, gas/oil wells, maintained levees, or power lines.

A canal that qualifies as census or noncensus water is coded as 3 or 4.

An improved road that specifically serves a Developed area such as a residence, parking lot, campground, or a cemetery is considered a part of that greater Developed NFLU, and is not delineated as a Right-of-Way so long as it remains within that Developed land use. Once that road departs from the specific Developed land use, it may be considered a Right-of-Way. Improved roads that are adjacent to Developed Nonforest areas, but do not uniquely serve those areas are considered rights-of-way and are not incorporated into the greater Developed condition.

A rail trail that is part of the "rail banking" program is classified as a R.O.W. The rail banking program, created by a congressional amendment in 1983 [to the 1968 National Trails System Act], allows the temporary, though often long-term, use of a disused rail corridor as a public trail while maintaining the option of reactivating the corridor for rail use. If a rail trail can be documented as being part of this program, then a rail trail is a R.O.W. Highly developed trails permanently surfaced with concrete, asphalt, structural wood or crushed stone may be considered Rights-of-Way.

33 – RECREATION

Parks, campgrounds, playing fields, athletic, sports tracks, etc. Highly developed trails permanently surfaced with concrete, asphalt, structural wood or crushed stone may be considered a Recreation Nonforest Land Use.

34 – MINING AND WASTELAND

Surface mining, gravel pits, dumps, landfills or reclaimed mining areas that are at least 1 acre and 120.0 feet in width. Note: Reclaimed mining areas are not always nonforest. Some trees such as black locust readily adapt to reclaimed areas. If the 10 %canopy cover requirement is met, the land is considered forest land. The field crew will make the decision of whether the land is productive or unproductive. Reclaimed mine areas should remain in this land use until either the 10% canopy cover threshold is met for accessible forest land or another nonforest land use applies.

42 – WETLAND
Areas subjected to periodic tidal flooding or other areas where water is present for extended periods during the growing season and for longer periods during the non-growing season. Water usually comes from rainfall, snowmelt, a rising water table, groundwater seepage, or incoming tides. Water may be present on the surface of wetlands for varying periods, as in flooded or ponded wetlands, or it may simply keep the underlying soils saturated near the surface with no surface water present. Wetlands include bogs, marshes, salt marshes, swamps, meadows and fens. [Source: Tiner]

Bogs are not always nonforest. Some tree species such as black spruce can adapt to bog conditions. If the 10% canopy cover requirement is met, the land is considered forest land.

Swamps are not always nonforest. Some tree species readily adapt to the swamp conditions. If the 10% canopy cover requirement is met, the land is considered forest land. Drained beaver ponds that are not stocked are included in this category.

43 – BEACH

Sandy or pebbly shore associated with an ocean or lake.

Ancillary (Non-Delineating) Urban / Ground Truth Condition Level Variables

2.5.29.1U‡NGTI-TREE LAND USE [i-TREE]

Assign each condition an i-TREE LAND USE. If multiple i-TREE LAND USES exist within a condition, record the first one that is encountered starting at zero degrees.

i-TREE LAND USE does not recognize URBAN NONFOREST LAND USE 320, Rights-of-way. Assign such conditions an i-TREE Land Use based on the surrounding condition. For example, a Right-of-Way in a multi-family residential neighborhood would be assigned an i-TREE LAND USE of 21 – Multi-family residential.

When collected: URBAN CONDITION CLASS STATUS = 1, 2, 3, 4
Field width: 2 digits
Tolerance: No errors
MQO: At least 99% of the time

Values:

10 Agriculture: Is defined as cropland, pasture, idle farmland, orchards, vineyards, nurseries, maintained wildlife openings, farmsteads and related buildings, feed lots, rangeland, and includes windbreaks and shelterbelts that do not meet the definition for forest land. Wooded areas /plantations that are managed for a specific crop such as nuts or Christmas trees or forest land that shows obvious evidence of management activity related specifically to wood production are also included. This code is valid with URBAN NONFOREST LAND USE 100, 110, 120, 130, 140, 150, 160,170,200, 320 and CONDITION CLASS STATUS = 1 (accessible forest land) conditions that are not reserved.

20 Residential: Freestanding, and related green space, structures serving one to four families each. This code is valid with URBAN NONFOREST LAND USE 311 and 320

21 Multi-family residential: Structures containing more than four residential units. [Note: A block of attached one- to four-family structures would be considered multi-family residential. A residential complex consisting of many separate one- to four-family structures and related green-space would be also considered multi-family residential]. This code is valid with URBAN NONFOREST LAND USE 312 and 320
Institutional: Schools, hospitals/medical complexes, colleges, religious buildings, government buildings, etc., and related green spaces. This code is valid with URBAN NONFOREST LAND USE 313 and 320.

[Note: If a parcel contains large unmaintained areas, possibly for expansion or other reasons, treat the area as Unused (i-TREE LAND USE 24). However, small islands of trees in a maintained landscape would be considered Institutional.]

Commercial/Industrial: In addition to standard commercial and industrial land uses, this category includes outdoor storage/staging areas as well as parking lots in downtown areas that are not connected with an institutional or residential use. This code is valid with URBAN NONFOREST LAND USE 314 and 320.

NOTE: For mixed-use buildings, land use is based on the dominant use, i.e., the use that receives the majority of the foot traffic. It might not always occupy the majority of space in the building. For example, a building with commercial use of the first floor and apartments on upper floors would be classified as Commercial/Industrial.

Unused: This category includes land with no clear intended present or past use. Abandoned buildings, vacant structures, and their associated infrastructure and green space should be classified based on their original intended use. For example, an overgrown parking lot and playground associated with an abandoned apartment complex would be classified as Multi-family Residential, not Unused. Idle farmland should be classified as Agriculture. Forest land that is not clearly actively managed for timber production and is not contained within the boundaries of a Park, Golf course, or Cemetery land use would be coded as Unused. For example, forest land in the form of a woodlot in the middle of a corn field that is not being managed for wood products would be considered Unused, as the land is not associated with a particular land use. Forest land contained within the boundaries of a Park, Golf Course, or Cemetery would be coded respectively. This code is valid with URBAN NONFOREST LAND USE 320, 410, 430, 450 and CONDITION CLASS STATUS = 1 (accessible forest land) conditions that are not managed for wood production or part of a Park, Cemetery, or Golf Course.

Cemetery: Includes associated access roads, buildings, green space (maintained & unmaintained), and forest land within the Cemetery boundary that is not being managed for wood products. This code is valid with URBAN NONFOREST LAND USE 316, 320, and CONDITION CLASS STATUS = 1 (accessible forest land) conditions that are not managed for wood production or part of a Park or Golf Course.

Transportation: Includes limited access roadways and related green-spaces (such as interstate highways with on and off ramps, sometimes fenced); railroad stations, tracks and yards; shipyards; airports; etc. If plot falls on any other type of road, or associated median strip, classify according to nearest adjacent land use. This code is valid with URBAN NONFOREST LAND USE 320 and 321.

Utility: Power-generating facilities, sewage treatment facilities, covered and uncovered reservoirs, and empty storm-water runoff retention areas, flood control channels, conduits. This code is valid with URBAN NONFOREST LAND USE 314, 320 and 322.

Park: Parks take on many forms but normally include “park”, “wilderness,” “wild river,” “reserve,” or “preserve” in their names and are normally publicly owned and are always open to the public. This land use includes associated access roads, buildings, green space (maintained and unmaintained), and forest land (reserved or not reserved) within the Park boundary that is not being managed for wood products. This code is valid with URBAN NONFOREST LAND USE 320, 330,331, and CONDITION CLASS STATUS = 1 (accessible forest land) conditions that are not managed for wood production or part of a Cemetery or Golf Course. **NRS NOTE: All Parks are considered Reserved.**
41 Golf Course: Includes associated access roads, buildings, green space (maintained and unmaintained), and forest land within the Golf Course boundary that is not being managed for wood products. This code is valid with URBAN NONFOREST LAND USE 320, 332 and CONDITION CLASS STATUS = 1 (accessible forest land) conditions that are not managed for wood production or part of a Park or Cemetery.

50 Water/wetland: Streams, rivers, lakes, storm-water retention areas and other water bodies / wetlands (natural or manmade) that meet the definition of URBAN CONDITION CLASS STATUS 3 or 4 or areas meeting the definition of URBAN NONFOREST LAND USE 420. Areas of standing water / wetlands that do not meet minimum size requirements should be classified based on the adjacent land use; such areas may include small pools and fountains. This code is valid with URBAN CONDITION CLASS STATUS 3 and 4 as well as URBAN NONFOREST LAND USE 320 and 420.

60 Other: Land uses that are not better described by one of the categories listed above. This designation should be used very sparingly as it provides very little useful information for the model. Clarify with comments in Notes. This code is valid with URBAN NONFOREST LAND USE 300, 310, 320, and 400.

2.5.7 +U+N+GT URBAN / GROUND TRUTH OWNER CLASS [UGTOWNC]
Record the URBAN / GROUND TRUTH OWNER CLASS code that best corresponds to the ownership (or the managing Agency for public lands) of the land in the condition class. Conditions will NOT be delineated based on changes in URBAN / GROUND TRUTH OWNER CLASS. If multiple URBAN / GROUND TRUTH OWNER CLASSes occur within a condition class (i.e., within an URBAN / GROUND TRUTH OWNER GROUP), record the URBAN / GROUND TRUTH OWNER CLASS closest to the center of the lowest numbered subplot in the condition.

When collected: CORE: All accessible forest land condition classes (URBAN / GROUND TRUTH CONDITION CLASS STATUS = 1), 2, 5
CORE OPTIONAL: All condition classes
Field width: 2 digits
Tolerance: No errors
MQO: At least 99% of the time
Values:
Owner Classes within Forest Service Lands (Owner Group 10)

11 National Forest
12 National Grassland and/or Prairie
13 Other Forest Service land

Owner Classes within Other Federal Lands (Owner Group 20)

21 National Park Service
22 Bureau of Land Management
23 Fish and Wildlife Service
24 Departments of Defense/Energy (Including the Army Corps of Engineers)
25 Other Federal
Owner Classes within State and Local Government Lands (Owner Group 30)

31 State including state public universities
32 Local (County, Municipality, etc.) including water authorities
33 Other Non Federal Public

Owner Classes within Private lands (Owner Group 40)

41 Corporate, including Native Corporations in Alaska and private universities (including private educational institutions)
42 Non Governmental Conservation / Natural Resources Organization Examples: Nature Conservancy, National Trust for Private Lands, Pacific Forest Trust, Boy Scouts of America, etc.
43 Unincorporated Partnerships / Associations / Clubs. Examples: Hunting Clubs that own, not lease property, recreation associations, 4H, churches, etc.
44 Native American (Indian) – within reservation boundaries
45 Individual and Family, including trusts, estates, and family partnerships

NRS Note: LLCs and LLPs that are associated with a family name, such as the Jones Family LLC are coded under OWNER CLASS 45. In the absence of any indication that the LLC or LLP is tied to a family, code as OWNER CLASS 41.

2.5.8 OWNER SUB-CLASS (CORE OPTIONAL) Not Collected in Ground Truth Not Collected in NRS

2.5.9 PUBLIC ADMINISTRATIVELY WITHDRAWN STATUS (CORE OPTIONAL) Not Collected in Ground Truth Not Collected in NRS

2.5.10 ADMINISTRATIVELY WITHDRAWN AREA NAME (CORE OPTIONAL) Not Collected in Ground Truth Not Collected in NRS

2.5.11 ADMINISTRATIVELY WITHDRAWN NOTES (CORE OPTIONAL) Not Collected in Ground Truth Not Collected in NRS

2.5.12 RESERVED AREA NAME [RNAM]
  Record the specific name of the area that identifies the reserved designation for the condition. If a drop-down list is provided in the PDR, either select the correct name or select “Other” and type the correct name in the notes field.

  When collected: All conditions with URBAN / GROUND TRUTH RESERVED STATUS=1
  Field width: Alphanumeric character field
  Tolerance: No errors
  MQO: At least 99% of the time
  Values: English language words, phrases, and numbers

2.5.28+N LAND COVER CLASS [LCOV]
  Record this variable for all mapped conditions. As with 2.4.2 CONDITION CLASS STATUS, LAND COVER CLASSes must meet the minimum area and width requirements (except those cases where the condition has been solely defined due to developed land uses, such as roads and rights-of-ways). If the condition is less than 1 acre, then apply the key to the condition. Within larger mapped conditions, evaluate the potential for multiple land cover classes as follows: if no
prospective land cover classes meet the minimum width and area requirements, apply the key to the acre area that is within the condition being evaluated and closest to the lowest numbered subplot center associated with the condition. If multiple land cover classes (i.e., those which meet minimum area and width requirements) exist in the condition, assign the first land cover class that is encountered to the condition. As with other condition attributes, inclusions (of less than 1 acre) within the condition should be ignored when assigning the LAND COVER CLASS. Therefore, areas of the inclusion within the acre area are ignored when making the relative cover assessments. Apply the key as a guide and/or to verify the LAND COVER CLASS selection.

NRS Note: For the purpose of assigning Land Cover Class, developed nonforest land uses are treated as a separate condition even within greater defined nonforest areas.

Assignment of LAND COVER CLASS code is hierarchical in nature, and should be performed using the following Land Cover Classification hierarchical key. Following the guidance of the key, codes should be examined in succession, and the first definition which describes the area of the condition should be chosen. For example, if an area has 15% tree cover that is taller than the 50% shrub cover, it is classified as class 01 (Treeland). Note: Treeland is not equivalent to Forestland (e.g., a recent clearcut could be Forestland, but would not be Treeland). Vegetative cover, as used below, includes the area of ground covered by the vertical projection of the live plant canopy (or other vegetation components like flowers, basal structures or vines) on the area defined by the condition. If foliage is absent due to senescence (leaves turning brown and falling off) or dormancy, the cover should be estimated based on the position of plant remains or other evidence of the foliar distribution during the growing season. If burned, then classify based on the remaining live vegetation, including the canopy cover of remaining live trees and shrubs.

When the land surface of a condition is covered by deep non-permanent snow, ice, or water, and/or a condition is defined as CONDITION CLASS STATUS 5 (denied access or hazardous), field crews should use aerial imagery, local knowledge, and field observations to best determine LAND COVER CLASS.

NRS Note: When the entire plot is defined as CONDITION CLASS STATUS 5, separate individual condition classes are not mapped. Only one LAND COVER CLASS is assigned per plot, base this class on the condition represented by plot center. If the class at plot center does not meet minimum area and width requirements to establish a condition, then use the class that occupies the majority of the visual acre surrounding plot center to describe the LAND COVER CLASS for the plot.

Full Land Cover Class Definitions

- **Dominant**: Refers to the highest (tallest) life form present, typically trees, then shrubs, then herbaceous layers.
- **Predominant**: Refers to the cover class with the highest percent cover in the condition.
- **Vegetated**: Contains at least 10% vegetation cover (modification of NVCS 2008)
- **Sparsely Vegetated**: Does not contain at least 10% vegetation cover
Natural vegetation is defined as vegetation where ecological processes primarily determine species and site characteristics; that is, vegetation comprised of a largely spontaneously growing set of plant species that are shaped by both site and biotic processes. Human activities influence these interactions to varying degrees (e.g., logging, livestock grazing, fire, introduced pathogens), but do not eliminate or dominate the spontaneous processes. Wherever doubt exists as to the naturalness of a vegetation type (e.g., old fields that have been left fallow for long enough are to be considered natural, various forest plantations, which are considered treed land if trees are present), it is classified as part of the natural / semi-natural vegetation (NVCS 2008).

Semi-natural vegetation typically encompasses vegetation types where the species composition and/or vegetation growth forms have been altered through anthropogenic disturbances (those caused by, or associated with human activity) such that no clear natural similar example is known, but they are a largely spontaneous set of plants shaped by ecological processes. Natural (or near-natural) and semi-natural vegetation are part of a continuum of change within natural vegetation that reflects varying degrees of anthropogenic (human – impacted) and other disturbances (NVCS 2008). Semi-natural vegetation includes vegetation types where the current structure and/or composition is anthropic, but where it is obvious that natural processes have since resumed (e.g., agricultural lands that have naturally reverted to forest).

Anthropic Vegetation is defined as vegetation with a distinctive structure, composition, and development determined by regular human activity. Developed vegetation has typically been planted or treated, and has relatively distinctive growth form, floristic, or site features when compared to natural vegetation. Distinctive growth form and structural attributes typically include one or more of the following:

- Dominant herbaceous vegetation that is regularly-spaced and/or growing in rows, often in areas with substantial cover of bare soil for significant periods of the year, usually determined by tillage or chemical treatment.
- Dominant vegetation with highly-manipulated growth forms or structure rarely found as a result of natural plant development, usually determined by mechanical pruning, mowing, clipping, etc. Also includes natural and semi-natural vegetated areas within developed land cover that are too small to be their own LAND COVER CLASS.
- Dominant vegetation comprised of species not native to the area that have been intentionally introduced to the site by humans and that would not persist without active management by humans (NVCS 2008).

Land Cover Classification Key

Follow the key in sequence. If a class described the condition, then look no further.

1. ≥10% vegetative Cover (when considering aquatic vegetation, only emergent vegetation is considered) = Vegetated, else 2.
   a. Areas where the majority of vegetation (≥50% relative cover) has been highly-manipulated = Anthropic Vegetation, else b
      i. Areas that are predominantly covered by vegetation grown for the production of food, non-woody fiber, and/or ornamental horticulture, including land in any stage of annual crop production, and land being regularly cultivated for production of crops from perennial plants = 06 Agricultural Vegetation
      ii. Other areas predominantly covered by vegetation with highly-manipulated growth forms or where natural and semi-natural like areas are too small to be own LAND COVER CLASS due to human development = 07 Developed, Vegetated
   b. Areas where majority of vegetation (≥50% relative cover) is natural or semi-natural = Natural/Semi-natural Vegetation
i. Areas on which trees provide 10% or greater canopy cover and are part of the dominant (uppermost) vegetation layer, including areas that have been planted to produce woody crops = 01 Treeland

ii. Areas on which shrubs provide 10% or greater cover and are part of the dominant (uppermost) vegetation layer = 02 Shrubland

iii. Areas on which herbaceous vegetation provide 10% or greater cover and are part of the dominant (uppermost) vegetation layer = 03 Grassland

iv. Areas on which non-vascular vegetation provide 10% or greater cover and are part of the dominant vegetation layer = 04 Non-vascular Vegetation

v. Areas with 10% or greater vegetative cover but no one life form has 10% or more cover = 05 Mixed Vegetation

2. <10% vegetative cover = Sparsely Vegetated
   a. Areas persistently and predominantly covered by water (census and noncensus water, permanent snow and ice) and with less than 10% cover of emergent vegetation. = 10 Water
   b. Areas predominantly covered with constructed materials with limited plant life = 09 Developed
   c. Natural areas with limited vegetation. Areas predominantly covered by bare rock, gravel, sand, silt, clay, or other earthen material, with little (<10% cover) or no "green" vegetation present regardless of its inherent ability to support life = 08 Barren

When collected: All condition classes
Field width: 2 digits
Tolerance: No errors
MQO: At least 95% of the time

Values:

Codes are >10% vegetative cover:

01 Treeland: Areas on which trees provide 10% or greater canopy cover and are part of the dominant (uppermost) vegetation layer, including areas that have been planted to produce woody crops. Only include tree species that can be tallied in the region, i.e., that are on the regional species list. Example areas include forests, forest plantations, reverting fields with ≥10% tree canopy cover, clearcuts with ≥10% tree canopy cover. This category includes cypress swamps and mangroves (not to be confused with aquatic vegetation).

02 Shrubland: Areas on which shrubs or subshrubs provide 10% or greater cover and are part of the dominant (uppermost) vegetation layer, provided these areas do not qualify as Treeland. Shrub/Subshrub — a woody plant that generally has several erect, spreading, or prostrate stems which give it a bushy appearance. This includes dwarf shrubs, and low or short woody vines (NVCS 2008) and excludes any species on FIA's tree list. Examples include cranberry bogs and other shrub-dominated wetlands, chaparral, and sagebrush.

03 Grassland: Areas on which herbaceous vegetation provide 10% or greater cover and are part of the dominant (uppermost) vegetation layer, provided these areas do not qualify as Treeland or Shrubland. This includes herbs, forbs, and graminoid species. Examples include meadows and prairies. Grazed land is also included, but not if the pasture is improved to such an extent that it meets the requirements for Agricultural Vegetation. This category also includes emergent wetland vegetation like seasonally flooded grasslands, cattail marshes, etc.

04 Non-vascular Vegetation: Areas on which non-vascular vegetation provide 10% or greater cover and are part of the dominant vegetation layer, provided these areas do not qualify as Treeland, Shrubland, or Grassland. Examples include mosses, sphagnum moss bogs, liverworts, hornworts, lichens, and algae.
Mixed Vegetation: Areas with 10% or greater vegetative cover but no one life form has 10% or more cover. That is, these areas do not qualify as Treeland, Shrubland, Grassland, or Non-vascular Vegetation, and thus are a mixture of plant life forms. Examples can include early stages of reverting fields and high deserts.

Agricultural Vegetation: Areas that are dominated by vegetation grown for the production of crops (food, non-woody fiber and/or ornamental horticulture), including land in any stage of annual crop production, and land being regularly cultivated for production of crops from perennial plants. Agricultural vegetation shows a) rapid turnover in structure, typically at least on an annual basis, either through harvesting and/or planting, or by continual removal of above ground structure (e.g., cutting, haying, or intensive grazing), or b) showing strong linear (planted) features. The herbaceous layer may be bare at various times of the year (NVCS 2008). Examples include row crops and closely sown crops; sod farms, hay and silage crops; orchards (tree fruits and nuts, Christmas trees, nurseries of trees and shrubs), small fruits, and berries; vegetables and melons; unharvested crops; cultivated or improved pasture; idle cropland (can include land in cover and soil-improvement crops and cropland on which no crops were planted) (NRI Field guide). When idle or fallow land ceases to be predominantly covered with manipulated vegetation, then it is no longer Agricultural Vegetation.

Developed, Vegetated: Areas predominantly covered by vegetation with highly manipulated growth forms (usually by mechanical pruning, mowing, clipping, etc.), but are not Agricultural. This vegetation type typically contains an almost continuous herbaceous (typically grass) layer, with a closely cropped physiognomy, typically through continual removal of above ground structure (e.g., cutting, mowing), and where tree cover is highly variable, or other highly manipulated planted gardens (NVCS 2008). Examples can include lawns, maintained utility rights-of-way, office parks, and cemeteries.

Barren: Natural areas of limited plant life (< 10%). Areas generally characterized by bare rock, gravel, sand, silt, clay, or other earthen material, with little or no “green” vegetation present regardless of its inherent ability to support life. Examples include naturally barren areas such as lava fields, gravel bars and sand dunes, as well as areas where land clearance has removed the vegetative cover. Can include the natural material portions of quarries, mines, gravel pits, and cut or burned land <10% vegetation.

Developed: Areas predominantly covered with constructed materials with limited plant life (< 10%). Examples include completely paved surfaces like roads, parking lots and densely developed urban areas.

Water: Areas persistently covered and predominated by water and have <10% emergent vegetative cover. Examples include census and noncensus water and permanent snow and ice. For example, only the open water portion of a bog is to be included.
Ocular method - The Ocular method is only used in areas that are obviously 0% LIVE PLUS MISSING CANOPY COVER or obviously greater than 10% LIVE PLUS MISSING CANOPY COVER. In addition to visual inspections of what is on the ground, crews can also use various types of aerial imagery to help determine LIVE CANOPY COVER and LIVE PLUS MISSING CANOPY COVER values using this method. The Ocular method may also be used on URBAN / GROUND TRUTH CONDITION CLASS STATUS 2, 3, and 4 plots where access to the nonforest land cover area may be limited or the nonforest condition is a developed nonforest land use. Note that when the Ocular method is used, it is likely to be easier for the observer to ignore subplot boundaries and assess the percentage of tree canopy cover over the visual acre of the condition in question, without regard to the locations of the stems supporting the canopy over the plot.

See NRS Note below for guidance on locating the “visual acre surrounding Plot Center”

NRS Note: National defined “phantom subplots” are the equivalent to NRS defined “temporary subplots”.

Subplot method - The Subplot method is used when the ocular method is not appropriate and in cases where the terrain, vegetation, and dimensions of a condition or the size of the field crew DO NOT allow a safe or practical sample using the acre method.

1. To estimate cover using the subplot method, the crew measures the crowns of all live trees, seedlings, and saplings on each of the four 1/24 acre subplots. To estimate total stems per acre, stems ≥ 5.0 inches diameter are counted on the subplots and stems <5.0 inches diameter are counted only on the four 1/300 acre microplots located 90 degrees and 12.0 feet from the subplot centers. The sample may consist of any combination of regular subplots and/or phantom subplots, provided all subplots fall entirely in the questionable condition.

   NRS Note: TOTAL STEMS are calculated based on actual stem tally on points 1 - 4 in the PDR, no additional input by the crews is needed.

2. Install phantom subplots as necessary to yield four 1/24-acre sample areas that fall entirely within the questionable condition. Record the location of these phantom or temporary subplots on your four point plot sketch and monument with pins/dowels and flagging. Include reference trees (>3” DBH when they are available or otherwise trees <3” DBH may be used) along with their distance and azimuth from ‘X’ subplot. Establish phantom subplots using the following protocol (Figure 16):
   a. Begin by locating the phantom subplots using the “highest” numbered regular subplot that falls in the questionable condition (e.g., 4 is the highest numbered regular subplot, next 3 and then 2). The phantom subplots are located in the following fashion (1) 120.0 feet at 360 degrees, (2) 120.0 feet at 120 degrees, then (3) 120.0 feet at 240 degrees.
   b. If this fails to yield 4 subplots that fall entirely within the questionable condition, install the remaining phantom subplots off the next highest numbered regular subplot that falls in the questionable condition.
   c. If this fails to produce a suitable location, rotate the phantom subplot off the other phantom subplots in the attempted order of installation until 4 subplots have been located in the questionable condition.

   NRS Note: Install pins and reference trees at all phantom subplots, when proper reference trees are not present use what you can find.
Figure 16. Example of the subplot method with phantom subplots.

NRS Note: When using the Ocular method to estimate LIVE CANOPY COVER and LIVE PLUS MISSING CANOPY COVER for conditions that do not contain four full subplots, use the visual acre surrounding the estimated location of your phantom subplots. In Figure 16 the visual acre would be the acre surrounding Subplots 4 through 7 for Condition 2. If Condition 1 is being estimated, install a phantom Subplot 120’ North of point 3 (in order to ensure that there are 4 full Subplots within the condition in question). The visual acres for condition 1 would then represent the area around the three subplots and one phantom plot in Condition 1.

NRS Note: If a portion of a plot falls in a Condition that is clearly Status 2 and the remaining portion falls in a reverting field of marginal canopy cover, 4 subplots/phantom subplots will need to be installed in the reverting field to check for 10% canopy cover to qualify for forest land. If the results turn out to be less than 10% canopy cover, the plot as a whole is defined as one Status 2 Condition. With only one Condition, the phantom subplots will be ignored and the Canopy estimates for the plot as a whole will be based on the original four subplots.

3. The Subplot method uses a 1/6 acre sample, so it would require a total of 726 ft² of LIVE PLUS MISSING CANOPY COVER to reach 10% threshold and be sampled as accessible forestland.

Acre method - The Acre method is used when the ocular method is not appropriate and when it is safe and practical to sample on the entire acre.

NRS Note: The Acre method will not be used when determining Canopy Cover in our region.
Sub- acre method - The Sub-Acre method is only used when the Ocular method is not appropriate and only when the acre or subplot methods cannot be established due to the condition’s shape, dimensions or accessibility.

1. Ensure that the canopy cover sample area is representative of the condition in question.
2. Determine if minimum 10% LIVE PLUS MISSING CANOPY COVER is reached. The crew samples all live, dead, and missing tree canopies on the canopy cover sample plot as described above in LIVE PLUS MISSING CANOPY COVER. The 10% threshold is dependent on the sample plot size and respective area in square feet.
3. If the 10% LIVE PLUS MISSING CANOPY COVER threshold is met and there is additional LIVE PLUS MISSING CANOPY COVER on the sub-acre plot, crews can estimate the remaining LIVE PLUS MISSING CANOPY COVER using the ocular method.
4. As with the acre and subplot method, the sub-acre sample plot(s) must fall entirely in the questionable condition.
5. Potential circular plot sizes and appropriate scaling factors:

<table>
<thead>
<tr>
<th>Acre Fraction</th>
<th>Radius (ft)</th>
<th>Area (sq ft)</th>
<th>10% Cover (sq ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>117.7</td>
<td>43,560</td>
<td>4356</td>
</tr>
<tr>
<td>1/2</td>
<td>83.3</td>
<td>21,780</td>
<td>2178</td>
</tr>
<tr>
<td>1/3</td>
<td>68.0</td>
<td>14,520</td>
<td>1452</td>
</tr>
<tr>
<td>1/4</td>
<td>58.9</td>
<td>10,890</td>
<td>1089</td>
</tr>
<tr>
<td>1/5</td>
<td>52.7</td>
<td>8,712</td>
<td>872</td>
</tr>
<tr>
<td>1/6</td>
<td>48.1</td>
<td>7,260</td>
<td>726</td>
</tr>
</tbody>
</table>

When collected: CONDITION CLASS STATUS = 1, 2, 3, 4, or 5
Field width: 1 digit
Tolerance: None
MQO: At least 90% of the time
Values:
1 Ocular method
2 Subplot method
3 Acre method
4 Sub- acre method

2.5.31 U+N+GT LIVE CANOPY COVER [LCC]
Record the percentage of LIVE CANOPY COVER for the condition. Include live tally trees, saplings, and seedlings (include all species not grayed out in Appendix 3+N only) that cover the sample area. For conditions where the LIVE CANOPY COVER is low and there is a question whether it meets 10 percent LIVE CANOPY COVER, the crew will measure every crown width within the canopy cover sample area. When the 10% threshold is determined by measuring crown widths, the crew can use the ocular method to determine the total LIVE CANOPY COVER value.

Canopy widths are measured using the ellipse formula for calculation of canopy area. This requires two measurements. The first measurement is the long axis diameter. The second measurement is made at 90 degrees to the first measurement at the widest point of the crown (Figure 17). Canopy area = π*((long axis diameter/2)*(90 degrees axis diameter/2)).

NRS Note: LCC and can be calculated on the PDR. If calculating by hand use π = 3.14 in the above formula. Round all axis diameters to the nearest foot. Enter all seedlings whose crowns are less than 1’ by 1’ as 1’ by 1’. Ctrl. C on the Allegro brings up the canopy calculator, enter
length x width, number of occurrences, and live or missing – the system will keep a running total for the plot and the data will not be saved.

- Do not include the crown portion of trees, saplings, or seedlings that are vertically overtopped by other trees, saplings or seedlings whose stem originates within the PLOT.

- Hardwood seedlings must have a length of at least 1 foot and softwoods a length of at least 6” to be included in canopy cover.

- Ignore crowns from trees, saplings, and seedlings whose stems originate outside of the SUBPLOT area. These invading crowns can NOT overtop crowns originating within the SUBPLOT area.

- Grasses, herbs, shrubs, and non-tally tree species are not considered when determining whether a crown is overtopped.

- Only include tree canopy measurements from trees with stems that originate within the sample area, although canopy measurements can extend outside the sample area. NRS Note: When a clump of trees are encountered within a subplot their combined crown can be measured as one unified crown. When stems from a clump of trees falls outside the subplot area, ignore the canopy cover associated with these stems.

- Trees, saplings, and seedlings originating within the entire SUBPLOT area are counted in this process.

- Do not compact canopy axis measurements (with exception of abnormal branches) even if trees are sparsely leafed. Canopy axis measurements are not compacted and are measured to the end of the branches regardless of how sparsely leafed the branches are.

- Occasionally, a branch may protrude abnormally, but the lateral crown line is drawn across the portion of the branch which includes the “normal outline” of the tree.

- For leaning trees, ocularly upright the trees and measure crowns as if the trees were upright. For leaning/fallen trees whose current canopy position is part of the Canopy Cover, take its axis measurements as it would be if it were standing up. Do not count any canopy cover of any seedlings/saplings that are being overtopped by the fallen tree in its current position. However, if the leaning/fallen tree is overtopped by other trees/saplings, the overtopped part of the fallen tree’s canopy would not be added to the Canopy Cover estimate.

- Approximately 925 seedlings with a canopy width of 1’x1’ or less must be counted across all four subplots in order to reach 10% Cover (726 ft² of Cover).

- A tree with a canopy width of approximately 31’x30’ is approximately 10% Cover (726 ft² of Cover).

![Diagram showing how to measure canopy widths.](image-url)

Figure 17. Examples of where to measure canopy widths.
LIVE CANOPY COVER can be based on an ocular estimate when the condition in question is certain to contain greater than 10% LIVE PLUS MISSING CANOPY COVER or CURRENT AFFORESTATION CODE =1 and TOTAL STEMS greater than or equal to 150. For LIVE CANOPY COVER <1 percent (trace), record 01.

When collected: URBAN / GROUND TRUTH CONDITION CLASS STATUS = 1, 2, 3, 4, or 5
Field width: 2 digits
Tolerance: 0 – 12% - No errors
13 – 20% - 10% error
21 – 100% - 25% error
MQO: At least 99% of the time
Values: 00 – 99 (where 99=99-100%)

NRS Note: When the CONDITION CLASS STATUS = 5 use the imagery provided with the plot packet to estimate both LIVE CANOPY COVER & LIVE PLUS MISSING CANOPY COVER for the acre surrounding plot center.

2.5.31.1 UGT URBAN / GROUND TRUTH LIVE CANOPY COVER
Record the percentage of URBAN LIVE CANOPY COVER for the condition. Include live tally trees, saplings, and seedlings (all tree species not grayed out in Appendix 3 +N and 3B +N). For conditions where the URBAN LIVE CANOPY COVER is low and there is a question whether it meets 10 percent URBAN LIVE CANOPY COVER, the crew will measure every crown width within the canopy cover sample area. When the 10% threshold is determined by measuring crown widths, the crew can use the ocular method to determine the total URBAN LIVE CANOPY COVER value.

Canopy widths are measured using the ellipse formula for calculation of canopy area. This requires two measurements. The first measurement is the long axis diameter. The second measurement is made at 90 degrees to the first measurement at the widest point of the crown (Figure 18UGT). Canopy area = pi*((long axis diameter/2)*(90 degrees axis diameter/2)).

Do not include the crown portion of trees, saplings, or seedlings that are vertically overtopped by other trees, saplings or seedlings.

Only include tree canopy measurements from trees with stems that originate within the sample area, although canopy measurements can extend outside the sample area.

Occasionally, a branch may protrude abnormally, but the lateral crown line is drawn across the portion of the branch which includes the "normal outline" of the tree.

For leaning trees, ocularly upright the trees and measure crowns as if the trees were upright.
Figure 18UGC. Examples of where to measure canopy widths.

URBAN LIVE CANOPY COVER can be based on an ocular estimate when the condition in question is certain to contain greater than 10% URBAN LIVE PLUS MISSING CANOPY COVER or URBAN CURRENT AFFORESTATION CODE = 1 and URBAN TOTAL STEMS greater than or equal to 150. For URBAN LIVE CANOPY COVER <1 percent (trace), record 01.

When collected: **URBAN / GROUND TRUTH CONDITION CLASS STATUS = 1, 2, 3, 4, or 5**  
Field width: 2 digits  
Tolerance: 0 – 12% - No errors  
13 – 20% - 10% error  
21 – 100% - 25% error  
MQO: At least 99% of the time  
Values: 00 – 99 (where 99=99-100%)  

2.5.32+U+N+GT LIVE PLUS MISSING CANOPY COVER [LMCC]  
Record the percentage of LIVE PLUS MISSING CANOPY COVER for the condition by adding the LIVE CANOPY COVER plus the estimated missing canopy cover that existed prior to disturbance (harvesting, fire, etc.). Include live and, dead and removed tally trees, saplings, and seedlings (Include all species not grayed out in Appendix 3+N only). Dead trees and dead portions of live trees are not considered as missing unless it is part of the condition disturbance. Base the estimate on field observations, aerial photos, historical aerial imagery, and similar evidence of undisturbed conditions. The total of the LIVE PLUS MISSING CANOPY COVER cannot exceed 100%.

**NRS Note:** MISSING CANOPY COVER is any loss of canopy due to a DISTURBANCE or TREATMENT such as fire, windthrow, harvest, or other causes, at any time in the past, which is not associated with a land use conversion. The estimate of MISSING CANOPY COVER must be based on some evidence of the past canopy cover, as indicated by stumps and snags, or trees on adjacent undisturbed sites. DISTURBANCE is defined in Section 2.5.15 and TREATMENT is defined in Section 2.5.21.

- Dead portions of live trees are not considered as missing unless it is part of the condition DISTURBANCE.
- Stumps and dead trees are not considered unless they originate within the sample area and are a direct result of a defined DISTURBANCE OR TREATMENT.
- Do not double count canopy layers; any live canopy supersedes any presence of missing canopy; ignore portions of missing canopy that have live trees, saplings, and seedlings below them.
Use your best professional judgment when estimating missing crowns from stumps. Take into consideration the spacing of the stumps and the size of any possible remaining live crowns in the area. Also ensure that your estimated missing crown is not overtopping any live crown cover when estimating missing cover.

NRS Note: If a DISTURBANCE prevents the establishment and survival of trees, such as in cases where forest land is converted to a marsh (STATUS 2) or a small pond (STATUS 3) by a beaver dam, only LIVE CROWN CANOPY will be counted towards LIVE PLUS MISSING CANOPY COVER.

NRS Note: LCC and LMCC receive the same values when CONDITION CLASS STATUS = 2.

When collected: URBAN / GROUND TRUTH, CONDITION CLASS STATUS = 1, 2, 3, 4, or 5
Field width: 2 digits
Tolerance: 0 – 12% - No errors
13 – 20% - 10% error
21 – 100% - 25% error
MQO: At least 80% of the time
Values: 00 – 99 (where 99=99-100%)

2.5.32.1 UGT URBAN / GROUND TRUTH LIVE PLUS MISSING CANOPY COVER
Record the percentage of URBAN LIVE PLUS MISSING CANOPY COVER for the condition by adding the URBAN LIVE CANOPY COVER plus the estimated missing canopy cover that existed prior to disturbance (harvesting, fire, etc.). Include live and, dead and removed tally trees, saplings, and seedlings (all tree species not grayed out in Appendix 3+N and 3B+N). Dead trees and dead portions of live trees are not considered as missing unless it is part of the condition disturbance. Base the estimate on field observations, aerial photos, historical aerial imagery, and similar evidence of undisturbed conditions. The total of the URBAN LIVE PLUS MISSING CANOPY COVER cannot exceed 100%.

When collected: URBAN / GROUND TRUTH, CONDITION CLASS STATUS = 1, 2, 3, 4, or 5
Field width: 2 digits
Tolerance: 0 – 12% - No errors
13 – 20% - 10% error
21 – 100% - 25% error
MQO: At least 80% of the time
Values: 00 – 99 (where 99=99-100%)

2.5.33+U+N+GT CURRENT AFFORESTATION CODE [CRAF]
Record the code identifying a condition that has no evidence of prior forest, but does have evidence suggesting deliberate afforestation attempts (planted or prepared to promote tree establishment) to convert to forest in the current inventory cycle or since the last measurement.

NRS Note: Need a total of 25 planted seedlings/trees on 4 SUBplots to be able to code afforestation. For a more detailed description of deliberate afforestation, see f, item 1. Accessible Forest Land.
When collected: **URBAN / GROUND TRUTH, CONDITION CLASS STATUS = 1 or 2, 3, 4**
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values:

0. No
1. Yes

### 2.5.34 [PRAF] PREVIOUS AFFORESTATION CODE

Record the code identifying a condition that has no evidence of prior forest, but does have evidence suggesting deliberate afforestation attempts (planted or prepared to promote tree establishment) to convert to forest the prior inventory cycle or prior to the last measurement.

NRS Note: Need a total of 25 planted seedlings/trees on 4 SUBplots to be able to code afforestation. For a more detailed description of deliberate afforestation, see Section 2.2, item 1, Accessible Forest Land.

When collected: When SAMPLE KIND = 2 and **URBAN / GROUND TRUTH, CONDITION CLASS STATUS = 1 or 2, 3, 4**
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values:

0. No
1. Yes

### 2.5.35 [STEM] TOTAL STEMS

Record the estimated number of live stems per acre of the condition. Base the estimate on actual stem count of tally tree species within the sample area. When using the subplot method, use the appropriate expansion factor according to tree and subplot size to obtain an estimate of the number of live stems per acre. Using microplots (i.e., the subplot method) to estimate stems <5.0 inches diameter in conditions with wide spacing or ‘clumping’ is discouraged.

NRS Note: For both Condition Status 1 and 2, TOTAL STEMS will be determined by the STEMS calculator in the PDR based on the actual stem count tallied on subplots and microplots 1-4. The STEMS calculator will provide an option to override this calculation and enter an estimated STEM count based on field observations, but NRS policy is to only accept the STEM value produced by the calculator.

When collected: CURRENT AFFORESTATION CODE = 1 or PREVIOUS AFFORESTATION CODE = 1
Field width: 5 digits
Tolerance: 10%
MQO: At least 90% of the time
Values: 00000 – 99999

### 2.5.36 [CHAN] CHAINING CODE

Record the code identifying if a condition has been chained, shear bladed, roller chopped, etc., for the purpose of increased forage production. These treatments contrast with silvicultural removals in that little or none of the woody material is removed from the site and there are few residual live trees.
When collected: When **URBAN / GROUND TRUTH** CONDITION CLASS STATUS = 1 or 2, 3, 4
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values:

0  No
1  Yes

2.6. P24 Optional Fuels Variables for DWM Protocol **Not Collected in Ground Truth** Not Collected in NRS
3.0+ SUBPLOT INFORMATION

Each subplot is described by a series of area parameters relating to topographic features and existing cover type. These data also relate to the microplot, since the microplot is contained within the subplot perimeter.

Subplots 2, 3 and 4 are located 120.0 feet horizontal (+/- 7 feet tolerance for initial establishment) at azimuths of 360, 120 and 240 degrees, respectively, from the center of subplot 1. The center of the microplot is offset 90 degrees and 12.0 feet horizontal (+/- 1 foot tolerance for initial establishment) from each subplot center. If a subplot or microplot was installed incorrectly at the previous cycle, remeasure the subplot or microplot in its present location, make a notation in the plot record, and contact a field supervisor. [Preceding paragraph paraphrased from Section 0.1 Plot Setup.]

NRS Note: A subplot with forest land may be difficult to occupy for accurate tree data measurements due to inaccessibility of the subplot center (e.g., seasonal high water, busy road way, etc.). In the case of water, some inaccessibility can be minimized by accessing a plot during low tide, the dry season, or after winter freezing. crews should do their best to safely occupy the subplot center. If necessary, a crew should return to a plot with additional gear so a subplot can be safely occupied. If the condition limiting access is temporary, crews should return to plot when site can be accessed safely. However, if a subplot cannot be done safely, the entire subplot should be classified as CONDITION CLASS STATUS = 5 and SUBPLOT NONSAMPLED REASON = 03. Crews should also be aware that each state has a sample of plots that are completed during the summer window. This sample includes P2+ plots, P3 plots, and plots selected for the Pennsylvania Regeneration study. For these plots, do your best to occupy the plot and collect the data. Anytime a subplot cannot be occupied, a PLOT NOTE is required explaining conditions that prevented occupancy.

NRS Note: When a potentially forested portion of a subplot cannot be measured because the subplot center falls under a building, the entire subplot should be classified as a CONDITION CLASS STATUS = 5 with a CONDITION NONSAMPLED REASON code = 10.

NRS Note: Subplots and microplots are monumented by either a metal pin or wooden dowel. Only a single marker is required at the subplot or microplot centers. The current crew should replace a marker if it has deteriorated. The replaced marker should be removed from the plot site. If the old marker is not found, write a PLOT NOTE indicating that a new marker has been set by triangulating from existing tally trees or reference trees. Crews should be careful that edge trees (subplot or microplot) that were correctly determined to be "out or in" by the previous crew are not now "in or out" when replacing a marker.

3.1+ SUBPLOT NUMBER

Record the code corresponding to the number of the subplot.

NRS PDR Note: This variable is determined by the subplot selection in the MIDAS PDR Application.
When Collected: All subplots
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values:
1. Center subplot
2. North subplot
3. Southeast subplot
4. Southwest subplot

3.2GT+U+N  URBAN / GROUND TRUTH SUBPLOT/MACROPLOT STATUS [UGTSTAT]
Indicate whether or not this subplot was sampled or not sampled.

Indicate whether or not this subplot currently has at least one accessible forest land condition class. In regions measuring the CORE OPTIONAL macroplot, indicate whether or not this macroplot currently has at least one forested condition class. In situations where a subplot/macroplot is denied access or hazardous, but obviously contains no forest land, record SUBPLOT/MACROPLOT STATUS = 2. In cases where a subplot/macroplot is access-denied or hazardous land use and has the possibility of forest, record SUBPLOT/MACROPLOT STATUS = 3.

NRS Note: Reference Section 2.1.1, NRS Note, when determining if a separate condition is defined under these guidelines.

When collected: All subplots
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 on subplot
2. Sampled – no accessible forest but at least one accessible nonforest land condition present on subplot
3. Sampled – possibility of forest land no accessible forest or accessible nonforest land condition present on subplot, i.e., subplot is either census and/or noncensus water
4. NonSampled
5. Sampled: QA crew did not measure trees, saplings, or seedlings. QA crew did measure all other data items (condition, boundary, and subplot-level data). For use only on check plots (QA STATUS = 2 - 6). Not a legal entry on production plots (QA STATUS = 1 or 7) possibility of forest land

3.3GT+U+N  URBAN / GROUND TRUTH SUBPLOT NONSAMPLED REASON [UGTREAS]
For entire subplots that cannot be sampled, record one of the following reasons.
When collected: When \textcolor{red}{\textsc{URBAN/GROUND TRUTH}} \textsc{SUBPLOT/MACROPLOT STATUS} = \textcolor{red}{4}

Field width: 2 digits
Tolerance: No errors
MQO: At least 99\% of the time

<table>
<thead>
<tr>
<th>Values</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>Outside U.S. boundary – Assign this code to condition classes beyond the U.S. border.</td>
</tr>
<tr>
<td>02</td>
<td>Denied access area – Any area within the sampled area of a plot to which access is denied by the legal owner, or to which an owner of the only reasonable route to the plot denies access. There are no minimum area or width requirements for a condition class delineated by denied access. Because a denied-access condition can become accessible in the future, it remains in the sample and is re-examined at the next occasion to determine if access is available.</td>
</tr>
<tr>
<td>03</td>
<td>Hazardous situation – Any area within the sampled area on plot that cannot be accessed because of a hazard or danger, for example cliffs, quarries, strip mines, illegal substance plantations, temporary high water, etc. Although the hazard is not likely to change over time, a hazardous condition remains in the sample and is re-examined at the next occasion to determine if the hazard is still present. There are no minimum size or width requirements for a condition class delineated by a hazardous condition.</td>
</tr>
<tr>
<td>04</td>
<td>Time limitation – This code applies to full subplots that cannot be sampled due to a time restriction. This code is reserved for areas with limited access and in situations where it is imperative for the crew to leave before the plot can be completed (e.g., scheduled helicopter rendezvous) and it is impossible for the crew to return to complete the data collection. Use of this code requires notification to the field supervisor. This code should not be used for an entire plot (use code \textcolor{red}{8} [skipped visit] when an entire plot is skipped; see Section 1.5). Not Collected in NRS URBAN</td>
</tr>
<tr>
<td>05</td>
<td>Lost data – The plot data file was discovered to be corrupt after a panel was completed and submitted for processing. This code is assigned to entire plots or full subplots that could not be processed, and is applied at the time of processing after notification to the region. Note: This code is for office use only. Not Collected in NRS</td>
</tr>
<tr>
<td>06</td>
<td>Lost plot – Entire plot cannot be found. Used for the four subplots that are required for this plot. Used only in conjunction with \textcolor{red}{\textsc{URBAN/GROUND TRUTH PLOT NONSAMPLED REASON}} code 06. Can be either generated by the data recorder or in the office.</td>
</tr>
<tr>
<td>07</td>
<td>Wrong location – Previous plot can be found, but its placement is beyond the tolerance limits for plot location. Used for the four subplots that are required for this plot. Used only in conjunction with \textcolor{red}{\textsc{PLOT NONSAMPLED REASON}} code 07. Can be either generated by the data recorder or in the office. Not Collected in NRS</td>
</tr>
<tr>
<td>08</td>
<td>Skipped visit – Entire plot skipped. Used for the four subplots that are required for this plot. Applied at the time of processing and used only in conjunction with \textcolor{red}{\textsc{PLOT NONSAMPLED REASON}} code 08. This code is for office use only. Not Collected in NRS</td>
</tr>
<tr>
<td>09</td>
<td>Dropped intensified plot – Used for the four subplots that are required for this plot. Used only by units engaged in intensification. Applied at the time of processing and used only in conjunction with \textcolor{red}{\textsc{PLOT NONSAMPLED REASON}} code 09. This code is for office use only. Not Collected in NRS</td>
</tr>
<tr>
<td>10</td>
<td>Other – This code is used whenever a plot or condition class is not sampled due to a reason other than one of the specific reasons already listed. A field note is required to describe the situation.</td>
</tr>
<tr>
<td>11</td>
<td>Ocean – Subplot falls in ocean water below mean high tide line.</td>
</tr>
</tbody>
</table>
3.4 NONFOREST SUBPLOT/MACROPLOT STATUS

Not Collected in NRS  Not Collected in Ground Truth

3.5 NONFOREST SUBPLOT/MACROPLOT NONSAMPLED REASON

Not Collected in NRS  Not Collected in Ground Truth

3.6 SUBPLOT CENTER CONDITION [SCEN]

Record the CONDITION CLASS NUMBER of the condition class at the subplot center.

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

3.7 MICROPLOT CENTER CONDITION [MCEN]

3.7.1U GT URBAN MICROPLOT 11 (EAST) CENTER CONDITION [11CC]

Record the CONDITION CLASS NUMBER of the condition class at the microplot center.

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

3.7.2U GT URBAN MICROPLOT 21 (SOUTH) CENTER CONDITION [12CC]

Record the CONDITION CLASS NUMBER of the condition class at the microplot center.

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

3.7.3U GT URBAN MICROPLOT 31 (WEST) CENTER CONDITION [13CC]

Record the CONDITION CLASS NUMBER of the condition class at the microplot center.

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

3.7.4U GT URBAN MICROPLOT 41 (NORTH) CENTER CONDITION [14CC]

Record the CONDITION CLASS NUMBER of the condition class at the microplot center.

When Collected: All microplots
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values: 1 to 9
3.7.5 N-P2+ and PA REGEN+GT REGENERATION MICROPLOT STATUS [SEST]
Record the code to indicate whether the microplot was sampled for advance regeneration. If there is any part of an accessible forest or nonforest land condition present on a portion of the microplot where other subplot measurements are made but advance regeneration variables can’t be assessed (e.g., because of snow, water), enter code 3 (Advance Regeneration Nonsampled).

When collected: All counts of seedlings
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values:
1 Advance Regeneration Not Sampled – accessible forest land is the only condition present on microplot
2 Advance Regeneration Sampled – at least one accessible Nonforest condition present on microplot
3 Advance Regeneration Nonsampled – accessible forest or nonforest land condition present on microplot but advance regeneration variables can’t be assessed (Core SEEDLING COUNT is still measured)
4 Advance Regeneration Not Sampled – QA crew did not measure subplot/microplot for Tree/Sapling/Seedling data. For use only on check plots (QA STATUS = 2 - 6). Not a legal entry on production plots (QA STATUS = 1 or 7).
5 Nonsampled (SUBPLOT STATUS = 4)

3.7.6 N-P2+ and PA REGEN+GT REGENERATION NONSAMPLED REASON
Record the reason why a microplot cannot be sampled for regeneration.

When collected: On all microplots where REGENERATION MICROPLOT STATUS = 3 or 5
Field width: 2 digits
Tolerance: No errors
MQO: At least 99% of the time
Values:
10 Other (for example, snow or water covering vegetation that is supposed to be sampled) (Note Required)

3.7.7 N-P2+ and PA REGEN+GT MICROPLOT SITE LIMITATION [MLIM]
Record site limitation code 2, 3, or 4 if the limitation occurs on at least 30 percent of the accessible forest land present on the microplot, otherwise code as 1.

When Collected: When at least one accessible nonforest land condition class (CONDITION CLASS STATUS = 2, 3, or 4) is present on a microplot and REGENERATION MICROPLOT STATUS = 2, 3, or 5.

Field width: 1 digit
Tolerance: none
MQO: At least 99% of the time
Values:
1 No site limitation
2 Rocky surface with little or no soil
3 Water-saturated soil (during the growing season)
4 Thick duff layer (in excess of two-inches thick)

3.8+ U+GT SUBPLOT SLOPE [SLOP]
Record the angle of slope across the subplot to the nearest 1 percent. SUBPLOT SLOPE is determined by sighting the clinometer along a line parallel to the average incline (or decline) of
This angle is measured along the shortest pathway down slope before the drainage direction changes. To measure SUBPLOT SLOPE, Observer 1 should stand at the uphill edge of the subplot and sight Observer 2, who stands at the downhill edge of the subplot. Sight Observer 2 at the same height as the eye-level of Observer 1. Read the slope directly from the percent scale of the clinometer:

- If slope changes gradually across the subplot, record an average slope.
- If slope changes across the subplot but the slope is predominantly of one direction, code the predominant slope percentage rather than the average.
- If the subplot center falls directly on or straddles a canyon bottom or narrow ridge top, code the average slope of the side hill(s).
- If the subplot falls on a canyon bottom or on a narrow ridge top, but most of the area lies on one side hill, code the slope of the side hill where most of the area lies.

**NRS Note:** The slope is determined across the entire subplot—record slope even if <5%. Use previous crew SUBPLOT SLOPE and ASPECT measurements if within tolerance of your measurement. If worried about QA, record your actual measurement in the note section.

When collected: All subplots with at least one accessible forest or nonforest land condition present on subplot (URBAN / GROUND TRUTH SUBPLOT/MACROPLOT STATUS = 1) or subplots with an accessible nonforest condition class present when nonforest is being sampled (NONFOREST SUBPLOT/MACROPLOT STATUS = 1 or 2)

Field width: 3 digits
Tolerance: +/- 10%
MQO: At least 90% of the time
Values: 000 to 155

3.9 U+N+GT SUBPLOT ASPECT [ASP]

Record the aspect across the subplot, to the nearest 1 degree. SUBPLOT ASPECT is determined along the direction of slope for land surfaces with at least 5 percent slope in a generally uniform direction. SUBPLOT ASPECT is measured with a hand compass along the same direction used to determine slope.

- If aspect changes gradually across the subplot, record an average aspect.
- If aspect changes across the subplot but the aspect is predominately of one direction, code the predominate direction rather than the average.
- If the subplot center falls directly on or straddles a canyon bottom or narrow ridge top, code the aspect of the ridge line or canyon bottom.
- If the subplot falls on a canyon bottom or on a narrow ridge top, but most of the area lies on one side hill, code the aspect of the side hill.

**NRS Note:** If SUBPLOT SLOPE is less than 5 percent, Subplot Aspect = 000. If subplot is partially forested, the aspect is determined across the entire subplot. Use previous crew SUBPLOT SLOPE and SUBPLOT ASPECT measurements if within tolerance of your measurement. If worried about QA, record your actual measurement in the note section.
When collected: All subplots with at least one accessible forest or nonforest land condition present on subplot (URBAN / GROUND TRUTH SUBPLOT/MACROPLOT STATUS = 1) or subplots with an accessible nonforest condition class present when nonforest is being sampled (NONFOREST SUBPLOT/MACROPLOT STATUS = 1 or 2)

Field width: 3 digits
Tolerance: +/- 10 degrees
MQO: At least 90% of the time
Values:
000 no aspect, slope < 5 percent
001 1 degree
002 2 degrees
--- ---
360 360 degrees, due north

3.10.1U+GT SNOW/WATER DEPTH [SWD]
Record to the nearest 0.1 foot the average approximate depth of water or snow covering the subplot at the time of data collection. This variable is used to indicate subplots where some variables (e.g., seedling count, total lengths) may be measured with less certainty due to conditions at the time of measurement.

NRS Note: If snow amounts are excessive on the microplot, the seedling tally as described in Section 6.0 U+GT Urban / GROUND TRUTH Seedling Data is restricted to seedlings visible above the snow. Do not excavate snow from the microplot to achieve a better measurement. This practice may compromise the integrity of the microplot by exposing seedlings and other vegetation to animal browsing; and by exposing seedlings to extreme temperatures that may lead to mortality.

NRS Note: Disregard permanent bodies of water such as streams. For snow and flooding that covers the entire subplot, use an average depth across the entire subplot. This variable is used to filter out unusual situations that compromise the data, like deep snow or flooding that affects the accuracy of various SEEDLING DATA and TREE DATA measurements.

When collected: All subplots with at least one accessible forest land condition present on subplot (URBAN / GROUND TRUTH SUBPLOT/MACROPLOT STATUS = 1, 2, 3) or subplots with an accessible Nonforest condition class present when Nonforest is being sampled (NONFOREST SUBPLOT/MACROPLOT STATUS = 1)

Field width: 2 digits (x.y)
Tolerance: +/- 0.5 ft
MQO: At the time of measurement (no MQO after initial date of visit)
Values: 0.0 to 9.9

3.10.1N-ME CROWN CLOSURE [MECC] Not Collected in Ground Truth

3.11.1U+GT URBAN / GROUND TRUTH SUBPLOT/MACROPLOT CONDITION LIST [UGT CLST]
This is a listing of all condition classes located within the 24.0-foot radius around the subplot center. In regions measuring the CORE OPTIONAL macroplot, this is a listing of all condition classes located within the 58.9-foot radius around the macroplot center. A maximum of four six conditions is permitted at any individual subplot / macroplot. If a condition class has already been defined at a previously completed subplot / macroplot, use the same condition class number whenever that condition is encountered. Define new condition classes as they are encountered. If more than one condition class is listed here, boundary data are required. If only one condition
class is listed, this condition is automatically assigned to the subplot center and microplot center. If less than four six condition classes occur on this subplot, complete the remainder of this field with zeroes. For example, if condition 1 is the only condition class on a subplot, record 1000 00.

When collected: All plots
Field width: 4 6 digits
Tolerance: No errors
MQO: At least 99% of the time
Values: 1000 00 to 9876 654321

3.12 P2+ and PA Regen - GT P2 VEG SUBPLOT SAMPLE STATUS
Record the code to indicate if the subplot was sampled for P2 Vegetation. A subplot may be sampled for P2 Vegetation but not have any vascular plants present. If there is any part of an accessible portion of the subplot where other plot measurements are made but all the P2 Vegetation measurements cannot be completed on the subplot (for example, deep snow or water, hazardous weather, time limitation), enter code 2 and do not record any P2 Vegetation measurements.

When collected: When P2 VEGETATION SAMPLING STATUS =1 and at least one accessible forest land condition (CONDITION CLASS STATUS = 1) exists within the 24-foot radius subplot, or P2 VEGETATION SAMPLING STATUS =2 and at least one accessible forest condition or measurable nonforest condition (CONDITION CLASS STATUS = 1 or NONFOREST CONDITION CLASS STATUS = 2) exists within the 24-foot radius subplot.

Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values:
1 Subplot sampled for P2 Vegetation
2 Subplot not sampled for P2 Vegetation

3.13 P2+ and PA Regen - GT VEGETATION NONSAMPLED REASON
Record the reason why P2 Vegetation on a subplot cannot be sampled.

When collected: On all subplots where P2 VEG SUBPLOT SAMPLE STATUS = 2
Field width: 2 digits
Tolerance: No errors
MQO: At least 99% of the time
Values:
04 Time limitation
05 Lost data (for office use only)
10 Other (for example, snow or water covering vegetation that is supposed to be sampled)

3.14 P2+ and PA Regen - GT VEGETATION SUBPLOT NOTES
Use this field to record notes pertaining to the subplot, and any unusual conditions encountered.

When plant specimens are collected, use this field to record a community type description for each subplot sampled for P2 Vegetation. The community description is intended to fully automate the specimen collection process by providing a description of the community in which this plant was found. Some examples of community descriptions are as follows:

- 25 year aspen boundary of mature trees. very little slope. a lot of light entry
- acer saccharum floodplain forest. hummock-hollow microtopography.
- mature mesic hemlock-hardwood forest adjacent to pond

The community type description field is a note that is accessible via Ctrl+E from the P2 Subplot screen for P2VEG.

When collected: VEGETATION NONSAMPLED REASON = 10 or as needed
Field width: 2000 alphanumeric characters
Tolerance: N/A
MQO: N/A
Values: English language words, phrases, and numbers

3.15 INVASIVE PLANT SUBPLOT SAMPLE STATUS (Subplot-level variable)
Record the code to indicate whether the subplot was sampled for invasive plants. A subplot may be sampled but not have any invasive plants present. If there is any part of an accessible portion of the subplot where other plot measurements are made but invasive plants cannot be assessed (e.g., because of snow, water, hazardous weather, time limitation), enter code 3 and do not record any invasive plant measurements.

When collected: On all subplots where invasive species are being sampled on accessible forest land (INVASIVE PLANT SAMPLING STATUS= 1 or 2) and at least one accessible forest land condition (URBAN / GROUND TRUTH CONDITION CLASS STATUS = 1, 2, 3, and 4) exists within the 24-foot radius subplot, or invasive species are being sampled on all accessible land conditions (INVASIVE PLANT SAMPLING STATUS = 2) and at least one accessible forest condition or measurable nonforest condition (CONDITION CLASS STATUS = 1 or NONFOREST CONDITION CLASS STATUS = 2) exists within the 24-foot radius subplot
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values:
1. subplot sampled, invasive plants present
2. subplot sampled, no invasive plants present
3. subplot not sampled for invasive plants

3.16 INVASIVE PLANT NONSAMPLED REASON (Subplot-level variable)
Record the reason why a subplot cannot be sampled for invasive plants.

When collected: On all subplots where INVASIVE PLANT SUBPLOT SAMPLE STATUS = 3
Field width: 2 digits
Tolerance: No errors
MQO: At least 99% of the time
Values:
4. Time limitation
5. Lost data (office use only)
10. Other (for example, snow or water covering vegetation that is supposed to be sampled)

3.17 INVASIVE PLANT DATA NOTES
Use this field to record any notes about the condition on the subplot, particularly any unusual conditions encountered.
When collected: INVASIVE PLANT NONSAMPLED REASON=10 or as needed
Field width: Unlimited alphanumeric character field
Tolerance: N/A
MQO: N/A
Values: English language words, phrases, and numbers

[REM] Not Collected in Ground Truth

3.19 UGT .......... NON-TALLY TREE PRESENT [NTT]
The species list used in URBAN FIA is an expansion of the traditional CORE species list and is
the result of consultations between arborists, foresters, and urban forest specialists around the
nation. Although it is a comprehensive list that will account for the majority of species that crews
may encounter in the field, it is possible to encounter a species that was unintentionally excluded
from this expanded list. The purpose of this variable is to provide information on such species in
an attempt to further refine the urban species list in future inventories.

A NON-TALLY TREE is defined as a tree that is at least 5 inches DBH and located within the
subplot that is not on your regional urban species list (Appendix 3+N and Appendix 3BU+N).
Record the presence or absence of any NON-TALLY TREES found on the subplot. When non
tally trees are present, record the data for each individual species as described in chapter 11.

When Collected: All subplots with URBAN / GROUND TRUTH CONDITION STATUS 1, 2, 3, 4
Field width: 1 digit
Tolerance: No errors
MQO: At least 90% of the time
Values:
0   No non-tally trees present
1   Non-tally tree/s present

3.20 UGT .......... Subplot-Condition Level
Surface and Vegetation cover is the area represented within the intersection between the
SUBPLOT footprint and each mapped CONDITION. Vegetation does not need to originate within
the subplot or condition being evaluated, this variable is measured from the stand point of looking
down from above.

3.21 UGT .......... SUBPLOT–CONDITION SUBPLOT NUMBER
Record the code corresponding to the number of the subplot.

When Collected: All subplots
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values:
1   Urban subplot

3.22 UGT .......... SUBPLOT–CONDITION CONDITION NUMBER [CON#]
Record the CONDITION CLASS NUMBER for each condition encountered on the SUBPLOT.
When collected: All subplots
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values: 1 to 6

### 3.23UGT Subplot-Condition Vegetation Cover

VEGETATION COVER will be measured for the portion of each CONDITION contained within the SUBPLOT. Ignore portions of a CONDITION that fall outside of the boundary of the SUBPLOT. Vegetation must cover a minimum of 1% of a CONDITION contained within the SUBPLOT in order to be recorded. VEGETATION COVER is split into two categories, PERCENT TREE / SAPLING COVER and PERCENT SHRUB / SEEDLING COVER. These two variables are evaluated independently of each other. For example, a condition could contain both 100% PERCENT TREE / SAPLING COVER and 100% PERCENT SHRUB / SEEDLING COVER. In the following text height refers to the height from the ground to the highest foliage regardless of subject’s specific length. Trees, saplings, and seedlings are limited to those species that are not grayed out in Appendix 3 + N and Appendix 3BU + N; all other woody vegetation, including grayed out species Appendix 3 + N and Appendix 3BU + N and trees that are landscaped or manicured to the extent that an accurate DBH / DRC can not be measured, are considered shrubs. Vegetation must be alive. Consider all vegetation contained within a cylinder coincident to the subplot radius regardless of where it originates.

Subplot radius = 24 feet, Subplot area = 1809.5 ft²

<table>
<thead>
<tr>
<th>Cover</th>
<th>Area (ft²)</th>
<th>Square length on side (ft)</th>
<th>Circle radius (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1%</td>
<td>18</td>
<td>4.3</td>
<td>2.4</td>
</tr>
<tr>
<td>3%</td>
<td>54</td>
<td>7.4</td>
<td>4.2</td>
</tr>
<tr>
<td>5%</td>
<td>90</td>
<td>9.5</td>
<td>5.4</td>
</tr>
<tr>
<td>10%</td>
<td>181</td>
<td>13.4</td>
<td>7.6</td>
</tr>
<tr>
<td>15%</td>
<td>271</td>
<td>16.5</td>
<td>9.3</td>
</tr>
<tr>
<td>20%</td>
<td>362</td>
<td>19.0</td>
<td>10.7</td>
</tr>
<tr>
<td>25%</td>
<td>452</td>
<td>21.3</td>
<td>12.0</td>
</tr>
<tr>
<td>50%</td>
<td>905</td>
<td>30.1</td>
<td>17.0</td>
</tr>
</tbody>
</table>

**Table 1GT.** Canopy cover to area relationships for a 1/24 acre subplot. See Figure 2GT for additional visual calibrations.

### 3.23.1UGT PERCENT TREE / SAPLING COVER [%TREE]

Is defined as the amount of tree canopies, (defined as all tree species with a diameter of at least 1” DBH/DRC), covering the portion of each CONDITION contained within the SUBPLOT.

When collected: URBAN / GROUND TRUTH CONDITION CLASS STATUS 1, 2, 3, 4
Field width: 3 digits
Tolerance: +/- 10%
MQO: At least 90% of the time
Values: 00 to 100

### 3.23.2UGT PERCENT SHRUB / SEEDLING COVER [%SHSE]

Is defined as the amount of shrub / seedling cover (defined as all shrub species ≥12” in height and all tree species <1” diameter and ≥12” in height) covering the portion of each CONDITION contained within the SUBPLOT. Woody vines are included as shrubs.
When collected: URBAN / GROUND TRUTH CONDITION CLASS STATUS 1, 2, 3, 4
Field width: 3 digits
Tolerance: +/- 10%
MQO: At least 90% of the time
Values: 00 to 100

3.24 UGT Subplot-Condition Surface Cover

Record SURFACE COVER for the portion of each recorded condition that is contained within the SUBPLOT (example - the % surface covered by a 72ft² area will vary depending on whether the entire subplot is one condition or more than one condition); ignore portions of a CONDITION that fall outside of the perimeter of the SUBPLOT. Record percentages of SURFACE COVER as follows:

- BUILDINGS
- IMPERVIOUS (concrete, asphalt, etc.)
- HERBACEOUS (grasses, low shrubs, etc.)
- PERMEABLE (gravel, mulch, sand, dirt, duff etc.)
- WATER

A particular material must cover a minimum of 1% of a CONDITION contained within the SUBPLOT in order to be recorded. The sum of the cover types listed above MUST sum to 100% for each CONDITION encountered. The purpose of this variable is to estimate the effect that surface cover will have on rain runoff, so record cover to the lowest permanent cover type in relation to the ground. This would include the ground beneath a building’s eaves or decks that are either elevated or sitting on footers resting on the ground. Another example would be to code WATER instead of IMPERVIOUS if the evaluation area falls entirely on an IMPERVIOUS bridge if there is WATER below the bridge. Objects that not permanent and can be moved, such as picnic tables, a sheet of metal on ground, or inflatable/portable swimming pool are not considered surface cover. If an object would require the assistance of machinery to move or if there is any doubt as to if an object can be moved consider them permanent.

IMPERVIOUS is defined as non-building material that does not allow water to percolate through, such as rock, asphalt, and cement. Examples of PERMEABLE include soil and gravel. HERBACEOUS overrides PERMEABLE. WATER overrides HERBACEOUS (in the form of emergent vegetation) and includes swimming pools that are permanent in nature.

3.24.1 UGT PERCENT BUILDINGS [BUILD]

Record the percent of buildings covering the portion of each CONDITION contained within the SUBPLOT.

When collected: URBAN / GROUND TRUTH CONDITION CLASS STATUS 1, 2, 3, 4
Field width: 3 digits
Tolerance: +/- 10%
MQO: At least 90% of the time
Values: 00 to 100

3.24.2 UGT PERCENT IMPERVIOUS [IMPER]

Record the percent of impervious materials (concrete, asphalt, tennis courts, etc.) covering the portion of each CONDITION contained within the SUBPLOT. Artificial turf laid on top of an impervious surface, such as concrete, is considered impervious; otherwise artificial turf is considered permeable.
When collected: URBAN / GROUND TRUTH CONDITION CLASS STATUS 1, 2, 3, 4
Field width: 3 digits
Tolerance: +/- 10%
MQO: At least 90% of the time
Values: 00 to 100

3.24.3 UGT  PERCENT PERMEABLE [PERME]
Record the percent of permeable materials (gravel, bare soil, sand, mulch, leaf litter, etc.) covering the portion of each CONDITION contained within the SUBPLOT. Gravel or other material that is applied over a fabric or plastic base is considered permeable. Patios, walkways, and other related features that use stonework or bricks are considered Permeable IF they are pieced together without the use of grout of some sort.

When collected: URBAN / GROUND TRUTH CONDITION CLASS STATUS 1, 2, 3, 4
Field width: 3 digits
Tolerance: +/- 10%
MQO: At least 90% of the time
Values: 00 to 100

3.24.4 UGT  PERCENT LOW WOODY VEGETATION/HERBACEOUS [HERBA]
Record the percent of herbaceous materials (herbaceous ground cover, including agricultural crops, grass, low shrubs; also includes woody plants <12” in height) covering the portion of each CONDITION contained within the SUBPLOT.

When collected: URBAN / GROUND TRUTH CONDITION CLASS STATUS 1, 2, 3, 4
Field width: 3 digits
Tolerance: +/- 10%
MQO: At least 90% of the time
Values: 00 to 100

3.24.5 UGT  PERCENT WATER [WATER]
Record the percent of water (swimming pools, canals, etc.) covering the portion of each CONDITION contained within the SUBPLOT.

When collected: URBAN / GROUND TRUTH CONDITION CLASS STATUS 1, 2, 3, 4
Field width: 3 digits
Tolerance: +/- 10%
MQO: At least 90% of the time
Values: 00 to 100
4.0 Boundary References

Boundary reference data are used to compute the area for the condition classes sampled on a plot and to remeasure plots. Record all boundaries between condition classes that occur within the sampled (fixed-radius) area on subplots and microplots (and optionally macroplots). Boundaries outside sampled (fixed-radius) areas are not referenced.

NRS Note: Reference Section 2.1.1, NRS Note, when determining if boundaries are required between CONDITION CLASS STATUSes.

In addition to using the recording procedures described herein, sketch maps of condition class boundaries onto the pre-printed plot diagrams on paper field tally sheets.

4.1 Reference Procedure

Within the sampled area on each microplot, subplot, and macroplot, reference the approximate boundary of each condition class that differs from the condition classes at a subplot center. Trees selected on these fixed-radius plots are assigned to the actual condition in which they lie regardless of the recorded approximate boundary delineated.

NRS Note: Not all boundaries are straight lines. The straight lines determined by the boundary referencing procedure should not be used to assign a tree’s condition number.

Boundary referencing is done by recording azimuths and distances from subplot center to the reference points and/or from microplot center to the reference points (Figure 19 and Figure 20). Each boundary is marked by a maximum of three points - two where the boundary intersects the subplot circumference or microplot circumference, and one “corner” point between the two end points, if necessary. Only the corner point requires a distance, since the distance from the center to the circumference is always equal to the fixed plot radius.

Figure 19. How to measure a straight boundary on a microplot, subplot, or macroplot.
Figure 20. How to measure a boundary with a corner on a subplot or macroplot.

Microplot boundaries are referenced to the microplot center, and macroplot boundaries are referenced to the subplot center in the same manner described for subplots. Note that the larger the plot, the greater likelihood of a need for a boundary corner to record boundaries that are not straight lines.

Refer to Section 2.1 and Section 2.4 for general condition class delineation guidelines. The following additional rules apply when referencing a boundary within a subplot microplot, or macroplot:

1. When a boundary between accessible forest land and nonforest land or between two contrasting accessible forest land condition classes is clearly marked, use that feature to define the boundary. Examples of clear demarcation are a fence line, plowed field edge, sharp ridge line, and water’s edge along a stream course, ditch, or canal.
2. When a boundary between forest land and nonforest land is not clearly marked by an obvious feature, the boundary should follow the nonforest side of the stems of the trees at the forest edge.
3. When a boundary between two contrasting forest land condition classes is not clearly marked, map along the stems of the contrasting condition. When the boundary between two contrasting forest land condition classes is separated by a narrow linear inclusion (creek, fire line, narrow meadow, unimproved road), establish the boundary at the far edge of the inclusion relative to subplot center.
4. When a plot is remeasured, the crew will examine the boundaries referenced at last inventory. If no change has occurred, the current crew will retain the boundary data that were recorded at last inventory. If a boundary has changed, or a new boundary is present, or the previous crew made an obvious error, record new or updated boundary data. Delete boundaries that are no longer distinct.
5. Although individual tolerances are specified for the azimuths and distances, in practice a crew will be considered 'correct' when the difference in areas as mapped by the current crew and by the QA crew is less than 10 percent of the subplot or microplot area. This allows for slight variations in azimuths or distances due to the approximate nature of mapping procedures. (See NRS Note in the BOUNDARY CHANGE section.)

4.2 Boundary Data
Record the appropriate values for each boundary mapped on the subplot, microplot, or macroplot as follows:

4.2.1 N SUBPLOT NUMBER
Record the code corresponding to the number of the subplot.

NRS PDR Note: This variable is determined by the subplot selection in the MIDAS PDR Application.

When collected: All boundaries
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values:
1 Center subplot
2 North subplot
3 Southeast subplot
4 Southwest subplot

4.2.2 PLOT TYPE [TYPE]
Record the code to specify whether the boundary data are for a subplot, microplot, or macroplot.

When collected: All boundaries
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values:
1 Subplot boundary
2 Microplot boundary
3 Macroplot boundary (coded only when macroplots are taken)
4 Hectare plot boundary (coded from subplot 1 only)

4.2.3 N BOUNDARY CHANGE [CHNG]
Remeasurement (SAMPLE KIND = 2) locations only. Record the appropriate code to indicate the relationship between previously recorded and current boundary information.

NRS Note: On remeasurement plots, if the current azimuths are within 10 degrees of the previous azimuths and no physical change has taken place, record the previous crew's boundary data. BOUNDARY CHANGE = 0.
When collected: SAMPLE KIND = 2, All boundaries
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values:

0  No change - boundary is the same as indicated on plot map and/or data collected by a previous crew.
1  New boundary, or boundary data has been changed to reflect an actual on-the-ground physical change resulting in a difference from the boundaries recorded.
2  Boundary has been changed to correct an error from previous crew.
3  Boundary has been changed to reflect a change in variable definition.

4.2.4 CONTRASTING CONDITION [CCON]
Record the CONDITION CLASS NUMBER of the condition class that contrasts with the condition class located at the subplot center (for boundaries on the subplot or macroplot) or at the microplot center (for boundaries on the microplot), e.g., the condition class present on the other side of the boundary line. See section 3.0 for subplot data.

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

4.2.5 LEFT AZIMUTH [LAZM]
Record the azimuth from the subplot, microplot, or macroplot center to the farthest left point (facing the contrasting condition where the boundary intersects the subplot, microplot, or macroplot circumference.

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

4.2.6 CORNER AZIMUTH [CAZM]
Record the azimuth from the subplot, microplot, or macroplot center to a corner or curve in a boundary. If a boundary is best described by a straight line between the two circumference points, then record 000 for CORNER AZIMUTH (000=none).

When collected: All Boundaries
Field width: 3 digits
Tolerance: +/- 10 degrees
MQO: At least 90% of the time
Values: 000 to 360

4.2.7 CORNER DISTANCE [CDIS]
Record the horizontal distance, to the nearest 1 foot, from the subplot, microplot, or macroplot center to a boundary corner point.
When collected: All boundaries when CORNER AZIMUTH > 000
Field width: 3 digits
Tolerance: +/- 1 ft
MQO: At least 90% of the time
Values:
  - microplot: 001 to 007 ft (actual limiting distance is 6.8 ft)
  - subplot: 001 to 024 ft
  - macroplot: 001 to 059 ft (actual limiting distance is 58.9 ft)
  - hectare: 001 to 185 ft

4.2.8 RIGHT AZIMUTH [RAZM]
Record the azimuth from subplot, microplot, or macroplot center to the farthest right point (facing the contrasting condition where the boundary intersects the subplot, microplot, or macroplot circumference.

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

4.2.9N PERCENT AREA [%ARE]
The percent area represents the portion of the plot in the CONTRASTING CONDITION.

When collected: All boundaries
Field width: 3 digits
Tolerance: N/A
MQO: N/A
Values: 001 to 100
5.0 Tree and Sapling Data

Trees at least 5.0 inches in diameter are sampled within the subplot on all Urban/Ground Truth Condition Class Status 2, 3, and 4 conditions. 'Tally trees' are defined as all live and standing dead trees in accessible forest land condition classes encountered on the subplot the first time a subplot is established, and all trees that grow into a subplot thereafter. These data yield information on tree volume, growth, mortality, and removals; wildlife habitats; forest structure and composition; biomass; and carbon sequestration.

Trees with a diameter at least 1.0 inch but less than 5.0 inches, termed saplings, are sampled within the microplot on all Urban/Ground Truth Condition Class Status 2, 3, and 4 conditions. 'Tally saplings' are defined as all live and standing dead saplings in accessible forest land condition classes encountered the first time a microplot is established, and all saplings that grow into each microplot thereafter are included until they grow to 5.0 inches or larger, at which time they are tallied on the subplot and referenced (new AZIMUTH and HORIZONTAL DISTANCE taken) to the subplot center. Saplings are often generically termed trees within the national and regional variable text. Refer to "When Collected" to see if a variable pertains to a sapling as well as tree.

For multi-stemmed woodland species, a cumulative DRC is used to compute diameter as described in Sections 5.9 and 5.9.4. DRC species are noted in Appendix 3 and Appendix 3B with a "W".

NRS Note: DRC procedures are applied only on Rocky Mountain Juniper (Juniperis scopulorum) – species code 0066 – in the states of KS, NE, ND and SD. This species is generally found in the western half of these states.

Include trees, saplings, and seedlings growing in permanent planters and other forms of raised beds while excluding those growing on top of or inside buildings and in movable planters. Moveable planters are defined as ones that the average person could lift up and move. Include trees and vegetation growing in courtyards but exclude them when growing inside or on top of buildings.

Exclude trees, saplings, and seedlings that are, or have been, landscaped or manicured in such manner that they are prevented from reaching a form that allows for accurate and repeatable diameter measurement. They shall be treated as shrubs and tallied as SHRUB/SEEDLING COVER. Landscaped trees may take the form of, but are not limited to, hedgerows or bushes.
Figure 21UGT. Examples of landscaped and manicured hedgerows or bushes treated as SHRUB/SEEDLING COVER.

Trees are alive if they have any living parts (leaves, buds, and cambium) at or above the point of diameter measurement, either diameter at breast height (DBH) or diameter at root collar (DRC). Trees that have been temporarily defoliated are still alive. If the stem is broken and still attached below DBH, the stem is tallied as a live tree. The severity of the break (i.e., more or less than 50% attached) on a live stem is not considered. Therefore as long as the stem is attached and the tree is live at DBH, it is tallied. See Figure 22.aN.

Figure 22.aN. Example of a live tree with a broken stem below 4.5 feet.

Once tallied, dead trees 1.0 inch and greater in diameter are tracked until they no longer qualify as standing dead. Working around dead trees is a safety hazard - crews should exercise extreme caution! Trees that are deemed unsafe to measure should be estimated.

To qualify as a standing dead tally tree, dead trees must be at least 1.0 inch in diameter, have a bole which has an unbroken ACTUAL LENGTH of at least 4.5 feet, and lean less than 45 degrees from vertical as measured from the base of the tree to 4.5 feet.

The portion of a bole on dead trees that are separated greater than 50 percent (either above or below 4.5 feet), are considered severed and may qualify as Down Woody Material (DWM). See DWM procedures for tally criteria.

NRS Note: Dead trees where the bole is separated greater than 50 percent at 4.5 feet (or previous DBH height) but maintains a DBH of 5.0/1.0 inches or greater will be measured as a Standing Dead tree. ACTUAL LENGTH will be coded the same as LENGTH TO DIAMETER MEASUREMENT POINT rounded to the nearest foot in this situation.
For woodland species (Appendix 3+N and Appendix 3BU+N) with multiple stems, a tree is considered down if more than 2/3 of the volume is no longer attached or upright; do not consider cut and removed volume. For woodland species with single stems to qualify as a standing dead tally tree, dead trees must be at least 1.0 inch in diameter, be at least 1.0 foot in unbroken ACTUAL LENGTH, and lean less than 45 degrees from vertical.

Live and dead standing tally trees, and partially separated boles of dead tally trees, do not have to be self-supported. They may be supported by other trees, branches, or their crown.

Trees that have been cut above DBH qualify as tally trees, provided they meet the size requirement.

NRS Note: Trees that have been cut above DBH no longer qualify as STANDING DEAD. This includes trees with high stumps and trees that have been cut with wood remaining at DBH (i.e., barber-chair). High stumps are usually a result of winter harvesting due to excessive snow total amounts. In addition, high stumps on trees with natural butt-swell (where it is normal to cut above 4.5 ft.) do not qualify as standing dead trees.

The following apply at remeasurement:

- If at the previous visit a forked tree was recorded as two separate trees but should have been recorded as one tree, reconcile one tree and correct the diameter for the remaining tree. Give one of the tree data lines a URBN/GRNTRUTH PRESENT TREE STATUS = 0, URBN/GRNTRUTH RECONCILE = 7, and a TREE NOTE in the PDR. The remaining tree data line receives URBN/GRNTRUTH PRESENT TREE STATUS = 1 or 2 with DIAMETER CHECK = 2, and a TREE NOTE in the PDR.

- If at the previous visit a forked tree was recorded as one tree but should have been recorded as two separate trees, correct the diameter for the remeasured tree to represent one tree, and add the other fork as a missed tree. Use the existing tree data line to represent one of the stems. URBN/GRNTRUTH PRESENT TREE STATUS = 1 or 2, DIAMETER CHECK = 2, and a TREE NOTE in the PDR. The second stem would get URBN/GRNTRUTH PRESENT TREE STATUS = 1 or 2, URBN/GRNTRUTH RECONCILE 3 or 4, and a TREE NOTE in the PDR.

NRS Note: If a subplot was installed incorrectly at the previous visit, the current crew should remeasure the subplot in its present location. In cases where individual forested subplots are lost (cannot be relocated and is not a land use change), apply the following procedures:

- Assign URBN/GRNTRUTH PRESENT TREE STATUS = 0 and URBN/GRNTRUTH RECONCILE = 7 to all downloaded trees (i.e., incorrectly tallied at the previous survey)
- Assign URBN/GRNTRUTH PRESENT TREE STATUS = 1 or 2 AND URBN/GRNTRUTH RECONCILE codes 3 or 4 (i.e., missed live or missed dead) to all trees on the new installed subplot with the next new URBN/GRNTRUTH TREE RECORD NUMBER for that subplot.

Begin tallying trees at an azimuth of 001 degrees from subplot center and continue clockwise around the subplot. Repeat this sequence for trees on the microplot and again on the annular plot.

5.1+N SUBPLOT NUMBER
Record the subplot number where the tree occurs.
5.2+ N TREE RECORD NUMBER [TR#]
Record a code to uniquely and permanently identify each tree on a given subplot. The TREE RECORD NUMBERs must be unique within a subplot – being unique is more important than being sequential. In general, work clockwise from azimuth 001 to 360, and work outwards from subplot center to subplot perimeter. On remeasured plots, use the previously assigned tree number. Saplings tallied on microplots will retain their initially assigned tree number if they grow to tree size. Missed trees and ingrowth trees (trees that either grew over the 1.0-inch threshold on the microplot or grew onto the subplot) will be assigned the next available tree number. DO NOT renumber all plot trees in order to assign a more “correct” tree number to a missed tree. Numbers assigned to trees that are subsequently found to be extra will be dropped and not reused.

If TREE RECORD NUMBERs are not assigned in the field, record 000.

NRS PDR Note: A new TREE RECORD NUMBER is assigned in the field. The next available tree number is on the printed plot sheets and is also an option on the MIDAS PDR Application. Click “Ctrl+C” on the PDR for the Next Tree Number. If a remeasurement tree is missing from the electronic data file, enter the data using the assigned tree number from the previous cycle’s printed tree data and enter all associated previous history data.

Note: If this is a Phase 3 plot, match the trees on this point to the hard copy list provided. Record the three-digit FHM tree number assigned to each standing tree.

When Collected: All tree records
Field width: 3 digits
Tolerance: No errors
MQO: At least 99% of the time
Values: 000 or 001 to 999

5.3+ N CONDITION CLASS NUMBER [CON#]
Record the CONDITION CLASS NUMBER in which each tree is located. Often, a referenced boundary is approximate and may or may not represent the actual “on the ground” boundary, and trees selected for tally are assigned to the actual condition in which they lie regardless of the recorded approximate boundary (Figure 22).

NRS Note: Trees and saplings are tallied only on accessible forest land. Trees and saplings that were previously measured on forest land and now fall in a nonforest condition require minimal tree data collection. See 5.34N FOREST TO NONFOREST VARIABLES for a listing of these variables.
When Collected: All trees
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values: 1 to 9

Figure 22. Ragged CONDITION CLASS boundary and tree condition class designation.

5.4 AZIMUTH [AZM]
Record the AZIMUTH from the subplot center (for trees greater than or equal to 5.0 inches DBH/DRC) or the microplot center (for trees greater than or equal to 1.0 inch and less than 5.0 inches DBH/DRC), sight the center of the base of each tree with a compass. Sight to the “geographic center” for multi-stemmed woodland species (Appendix 3+N+N). The geographic center is a point of equal distance between all tallied stems for a given woodland tree. Record AZIMUTH to the nearest degree. Use 360 for north.

When Collected: All live and standing dead tally trees ≥ 1.0 inch DBH/DRC
Field width: 3 digits
Tolerance: +/- 10 degrees
MQO: At least 90% of the time
Values: 001 to 360

5.5+N HORIZONTAL DISTANCE [DIST]
Record the measured HORIZONTAL DISTANCE, to the nearest 0.1 foot, from the subplot center (for trees greater than or equal to 5.0 inches DBH/DRC) or microplot center (for trees greater than or equal to 1.0 inch and less than 5.0 inches DBH/DRC) to the pith of the tree at the base. For all multi-stemmed woodland trees (woodland species indicated in Appendix 3+N+N), the HORIZONTAL DISTANCE is measured from subplot or microplot center to the “geographic center” of the tree. The geographic center is a point of equal distance between all tallied stems for a given woodland tree.
The following are additional regional instructions to determine HORIZONTAL DISTANCE for trees that lean, are windthrown, or on steep terrain.

- A leaning tree is determined to be "in" or "out" of a plot radius by measuring the horizontal distance from plot center to the center of the tree at the base. The direction that the tree leans is of no consequence.

- For a LIVE down and windthrown tree, measure the horizontal distance to the spot where the center of the tree would have been if the tree was still standing (i.e., measure the distance to the center of the stump, or ground cavity). This guideline applies to New plots as well as Remeasurement plots. See Figure 22.bN below.

![Figure 22.bN. Down and Windthrown Tree.](image)

NRS Note: If the main bole is below the duff line (The general pith line of the main bole is below the duff layer.) reference 5.9.2 Figure 41 for more instructions.

- When direct horizontal distance cannot be accurately measured due to steep terrain, slope distance and percent slope (both measured with a clinometer parallel to the ground) should be used to calculate the horizontal distance. See below formula and Figure 22.cN.

\[
\text{measure slope distance to tree} = \frac{\text{horizontal distance to tree}}{\text{100 ft slope distance}} = \frac{\text{horizontal distance to tree}}{\text{100 ft horizontal distance}}
\]

For example, a tree has a slope distance of 25.9 ft and the slope is 48 %. Using the Slope Correction table in the Regional Appendix E, you find that the correction for 100 ft with 48 % slope is 10.9 ft.

All that’s left is to solve the equation:

\[
\frac{25.9 \text{ ft}}{100 \text{ ft}} = \frac{\text{horizontal distance to tree}}{100 \text{ ft}}
\]

Solve for the horizontal distance, HD = 23.4 ft.
NRS PDR Note: If the MIDAS PDR Application is available, there is a function utility that allows you to determine horizontal distance. For this utility enter the measured slope distance and the percent slope and the utility calculates a horizontal distance.

Figure 22.cN. A slope distance (dashed line) is measured parallel to the ground from the subplot center to the center of the tree and percent slope is measured along this dashed line (slope distance).

There is an alternative method to measure the slope distance and percent slope as shown in Figure 22.dN. Either measurement method will yield a horizontal distance when applied to the formula on the previous page or entered into the horizontal distance utility in the MIDAS PDR Application.

Figure 22.dN. A slope distance (dashed line) is measured from the subplot center to the center of the tree and percent slope is measured along the dashed line (slope distance.)

NRS Note: If a previous tree is located on the "outer" edge of a subplot (i.e., 23.8 to 24.2 ft to the pith of the tree at the base), then apply the following rules. If the current crew determines a previously tallied tree is now at ≤ 24.2 ft, the tree will remain IN. Similarly if the current crew determines that a previously non-tallied tree is ≥ 23.8 ft, the tree will remain OUT unless it is
considered ingrowth. This also applies to saplings on the microplot’s “outer” ring (i.e., 6.6 to 7.0 ft to the pith of the tree at the base). On the microplot, a previously tallied sapling is now at ≤ 7.0 ft, the sapling will remain IN. If a previously non-tallied sapling is at ≥ 6.6 ft, the sapling will remain OUT unless it is considered ingrowth. This allowance is due to the difficulty of determining pith location and other factors like slope and subplot and/or microplot center relocation.

When the old pin or dowel is not found, the current crew should make sure that all “edge” trees or saplings that were in or out on the previous occasion, are still in or out unless ingrowth.

Borderline trees that either fall just outside the 24.0 ft or 6.8 ft circle or are just under 5.0 inches or 1.0 inch require some type of indication that they should not be considered missed. To ensure these trees are handled properly by a QA crew or the next field crew, either make a mark on the tree or place a Note on the plotsheet indicating the tree is out or too small. The mark could include but is not limited to a scribe mark on thick bark trees or a line from a permanent marker.

NRS PDR Note: Change the previous recorded distance if it is does not meet the indicated regional tolerance for trees. Example, if the previous distance was recorded as 15.2 and the current distance is now 16.0, the previous value is satisfactory. There is no need to change this value unless the previous distance causes current on the ground confusion like trees located in a clump. In these situations it makes sense to change this distance even if the previous distance is within tolerance.

Note: On remeasurement plots (SAMPLE KIND = 2), the current crew is responsible for verifying downloaded data and updating when it is out of tolerance. When the old pin or dowel is not found, current cruisers should consider all “edge” trees or saplings that were in or out on the previous occasion when reestablishing the subplot center. For saplings on the microplot that become trees at the time of plot remeasurement, crews must collect new HORIZONTAL DISTANCE information from the subplot center.

When Collected: All live and standing dead tally trees ≥ 1.0 inch DBH/DRC
Field width: 3 digits (xx.y)
Tolerance:
  microplot: +/- 0.2 ft.
  microplot woodland species: +/- 0.4 ft
  subplot: +/- 1.0 ft. from 0.1 to 23.0 ft.
  subplot: +/- 0.2 ft. from 23.1 to 24.0 ft.
  subplot multi-stemmed woodland species: +/- 2.0 ft.
  Annular plot: +/- 3.0 ft from 24.0 to 55.9 ft
  Annular plot: +/- 1.0 ft from 55.9 to 58.9 ft
  Annular plot woodland species: +/- 6.0 ft
MQO: At least 90% of the time
Values:
  Microplot: 00.1 ft. to 06.8 ft.
  Subplot: 00.1 ft. to 24.0 ft.
  Annular plot: 24.1 to 58.9

5.6 PREVIOUS TREE STATUS [PAST]
If not downloaded from the previous inventory, record PREVIOUS TREE STATUS for each remeasured tally tree. This code is used to track the status of sample trees over time. This information is needed to correctly assign the tree’s volume to the proper component of volume change.
When collected: On remeasurement plots (SAMPLE KIND = 2), all previously tallied trees ≥ 1.0 inch DBH
Field width: 1 digit
Tolerance: No errors
MQO: At least 95% of the time
Values:
1  Live Tree – alive at the previous inventory
2  Dead tree – standing dead tree at the previous inventory

5.7 U+N+GT URBAN / GROUND TRUTH PRESENT TREE STATUS [UGTTRST]
Record a current URBAN / GROUND TRUTH PRESENT TREE STATUS for each tallied tree.
This code is used to track the status of sample trees over time: as they first appear, as ingrowth, as they survive, and when they die or are removed. This information is needed to correctly assign the tree’s volume to the proper component of volume change.

NRS Note: A remeasured tree that is now in a "nonforest" condition is assigned the appropriate PRESENT TREE STATUS. For example, a tree that was previously live in accessible forest land and is still present and live in a residential area is coded as 1. If the tree has died (includes trees that have been removed and not utilized), it is coded as 2. If the tree has been removed and utilized, it is coded as 3. If the PRESENT TREE STATUS cannot be determined for a tree now in a "nonforest" condition (i.e., crew is unable to occupy the subplot), apply code 2 or 3. When applying code 2 or 3, apply known local utilization practices or best professional judgment for a tree that is now located in a nonforest condition.

NRS Note: When occupying accessible forest land, a remeasured tree that has a temporary hazardous situation (e.g., hornet’s nest, seasonal high water, etc.) isolating the tree on the subplot or microplot, should not be given a PRESENT TREE STATUS = 0. These trees should be given PRESENT TREE STATUS = 1 or 2 and the crew is allowed to estimate the measured variables. When estimating measured variables, view similar trees on plot and be conservative. For a new tree, these same rules apply. A tree that occupies a permanent hazardous situation requires that the subplot area be delineated as nonsampled (CONDITION CLASS STATUS 5).

NRS Note: If the current CONDITION of previous tally trees converts from forest to nonforest between cycles, reference "Condition Change from Forest to Nonforest" in Regional Appendix C to determine required Tree and Sapling variables.
When Collected: All new live and standing dead tally trees ≥ 1.0 inch DBH/DRC
On remeasurement plots, all previously tallied trees
Field width: 1 digit
Tolerance: No errors
MQO: At least 95% of the time

Values:

1. **No status** – tree is not presently in the sample (remeasurement plots only). Tree was incorrectly tallied at the previous inventory, currently is not tallied due to definition or procedural change, or is not tallied due to natural causes, or is not tallied because it is located on a Nonsampled Condition (i.e., hazardous or denied). Requires RECONCILE code = 5-9.

2. **Dead tree** – any live tree (new, remeasured or ingrowth) where the bole of the tree remains on the site, regardless of cause of death. Includes all previously standing dead trees that no longer qualify as standing dead, trees killed by silvicultural or land clearing activity and assumed not to have been utilized, as well as dead trees that may have been present at the time of plot establishment but only tallied now due to procedural change. Does not include trees that are removed from the site.

3. **Removed Cut & Utilized** – Collected on remeasurement trees. A tree that occupied a forested condition in the previous inventory only. A tree that has been cut and removed by direct human activity related to harvesting, silviculture or land clearing (remeasurement plots only). The tree is assumed to have been utilized for commercial purposes, such as timber, chips, or firewood, and noncommercial purposes such as domestic firewood, landscaping, and fence posts.

4. **Removed** – Collected on remeasurement trees only. A tree that has been removed by direct human activity but not likely utilized for a commercial product, such as timber, chips, or firewood, and noncommercial purposes such as domestic firewood, landscaping, and fence posts.

<table>
<thead>
<tr>
<th>Time 1 Condition</th>
<th>Time 2 Condition</th>
<th>URBAN PRESENT TREE STATUS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forest</td>
<td>Forest</td>
<td>0</td>
</tr>
<tr>
<td>Forest</td>
<td>Nonforest</td>
<td>1</td>
</tr>
<tr>
<td>Nonforest</td>
<td>Forest</td>
<td>2</td>
</tr>
<tr>
<td>Nonforest</td>
<td>Nonforest</td>
<td>3</td>
</tr>
</tbody>
</table>

Table 2UGT. Table summarizes the legal values for URBAN PRESENT TREE STATUS for every combination of Time 1 and Time 2 conditions.

Note: On remeasured plots, crews must collect new AZIMUTH and HORIZONTAL DISTANCE information from the subplot center for microplot saplings that grow to become subplot trees. For live or standing dead subplot trees that shrink to become live or dead saplings on the microplot, crews must collect new AZIMUTH and HORIZONTAL DISTANCE information from the microplot center.

5.7.1 **URBAN / GROUND TRUTH RECONCILE [UGTRECO]**

For remeasurement locations only, record a URBAN / GROUND TRUTH RECONCILE code for any new tally tree that was not tallied in the previous inventory, and for all no status remeasurement trees (URBAN / GROUND TRUTH PRESENT TREE STATUS = 0). This code is used to identify the reason a new tree appeared in the inventory, and identify the reason a remeasurement tree no longer qualifies as a tally tree. This information is needed to correctly assign volume information to the proper component of volume change.
When Collected: On SAMPLE KIND = 2; all new live and standing dead tally trees and saplings ≥ 1.0 inch DBH/DRC (URBAN / GROUND TRUTH PRESENT TREE STATUS = 1 or 2 and no PREVIOUS TREE STATUS) and all no status previously tallied trees (when URBAN / GROUND TRUTH PRESENT TREE STATUS = 0)

Field width: 1 digit
Tolerance: No errors
MQO: At least 95% of the time
Values:

Codes 1-4 are valid for new trees (URBAN / GROUND TRUTH PRESENT TREE STATUS = 1 or 2) on the plot:

1. Ingrowth – either a new tally tree not qualifying as through growth or a new tree on land that was formerly nonforest and now qualifies as forest land (reversion or encroachment).
2. Through growth – new tally tree 5.0 inches DBH/DRC and larger, within the microplot, which was not missed at the previous inventory (i.e., grew from seedling to pole size between inventory cycles). Code is valid on SK 2. Extremely rare for NRS. This code would be used for trees that were transplanted to the site and had a DBH/DRC of 5" or greater.
3. Missed live – a live tree missed at previous inventory and that is live or dead now. Includes currently tallied trees on previously nonsampled conditions. NRS Note: Includes Cruiser Error as well as previous partial DA or Haz plots where tree was live at previous inventory.
4. Missed dead – a dead tree missed at previous inventory that is dead now. Includes currently tallied trees on previously nonsampled conditions. NRS Note: Includes Cruiser Error as well as previous partial DA or Haz plots where tree was dead at previous inventory.

Codes 5-9 are valid for remeasured trees (URBAN / GROUND TRUTH PRESENT TREE STATUS = 0) that no longer qualify as tally:

5. Shrank – live tree that shrank below threshold diameter on microplot/subplot/macroplot. Must currently be alive.
6. Missing (moved) – tree was correctly tallied in previous inventory, but has now moved beyond the radius of the plot due to natural causes (e.g., small earth movement, hurricane). Tree must be either live before and still alive now or dead before and dead now. If tree was live before and now dead, this is a mortality tree and should have URBAN / GROUND TRUTH PRESENT TREE STATUS = 2 (not 0).
7. Cruiser error – erroneously tallied at previous inventory.
8. Procedural change – tree was tallied at the previous inventory, but is no longer tallied due to a definition or procedural change.
9. Tree was sampled before, but now the area where the tree was located is nonsampled. All trees on the nonsampled area have URBAN / GROUND TRUTH RECONCILE = 9.

Code 5 is used to indicate live trees that shrink below the diameter threshold on the microplot/subplot/macroplot. For example, if a live remeasurement tree shrinks below the 5.0 inch DBH/DRC, then record the following combination of codes: PREVIOUS TREE STATUS = 1,
**URBAN / GROUND TRUTH** PRESENT TREE STATUS = 0. **URBAN / GROUND TRUTH** RECONCILE = 5. If a live measured tree shrinks below the 5.0 inch threshold on the subplot and is currently greater than or equal to 1.0 inch on the microplot, then record PREVIOUS TREE STATUS = 1. **URBAN / GROUND TRUTH** PRESENT TREE STATUS = 1. Record all required items for a tally sapling. Use the tree coding guide in Appendix 8 to determine the national coding method for remeasurement trees.

The following table, which is an abbreviated list from Appendix 8, describes how to tally standing dead saplings with respective PRESENT TREE STATUS, RECONCILE CODE, and STANDING DEAD, which are being collected for the first time in Field Guide version 7.0:

<table>
<thead>
<tr>
<th>Dead Sapling Tally – New plots</th>
<th>PRESENT TREE STATUS</th>
<th>RECONCILE CODE</th>
<th>STANDING DEAD</th>
<th>CAUSE of DEATH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standing dead 1.0 – 4.9 DBH/DRC</td>
<td>2</td>
<td>Null</td>
<td>Auto-populated</td>
<td>Core optional</td>
</tr>
<tr>
<td>Dead Sapling Tally – Remeasure plots</td>
<td>PRESENT TREE STATUS</td>
<td>RECONCILE CODE</td>
<td>STANDING DEAD</td>
<td>CAUSE of DEATH</td>
</tr>
<tr>
<td>-------------------------------------</td>
<td>---------------------</td>
<td>----------------</td>
<td>---------------</td>
<td>----------------</td>
</tr>
<tr>
<td>Previous live &lt;1.0 and has grown to ≥1.0 and died</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>10-80</td>
</tr>
<tr>
<td>Previous live 1.0+; now standing dead 5.0+ DBH/DRC</td>
<td>2</td>
<td>Null</td>
<td>1</td>
<td>10-80</td>
</tr>
<tr>
<td>Previous ≥ 1 inch and &lt;5 inches and was dead and is still standing dead</td>
<td>2</td>
<td>4</td>
<td>1</td>
<td>Null</td>
</tr>
<tr>
<td>Previous live 1+ missed; now 1+ DBH/DRC and dead</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td>10-80</td>
</tr>
<tr>
<td>Previous live 5.0+ DBH/DRC; now tree shrank &lt;5.0 but ≥1.0 (e.g., bark loss) and is standing dead, located on subplot (not located on microplot).</td>
<td>2</td>
<td>Null</td>
<td>0</td>
<td>10-80</td>
</tr>
<tr>
<td>Previous dead 5.0+ DBH/DRC; now tree shrank &lt;5.0 but ≥1.0 (e.g., bark loss) and is standing dead, located on subplot (not located on microplot).</td>
<td>2</td>
<td>Null</td>
<td>0</td>
<td>Null</td>
</tr>
<tr>
<td>Previous live 5.0+ DBH/DRC; now tree shrank &lt;5.0 but ≥1.0 (e.g., bark loss) and is standing dead located on the microplot. Note: this dead sapling should be referenced with a new distance and azimuth from the microplot center.</td>
<td>2</td>
<td>Null</td>
<td>1</td>
<td>10-80</td>
</tr>
<tr>
<td>Previous dead 5.0+ DBH/DRC; now tree shrank &lt;5.0 but ≥1.0 (e.g., bark loss) and is standing dead located on the microplot. Note: this dead sapling should be referenced with a new distance and azimuth from the microplot center.</td>
<td>2</td>
<td>Null</td>
<td>1</td>
<td>Null</td>
</tr>
</tbody>
</table>

5.7.2 I N STANDING DEAD I [DEAD]

Record the code that describes whether or not a tree qualifies as standing dead. To qualify as a standing dead tally tree, dead trees must be at least 1.0 inch in diameter, have a bole that has an unbroken ACTUAL LENGTH of at least 4.5 feet, and lean less than 45 degrees from vertical as measured from the base of the tree to 4.5 feet. For standing dead trees that are curved or bent, apply the same rules (i.e., from the base of the tree to 4.5 feet). See Figure 23–Figure 25.bN for examples.

“Unbroken” is defined as at least 50 percent attached to the original source of growth. The degree of lean on dead trees with partially separated (i.e., 1 to 50 percent) boles is measured from the base of the tree to the top of at 4.5 feet ACTUAL LENGTH.

Portions of boles on dead trees that are separated greater than 50 percent (either above or below 4.5 feet) are considered severed and are included in Down Woody Material (DWM) if they otherwise meet DWM tally criteria.
NRS Note: Dead trees where the bole is separated greater than 50 percent at 4.5 feet but maintains a DBH of 1.0 inches or greater will be measured as a Standing Dead tree. ACTUAL LENGTH will be coded as 5 feet in this situation.

For woodland species (Appendix 3) with multiple stems, a tree is considered down if more than 2/3 of the volume is no longer attached or upright; do not consider cut and removed volume. For woodland species with single stems to qualify as a standing dead tally tree, dead trees must be at least 1.0 inch in diameter, be at least 1.0 foot in unbroken ACTUAL LENGTH, and lean less than 45 degrees from vertical.

Live and dead standing tally trees, and partially separated boles of dead tally trees, do not have to be self-supported. They may be supported by other trees, branches, or their crown.

NRS Note: Dead standing remeasurement trees that have dropped below 5.0 inches on the subplot or 1.0 inch on the microplot due to loss of bark will be given a PRESENT TREE STATUS code of ’2’ and a STANDING DEAD code of ’0’. These trees no longer qualify as a STANDING DEAD but they still need to be accounted for in the sample. They would not receive a PRESENT TREE STATUS code of ’0’.

When collected: SAMPLE KIND = 2 only: All dead tally trees (PRESENT TREE STATUS = 2)
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values:
0 No – tree does not qualify as standing dead (includes a previously tallied tree that is still standing but with a current diameter < 1.0 inch DBH)
1 Yes – tree does qualify as standing dead.

Figure 23. Example of an unbroken bole to 4.5 feet.
STANDING DEAD = 0 (no)

(Tree is at least 1.0 inch at 4.5 feet, but does not have 4.5 feet in unbroken ACTUAL LENGTH)

Figure 24+N. Example of an unbroken length of < 4.5 feet. NRS Note: The break at 1.5 ft is at least 50% attached. The lean angle is determined at 4.5 ft.

STANDING DEAD = 1 (yes)

(Trees are at least 1.0 inch at 4.5 feet and are at least 4.5 feet in unbroken ACTUAL LENGTH)

Figure 25. Other examples of dead trees
5.7.3 RI and R2 MORTALITY (CORE OPTIONAL) Not Collected in NRS URBAN
Record a mortality code for any tree that was live within the past five years but has died, regardless of cause of death. This information is needed to correctly assign volume information to the proper component of volume change.

When Collected: All standing dead trees 1.0 inch DBH/DRC and larger that were live within the past 5 years if no previous inventory (PRESENT TREE STATUS = 2 on SAMPLE KIND = 1 or 3 plots).

Field width: 1 digit
Tolerance: No errors
MQO: At least 85% of the time
Values:
0 No - tree does not qualify as mortality.
1 Yes – tree does qualify as mortality.

5.7.4 UGT BOLE/STUMP REMOVED [BSRMV]
For remeasurement locations only, record a BOLE/STUMP REMOVED code for any tree that was tallied in the previous inventory but has now been removed from the site (URBAN PRESENT TREE STATUS = 3 or 4). This code is used to track the types of tree removal as well as influence predictions on future occupancy of the site. The method of stump removal does not matter as long as the entire surface of the stump is removed or reduced below ground level. Common methods include heavy equipment (bulldozer or tractor), digging, or grinding.
When Collected: On SAMPLE KIND = 2; all tally trees with an URBAN PRESENT TREE STATUS of 3 or 4.

Field width: 1 digit
Tolerance: No errors
MQO: At least 95% of the time

Values:
1. Bole removed – The bole of the tree was removed but the stump remains on site
2. Bole & stump removed – The bole and stump were removed from the site. Use this code if the entire surface of the stump has been reduced below ground level or removed completely.

5.8+U+N+GT URBAN / GROUND TRUTH SPECIES [UGT SPP]
Record the appropriate SPECIES code from the list in Appendix 3+N and Appendix 3BU+N. If the species cannot be determined in the field, tally the tree, but bring branch samples, foliage, cones, flowers, bark, etc. to the supervisor for identification. If possible, collect samples outside the subplots from similar specimens and make a note in the PDR to correct the SPECIES code later.
Use code 0299 for unknown dead conifer, 0998 for unknown dead hardwood when the genus or species codes cannot be used, and 0999 for other or unknown live tree. The generic genus code should only be used when you are sure the species is on the species list, but you cannot differentiate among acceptable species. This is often the case with standing dead trees on newly established plots. In this case use the sample collections procedures described earlier in this paragraph. If a hybrid species is found, naturally or planted, and is listed in the Appendix 3 or Appendix 3BU, use the hybrid code; otherwise code the parent species with the most dominant characteristic from Appendix 3+N or Appendix 3BU+N. If neither the hybrid nor either of the parent species are listed, then do not tally the species and follow NON-TALLY TREE procedures in Section 3.19U. If a variety or subspecies is found, naturally or planted, and is listed in Appendix 3+N or Appendix 3BU+N, use the corresponding variety/ subspecies code. If the variety is not listed, but the species is listed, code the specimen using the species code.

The species code list in Appendix 3+N and Appendix 3BU+N includes all tree species tallied in the Continental U.S., Alaska and the Caribbean. Species designated East/West (East includes NRS and SRS and West includes PNW and IW) are commonly found in those regions, although species designated for one region may occasionally be found in another, those designated as Urban (U) are limited to urban inventories. Species marked as Woodland (W) designate species where DRC is measured instead of DBH. Species that have an "X" in the Core column are tallied in all regions. All other species on the list are “core optional.” both CORE and URBAN OPTIONAL. Species that are “grayed out” on either list are not collected in your specific Region.

NRS Note: All larch (Larix spp.), serviceberry (Amelanchier spp.), hawthorn (Crataegus spp.), apple (Malus spp.), cottonwood and poplar (Populus spp.), pear (Pyrus spp.), and mountain ash (Sorbus spp.) are tallied. These species can be coded using the generic genus code (0070, 0356, 0500, 0660, 0740, 8420, and 0934), with the exception of Callery Pear (8421), if the species cannot be determined. If a hybrid species is found, naturally or planted, and is listed in Appendix 3+N or Appendix 3BU+N, use the hybrid code; otherwise code the parent species with the most dominant characteristic from Appendix 3+N and Appendix 3BU+N. If neither the hybrid nor either of the parent species are listed, then do not tally the tree and follow NON-TALLY TREE procedures in Section 3.19U. When a willow species (Salix spp.) cannot be positively identified to species, but has many of the characteristics associated with White willow (S. alba) (0927), Peachleaf willow (S. amygdaloides) (0921), Black willow (S. nigra) (0922), or Coastal Plain willow (S.caroliniana) (0925) tally the willow using the generic code 0920. The generic code 0920 should not be used for Weeping willow (S. sepulcralis) (0929) or Balsam willow (S. pyrifolia) (0926).

NRS Note: The 0999 code shall only be used as a place holder in the PDR while the crew researches the identification of the unknown live tree. Once the tree is identified crews will
replace the 0999 code with the correct species code, if the species cannot be identified the tree record shall be deleted prior to loading the plot file into the database.

When Collected: All tree records
Field width: 4 digits
Tolerance: No errors
MQO: At least 99% of the time for genus, at least 95% of the time for species
Values: See Appendix 3+N and Appendix 3BU+N

5.9+N Diameter
Diameters are measured at either breast height (DBH) or at the root collar (DRC). Species requiring DRC, referred to as woodland species, are denoted with a “w” in Appendix 3+N. Trees with diameters between 1.0- and 4.9-inches are measured on the 6.8-foot radius microplot, those with diameters of 5.0-inches and larger are measured on the 24-foot radius subplots.

In order to accurately remeasure diameter (DBH or DRC) at the same point on the tree bole at successive visits, regions have the option of measuring and recording the distance from the ground to the point of diameter measurement, or marking the point of measurement with a scribe, crayon, paint, or aluminum nail. When marking trees for the first time, measure the diameter after the mark is in place. Use caution to avoid damaging trees with scribes and nails. Do not scribe or nail trees less than 3.0-inches in diameter, or species vulnerable to introduction of pathogens (e.g., aspen) or thin barked trees. Do not penetrate the cambium when using a bark scribe. A scribe that penetrates the cambium has been found to cause damage and swelling that affects not only the health of tree but compromises growth calculations. Any tree that has been scribed in the past, do not scribe again. Apply paint to the mark created by the scribe.

The diameter mark is located within one inch below where the diameter is taken and it faces the subplot center or microplot center. If using a bark scribe or paint marker, the mark should be approximately two inches long or as appropriate for a sapling. Check for irregularities before making diameter marks (see Section 5.9.2, "Special DBH situations," rule #4).

The use of scribes and paint are prohibited on plots located in Wilderness Areas on National Forests. Tally trees will not be painted or scribed. Mark each tally tree 5.0” DBH and larger with only a nail at ground level either facing subplot center or on the uphill side of the tree if there is a slope. If the sample tree is in view of a known path or trail, place the nail away from the path or trail and make a PLOT NOTE in the PDR. A reference tree to the subplot center utilizes both a nail and tag. If only saplings are on the subplot, mark a couple of them with nails at ground level and note which are marked in the PLOT NOTE in the PDR. Nails should not be used on thin barked trees. If diameter is not taken at DBH, the LENGTH TO DIAMETER MEASUREMENT POINT is recorded. Cutting vines and moss will not be done. In cases where vines or moss preclude the use of diameter tapes for estimation of diameter, calipers or other estimation procedures may be used. [INTRA-AGENCY AGREEMENT 05-SU-FIA01]

Remeasurement trees:
When remeasuring the diameter of a tree tallied at a previous survey, always take the measurement at the location monumented by the previous crew unless it is not physically possible (e.g., tree buried by mudslide), there is an abnormality at the previous DIAMETER measurement point, or the previous location is more than 12 inches beyond where the diameter should be measured according to current protocols (either because protocols have changed or the previous crew made a mistake). Previous diameter measurement locations should not be moved due to the loss or addition of a forked stem. Assign a DIAMETER CHECK code of 2 whenever the point of measurement is moved.
NRS Note: If a remeasurement tree with a DBH measured above 4.5 feet is severed below the previously established DBH, the tree is no longer a ‘Tally tree’ regardless whether the tree maintains 5.0/1.0 inches at or above 4.5 feet.

The following are additional regional instructions on how to establish the initial DBH location and when to move a remeasurement location. Remember we are looking for ‘Growth Over Time’, so we want DBH initially placed in the best possible location and moved only if a gross deformity has formed or if it is no longer physically possible to collect DBH in the same location as the previous crew.

- For new measurement trees, initially attempt to measure DBH at 4.5 ft. If there is a gross deformity at that location, begin to move up the bole for a suitable location that will remain normal over time and to which an average-height crewmember can access. If there isn’t a suitable location above, then move below 4.5 for a suitable location. If that fails as well, last resort is to estimate DBH at a location that will best represent the tree volume.

- For remeasurement trees, initially attempt to measure DBH at the same location the previous crew measured. If a gross deformity is present at that location, once again start at 4.5 ft and move up and then down. If a new suitable location cannot be located, estimate the DBH at a location that will best represent the tree volume.

- For new measurement forked trees where multiple trees are recorded, attempt to measure each DBH at an accessible location above the crotch of the fork where the stem becomes normal and will remain normal over time. If that fails, last resort is to estimate DBH at a location that will best represent the tree volume.

- For remeasurement forked trees where multiple trees are recorded, attempt to measure each DBH at the same location the previous crew measured. If a gross deformity is present at that location or the crotch has fused, attempt to move the DBH up to an accessible location. Attempt to ensure a new location will be accessible in future cycles. If the location must be moved and it is predicted that the crotch will fuse within the next cycle, estimate the DBH at a location that will best represent the tree volume.

NRS Note: Record a TREE NOTE in the PDR if the previous DBH location is:

1. poor but was left “as is” for consistency purposes.
2. moved because previous location was egregiously off.

NRS Note: Borderline trees that either fall just outside the 24.0 ft or 6.8 ft circle or are just under 5.0 inches or 1.0 inch require some type of indication that they should not be considered missed. To ensure these trees are handled properly by a QA crew or the next field crew, either make a mark on the tree or place a Note on the plotsheet indicating the tree is out or too small. The mark could include but is not limited to a scribe mark on thick bark trees or a line from a permanent marker.
When Collected: All live and standing dead tally trees ≥ 1.0 inch DBH/DRC
Field width: 4 digits (xxx.y)
Tolerance: +/- 0.1 inch per 20.0-inch increment of measured diameter on all live trees and
standing dead trees with DECAY CLASS = 1, 2
+/- 1.0 inch per 20.0-inch increment of measured diameter on standing dead trees with DECAY
CLASS = 3, 4, 5
For woodland species: +/- 0.2 inch per stem
MQO: At least 95% of the time. For example: a tree with a diameter of 41.0 inches would have a
tolerance of plus or minus 0.3 inch. (Note: the MQO for point of measurement is
 +/- 0.2 inch when the tree is first measured and within 1 foot of the location
established by the previous crew when the tree is remeasured.)
Values: 001.0 to 999.9

5.9.1 PREVIOUS DIAMETER AT BREAST HEIGHT [DBHO]
This is the DBH assigned at the previous survey. It has been downloaded from the previous
inventory. Any change made to this field signifies an error at the time of the previous inventory.
DIAMETER CHECK should be set to 2 and an explanation is required in the notes if previous
DBH is changed.

5.9.2 DIAMETER AT BREAST HEIGHT [DBH]
Unless one of the following special situations is encountered, measure DBH at 4.5 feet above the
ground line on the uphill side of the tree. Round each measurement down to the last 0.1 inch. For
example, a reading of 3.68 inches is recorded as 3.6 inches.

NRS Note: Record diameter height for all trees not measured at 4.5 feet, even if diameter was
previously monumented.

NRS Note: If it can be determined that there is a gross error for the PREVIOUS DIAMETER AT
BREAST HEIGHT, enter a corrected value for DBHO. A ‘gross error’ doesn’t have a set range.
The range needs to reflect an obvious mistake and not just an acceptable level of growth. If a
mistake is evident then estimate what the DBH would have been.

Special DBH situations:

1. Forked tree: In order to qualify as a fork, the stem in question must be at least 1/3 the
diameter of the main stem at the point of attachment, measured just above the branch collar,
and must branch out from the main stem at an angle of 45 degrees or less. Forks originate at
the point on the bole where the piths intersect. Forked trees are handled differently
depending on whether the fork originates below 1.0 foot, between 1.0 and 4.5 feet, or above
4.5 feet.

NRS Note: The regional guideline regarding the consideration of missing forks for Tree Class
determination applies only to the regional merchantability variables. Do not consider missing forks
when locating the diameter measurement. For trees not tallied in the past, a fork is considered
missing if it is broken below the location where DBH should be located using the standard forking
rules. For a remeasurement tree, a fork is considered missing if the stem is broken and gone
below the previous DBH measurement (UGTTRST=2 and DEAD=0).

NRS Note: Evaluate the angle that the pith enters the main stem, not the general form extending
from the tree, to determine if it is a fork or a branch.

NRS Note: A dead stem that is ≥ 1.0 inch DBH/DRC is treated the same as a live stem on forked
trees.
NRS Note: Disregard any fork, live or dead, that is < 1.0 inch DBH/DRC.

a. Trees forked below 1.0 foot. Trees forked below 1.0 foot are treated as distinctly separate trees (Figure 26). Distances and azimuths are measured individually to the center of each stem where it splits from the stump (Figure 31 A-C). DBH is measured for each stem at 4.5 feet above the ground. When stems originate from pith intersections below 1 foot, it is possible for some stems to be within the limiting distance of the microplot or subplot, and others to be beyond the limiting distance. If stems originating from forks that occur below 1.0 foot fork again between 1.0 and 4.5 feet (Figure 31-E), the rules in the next paragraph apply.

![Figure 26. Forked below 1.0 ft.](image)

b. Trees forked between 1.0 foot and 4.5 feet. Trees forked between 1.0 foot and 4.5 feet are also counted as separate trees (Figure 27), but only one distance and azimuth (to the central stump) is recorded for each stem (Figure 31 D-F). Although a single azimuth and distance applies to all, multiple stems should be recorded as they occur in clockwise order (from front to back when one stem is directly in front of another). The DBH of each fork is measured at a point 3.5 feet above the pith intersection. When forks originate from pith intersections between 1.0 and 4.5 feet, the limiting distance is the same for all forks--they are either all on, or all off the plot.

![Figure 27. Forked between 1.0-4.5 ft.](image)

Multiple forks are possible if they all originate from approximately the same point on the main stem. In such cases, measure DBH on all stems at 3.5 feet above the common pith intersection (Figure 31-F).

Crews may encounter trees of any species displaying growth forms that make applying traditional forking rules very difficult. Often these growth forms are the result of either the immediate growing
conditions or the fact that the trees have been bred, pruned, or managed in a way that promotes multiple stems in order to promote a certain crown shape. In such cases crews are still instructed to apply traditional forking rules to the greatest extent possible, if doing so does not result in an accurate and repeatable measurement or estimate use the following guidance:

Tally as one tree at the highest most repeatable location between the 1 foot stump and any swelling associated with the first potential fork when either of the following are encountered:

- Prolific branching / forking make it very difficult to determine if all the piths originate from approximately the same location (Figure 28UGT).

- Pith origination can be determined but multiple forks / branches are grown together below the base of the secondary fork in such a manner that an accurate measurement OR estimation is NOT possible (Figure 29UGT) (THIS IS A LAST RESORT RESERVED FOR THE RARE TIMES WHEN THE TREE IS SO CONFOUNDED THAT EVEN A GOOD ESTIMATE IS NOT POSSIBLE). If such measurements / estimates ARE possible follow guidance in Figure 31 and Figure 32UGT.

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**Figure 28UGT.** Prolific branching / forking makes it very difficult to determine if all the piths originate from approximately the same location. Traditional forking rules will not provide accurate and repeatable diameter measurements so the diameter should be taken as shown.
Figure 29 UGT. Multiple overgrown forks and secondary forks make an accurate measurement or estimation of diameters impossible (THIS IS A LAST RESORT RESERVED FOR THE RARE TIMES WHEN THE TREE IS SO CONFOUNDED THAT EVEN A GOOD ESTIMATE IS NOT POSSIBLE).

NRS Note: Diameter measurement due to a fork is to be taken 3.5 feet above the pith separation or at a “reasonable” reach for remeasurement. Place a diameter mark that can be consistently reached and remeasured by the next crew. If a diameter mark has already been placed, review the diameter procedures for “remeasurement trees” described in 5.9 Diameter.

Once a stem is tallied as a fork that originated from a pith intersection between 1.0 and 4.5 feet, do not recognize any additional forks that may occur on that stem. These secondary forks need only meet the 1/3 diameter and 45 degree requirements to be considered forks. They do not need to be 1 inch in diameter. Measure the diameter of such stems just below the base of stem separation as shown in Figure 31-E and Figure 31-F (i.e., do not move the point of diameter the entire 3.5 feet above the first fork).

c. Trees forked at or above 4.5 feet. Trees forked at or above 4.5 feet count as one single tree (Figure 30). If a fork occurs at or immediately above 4.5 feet, measure diameter below the fork just beneath any swelling that would inflate DBH.

Figure 30. One tree.
2. Stump sprouts: Stump sprouts originate between ground level and 4.5 feet on the boles of trees that have died or been cut. Stump sprouts are handled the same as forked trees, with the exception that stump sprouts are not required to be 1/3 the diameter of the dead bole. Stump sprouts originating between 1.0 foot and 4.5 feet are measured at 3.5 feet above their point of occurrence. As with forks, rules for measuring distance and azimuth depend on whether the sprouts originate above or below 1.0 foot. For multi-stemmed woodland species, treat all new sprouts as part of the same new tree.

Figure 31. Summary of where to measure DBH, distance, and azimuth on forked trees.
3. Tree with butt-swell or bottleneck: Measure these trees 1.5 feet above the end of the swell or bottleneck if the swell or bottleneck extends 3.0 feet or more above the ground (Figure 33).

4. Tree with irregularities at DBH: On trees with swellings (Figure 34), bumps, depressions, and branches (Figure 35) at DBH, diameter will be measured immediately above the irregularity at the place it ceases to affect normal stem form.

NRS Note: If the normal diameter point is out of reach due to the irregularity, it is acceptable to measure the diameter below 4.5 feet. Indicate the diameter height with variable 5.24 LENGTH TO DIAMETER MEASUREMENT POINT.
5. Tree on slope: Measure diameter at 4.5 feet from the ground along the bole on the uphill side of the tree (Figure 36).

6. Leaning tree: Measure diameter at 4.5 feet from the ground along the bole. The 4.5-foot distance is measured along the underside face of the bole (Figure 37).

7. Turpentine tree: On trees with turpentine face extending above 4.5 feet, estimate the diameter at 10.0 feet above the ground and multiply by 1.1 to estimate DBH outside bark.

8. Independent trees that grow together: If two or more independent stems have grown together at or above the point of DBH, continue to treat them as separate trees. Estimate the diameter of each, set the “DIAMETER CHECK” code to 1, and explain the situation in the notes in the PDR.

9. Missing wood or bark: Do not reconstruct the DBH of a tree that is missing wood or bark at the point of measurement. Record the diameter, to the nearest 0.1 inch, of the wood and bark that is still attached to the tree (Figure 38). If a tree has a localized abnormality (gouge, depression, etc.) at the point of DBH, apply the procedure described for trees with irregularities at DBH (Figure 34 and Figure 35).
10. Live windthrown tree: Measure from the top of the root collar along the length to 4.5 feet (Figure 39).

Figure 38. Tree with part of stem missing.

11. Down live tree with tree-form branches growing vertical from main bole: When a down live tree, touching the ground, has vertical (less than 45 degrees from vertical) tree-like branches coming off the main bole, first determine whether or not the pith of the main bole (averaged along the first log of the tree) is above or below the duff layer.

Figure 39. Tree on the ground.

In this example, 2 stems are measured: the stem along the ground and the 1st tree-like branch.

a. If the general pith line of the main bole is above the duff layer, use the same forking rules specified for a forked tree, and take all measurements accordingly (Figure 40+N).
b. If the pith intersection of the main down bole and vertical tree-like branch occurs below 4.5 feet from the stump along the main bole, treat that branch as a separate tree, and measure DBH 3.5 feet above the pith intersection for both the main bole and the tree-like branch.

c. If the intersection between the main down bole and the tree-like branch occurs beyond the 4.5 feet point from the stump along the main bole, treat that branch as part of the main down bole.

---

**Figure 41. Down tree below duff.**

d. If the general pith line of main tree bole is below the duff layer (Duff = ground level below the green sphagnum), ignore the main bole, and treat each tree-like branch as a separate tree; take DBH and length measurements from the ground, not necessarily from the top of the down bole (Figure 41). However, if the top of the main tree bole curves out of the ground towards a vertical angle, treat that portion of that top as an individual tree originating where the pith leaves the duff layer.

NRS Note: If the general pith line of a remeasurement tally tree is now below the duff layer, code PRESENT TREE STATUS as 0 and RECONCILE as 6 and measure each tree-like branch as a new tree with a UGTRECO = 1. Record a TREE NOTE in the PDR to explain the situation.

---

12. Tree with curved bole (pistol butt tree): Measure along the bole on the uphill side (upper surface) of the tree (Figure 42).

---

**Figure 42. Tree with curved bole (pistol butt tree).**

13. Tree growing on objects: When trees are growing on objects, such as rocks or logs, measure at 4.5 feet above the root crown rather than above the forest floor. (Figure 42.aN). [Source: FSH2409.12-2000] Trees that reside in water much of the year can also produce "prop-like" roots, measure diameter in a similar method at 4.5 feet above the root crown.
5.9.3 PREVIOUS DIAMETER AT ROOT COLLAR
This is the DRC assigned at the previous survey. It has been downloaded from the previous
inventory. Any change made to this field signifies a misclassification at the time of the previous
inventory. “DIAMETER CHECK” should be set to 2 and an explanation is required in the notes in
the PDR if previous DRC is changed.

5.9.4 Diameter At Root Collar (DRC)

For species requiring diameter at the root collar (refer to Appendix 3), measure the diameter at
the ground line or at the stem root collar, whichever is higher. For these trees, treat clumps of
stems having a unified crown and common root stock as a single tree; examples include
mesquite, juniper, and mountain mahogany. Treat stems of woodland species such as Gambel
oak and bigtooth maple as individual trees if they originate below the ground. For woodland trees,
record DRC STEM DIAMETER and DRC STEM STATUS (described below). Then compute and
record the DRC value from the individual stem diameter information.

NRS Note: The DRC procedure is applied only on Rocky Mountain Juniper (Juniperis
scopulorum) – species code 0066 – in the states of KS, NE, ND and SD. This species is generally
found in the western half of these states. DBH procedures described in are not applicable to
species code 0066.

Measuring woodland stem diameters: Before measuring DRC, remove the loose material on the
ground (e.g., litter) but not mineral soil. Measure just above any swells present, and in a location
so that the diameter measurements are a good representation of the volume in the stems
-especially when trees are extremely deformed at the base). Stems must be at least 1 foot in
length and at least 1.0 inch in diameter 1 foot up from the stem diameter measurement point to
qualify for measurement. Whenever DRC is impossible or extremely difficult to measure with a
diameter tape (e.g., due to thorns, extreme number of limbs), stems may be estimated and
recorded to the nearest 1.0-inch class. Additional instructions for DRC measurements are
illustrated in Figure 43 For each qualifying stem of the woodland tree, measure and record DRC
STEM DIAMETER (5.9.4.1) and indicate the DRC STEM STATUS (5.9.4.2).

NRS Note: If one measurement of DRC at the root collar can be accomplished, then take one
measurement as shown in Figure 43, example 3. Mark the DRC measurement point. If growth
habits and/or soil level make one measurement impossible as shown in Figure 43, example 6,
then mark and measure the qualifying stems.

Computing and Recording DRC: For all tally trees requiring DRC, with at least one stem 1 foot in
length and at least 1.0 inch in diameter 1 foot up from the stem diameter measurement point,
DRC is computed as the square root of the sum of the squared stem diameters. For a single-stemmed DRC tree, the computed DRC is equal to the single diameter measured.

Use the following formula to compute DRC:

\[
DRC = \sqrt{\text{SUM} (\text{stem diameter}^2)}
\]

Round the result to the nearest 0.1 inch. For example, a multi-stemmed woodland tree with stems of 12.2, 13.2, 3.8, and 22.1 would be calculated as:

\[
DRC = \sqrt{12.2^2 + 13.2^2 + 3.8^2 + 22.1^2}
\]

\[
= \sqrt{825.93}
\]

\[
= 28.74
\]

\[
= 28.7
\]

Figure 43. How to measure DRC in a variety of situations.
NRS PDR Note: When species code 0066 is entered, the MIDAS PDR Application will shade out DBH and require the activation of the DRC entry screen by clicking on CTRL/ALT+P. The DRC entry screen allows the entry of the next two variables – DRC STEM DIAMETER and DRC STEM STATUS. The utility allows the entry of multiple stems and upon completion of these entries, it calculates a value for 5.9 DIAMETER.

5.9.4.1 DRC STEM DIAMETER
Record the diameter of each individual qualifying stem on the woodland tree.

When collected: All stems on woodland tree species that are at least 1 foot in length and at least 1.0 inch in diameter 1 foot up from the stem diameter measurement point
Field width: 4 digits (xxx.y)
Tolerance: +/- 0.2 inch per stem
MQO: At least 95% of the time
Values: 001.0 to 999.9

5.9.4.2 DRC STEM STATUS
Record the status of each individual stem on the woodland tally tree.

When collected: All stems on woodland tree species that are at least 1 foot in length and at least 1.0 inch in diameter 1 foot up from the stem diameter measurement point
Field width: 1 digit
Tolerance: No errors
MQO: At least 95% of the time
Values:
1 live stem
2 dead stem

5.10 PAST NUMBER OF STEMS [PSTM]
If the PAST NUMBER OF STEMS does not equal the CURRENT NUMBER OF STEMS, do not change the preprinted value. Make a note in TREE NOTES suggesting the possible reason for the difference.

When collected: Value is preprinted for SAMPLE KIND = 2 locations
Field width: 2 digits
Tolerance: No errors
MQO: At least 90% of the time
Values: 1 to 99

5.11 CURRENT NUMBER OF STEMS [#STM]
Record the total number of stems that were measured for DRC (e.g., record 1 stem as 01; record 12 stems as 12). Count only the number of qualifying stems used to calculate DRC. Qualifying stems are those that are at least 1.0 foot in length and at least 1.0 inch in diameter, 1 foot up from the measurement point.

NRS Note: CURRENT NUMBER OF STEMS is auto-tallied in the DRC Calculator Screen and will be auto-populated as a hidden variable in our region.
When collected: For tallied woodland species with at least one stem 1.0 inch in diameter or larger; includes woodland species tallied on the microplot
Field width: 2 digits
Tolerance: No errors
MQO: At least 90% of the time
Values: 1 to 99

5.12 DIAMETER CHECK [DCHE]
Record this code to identify the accuracy of the diameter measurement (due to factors such as abnormal swellings, diseases, damage, new measurement positions, etc.) that may affect use of this tree in diameter growth/change analyses.

When Collected: All live and standing dead tally trees ≥ 1.0 inch DBH/DRC
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values:
0 Diameter measured accurately.
1 Diameter estimated.
2 Diameter measured at different location than previous measurement (remeasurement trees only).
Note: If both codes 1 and 2 apply, use code 2.
Note: If either code 1 or code 2 is used, a tree-level note is required.

5.12.1 UGT MOTHER TREE NUMBER
When a single bole forks above ground, FIA pith/forking protocols may result in the differentiation of multiple stems into individual tally trees that originate from a single common stump or bole. The i-Tree protocols consider this a single tree. The MOTHER TREE NUMBER variable will account for this difference by linking each of these FIA-defined trees together. When pith and forking protocols create multiple trees from a single stump, the resulting trees will receive a MOTHER TREE NUMBER equal to the URBAN TREE RECORD NUMBER of the first tree (or fork that qualifies as a tree) that is encountered on the bole. Subsequent piths and/or forks from the same stump that qualify as trees will be assigned the same MOTHER TREE NUMBER as the first tree or fork. Presumably, such trees should have the same azimuth and distance unless they represent both microplot and subplot tree/s. If the piths of trees are separate when they enter the ground then the trees will not receive a MOTHER TREE NUMBER even if they are in close proximity to one another.

<table>
<thead>
<tr>
<th>URBAN TREE RECORD NUMBER</th>
<th>SPECIES</th>
<th>URBAN DISTANCE</th>
<th>URBAN AZIMUTH</th>
<th>DBH</th>
<th>MOTHER TREE NUMBER</th>
<th>To Clarify</th>
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<tbody>
<tr>
<td>1</td>
<td>131</td>
<td>46.2</td>
<td>024</td>
<td>06.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>131</td>
<td>08.4</td>
<td>071</td>
<td>09.8</td>
<td></td>
<td>1st Fork</td>
</tr>
<tr>
<td>3</td>
<td>837</td>
<td>15.2</td>
<td>225</td>
<td>15.3</td>
<td>3</td>
<td>1st Fork</td>
</tr>
<tr>
<td>4</td>
<td>837</td>
<td>15.2</td>
<td>225</td>
<td>13.2</td>
<td>3</td>
<td>2nd Fork</td>
</tr>
</tbody>
</table>

Table 3 UGT, MOTHER TREE # PDR example. This subplot contains 4 tree records. Two of them are for trees originating from a single bole which forks below 4.5 ft. but above ground level. The purpose of the MOTHER TREE # variable is to link such trees (that are derived from forks) back to the single bole from which they originate. In this example, the link is established by assigning tree number 3 as the “Mother Tree”; as it is the first of the two forks encountered that originate from the same bole. The second fork happens to be recorded as tree number 4, so both trees 3 and 4 will receive a MOTHER TREE # = 3.
Figure 44UGT. Mother Tree Pith and Forking protocols.

When Collected: All DBH species tally trees that are the result of FIA pith or forking protocols ≥ 1.0 in DBH. Leave this variable blank for all DRC species trees as well as trees that are not a result of pith or forking protocols.

Field width: 3 digits
Tolerance: No errors
MQO: At least 99% of the time
Values: 001 to 999

5.12.2N TREE CLASS (USE REGIONAL DEFINITIONS) [TCC]

This code represents a classification of the overall quality of a tree that is ≥ 5.0 inches DBH. It classifies the quality of a live sawtimber tree based on the present condition. It also forecasts the potential quality of a live poletimber tree when it becomes sawtimber size. For standing dead trees, it will identify those trees that could be salvaged for wood fiber (i.e., chips) if a salvage operation was imminent.

Prior to assigning a tree class, it is necessary to determine sawlog length and the amount of board-foot cull present within the sawlog length. When evaluating the sawlog length for tree class, the sawlog length is measured between a 1 foot stump and a 9.0-in Top Diameter Outside Bark (DOB) for hardwoods or a 7.0-in Top DOB for softwoods. For trees that fork, only use one stem when determining sawlog length (i.e., follow the stem yielding the most merchantable volume). See % ROUGH BOARD-FOOT CULL and % ROTTEN BOARD-FOOT CULL in Regional Appendix D for the criterion that determines cull within the sawlog length.

When estimating the potential sawlog length for live poletimber size trees, apply the following “Two-inch Rule”. Take the current DBH minus two-inches on a poletimber size tree. This calculated diameter is used to determine the potential Top DOB of the future sawlog length when the tree becomes sawtimber-size. Once the potential Top DOB is determined, the tree must maintain this diameter for at least the length of a potential sawlog to receive a TREE CLASS 2, Growing Stock. For example, a tree with an 8.0-in DBH today, applies a 6.0-in Top DOB on today’s bole to project the potential sawlog length when the tree reaches sawtimber size. If 6.0-in is not maintained within the potential sawlog length then the tree is not eligible to receive a TREE CLASS of 2. (The “Two-inch Rule” assumes that a tree’s diameter increases uniformly along its bole.)

When estimating the potential of Other Softwoods poletimber, branch diameters can be forecast in order to determine TREE CLASS. If multiple branches within the merchantable log/s are receiving direct sunlight and have the potential to exceed 2 inches, the poletimber sized tree can be given a TREE CLASS of ‘3’. Once the tree reaches sawlog size, forecasting is no longer an acceptable practice.
During the determination of TREE CLASS, Dead Tops within live trees will factor into the classification. The dead material is considered Cull so it will not contribute to the tree being classified as Growing Stock. Determination must still be made whether the Cull is predominantly Rough or Rotten. The TREE CLASS will be classified depending on the assessment of the total volume of the tree. All dead sections within the sawlog portion will be considered either rough or rotten cull.

When Collected: All trees ≥ 5.0 inches DBH/DRC when PRESENT TREE STATUS = 1 or PRESENT TREE STATUS = 2 and STANDING DEAD = 1

Field width: 1 digit
Tolerance: No errors
MQO: At least 90% of the time

Values:

2 Growing Stock – A live sawtimber-size tree with one-third or more of the gross board-foot volume in the entire sawlog length meeting grade, soundness, and size requirements; or the potential to do so for poletimber-size trees. It must contain one merchantable 12-foot log or two non-contiguous merchantable 8-foot logs, now (sawtimber) or prospectively (poletimber).

3 Rough Cull – A live tree that does not contain at least one 12-foot sawlog or two non-contiguous 8-foot logs now (sawtimber) or prospectively (poletimber), primarily because of roughness or poor form within the sawlog length. Or sawtimber and prospectively poletimber with two-thirds or more of its gross board-foot volume that does not meet size, soundness, and grade requirements; and 50% or more of the assigned total board-foot cull within the sawlog length is rough cull.

4 Rotten Cull – A live tree that does not contain at least one 12-foot sawlog or two non-contiguous 8-foot logs now (sawtimber) or prospectively (poletimber) and/or do not meet grade specifications for percent sound primarily because of rot within the sawlog length. Or sawtimber and prospectively poletimber with two-thirds or more of its gross board-foot volume that does not meet size, soundness, and grade requirements; and 50% or more of the assigned total board-foot cull within the sawlog length is rotten cull.

5 Salvable Dead – A standing dead tree with at least 50 percent sound cubic-foot volume in the bole. (ROTTEN/MISSING CUBIC-FOOT CULL does not exceed 49 percent.) Note: ROUGH CUBIC-FOOT CULL is not a criterion. For the initial measurement of a tree, the tree must have been live during the previous Cycle/Subcycle. For remeasurement trees, the tree must have been alive during previous measurement.

6 Nonsalvable Dead – A standing dead tree that does not qualify as salvable.
Figure 45.1N. TREE CLASS flowchart for sawtimber-size trees -- ≥ 9.0-inches for softwoods or ≥ 11.0-inches DBH for hardwoods.

Figure 45.2N. TREE CLASS flowchart for poletimber-size trees – ≥ 5.0-inches DBH all trees.
1. Step 1: When determining TREE CLASS, the entire sawlog length (1 foot stump to a 9.0-in Top DOB hardwoods or 7.0-in Top DOB softwoods) must be visually divided into 8 foot or longer log lengths. The length of 8 foot or longer logs is determined by the presence of “stoppers” within the entire sawlog length. The following is a list of “stoppers” to be applied:
   
a. Fork – A fork must be at least 1/3 the diameter of the main stem and branch out from the main stem at 45 degrees or less where the pith enters the main stem. For trees that fork, only use one stem when determining the remaining sawlog length (i.e., follow the stem yielding the most merchantable volume). When one of the forks is dead, the live fork will provide the most merchantable volume.
   
b. Evaluate the angle that the pith enters the main stem, not the general form extending from the tree, to determine if it is a fork or a branch.
   
c. A dead or missing stem is treated the same as a live stem on forked trees for the purpose of determining TREE CLASS. Do not consider missing forks when locating the diameter measurement or when determining what constitutes a tally tree.
   
d. Excessive sweep or crook – To determine if the sweep or crook exceeds the maximum allowed; refer to the sweep or crook deduction tables in Regional Appendix E.
   
e. Rot or missing wood – A cross-section that is 50% or more affected by rot or missing wood. All conks and fungal wedges are stoppers, except Phellinus Tremulae on aspen.
   
f. Cankers – A canker that is at least 50% or more of the circumference at the point of occurrence. Galls and Rust can be included in the Canker section when identifying Stoppers. Note: One face or side represents 40% of the circumference. A canker is measured at the widest distance between the outside of the canker swelling. (Do not confuse burls with cankers. Burls are not classified as a stopper.)
   
g. Metal – All metal except aluminum research tags and nails.

Note: “Rough stoppers” include forks, excessive sweep and crook as described above. “Rot stoppers” include rot/missing wood, cankers and metal as described above. Depending on the type of stopper, the board-foot cull associated below a stopper is either rough board-foot cull or rotten/missing board-foot cull.

2. Step 2: Assume that all live trees will reach sawtimber-size. Assume all poletimber-size trees will become sawtimber. Use the “two-inch rule” for poletimber-size trees to estimate the future Top DOB for either a hardwood or a softwood. Do not attempt to predict mortality. The goal of the tree classification system is basically a check of the straightness and soundness of the sawlog length or the potential sawlog length for poletimber-size trees. A small diameter poletimber-size tree should be allowed more leeway due to the possibilities of growing out of deformities. Noncommercial species should be treated the same as commercial species.
   
a. Live Trees
   
i. Start at a 1 ft stump and continue up the stem until the first stopper is encountered. Note: If the tree forks between 1 ft and 4.5 ft, start at the pith intersection (see Figure 27).
   
ii. Measure the distance between the starting point and the stopper.
   
iii. If the length is less than 8 ft, the entire length is either rough or rotten board-foot cull. If a rot stopper is encountered, the associated volume below the stopper is assessed as rotten/missing board-foot cull. If a rough stopper is encountered, the associated volume below the stopper is assessed as rough board-foot cull.
   
iv. If the length is 8 ft or more, the 8 ft or longer length must meet minimum grading specification for that species. If grading specifications are not met, the portion of the 8 ft or longer length that does not meet grade is assessed as board-foot cull. E.g., 20 ft is measured between a starting point and a stopper. The 20 ft length can be divided into an 8 ft and 12 ft logs. The 12 ft log meets grade and is not culled, but the 8 foot log does not meet grade and is culled.
   
v. The first stopper becomes the next starting point. Again measure up the tree until the next stopper is encountered. Continue this process until a 9.0-in Top DOB for hardwoods or a 7.0-in Top DOB for softwoods is reached.
vi. If one 12 ft or two noncontiguous 8 ft merchantable logs are not present, the tree is classified as either rough or rotten cull. If the majority of the total board-foot cull in the entire sawlog length is assessed as rough cull, TREE CLASS = 3. If the majority of total board-foot cull in the entire sawlog length is assessed as rotten/missing cull, TREE CLASS = 4.

vii. If one 12 ft or two noncontiguous 8 ft merchantable logs are present, the entire sawlog length is next assessed for total board-foot cull including any rot or missing wood that is assessed to be less than 50% at the cross-section (i.e., sector cull). If the tree has one-third or more merchantable volume (i.e., 67% or less total board-foot cull), TREE CLASS = 2. If total board-foot cull is greater than 67%, TREE CLASS = 3 or 4.

b. Standing Dead Trees: If the tree is dead (sawtimber or poletimber), determine whether or not the ROTTEN/MISSING CUBIC-FOOT CULL in the entire bole length is greater than 49%. If yes, TREE CLASS = 6. If no, TREE CLASS = 5.

ROTT = 01 - 49%, TREE CLASS = 5.

ROTT = 50 - 99%, TREE CLASS = 6.

SEE TREE CLASS ILLUSTRATIONS IN REGIONAL APPENDIX F.

5.12.3N TREE GRADE (USE REGIONAL DEFINITIONS) [TRGD]

Record a tree grade for all sawtimber size trees classified as Growing Stock. To be classified as Growing Stock and receive a TREE GRADE, all rules in Section 5.12.1N for Growing Stock must be met.

In order to receive a TREE GRADE 1, 2, 3 or 4 (when valid), at least a 12 foot grading section is required in the butt 16 feet for all species. Trees meeting the definition of Growing Stock that do not have a merchantable grade in the butt 16 but do have a 12 ft or two 8 ft gradable sections somewhere in the tree will be assigned a TREE GRADE 5.
When Collected: TREE CLASS = 2 when DBH ≥ 9.0 inches for softwoods or ≥ 11.0 inches DBH for hardwoods
Field width: 1 digit
Tolerance: No errors
MQO: At least 90% of the time
Values: See Regional Appendix E for complete grading specifications for each species group

Hardwoods – Use the specifications for Hardwood Tree Grades (1, 2 or 3) or the Tie and Timber Grade (4) for all hardwood trees. Trees meeting the definition of Growing Stock that do not have a merchantable grade in the butt 16 but do have a 12 foot or two 8 foot gradable sections somewhere in the tree will be assigned grade 5. Note: When determining the grade of upper logs, 8-foot sawlogs need to meet all the minimum grading factors except for length for hardwood tree grades 3 or 4.

Eastern white pine – Use the Eastern White Pine Tree Grades (1, 2, 3 or 4) for eastern white pine only. Trees meeting the definition of Growing Stock that do not have a merchantable grade in the butt 16 but do have a 12 foot or two 8 foot gradable sections somewhere in the tree will be assigned grade 5. Note: When determining the grade of upper logs, 8-foot sawlogs need to meet all the minimum grading factors except for length for white pine tree grade 4.

Other pines – Use the Pine Tree Grades (1, 2 or 3) for all pines except eastern white pine. There is no grade 4 for the Pine Tree Grades. Trees meeting the definition of Growing Stock that do not have a merchantable grade in the butt 16 but do have a 12 foot or two 8 foot gradable sections somewhere in the tree will be assigned grade 5. Note: When determining the grade of upper logs, 8-foot sawlogs need to meet all the minimum grading factors except for length for pine tree grade 3.

Other softwoods – Use the Other Softwoods Tree Grade (1) for spruce, fir, hemlock, larch (tamarack), cedar and cypress. Trees meeting the definition of Growing Stock that do not have a merchantable grade in the butt 16 but do have a 12 foot or two 8 foot gradable sections somewhere in the tree will be assigned grade 5. Note: When determining the grade of upper logs, 8-foot sawlogs need to meet all the minimum grading factors except for length for other softwood grade 1.

A minimum of 12 feet gradable length within the butt 16 feet is required to meet minimum grading specs for Grades 1-4 (depending on available grades per species). The 12 feet gradable length can be located anywhere within the butt 16 feet as long as all four grading faces are contained in the same linear 12 feet that is sliding. To explain further, the 12 foot graded section can be slid up or down within the butt 16 feet to obtain the highest possible grade while continuing to maintain all grading faces within that sliding 12 foot grading section.

The grading section is determined by the position of “stoppers” as defined in TREE CLASS within the butt 16 feet. E.g., if a stopper is positioned at 9 feet, then a 12 foot grading section cannot be obtained within the butt 16 feet. These trees are potentially graded as 5 if they still meet the definition of Growing Stock and contain a merchantable 12 foot gradable length or two 8 foot gradable lengths somewhere in the sawlog section. Any section containing a rot or metal stopper is unsound cull. Rot does not necessarily eliminate grades 1-4 unless it is positioned so it is impossible to get a grading section that meets the minimum merchantable tree grade associated with the species. Metal does not necessarily eliminate grades 1-4 unless the metal is positioned so it is impossible to obtain a 12 foot section free of metal in the 16 foot grading section.

Note: Aluminum DBH tags and nails that have been placed for research are ignored and are not treated as cull and does not affect grade.
5.13 N % ROTTEN/MISSING CUBIC FOOT CULL [ROTT]

Record the percent rotten or missing cubic-foot cull for all live tally trees greater than or equal to 5.0 inches DBH/DRC (CORE) and all standing dead tally trees greater than or equal to 5.0 inches DBH/DRC (CORE OPTIONAL).

Record the percentage of rotten and missing cubic-foot volume, to the nearest 1 percent. (“Missing” is wood absent from a log or part of a log that otherwise would usually be regarded as naturally complete. It may be caused by advanced decay, fire, or the operation of a machine or tool. It also includes sections that contain metal other than aluminum research tags and nails.) When estimating volume loss (tree cull), only consider the cull on the merchantable bole/portion of the tree, from a 1-foot stump to a 4-inch DOB top. Do not include any cull estimate above ACTUAL LENGTH. For woodland species, the merchantable portion is between the point of DRC measurement to a 1.5-inch DOB top.

NRS Note: Rotten and missing cubic-foot cull includes sections that contain rot or missing wood or as determined by sector cull. Estimate percent rotten cull volume by using the appropriate cubic-foot volume cull estimating aid tables for all species found in Regional Appendix E.

NRS Note: Do not include rotten material contained within dead tops in the percent ROTT estimate.

Rotten and missing volume loss is often difficult to estimate. Refer to supplemental disease and insect pests field guides and local defect guidelines as an aid in identifying damaging agents and their impact on volume loss. Use your best judgment and be alert to such defect indicators as the following:

- Cankers or fruiting bodies – any presence.
- Swollen or punky knots.
- Dull, hollow sound of bole (use regional standards).
- Large dead limbs, especially those with frayed ends.
- Sawdust around the base of the tree.
- Metal imbedded in the wood (except aluminum research nails and tags) – Cull at least a 1 foot cross-section above and below the metal at the point of occurrence.

NRS Note: Sounding of the tree can be used to help determine the percent ROTT when visual evidence of rotten material is present and sounding will not further damage the tree.

When Collected: CORE: All live tally trees ≥ 5.0 inches DBH/DRC
CORE OPTIONAL: All live and standing dead tally trees ≥ 5.0 inches DBH/DRC
Field width: 2 digits
Tolerance: Zero Tolerance 0%-1%
+- 10 % between 1%-99%
MQO: At least 90% of the time
Values: 00 to 99

5.14 N TOTAL LENGTH [THGT]

Record the TOTAL LENGTH of the tree, to the nearest 1.0 foot from ground level to the top of the tree. For trees growing on a slope, measure length on the uphill side of the tree. If the tree has a missing top (top is broken and completely detached from the tree), estimate what the total length would be if there were no missing top. Forked trees should be treated the same as unforked trees.
NRS Note: TOTAL LENGTH for DRC species is recorded as the highest top of all the stems.

When Collected: All live and standing dead tally trees ≥ 1.0 inch DBH/DRC
Field width: 3 digits
Tolerance: +/- 10 % of true length
MQO: At least 90% of the time
Values: 001 to 400

5.15+N ACTUAL LENGTH [ACTU]
Record for trees with missing tops (top on live trees is completely detached; top on dead trees is greater than 50 percent detached from the tree). Examples:

- Live tree with live broken top with more than 50% detachment from the tree but is minimally attached – do not record ACTUAL LENGTH. TOTAL LENGTH is taken through or past the break as are BOLE and SAWLOG LENGTHs.
- Live tree with dead broken top with more than 50% detachment from the tree – record ACTUAL LENGTH in addition to TOTAL LENGTH.
- Dead tree with dead broken top with more than 50% detachment from the tree – Record an ACTUAL LENGTH to the break.
- Dead tree with dead broken top with less than or equal to 50% detachment from the tree – record ACTUAL LENGTH through or past the break as well as BOLE and SAWLOG LENGTHs.

If the break is along the stem length, the actual length terminates where there is 50% of the stem remaining. If the top is intact including dead tops on live trees, this item may be omitted. Record the ACTUAL LENGTH of the tree to the nearest 1.0 foot from ground level to the break. Use the length to the break for ACTUAL LENGTH until a new leader qualifies as the new top for TOTAL LENGTH; until that occurs, continue to record ACTUAL LENGTH to the break. Trees with previously broken tops are considered recovered (i.e., ACTUAL LENGTH = TOTAL LENGTH) when a new leader (dead or alive) is 1/3 the diameter of the broken top at the point where the top was broken (not where the new leader originates from the trunk). Forked trees should be treated the same as unforked trees.

NRS Note: Record ACTUAL LENGTH for DRC species if what would have been the highest top is now missing.

Note: Some regions will measure ACTUAL LENGTH differently due to growth form. Some examples are swamp tupelo, cypress, and trees growing off of old high stumps with stilted roots in the West. Check regional field guides for regional guidance.

When Collected: All live and standing dead tally trees (with broken or missing tops) ≥ 1.0 inch DBH/DRC
Field width: 3 digits
Tolerance: +/- 10 % of true length
MQO: At least 90% of the time
Values: 001 to 400

5.16+N LENGTH METHOD [METH]
Record the code that indicates the method used to determine tree lengths.

When Collected: All live and standing dead tally trees ≥ 1.0 inch DBH/DRC
5.17 N CROWN CLASS [CCC]

Rate tree crowns in relation to the sunlight received and proximity to neighboring trees (Figure 45). Base the assessment on the position of the crown at the time of observation. Example: a formerly overtopped tree that is now dominant due to tree removal is classified as dominant.

NRS Note: Following is a systematic approach in determining Crown Class

- Determine the midpoint of the canopy of the neighboring trees
- Determine the height to the top of the crown
- Determine where the crown is receiving direct light
- Determine how crowded the crown is

Once the above items have been evaluated, a combination of each will be used to assign a Crown Class. (CCC 1 is addressed differently)

- If the top of the crown is below the midpoint, consider the amount of light received
  - If it receives no light, code CCC 5
  - If it receives some light but is very crowded, code CCC 4
- If the top of the crown reaches the midpoint, consider light received and how crowded it is
  - If it receives no light, code CCC 5
  - If it receives some light but is very crowded, code CCC 4
  - If it receives some light and is somewhat crowded by similar crowns, code CCC 3
- If the top of the crown extends above the general level
  - If it receives significant light, and is taller than the average trees, code CCC 2

The midpoint is defined as the neighboring trees’ halfway point for their average Compacted Crown Ratio.

Crowded is defined as sunlight being partially blocked along with smaller and possibly malformed crowns.
When Collected: All live tally trees ≥ 1.0 inch DBH/DRC
Field width: 1 digit
Tolerance: No errors
MQO: At least 85% of the time

Values:
1. Open Grown – trees with crowns that received full light from above and from all sides throughout most of its life, particularly during its early developmental period.
2. Dominant – trees with crown extending above the general level of the crown canopy and receiving full light from above and partly from the sides. These trees are taller than the average trees in the stand and their crowns are well developed, but they could be somewhat crowded on the sides. Also, trees whose crowns have received full light from above and from all sides during early development and most of their life. Their crown form or shape appears to be free of influence from neighboring trees.
3. Co-dominant – trees with crowns at the general level of the crown canopy. Crowns receive full light from above but little direct sunlight penetrates their sides. Usually they have medium-sized crowns and are somewhat crowded from the sides. In stagnated stands, co-dominant trees have small-sized crowns and are crowded on the sides.
4. Intermediate – trees that are shorter than dominants and co-dominant, but their crowns extend into the canopy of co-dominant and dominant trees. They receive little direct light from above and none from the sides. As a result, intermediate trees usually have small crowns and are very crowded from the sides.
5. Overtopped – trees with crowns entirely below the general level of the crown canopy that receive no direct sunlight either from above or the sides.

Figure 45. Examples of CROWN CLASS code definitions (numbers are the CROWN CLASS codes).
5.18 +U +GT UNCOMPACTED LIVE CROWN RATIO (Phase 2 – CORE OPTIONAL, URBAN FIA / Ground Truth, Phase 3 – CORE) [UCRC]
Variable not collected for PHASE 2 in the North. See VOLUME I SUPPLEMENT: FIELD DATA COLLECTION PROCEDURES FOR PHASE 2+ PLOTS

Record the UNCOMPACTED LIVE CROWN RATIO to the nearest one percent. UNCOMPACTED LIVE CROWN RATIO is the percentage of actual tree length supporting live
foliage (or in cases of extreme defoliation should be supporting live foliage) that is effectively contributing to tree growth. UNCOMPACTED LIVE CROWN RATIO is determined by the ratio of live crown length to ACTUAL LENGTH (Figure 46).

When trees have an associated mother tree, a single UNCOMPACTED CROWN RATIO measurement will be recorded for all trees with the same Mother Tree Number (aka “unit” or “Mother Tree Unit”). In these cases the UNCOMPACTED CROWN RATIO measurement will be determined using the crowns of all boles, forks and branches (including any boles/forks supported by the same stump that were not tallied) as a single unit and recorded in the UNCOMPACTED LIVE CROWN RATIO field of the Mother Tree.

Live crown length is determined from the last live foliage at the crown top (dieback in the upper portion of the crown is not part of the live crown) to the “base of live crown”. Many times there are additional live branches below the “base of live crown”. These branches are only included if they have a basal diameter greater than 1 inch and are within 5 feet of the base of the obvious live crown. 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.
Figure 46. UNCOMPACTED LIVE CROWN RATIO examples.

Determine sapling UNCOMPACTED LIVE CROWN RATIO by dividing the live crown length by ACTUAL LENGTH. Live crown length is the distance between the top live foliage (dieback and dead branches are not included) and the lowest live twig for saplings. The live crown base for saplings is different from trees 5.0 inches DBH/DRC and larger; the 1-inch/5-foot rule does not apply in this case. Do not include sprigs or leaves on the main stem below the lowest live twig (Figure 47).
**Figure 47. Sapling ratio determination examples.**

When collected: Phase 2 CORE OPTIONAL: All live tally trees ≥ 5.0 inches DBH/DRC
Phase 3 CORE: All live tally trees ≥ 1.0 inch DBH/DRC when MOTHER TREE # = null or when MOTHER TREE # = URBAN TREE RECORD NUMBER #

Field width: 2 digits
Tolerance: +/- 10%
MQO: At least 90% of the time
Values: 00 to 99 percent

5.18.1 UGT ... CROWN DIAMETER WIDE [CRDIW]
Live crown width estimated at the widest point. Record measurement to nearest 1 ft. Dead trees always have a CROWN DIAMETER WIDE of 0. If tree is downed or leaning, take width measurements perpendicular to tree bole. Exclude abnormally long branches that protrude from the general crown shape.

When trees have an associated Mother Tree only one CROWN DIAMETER WIDE measurement will be taken for all trees with the same MOTHER TREE NUMBER (aka- "unit" or "Mother Tree unit"). In these cases measure the widest point across the crowns of all live boles, forks and branches of the unit (all trees with the same Mother Tree Number including any boles/forks...
supported by the same stump that were not tallied). Exclude abnormally long branches that protrude from the general crown shape of the Mother Tree Unit. This measurement will be recorded in the CROWN DIAMETER WIDE field of the Mother Tree.

When Collected: Live tally trees ≥ 1.0 inch DBH/DRC when Mother Tree # = null or MOTHER TREE # = URBAN TREE RECORD NUMBER

Field width: 3 digits (xxx)
Tolerance: +/- 5 feet
MQO: At least 90% of the time
Values: 000 to 999

5.18.2UGT CROWN DIAMETER 90 DEGREES [CDI90]

Live crown width estimated of the widest point along the axis running perpendicular to CROWN DIAMETER WIDE measurement. Record measurement to nearest 1 ft. Dead trees always have a CROWN DIAMETER 90 DEGREES of 0. If tree is downed or leaning, take width measurements perpendicular to tree bole. Exclude abnormally long branches that protrude from the general crown shape.

When trees have an associated Mother Tree only one CROWN DIAMETER 90 DEGREES measurement will be taken for all trees with the same MOTHER TREE NUMBER (aka- "unit" or "Mother Tree unit"). In these cases measure the widest point along the axis running perpendicular to the CROWN DIAMETER WIDE measurement across the crowns of all live boles, forks and branches of the unit (all trees with the same Mother Tree Number including any boles/forks supported by the same stump that were not tallied). Exclude abnormally long branches that protrude from the general crown shape of the Mother Tree Unit. This measurement will be recorded in the CROWN DIAMETER 90 DEGREES field of the Mother Tree.

When Collected: Live tally trees ≥ 1.0 inch DBH/DRC when MOTHER TREE # = null or MOTHER TREE # = URBAN TREE RECORD NUMBER

Field width: 3 digits (xxx)
Tolerance: +/- 5 feet
MQO: At least 90% of the time
Values: 000 to 999
Figure 48UGT. Examples of where to measure crown diameter widths. The “long” axis is the CROWN DIAMETER WIDE measurement; the “short” axis is the CROWN DIAMETER 90 DEGREES measurement.
Figure 49 UGT. Examples of how to measure MOTHER TREE CROWN DIAMETER WIDE. In both of these examples the piths join in such a fashion that there is only one pith entering the ground.

5.18.3 UGT FOLIAGE ABSENT [FOLAB]
The UFORE model uses crown length and width, modified by FOLIAGE ABSENT, to estimate leaf area. FOLIAGE ABSENT is an estimate of the percent foliage missing within the Foliage Absent Outline due to the following:

- Pruning
- CROWN DIEBACK
- Defoliation
- Dead or missing branches unrelated to internal shading
- Uneven or missing crown due to:
  - Competition from other vegetation or interference from man made structures
  - Gaps in the crown that are unrelated to the natural crown shape of a particular species
The Foliage Absent Outline is defined as a silhouette around the shape of the crown created by:

- Live Crown width
- ACTUAL LENGTH
- Base of the UNCOMPACTED LIVE CROWN RATIO

The silhouette includes Dieback (within the Foliage Absent Outline), but excludes missing or removed tops and dead branches that extend beyond the live crown width. Visualize the crown area within the silhouette as being filled with leaves as if it were representative of a healthy tree in excellent condition. Thin or missing foliage due to “interior shading”, a characteristic of conifers or other trees with dense foliage, is not considered FOLIAGE ABSENT.

Be sure to base the estimate on the existing crown that is being evaluated. A third of the crown outside the Foliage Absent Outline may have been removed for power line clearance however, the crown that remains could have a 0% missing value, if the existing crown is full.

Dead branches in the interior or lower portion of the live crown area are assumed to have died from competition / shading.

Foliage from rogue branches that extend outside the Foliage Absent Outline (those not included in the crown width measurements) may be used to replace absent foliage within the outline.

When trees have an associated Mother Tree only one FOLIAGE ABSENT measurement will be taken for all trees with the same MOTHER TREE NUMBER (aka- “unit” or "Mother Tree unit"). In these cases the FOLIAGE ABSENT measurement will be determined using a single foliage absent outline drawn around the foliage of all boles, forks and branches of the Mother Tree Unit (all trees with the same Mother Tree # including any boles/forks/branches supported by the same stump that were not tallied). The foliage absent outline will be determined using the CROWN WIDE and UNCOMPACTED CROWN measurements of the unit and the ACTUAL HEIGHT of the tallest portion (whether tallied or not) of the Mother Tree Unit. The measurement will then be recorded in the FOLIAGE ABSENT field of the Mother Tree.

At times, after a sudden release or some type of damage, a tree may have very dense foliage present, yet by definition have no crown present (due to foliage that is limited to epicormics or sprigs). The following combination of codes is valid for trees with no crowns present.

- UNCOMPACTED LIVE CROWN RATIO URBAN FIA = 00
- CROWN LIGHT EXPOSURE = 0
- CROWN DIEBACK = 99
- FOLIAGE ABSENT = 99

When collected: Live trees ≥1.0 inch DBH/DRC when MOTHER TREE # = null or MOTHER TREE # = URBAN TREE RECORD NUMBER

Field width: 2 digits
Tolerance: +/- 10%
MQO: At least 80% of the time
Values: 00 to 99
Figure 50UGT. FOLIAGE ABSENT examples.
Figure 51 UGT. Defoliation: Foliage Absent = 99% based upon what foliage could have been within the Foliage Absent Outline without the current defoliation.

Figure 52 UGT. Dieback: Foliage Absent = 90%. The Foliage Absent Outline includes Dieback.
Figure 53UGT. Tops pruned: Foliage Absent = 60%. The Foliage Absent Outline excludes missing or removed tops. Rate the crown based only on the area within the outline. In this case most of the foliage in the foreground is missing, as well as some in the upper part of the backside of the tree.

Figure 54UGT. Dieback: FOLIAGE ABSENT = 70%. The Foliage Absent Outline includes Dieback. In this example the tree in the center of the photograph is being evaluated.
Figure 55UGT. Needle mortality (aphids): FOLIAGE ABSENT = 99% based on what could have been within the Foliage Absent Outline had it not been for the needle mortality. This example assumes there are some live needles still present.

Figure 56UGT. Utility Pruning: FOLIAGE ABSENT = 25%. Vertical and horizontal arrows show one width measurement and the height measure. The diagonal arrow within the outline indicates foliage absent.
Figure 57UGT. Pruning: Foliage Absent = 5% each for the first two hardwoods in the picture. In addition to excluding missing tops the Foliage Absent Outline excludes portions of the exterior of the crown that have been removed and only includes the portion of the crown that is still present. In this example, utility pruning reduced the size of the crown width.

Figure 58UGT. Utility pruning: Foliage Absent = 20%. The Foliage Absent Outline includes the entire width of the crown present as depicted by the arrow. Interior pruning for the utility lines in this picture has created a void within the width of the crown shown in the outlined area.
5.19+ \textbf{COMPACTED CROWN RATIO} (CRC)

Record the COMPACTED CROWN RATIO for each live tally tree, 1.0 inch and larger, to the nearest one percent. COMPACTED CROWN RATIO is that portion of the tree supporting live foliage (or in the case of extreme defoliation should be supporting live foliage) and is expressed as a percentage of the \textbf{ACTUAL LENGTH}. To determine COMPACTED CROWN RATIO, ocularly transfer lower live branches to fill in large holes in the upper portion of the tree until a full, even crown is visualized.

Do not over-compact trees beyond their typical full crown situation. For example, if tree branches tend to average 2 feet between whorls, do not compact crowns any tighter than the 2-foot spacing (Figure 59). Figure 60 shows an example of COMPACTED CROWN RATIO on a leaning tree.

\textbf{NRS Note:} Epicormic branches do very little for the productivity of a tree. Therefore, they will account for very little when it comes to CRC. When calculating CRC for a tree that has nothing more than epicormic branches, picture a normal crown for the tree and then ocularly estimate the percentage the epicormic branches would fill. For these trees, CRC will likely be less than 10%. 

Open-crown conifer (e.g., ponderosa pine, or white pine) –

Uncompacted: Compacted:

<table>
<thead>
<tr>
<th>Uncompacted</th>
<th>Compacted</th>
</tr>
</thead>
<tbody>
<tr>
<td>90%</td>
<td>65%</td>
</tr>
</tbody>
</table>

Dense-crown conifer (e.g., subalpine fir, or balsam fir) –

Uncompacted: Compacted:

<table>
<thead>
<tr>
<th>Uncompacted</th>
<th>Compacted</th>
</tr>
</thead>
<tbody>
<tr>
<td>90%</td>
<td>55%</td>
</tr>
</tbody>
</table>

Figure 59+N. Examples of and comparison between COMPACTED CROWN RATIO and UNCOMPACTED LIVE CROWN RATIO of open-crown and dense-crown conifers.
Figure 60. COMPACTED CROWN RATIO on a leaning tree. CROWN RATIO = (x/y)100.

For multi-stemmed woodland species, ocularly transfer lower live foliage to fill large holes on all stems and form an even crown across the tree (Figure 61).

When Collected: All live tally trees ≥ 1.0 inch DBH/DRC
Field width: 2 digits
Tolerance: +/- 10 %
MQO: At least 80% of the time
Values: 00 to 99
Figure 61. Examples of and comparison between COMPACTED CROWN RATIO and UNCOMPACTED LIVE CROWN RATIO of woodland species.

(23.1 +U+GT Crowns Overview)  
(See full data element description in Section 23.1 Crowns Overview)

(23.2 +U+GT Crown Definitions)  
(See full data element description in Section 23.2 Crown Definitions)
(23.4.2+U-GT) Crown Rating Precautions
(See full data element description in Section 23.4 Crown Rating Precautions)

(23.6.2+U-GT) CROWN LIGHT EXPOSURE
(See full data element description in Section 23.6 CROWN LIGHT EXPOSURE)

(23.10.2+U-GT) CROWN DIEBACK
(See full data element description in Section 23.10 CROWN DIEBACK)

5.20+U+N+GT URBAN / GROUND TRUTH Tree Damage (CORE)
Damage is a composite variable. Up to three damaging agents may be recorded per tree. Many damaging agents are host specific and their potential for damage could vary by region. In general, a recorded damage is likely to:

1. Prevent the tree from surviving more than 1-2 years
2. Reduce the growth of the tree in the near term
3. Negatively affect a tree’s marketable products (cubic, BF, or other)

It is not necessary to record damage agents in order of their severity unless there are more than three agents. If there are more than three agents, record only the most important ones using the list of impacts above as a guide (i.e., agents threatening survival are more important than agents that reduce wood quality). In general, agents that affect the roots or bole tend to be most threatening, because they have the capacity to affect the entire tree; damage to peripheral parts of the tree may be temporary because leaves, shoots, and reproductive structures may be replaced.

Codes used for this variable come from a January 2012 Pest Trend Impact Plot System, (PTIPS) list from the Forest Health Technology Enterprise Team (FHTET) that has been modified to meet FIA needs. This list is made up of General Agents and then further subdivided into specific agents. Not every General Agent PTIPS code will be available for use for this variable; some do not cause tree damage as defined above while others are better recorded in a different General Agent. Not every specific agent PTIPS code will be available for use for this variable. Regions will decide which specific agents they will identify in their areas.

Record the general agent unless the Region opts to collect specific agents. Specific agents can later be collapsed into the general agent categories for cross-region comparisons. In the unusual instance when more than one specific agent in the same general category occurs on the same tree, record them both. If a specific agent is identified on that plot but that agent is not on the regionally recognized list of codes for damage agents, use its General Agent code. Appendix 11 contains the regionally recognized list of codes for damage agent based on the modified PTIPS list from FHTET. Only the specific agent codes from Appendix 11 may be used instead of the general codes listed under URBAN / GROUND TRUTH DAMAGE AGENT 1. Any damage code in Appendix 11 may be used for URBAN / GROUND TRUTH DAMAGE AGENT 1, URBAN / GROUND TRUTH DAMAGE AGENT 2, or URBAN / GROUND TRUTH DAMAGE AGENT 3.

NRS Note: Do not divulge pest, disease or invasive species information on public or private property. See Section 0.2 of the field guide for more information.

5.20.1+U+N+GT URBAN / GROUND TRUTH DAMAGE AGENT 1 [1DAM]
Inspect the tree from bottom to top – roots, bole, branches, foliage (including buds and shoots), Record the first damage agent observed from the list of agents (unless you observe more than 3 damages). If there are more than three agents, record only the most important ones using the list of impacts listed in Section 5.20 as a guide (i.e., agents threatening survival are more important than agents that reduce wood quality). The general agent codes, damage thresholds, and general
agent descriptions are listed here. Specific agents within the general categories, if required by your Region, are listed in Appendix 11, along with their associated thresholds. These codes can be collapsed into the national CORE general codes. Note: in some cases, thresholds for specific agents may be different from the threshold for the corresponding general agent. If a region is collecting a specific insect agent and no one is collecting the general agent, then the specific insect agent is collapsed into the general insect category 10000.

When Collected: CORE: All live tally trees ≥ 5.0 inches DBH/DRC
CORE OPTIONAL: URBAN / GROUND TRUTH FIA: All live tally trees ≥ 1.0 inch DBH/DRC
Field width: 5 digits
Tolerance: No errors
MQO: Will be established following blind audit results
Values: Appendix 11

General Agent Damage Codes, Damage Thresholds, and Descriptions. Specific agent codes are in Appendix 11.

NRS Note: coding instructions (all examples assume that damage thresholds are met).

1. Do not describe the same tree damage with multiple damage codes:
   a. Example: A broken top from a wind storm is coded as 50013 (Wind); do not code both Wind and 90001 (Broken top). If there is a broken top of an unknown origin, just code the broken top.
   b. Example: A portion of a dead top from an unknown origin has broken off, code 90002 (Dead top) and ignore the broken top.
   c. Example: An open wound from a fire scar. Code as 30000 (Fire), not both Fire and 90000 (Other Damages and Symptoms).

2. Coding two damages at the same location:
   a. Example: An open wound caused by fire that has rotten wood going into the tree bole, code 30000 (Fire) and 22500 (Stem decay).
   b. Example: A Hypoxylon canker located on the bole at the point where the top of the tree has broken off. Code 22038 (Hypoxylon canker) and 90001 (Broken top).

3. Miscellaneous coding examples:
   a. Example: A wind storm breaks off a tree and it falls causing an open wound on a tally tree, code as 50013 (Wind). If a tree falls into a tally tree causing the open wound and the cause of the tree falling is unknown, code as 90000 (Other Damages and Symptoms) for the open wound.

4. 90000 (Other Damages and Symptoms) vs. 99000 (unknown). Code 99000 if you have a damage that does not fit within any other Agent code. Make a tree note explaining the damage whenever 99000 is used:
   a. Example: An Open wound on the bole of a tree that meets thresholds and is not addressed within another Agent code would be coded as 90000.
   b. Example: Resinosis on the bole of a tree that meets thresholds and that is not addressed within another Agent code would be coded as 90000.

NRS Note: Damage threshold clarifications.

1. Bole/Stem is defined as the main stem of a tree which yields greatest merchantable volume, extending from the 1 foot stump to the point on the tree where DOB reaches 4 inches. On forked trees use the same fork as is used to assign tree class to the tree.
2. Branches are defined as the primary branches on the tree that are not already defined as part of the bole/stem.
NRS Note: Damage within the dead top or branches of the tree will only be coded if it was the direct cause of the dead area and meets the required threshold.

NRS Note: This list has been modified to include the NRS Specific Agent codes.
<table>
<thead>
<tr>
<th>Code</th>
<th>General Agent / Specific Agents</th>
<th>Damage Threshold*</th>
<th>Descriptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>No Damage</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10000</td>
<td>General insects</td>
<td>Any damage to the terminal leader; damage ≥20% of the roots or boles with &gt;20% of the circumference affected; damage &gt;20% of the multiple-stems (on multi-stemmed woodland species) with &gt;20% of the circumference affected; &gt;20% of the branches affected; damage ≥20% of the foliage with ≥50% of the leaf/needle affected.</td>
<td>Insect damage that cannot be placed in any of the following insect categories.</td>
</tr>
<tr>
<td>10017</td>
<td>Bagworm moth</td>
<td>Any damage to the terminal leader; damage ≥ 20% of the foliage with ≥ 50% of the leaf/needle affected.</td>
<td></td>
</tr>
<tr>
<td>11000</td>
<td>Bark beetles</td>
<td>Any evidence of a successful attack (successful attacks generally exhibit boring dust, many pitch tubes and/or fading crowns).</td>
<td>Bark beetles (Dendroctonus, Ips, and other genera) are phloem-feeding insects that bore through the bark and create extensive galleries between the bark and the wood. Symptoms of beetle damage include fading or discolored tree crown (yellow or red), pitch tubes or pitch streaks on the bark, extensive egg galleries in the phloem, boring dust in the bark crevices or at the base of the tree. Bark chipping by woodpeckers may be conspicuous. They inflict damage or destroy all parts of trees at all stages of growth by boring in the bark, inner bark, and phloem. Visible signs of attack include pitch tubes or large pitch masses on the tree, dust and frass on the bark and ground, and resin streaming. Internal tunneling has various patterns. Most have tunnels of uniform width with smaller galleries of variable width radiating from them. Galleries may or may not be packed with fine boring dust.</td>
</tr>
<tr>
<td>11006</td>
<td>Mountain pine beetle</td>
<td>Any evidence of a successful attack</td>
<td></td>
</tr>
<tr>
<td>11012</td>
<td>Red turpentine beetle</td>
<td>Any evidence of a successful attack</td>
<td></td>
</tr>
<tr>
<td>11030</td>
<td>Ips engraver beetles</td>
<td>Any evidence of a successful attack</td>
<td></td>
</tr>
<tr>
<td>Code</td>
<td>General Agent / Specific Agents</td>
<td>Damage Threshold*</td>
<td>Descriptions</td>
</tr>
<tr>
<td>--------</td>
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<td>-------------------</td>
<td>-----------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>12000</td>
<td>Defoliators</td>
<td>Any damage to the terminal leader; damage ≥20% of the foliage with ≥50% of the leaf/needle affected.</td>
<td>These are foliage-feeding insects that may reduce growth and weaken the tree causing it to be more susceptible to other damaging agents. General symptoms of defoliation damage include large amounts of missing foliage, browning foliage, extensive branch mortality, or dead tree tops.</td>
</tr>
<tr>
<td>12005</td>
<td>Sawflies</td>
<td>Any damage to the terminal leader; damage ≥20% of the foliage with ≥50% of the leaf/needle affected.</td>
<td></td>
</tr>
<tr>
<td>12029</td>
<td>Oak skeletonizer</td>
<td>Any damage to the terminal leader; damage ≥20% of the foliage with ≥50% of the leaf/needle affected.</td>
<td></td>
</tr>
<tr>
<td>12038</td>
<td>Spruce budworm</td>
<td>Any damage to the terminal leader; damage ≥20% of the foliage with ≥50% of the leaf/needle affected.</td>
<td></td>
</tr>
<tr>
<td>12041</td>
<td>Jack pine budworm</td>
<td>Any damage to the terminal leader; damage ≥20% of the foliage with ≥50% of the leaf/needle affected.</td>
<td></td>
</tr>
<tr>
<td>12047</td>
<td>Larch casebearer</td>
<td>Any damage to the terminal leader; damage ≥20% of the foliage with ≥50% of the leaf/needle affected.</td>
<td></td>
</tr>
<tr>
<td>12048</td>
<td>Birch casebearer</td>
<td>Any damage to the terminal leader; damage ≥20% of the foliage with ≥50% of the leaf/needle affected.</td>
<td></td>
</tr>
<tr>
<td>12064</td>
<td>Elm spanworm</td>
<td>Any damage to the terminal leader; damage ≥20% of the foliage with ≥50% of the leaf/needle affected.</td>
<td></td>
</tr>
<tr>
<td>12068</td>
<td>Browntail moth</td>
<td>Any occurrence.</td>
<td></td>
</tr>
<tr>
<td>12081</td>
<td>Cherry scallop shell moth</td>
<td>Any damage to the terminal leader; damage ≥20% of the foliage with ≥50% of the leaf/needle affected.</td>
<td></td>
</tr>
<tr>
<td>12086</td>
<td>Satin moth</td>
<td>Any damage to the terminal leader; damage ≥20% of the foliage with ≥50% of the leaf/needle affected.</td>
<td></td>
</tr>
<tr>
<td>12089</td>
<td>Gypsy moth</td>
<td>Any occurrence. NRS note: Code damage if egg masses and body parts are on the tree.</td>
<td></td>
</tr>
<tr>
<td>12093</td>
<td>Eastern tent caterpillar</td>
<td>Any damage to the terminal leader; damage ≥20% of the foliage with ≥50% of the leaf/needle affected.</td>
<td></td>
</tr>
<tr>
<td>12096</td>
<td>Forest tent caterpillar</td>
<td>Any damage to the terminal leader; damage ≥20% of the foliage with ≥50% of the leaf/needle affected.</td>
<td></td>
</tr>
<tr>
<td>12136</td>
<td>Yellowheaded spruce sawfly</td>
<td>Any damage to the terminal leader; damage ≥20% of the foliage with ≥50% of the leaf/needle affected.</td>
<td></td>
</tr>
<tr>
<td>12197</td>
<td>Winter moth</td>
<td>Any occurrence.</td>
<td></td>
</tr>
<tr>
<td>Code</td>
<td>General Agent / Specific Agents</td>
<td>Damage Threshold*</td>
<td>Descriptions</td>
</tr>
<tr>
<td>--------</td>
<td>---------------------------------</td>
<td>----------------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>12200</td>
<td>Pyralid moth</td>
<td>Any damage to the terminal leader; damage ≥ 20% of the foliage with ≥ 50% of the leaf/needle affected.</td>
<td></td>
</tr>
<tr>
<td>13000</td>
<td>Chewing insects Note: this is only collected by IW and SRS.</td>
<td>Any damage to the terminal leader; damage ≥20% of the foliage with ≥50% of the leaf/needle affected.</td>
<td>Insects, like grasshoppers and cicadas that chew on trees (those insects not covered by defoliators in code 12000).</td>
</tr>
<tr>
<td>14000</td>
<td>Sucking insects</td>
<td>Any damage to the terminal leader; damage ≥20% of the foliage with ≥50% of the leaf/needle affected.</td>
<td>Adelgids, scales and aphids feed on all parts of the tree. Often they cause galling on branches and trunks. Some appear benign but enable fungi to invade where they otherwise could not (e.g., beech bark disease). The most important ones become conspicuous because of the mass of white, cottony wax that conceals eggs and young nymphs.</td>
</tr>
<tr>
<td>14001</td>
<td>Scale insects</td>
<td>Any damage to the terminal leader; damage ≥20% of the foliage with ≥50% of the leaf/needle affected.</td>
<td></td>
</tr>
<tr>
<td>14003</td>
<td>Balsam woolly adelgid</td>
<td>Any occurrence.</td>
<td></td>
</tr>
<tr>
<td>14004</td>
<td>Hemlock woolly adelgid</td>
<td>Any occurrence.</td>
<td></td>
</tr>
<tr>
<td>14016</td>
<td>Beech scale</td>
<td>Any occurrence.</td>
<td></td>
</tr>
<tr>
<td>14020</td>
<td>Elongate hemlock scale</td>
<td>Any damage to the terminal leader; damage ≥20% of the foliage with ≥50% of the leaf/needle affected.</td>
<td></td>
</tr>
<tr>
<td>14033</td>
<td>Red pine scale</td>
<td>Any occurrence.</td>
<td></td>
</tr>
<tr>
<td>Code</td>
<td>General Agent / Specific Agents</td>
<td>Damage Threshold*</td>
<td>Descriptions</td>
</tr>
<tr>
<td>--------</td>
<td>---------------------------------</td>
<td>-------------------</td>
<td>------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>15000</td>
<td>Boring insects</td>
<td>Any damage to the terminal leader; damage ≥20% of the roots, stems, or branches. NRS Note: Do not code if confined to dead wood. Example when you have the holes on exposed dead wood on an open wound.</td>
<td>Most wood boring insects attack only severely declining and dead trees. Certain wood boring insects cause significant damage to trees, especially the exotic Asian longhorn beetle, emerald ash borer, and Sirex wood wasp. Bark beetles have both larval and adult galleries in the phloem and adjacent surface of the wood. Wood borers have galleries caused only by larval feeding. Some, such as the genus Agrilus (including the emerald ash borer) have galleries only in the phloem and surface of the wood. Other wood borers, such as Asian longhorn beetle bore directly into the phloem and wood. Sirex adults oviposit their eggs through the bark, and developing larvae bore directly into the wood of pines.</td>
</tr>
<tr>
<td>15001</td>
<td>Shoot borer</td>
<td>Any damage to the terminal leader; damage ≥20% of the roots, stems, or branches.</td>
<td></td>
</tr>
<tr>
<td>15004</td>
<td>Bronze birch borer</td>
<td>Any damage to the terminal leader; damage ≥20% of the roots, stems, or branches.</td>
<td></td>
</tr>
<tr>
<td>15026</td>
<td>Red oak borer</td>
<td>Damage to ≥10% of the bole circumference.</td>
<td></td>
</tr>
<tr>
<td>15031</td>
<td>Sugar maple borer</td>
<td>Any damage to the terminal leader; damage ≥20% of the roots, stems, or branches.</td>
<td></td>
</tr>
<tr>
<td>15087</td>
<td>Emerald ash borer</td>
<td>Any occurrence.</td>
<td></td>
</tr>
<tr>
<td>15088</td>
<td>Hemlock borer</td>
<td>Any damage to the terminal leader; damage ≥20% of the roots, stems, or branches.</td>
<td></td>
</tr>
<tr>
<td>17000</td>
<td>Gallmaker Insects</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17011</td>
<td>Balsam gall midge</td>
<td>Any damage to the terminal leader; damage ≥20% of the foliage with ≥50% of the leaf/needle affected.</td>
<td></td>
</tr>
<tr>
<td>Code</td>
<td>General Agent / Specific Agents</td>
<td>Damage Threshold*</td>
<td>Descriptions</td>
</tr>
<tr>
<td>-------</td>
<td>---------------------------------</td>
<td>-------------------</td>
<td>--------------</td>
</tr>
<tr>
<td>19000</td>
<td>General diseases</td>
<td>Any damage to the terminal leader; damage ≥20% of the roots or boles with &gt;20% of the circumference affected; damage &gt;20% of the multiple-stems (on multi-stemmed woodland species) with &gt;20% of the circumference affected; &gt;20% of the branches affected; damage ≥20% of the foliage with ≥50% of the leaf/needle affected.</td>
<td>Diseases that cannot be placed in any of the following disease categories.</td>
</tr>
<tr>
<td>21000</td>
<td>Root/butt diseases</td>
<td>Any occurrence.</td>
<td>Root disease kills all or a portion of a tree’s roots. Quite often, the pathogenic fungus girdles the tree at the root collar. Tree damage includes mortality (often occurring in groups or “centers”), reduced tree growth, and increased susceptibility to other agents (especially bark beetles). General symptoms include resin at the root collar, thin, chlorotic (faded) foliage, and decay of roots. A rot is a wood decay caused by fungi. Rots are characterized by a progression of symptoms in the affected wood. First, the wood stains and discolors, then it begins to lose its structural strength, and finally the wood starts to break down, forming cavities in the stem. Even early stages of wood decay can cause cull due to losses in wood strength and staining of the wood. Rot can lead to mortality, cull, an increased susceptibility to other agents (such as insects), wind throw, and stem breakage.</td>
</tr>
<tr>
<td>21001</td>
<td>Armillaria root disease</td>
<td>Any occurrence.</td>
<td>Root disease kills all or a portion of a tree’s roots. Quite often, the pathogenic fungus girdles the tree at the root collar. Tree damage includes mortality (often occurring in groups or “centers”), reduced tree growth, and increased susceptibility to other agents (especially bark beetles). General symptoms include resin at the root collar, thin, chlorotic (faded) foliage, and decay of roots. A rot is a wood decay caused by fungi. Rots are characterized by a progression of symptoms in the affected wood. First, the wood stains and discolors, then it begins to lose its structural strength, and finally the wood starts to break down, forming cavities in the stem. Even early stages of wood decay can cause cull due to losses in wood strength and staining of the wood. Rot can lead to mortality, cull, an increased susceptibility to other agents (such as insects), wind throw, and stem breakage.</td>
</tr>
<tr>
<td>21010</td>
<td>Heterobasidion root disease</td>
<td>Any occurrence.</td>
<td>Root disease kills all or a portion of a tree’s roots. Quite often, the pathogenic fungus girdles the tree at the root collar. Tree damage includes mortality (often occurring in groups or “centers”), reduced tree growth, and increased susceptibility to other agents (especially bark beetles). General symptoms include resin at the root collar, thin, chlorotic (faded) foliage, and decay of roots. A rot is a wood decay caused by fungi. Rots are characterized by a progression of symptoms in the affected wood. First, the wood stains and discolors, then it begins to lose its structural strength, and finally the wood starts to break down, forming cavities in the stem. Even early stages of wood decay can cause cull due to losses in wood strength and staining of the wood. Rot can lead to mortality, cull, an increased susceptibility to other agents (such as insects), wind throw, and stem breakage.</td>
</tr>
<tr>
<td>Code</td>
<td>General Agent / Specific Agents</td>
<td>Damage Threshold*</td>
<td>Descriptions</td>
</tr>
<tr>
<td>-------</td>
<td>---------------------------------</td>
<td>-----------------------------------------------------------------------------------</td>
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</tr>
<tr>
<td>22000</td>
<td>Cankers (non-rust)</td>
<td>Any occurrence.</td>
<td>A canker -- a sunken lesion on the stem caused by the death of cambium -- may cause tree breakage or kill the portion of the tree above the canker. Cankers may be caused by various agents but are most often caused by fungi. A necrotic lesion begins in the bark of branches, trunk or roots, and progresses inward killing the cambium and underlying cells. The causal agent may or may not penetrate the wood. This results in areas of dead tissue that become deeper and wider. There are two types of cankers, annual and perennial. Annual cankers enlarge only once and do so within an interval briefer than the growth cycle of the tree, usually less than one year. Little or no callus is associated with annual cankers, and they may be difficult to distinguish from mechanical injuries. Perennial cankers are usually the more serious of the two, and grow from year to year with callus forming each year on the canker margin, often resulting in a target shape. The most serious non-rust cankers occur on hardwoods, although branch mortality often occurs on conifers.</td>
</tr>
<tr>
<td>22006</td>
<td>Black knot of cherry</td>
<td>Any occurrence on the bole or on branches ≤1 foot from bole; damage to ≥50% of branches.</td>
<td></td>
</tr>
<tr>
<td>22011</td>
<td>Caliciopsis canker</td>
<td>Any occurrence.</td>
<td></td>
</tr>
<tr>
<td>22023</td>
<td>Chestnut blight</td>
<td>Any occurrence.</td>
<td></td>
</tr>
<tr>
<td>22030</td>
<td>Eutypella canker</td>
<td>Any occurrence.</td>
<td></td>
</tr>
<tr>
<td>22038</td>
<td>Hypoxylon canker of aspen</td>
<td>Any occurrence.</td>
<td></td>
</tr>
<tr>
<td>22042</td>
<td>Beech bark disease</td>
<td>Any occurrence.</td>
<td></td>
</tr>
<tr>
<td>22043</td>
<td>Nectria canker</td>
<td>Any occurrence.</td>
<td></td>
</tr>
<tr>
<td>22053</td>
<td>Butternut canker</td>
<td>Any occurrence.</td>
<td></td>
</tr>
<tr>
<td>22075</td>
<td>Lachnellula canker</td>
<td>Any occurrence.</td>
<td></td>
</tr>
<tr>
<td>22076</td>
<td>Strumella canker</td>
<td>Any occurrence.</td>
<td></td>
</tr>
<tr>
<td>Code</td>
<td>General Agent / Specific Agents</td>
<td>Damage Threshold*</td>
<td>Descriptions</td>
</tr>
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<td>--------</td>
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</tr>
<tr>
<td>22500</td>
<td>Stem decays</td>
<td>Any visual evidence (conks; fruiting bodies; rotten wood)</td>
<td>Rot occurring in the bole/stems of trees above the roots and stump.</td>
</tr>
<tr>
<td>23000</td>
<td>Parasitic / Epiphytic plants</td>
<td>Dwarf mistletoes with Hawksworth rating of ≥3; true mistletoes and vines covering ≥ 50% of crown.</td>
<td>Parasitic and epiphytic plants can cause damage to trees in a variety of ways. The most serious ones are dwarf mistletoes, which reduce growth and can cause severe deformities. Vines may damage trees by strangulation, shading, or physical damage. Benign epiphytes, such as lichens or mosses, are not considered damaging agents.</td>
</tr>
<tr>
<td>23003</td>
<td>Vine damage</td>
<td>Vines covering ≥50% of crown</td>
<td></td>
</tr>
<tr>
<td>23015</td>
<td>Eastern dwarf mistletoe</td>
<td>Any occurrence.</td>
<td></td>
</tr>
<tr>
<td>24000</td>
<td>Decline Complexes/ Dieback/Wilts</td>
<td>Damage ≥ 20% dieback of crown area.</td>
<td>Tree disease which results not from a single causal agent but from an interacting set of factors. Terms that denote the symptom syndrome, such as dieback and wilt, are commonly used to identify these diseases.</td>
</tr>
<tr>
<td>24004</td>
<td>Ash decline/yellows</td>
<td>Damage ≥ 20% dieback of crown area.</td>
<td></td>
</tr>
<tr>
<td>24021</td>
<td>Oak wilt</td>
<td>Damage ≥ 20% dieback of crown area.</td>
<td></td>
</tr>
<tr>
<td>24022</td>
<td>Dutch elm disease</td>
<td>Damage ≥ 20% dieback of crown area.</td>
<td></td>
</tr>
<tr>
<td>25000</td>
<td>Foliage diseases</td>
<td>Damage ≥20% of the foliage with ≥50% of the leaf/needle affected.</td>
<td>Foliage diseases are caused by fungi and result in needle shed, growth loss, and, potentially, tree mortality. This category includes needle casts, blights, and needle rusts.</td>
</tr>
<tr>
<td>25057</td>
<td>Sirococcus tip blight</td>
<td>Damage ≥20% of the foliage with ≥50% of the leaf/needle affected.</td>
<td></td>
</tr>
<tr>
<td>25072</td>
<td>Sirococcus shoot blight</td>
<td>Damage ≥20% of the foliage with ≥50% of the leaf/needle affected.</td>
<td></td>
</tr>
<tr>
<td>Code</td>
<td>General Agent / Specific Agents</td>
<td>Damage Threshold*</td>
<td>Descriptions</td>
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</tr>
<tr>
<td>26000</td>
<td>Stem rusts</td>
<td>Any occurrence on the bole or stems (on multi-stemmed woodland species), or on branches ≤1 foot from boles or stems; damage to ≥20% of branches</td>
<td>A stem rust is a disease caused by fungi that kill or deform all or a portion of the stem or branches of a tree. Stem rusts are obligate parasites and host specialization is very common. They infect and develop on fast-growing tissues and cause accelerated growth of infected tissues resulting in galls or cankers. Heavy resinosis is usually associated with infections. Sometimes yellow or reddish-orange spores are present giving a “rusty” appearance. Damage occurs when the disease attacks the cambium of the host, girdling and eventually killing the stem above the attack. Symptoms of rusts include galls (an abnormal and pronounced swelling or deformation of plant tissue that forms on branches or stems) and cankers (a sunken lesion on the stem caused by death of the cambium which often results in the death of tree tops and branches).</td>
</tr>
<tr>
<td>27000</td>
<td>Broom rusts</td>
<td>≥50% of the crown area affected.</td>
<td>Broom rust is a disease caused by fungi that kill or deform all or a portion of the branches of a tree. Broom rusts are obligate parasites and host specialization is very common. They infect and develop on fast-growing tissues and cause accelerated growth of infected tissues resulting in galls. Symptoms of rusts include galls, an abnormal and pronounced swelling or deformation of plant tissue that forms on branches or stems.</td>
</tr>
<tr>
<td>Code</td>
<td>General Agent / Specific Agents</td>
<td>Damage Threshold*</td>
<td>Descriptions</td>
</tr>
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</tr>
<tr>
<td>30000</td>
<td>Fire</td>
<td>Damage ≥ 20% of bole circumference; &gt;20% of stems on multi-stemmed woodland species affected; ≥20% of crown affected.</td>
<td>Fire damage may be temporary, such as scorched foliage, or may be permanent, such as in cases where cambium is killed around some portion of the bole. The location and amount of fire damage will determine how the damage may affect the growth and survival of the tree. Fire often causes physiological stress, which may predispose the tree to attack by insects of other damaging agents.</td>
</tr>
<tr>
<td>41000</td>
<td>Wild animals</td>
<td>Any damage to the terminal leader; damage ≥20% of the roots or boles with &gt;20% of the circumference affected; damage &gt;20% of the multiple-stems (on multi-stemmed woodland species) with &gt;20% of the circumference affected; &gt;20% of the branches affected; damage ≥20% of the foliage with ≥50% of the leaf/needle affected. NRS Note: Code damage even if on dead wood within live portion of tree.</td>
<td>Wild animals from birds to large mammals cause open wounds. Some common types of damage include: sapsucker bird peck, deer rub, bear clawing, porcupine feeding, and beaver gnawing.</td>
</tr>
<tr>
<td>42000</td>
<td>Domestic animals</td>
<td>Any damage to the terminal leader; damage ≥20% of the roots or boles with &gt;20% of the circumference affected; damage &gt;20% of the multiple-stems (on multi-stemmed woodland species) with &gt;20% of the circumference affected; &gt;20% of the branches affected; damage ≥20% of the foliage with ≥50% of the leaf/needle affected.</td>
<td>Open wounds caused by cattle and horses occur on the roots and lower trunk. Soil compaction from the long term presence of these animals in a woodlot can also cause indirect damage.</td>
</tr>
<tr>
<td>50000</td>
<td>Abiotic</td>
<td>Any damage to the terminal leader; damage ≥20% of the roots or boles with &gt;20% of the circumference affected; damage &gt;20% of the multiple-stems (on multi-stemmed woodland species) with &gt;20% of the circumference affected; &gt;20% of the branches affected; damage ≥20% of the foliage with ≥50% of the leaf/needle affected.</td>
<td>Abiotic damages are those that are not caused by other organisms. In some cases, the type and severity of damage may be similar for different types of agents (e.g., broken branches from wind, snow, or ice).</td>
</tr>
<tr>
<td>50002</td>
<td>Chemical</td>
<td>Any damage to the terminal leader; damage ≥20% of the roots, stems, or branches; damage ≥20% of the foliage with ≥50% of the leaf/needle affected.</td>
<td></td>
</tr>
<tr>
<td>Code</td>
<td>General Agent / Specific Agents</td>
<td>Damage Threshold*</td>
<td>Descriptions</td>
</tr>
<tr>
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</tr>
<tr>
<td>50003</td>
<td>Drought</td>
<td>Any damage to the terminal leader; damage &gt; 20% of the roots or boles with &gt; 20% of the circumference affected; damage &gt; 20% of the multiple-stems (on multi-stemmed woodland species) with &gt; 20% of the circumference affected; &gt; 20% of the branches affected; damage &gt; 20% of the foliage with &gt; 50% of the leaf/needle affected.</td>
<td></td>
</tr>
<tr>
<td>50004</td>
<td>Flooding/high water</td>
<td>Any damage to the terminal leader; damage &gt; 20% of the roots or boles with &gt; 20% of the circumference affected; damage &gt; 20% of the multiple-stems (on multi-stemmed woodland species) with &gt; 20% of the circumference affected; &gt; 20% of the branches affected; damage &gt; 20% of the foliage with &gt; 50% of the leaf/needle affected.</td>
<td></td>
</tr>
<tr>
<td>50008</td>
<td>Lightning</td>
<td>Any damage to the terminal leader; damage &gt; 20% of the roots or boles with &gt; 20% of the circumference affected; damage &gt; 20% of the multiple-stems (on multi-stemmed woodland species) with &gt; 20% of the circumference affected; &gt; 20% of the branches affected; damage &gt; 20% of the foliage with &gt; 50% of the leaf/needle affected.</td>
<td></td>
</tr>
<tr>
<td>50011</td>
<td>Snow/ice</td>
<td>Any damage to the terminal leader; damage &gt; 20% of the roots or boles with &gt; 20% of the circumference affected; damage &gt; 20% of the multiple-stems (on multi-stemmed woodland species) with &gt; 20% of the circumference affected; &gt; 20% of the branches affected; damage &gt; 20% of the foliage with &gt; 50% of the leaf/needle affected.</td>
<td></td>
</tr>
<tr>
<td>Code</td>
<td>General Agent / Specific Agents</td>
<td>Damage Threshold*</td>
<td>Descriptions</td>
</tr>
<tr>
<td>--------</td>
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<td>-----------------------------------------------------------------------------------</td>
<td>-----------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>50013</td>
<td>Wind</td>
<td>Any damage to the terminal leader; damage &gt; 20% of the roots or boles with &gt; 20% of the circumference affected; damage &gt; 20% of the multiple-stems (on multi-stemmed woodland species) with &gt; 20% of the circumference affected; &gt; 20% of the branches affected; damage &gt; 20% of the foliage with &gt; 50% of the leaf/needle affected.</td>
<td>Suppression of overtopped shade intolerant species. Trees that are not expected to survive for 5 years or saplings not expected to reach tree size (5.0 inches DBH/DRC). NRS Note: Must show evidence of decline that will lead to death.</td>
</tr>
<tr>
<td>60000</td>
<td>Competition</td>
<td>Overtopped shade intolerant trees that are not expected to survive for 5 years or saplings not expected to reach tree size (5.0 inches DBH/DRC). NRS Note: Must show evidence of decline that will lead to death.</td>
<td>People can injure trees in a variety of ways, from poor pruning, to vandalism, to logging injury. Signs include open wounds or foreign embedded objects.</td>
</tr>
<tr>
<td>70000</td>
<td>Human activities</td>
<td>Any damage to the terminal leader; damage ≥20% of the roots or boles with &gt; 20% of the circumference affected; damage &gt; 20% of the multiple-stems (on multi-stemmed woodland species) with &gt;20% of the circumference affected; &gt;20% of the branches affected; damage ≥20% of the foliage with ≥50% of the leaf/needle affected.</td>
<td>People can injure trees in a variety of ways, from poor pruning, to vandalism, to logging injury. Signs include open wounds or foreign embedded objects.</td>
</tr>
<tr>
<td>70003</td>
<td>Imbedded objects</td>
<td>Any occurrence on the bole.</td>
<td></td>
</tr>
<tr>
<td>70007</td>
<td>Logging damage</td>
<td>Any damage to the terminal leader; damage &gt; 20% of the roots or boles with &gt; 20% of the circumference affected; damage &gt; 20% of the multiple-stems (on multi-stemmed woodland species) with &gt; 20% of the circumference affected; &gt; 20% of the branches affected; damage &gt; 20% of the foliage with &gt; 50% of the leaf/needle affected.</td>
<td>Only recorded for woodland species trees that have partial cutting.</td>
</tr>
<tr>
<td>71000</td>
<td>Harvest</td>
<td>Removal of ≥10% of cubic volume</td>
<td></td>
</tr>
<tr>
<td>Code</td>
<td>General Agent / Specific Agents</td>
<td>Damage Threshold*</td>
<td>Descriptions</td>
</tr>
<tr>
<td>----------</td>
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<td>-----------------------------------------------------------------------------------</td>
<td>------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>90000</td>
<td>Other damage</td>
<td>Any damage to the terminal leader; damage ≥20% of the roots or boles with &gt; 20% of the circumference affected; damage &gt; 20% of the multiple-stems (on multi-stemmed woodland species) with &gt; 20% of the circumference affected; &gt; 20% of the branches affected; damage ≥20% of the foliage with ≥ 50% of the leaf/needle affected.</td>
<td>NRS Note: Only use this code for checks, bole cracks, open wounds, Resinosis, and broken branches that meet thresholds. Do not include “tree form” situations (fork, crook, sweep, etc.) such as 90003 limby-wolf tree, 90004 forked tree, and 90005 forked below merch top as damage.</td>
</tr>
<tr>
<td>90001</td>
<td>Broken top</td>
<td>When actual length is less than total length</td>
<td></td>
</tr>
<tr>
<td>90002</td>
<td>Dead top</td>
<td>Any occurrence</td>
<td>NRS Note: If the tree forks and only a portion of the top is dead, do not code as dead top. All forks must have dead tops in order to code this damage.</td>
</tr>
<tr>
<td>90008</td>
<td>Foliage discoloration</td>
<td>Damage ≥ 20% of crown affected</td>
<td></td>
</tr>
<tr>
<td>90010</td>
<td>Dieback</td>
<td>Damage ≥ 20% of crown affected</td>
<td>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.</td>
</tr>
</tbody>
</table>
### Urban/Ground Truth Specific Damage Variables

For the urban forest inventory, there is the need to know of the presence of the seven urban specific damages described in detail below. Record the presence of up to all seven of these damages on each live tally tree ≥ 1 inch DBH/DRC. Be sure that any urban specific damages coded meet the thresholds noted within the description of that damage.

### Code General Agent / Specific Agents Damage Threshold* Descriptions

<table>
<thead>
<tr>
<th>Code</th>
<th>General Agent / Specific Agents</th>
<th>Damage Threshold*</th>
<th>Descriptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>99000</td>
<td>Unknown damage</td>
<td>Any damage to the terminal leader; damage ≥20% of the roots or boles with &gt;20% of the circumference affected; damage &gt;20% of the multiple-stems (on multi-stemmed woodland species) with &gt;20% of the circumference affected; &gt;20% of the branches affected; damage ≥20% of the foliage with ≥50% of the leaf/needle affected.</td>
<td>Use this code only when observed damage cannot be attributed to a general or specific agent.</td>
</tr>
</tbody>
</table>

*Some Regional specific damage agents within a category may have differing damage thresholds.

### NRS Note: If unknown damage, add a damage description to TREE NOTES.

#### 5.20.2 U GT URBAN / GROUND TRUTH DAMAGE AGENT 2 [2DAM]

Follow procedures described for URBAN / GROUND TRUTH DAMAGE AGENT 1

When Collected: CORE: All live tally trees ≥ 5.0 inches DBH/DRC

CORE OPTIONAL: URBAN / GROUND TRUTH FIA: All live tally trees ≥ 1.0 inch DBH/DRC

Field width: 5 digits

Tolerance: 1 of 2 damages correct

MQO: Will be established following blind audit results

Values: See 5.20.1 U GT

#### 5.20.3 U GT URBAN / GROUND TRUTH DAMAGE AGENT 3 [3DAM]

Follow procedures described for URBAN / GROUND TRUTH DAMAGE AGENT 1

When Collected: CORE: All live tally trees ≥ 5.0 inches DBH/DRC

CORE OPTIONAL: URBAN / GROUND TRUTH FIA: All live tally trees ≥ 1.0 inch DBH/DRC

Field width: 5 digits

Tolerance: 2 of 3 damages correct

MQO: Will be established following blind audit results

Values: See 5.20.1 U GT
When Collected: All live tally trees ≥ 1 inch DBH/DRC
Field width: 1 digit
Tolerance: No errors
MQO: At least 80% of the time
Values:

0  No urban specific damage present
1  Stem Girdling
2  Bark Inclusion
3  Severe Topping or Poor Pruning
4  Excessive Mulch
5  Conflict with Roots
6  Conflict with Tree Crown
7  Improper Planting

5.20.5UGT URBAN / GROUND TRUTH SPECIFIC DAMAGE VARIABLE 2
Follow procedures described for URBAN SPECIFIC DAMAGE VARIABLE 1

When Collected: All live tally trees ≥ 1 inch DBH/DRC when URBAN SPECIFIC DAMAGE VARIABLE 1 > 0
Field width: 1 digit
Tolerance: No errors
MQO: At least 80% of the time
Values: See 5.20.4U

5.20.6UGT URBAN / GROUND TRUTH SPECIFIC DAMAGE VARIABLE 3
Follow procedures described for URBAN SPECIFIC DAMAGE VARIABLE 1

When Collected: All live tally trees ≥ 1 inch DBH/DRC when URBAN SPECIFIC DAMAGE VARIABLE 2 > 0
Field width: 1 digit
Tolerance: No errors
MQO: At least 80% of the time
Values: See 5.20.4U

5.20.7UGT URBAN / GROUND TRUTH SPECIFIC DAMAGE VARIABLE 4
Follow procedures described for URBAN SPECIFIC DAMAGE VARIABLE 1

When Collected: All live tally trees ≥ 1 inch DBH/DRC when URBAN SPECIFIC DAMAGE VARIABLE 3 > 0
Field width: 1 digit
Tolerance: No errors
MQO: At least 80% of the time
Values: See 5.20.4U

5.20.8UGT URBAN / GROUND TRUTH SPECIFIC DAMAGE VARIABLE 5
Follow procedures described for URBAN SPECIFIC DAMAGE VARIABLE 1
When Collected: All live tally trees ≥ 1 inch DBH/DRC when URBAN SPECIFIC DAMAGE VARIABLE 4 > 0
Field width: 1 digit
Tolerance: No errors
MQO: At least 80% of the time
Values: See 5.20.4U

5.20.9UGT ... URBAN / GROUND TRUTH SPECIFIC DAMAGE VARIABLE 6
Follow procedures described for URBAN SPECIFIC DAMAGE VARIABLE 1

When Collected: All live tally trees ≥ 1 inch DBH/DRC when URBAN SPECIFIC DAMAGE VARIABLE 5 > 0
Field width: 1 digit
Tolerance: No errors
MQO: At least 80% of the time
Values: See 5.20.4U

5.20.10UGT ... URBAN / GROUND TRUTH SPECIFIC DAMAGE VARIABLE 7
Follow procedures described for URBAN SPECIFIC DAMAGE VARIABLE 1

When Collected: All live tally trees ≥ 1 inch DBH/DRC when URBAN SPECIFIC DAMAGE VARIABLE 6 > 0
Field width: 1 digit
Tolerance: No errors
MQO: At least 80% of the time
Values: See 5.20.4U

Stem Girdling
Description: Roots begin to grow around the main stem of the tree and cut off or restrict the movement of water, plant nutrients and stored food reserves. Certain trees are more prone to this problem than others. Lindens, magnolias, pines, and maples (other than the silver maple) are susceptible to root girdling. On the other hand, silver maple, oaks, ash, and elm are well known for their ability to form functional root grafts and are rarely adversely affected by girdling roots.

Location: Roots / Stump

Severity Threshold: 25% of circumference
Figure 62 UGT. The picture above illustrates a root crossing root, and is not considered a girdling root.

Figure 63 UGT. The pictures above illustrate a girdling root that is encircling the stem, though on the left, these girdling roots would probably not be apparent from above. The illustration on the right is the recordable damage. The photograph on the left shows below ground stem girdling.

Bark Inclusion
Description: Weak branch unions are places where branches are not strongly attached to the tree. A weak union occurs when two or more branches grow so closely together that bark grows between the branches and inside the union. This ingrown, or included, bark does not have the structural strength of wood and the union can become very weak. The inside bark may also act as a wedge and force the branch union to split apart. Trees with a tendency to form upright
branches, such as elm and maple, often produce weak branch unions. Focus on the V shaped appearance of the union as well as signs of where the bark has folded in on itself. Both forks and branches are included in this variable. In cases where this union is formed between two tally trees record the damage on both.

Location: Consider the first 15 feet of the bole from ground level.

Severity Threshold: None

Figure 64UGT. The photo above illustrates a strong branch union (left) and a weak branch union with the characteristic “V” branching pattern (right). Strong branch union vs. “V” notch. The branching pattern on the right is recordable because the two branches have grown closely together and contains included bark. Notice the easily identifiable branch bark ridge and “U” shape of the strong union of the left.
Figure 65UGT. A strong branch union has a conspicuous branch bark ridge.

Figure 66UGT. “V” Notch with included bark resulting in a split tree.

Figure 67UGT. “V” Notch.
Figure 68UGT. This is a “V” Notch and recordable. There is no branch bark ridge between the two branches.

Figure 69UGT. Normal Branching: These branch unions are okay and are not considered a “V” branching pattern.
Severe Topping or Poor Pruning

Description: A tree is considered to have been severely topped when it has been reduced to a single "pole" due to severe over-pruning and branch removal. "Topping" is the cutting of branches to stubs, or, if 25% or more at the main stem has been cut to reduce tree height. Topping usually results in a profusion of shoots rendering the tree more susceptible to wind damage. Poor pruning techniques include leaving stubs outside the branch collar, or cutting into the branch collar. A tree with proper pruning may still maintain the look and shape of the tree, just shorter.

Location: Crown Stem or Branches

Severity Threshold: 25% or more of crown area

Figure 70 UGT, Topping
Figure 71 UGT. Poor pruning.

Figure 72 UGT. Poor pruning.
Figure 73UGT. An example of severe topping, showing the weakly attached sprouts regenerating from the cut limb.

Figure 74UGT. Severe topping.
Excessive Mulch

Description: Root flare is not visible at base of trunk because of mulch. Mulch piled high around stem and mulch depth greater than 3 inches. Over mulching of landscape plants, sometimes to the extent of creating mountainous mulch "volcanoes," can result in disease or death of the tree. Mulch can take the form of many different materials and is not limited to wood chips. Over mulching can:

- promote excessive soil moisture and subsequent root rots
- cause inner bark tissue (phloem) death of aboveground stem flares
- cause fungal and bacterial diseases, and root, crown, and butt rots
- lead to rodent chewing on phloem tissue and subsequent stem girdling
- lead to the production of toxic organic acids (alcohols and volatile gases such as ammonia) by anaerobic microorganisms
- promote nutrient deficiencies and imbalances and possible allelopathic toxicities (allelopathy)
- lower soil temperatures during critical root growth periods, which may suppress overall root and plant growth
- prevent moisture penetration due to dry fungal masses becoming hydrophobic and actually repelling water

Location: Roots and Stump

Severity Threshold: None

Figure 75UGT. Excessive mulch.
Conflict With Roots

Description: Damage to sidewalk, driveway, road, or other hardscape directly caused by roots. Tree roots grow under sidewalks and asphalt. They do this in many instances because that is where the soil oxygen and moisture are located. Conflicts with curbs, driveways, or roads are all considered conflicts with roots. To be recorded, the conflict should be readily apparent (i.e. damage to sidewalk or hardscape is occurring). Or, as in the illustration below (Figure 77UGT), tree roots are being cut to avoid the damage.

Location: Stump

Severity Threshold: None

Shown below are examples of sidewalk conflicts.
Figure 77 UGT. Sidewalk conflicts with roots.

**Conflict with Tree Crown**

Description: Tree crown (branches or leaves) are within 5 feet of utility wires of any type, including drop lines that extend from the main line to a building. Conflict with overhead wires can cause problems for both trees and wires creating maintenance problems and hazard situations. Conflict with overhead power, cable, and telephone wires is common along streets, yards, parking lots, and in commercial areas. Conflict is present when utility wires (electric, telephone, and/or cable) are within 5 feet of tree branches or foliage.

Location: Overhead wires

Severity Threshold: None
Figure 78UGT. Utility wires, marked with blue arrows, going through a tree crown.

**Improper Planting**

Description: Evidence that burlap, twine or root ball wire was not removed prior to planting. Any of the following are visible at the soil surface: burlap, twine, or cage/wire.

Location: Roots and Stump of trees less than or equal to 10 in. DBH/DRC

Severity Threshold: None
5.21 \( + \text{GT} \) CAUSE OF DEATH [CAUS]

Record a cause of death for all trees that have died or been cut since the previous survey. If cause of death cannot be reliably estimated, record unknown/not sure/other.

NRS Note: A remeasure tree that has died and is now in a nonforest condition is assigned the appropriate CAUSE OF DEATH. For example, a tree that was previously live in accessible forest land and died due to disease in a residential area is coded as 20.
When Collected: CORE: SAMPLE KIND = 2 plots: all PREVIOUS TREE STATUS = 1 and URBAN / GROUND TRUTH PRESENT TREE STATUS = 2, 3, 4 or URBAN / GROUND TRUTH PRESENT TREE STATUS = 2 and URBAN / GROUND TRUTH RECONCILE = 1, 2, or 3

CORE URBAN / GROUND TRUTH OPTIONAL: SAMPLE KIND = 1 plots; all MORTALITY = 1

Field width: 2 digits
Tolerance: No errors
MQO: At least 80% of the time

Values:

10 Insect
20 Disease
30 Fire
40 Animal
50 Weather
60 Vegetation (suppression, competition, vines/kudzu)
70 Unknown/not sure/other - includes death from human activity not related to silvicultural or land clearing activity (accidental, random, etc.). TREE NOTES required.
80 Silvicultural or land clearing activity (death caused by harvesting or other silvicultural activity, including girdling, chaining, etc., or to land clearing activity)

5.22 R1 and R2 MORTALITY YEAR [MORT] (CORE OPTIONAL) Not Collected in NRS URBAN Not Collected in Ground Truth

5.23 DECAY CLASS [DECA]
Record for each standing dead tally tree, 1.0 inch in diameter and larger, the code indicating the tree’s stage of decay.
When Collected: All standing dead tally trees ≥ 1.0 inch DBH/DRC

Field width: 1 digit

Tolerance: +/- 1 class

MQO: At least 90% of the time

Values: Use the following table for guidelines:

<table>
<thead>
<tr>
<th>Decay class stage (code)</th>
<th>Limbs and branches</th>
<th>Top</th>
<th>% Bark Remaining</th>
<th>Sapwood presence and condition*</th>
<th>Heartwood condition*</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>All present</td>
<td>Pointed</td>
<td>100</td>
<td>Intact; sound, incipient decay, hard, original color</td>
<td>Sound, hard, original color</td>
</tr>
<tr>
<td>2</td>
<td>Few limbs, no fine branches</td>
<td>May be broken</td>
<td>Variable</td>
<td>Sloughing; advanced decay, fibrous, firm to soft, light brown</td>
<td>Sound at base, incipient decay in outer edge of upper bole, hard, light to reddish brown</td>
</tr>
<tr>
<td>3</td>
<td>Limb stubs only</td>
<td>Broken</td>
<td>Variable</td>
<td>Sloughing; fibrous, soft, light to reddish brown</td>
<td>Incipient decay at base, advanced decay throughout upper bole, fibrous, hard to firm, reddish brown</td>
</tr>
<tr>
<td>4</td>
<td>Few or no stubs</td>
<td>Broken</td>
<td>Variable</td>
<td>Sloughing; cubical, soft, reddish to dark brown</td>
<td>Advanced decay at base, sloughing from upper bole, fibrous to cubical, soft, dark reddish brown</td>
</tr>
<tr>
<td>5</td>
<td>None</td>
<td>Broken</td>
<td>Less than 20</td>
<td>Gone</td>
<td>Sloughing, cubical, soft, dark brown, OR fibrous, very soft, dark reddish brown, encased in hardened shell</td>
</tr>
</tbody>
</table>

*Characteristics are for Douglas-fir. Dead trees of other species may vary somewhat. Use this only as a guide.

5.24 | LENGTH TO DIAMETER MEASUREMENT POINT (CORE OPTIONAL) [DIAH] |
Record this item when tree diameter measurement locations are not monumented. For those trees measured directly at 4.5 feet above the ground, leave this item blank. If the diameter is not measured at 4.5 feet, record the actual length from the ground, to the nearest 0.1 foot, at which the diameter was measured for each tally tree, 1.0 inch DBH and larger. Leave this item blank for woodland species measured for diameter at root collar.

NRS Note: Record diameter height for all trees not measured at 4.5 feet (+/- 0.2 ft.), even if diameter was previously monumented.
When Collected: CORE OPTIONAL: All live and standing dead tally trees (except woodland species) ≥ 1.0 inch DBH
Field width: 3 digits
Tolerance: +/- 0.2 ft
MQO: At least 90% of the time
Values: 00.1 – 15.0

5.25 N-ME ROUGH CULL (CORE OPTIONAL) Not Collected in Ground Truth

5.26 R1 and R2 DWARF MISTLETOE CLASS (CORE OPTIONAL) Not Collected in NRS URBAN Not Collected in Ground Truth

5.27 TREE NOTES
Record notes pertaining to an individual tree as called for to explain or describe another variable.

When collected: All trees
Field width: Alphanumeric character field
Tolerance: N/A
MQO: N/A
Values: English language words, phrases and numbers

5.28UGT Building Energy Data
Data is collected for trees greater than or equal to 20 feet in vertical height (Figure 80U) within 60 feet of buildings. Both live and standing dead trees are included. Buildings are defined as structures that:

- Are estimated to have been originally constructed for residential purposes
- Contain no more than 3 stories (2 stories + attic) in height above ground level and include attached garages.
- Are space conditioned (heated and perhaps cooled).

The UFORE model utilizes an algorithm for single standing (excludes row-houses) residential-type structures no larger than 4000 square feet in total inhabitable (heated or cooled) space, although larger single-family homes or duplexes should be included regardless of size. Do not count unheated detached garages, sheds, or other outbuildings. If unsure if a detached out building is heated or cooled consider it unheated. Building Energy Data focuses on the definition of a building, not necessarily the land use associated with the building. For example a 2 story space-conditioned building that is being used as a Tax Preparation small business would be considered Commercial in terms of land use, but since the building was assumed to have been originally constructed for residential use, is 2 stories tall, and is spaced conditioned, it would still be considered a building in terms of Building Energy Data.

The building the tree affects does not have to be on the plot.

Distance is measured from the point where the pith of the tree enters the ground. The shortest distance to the building measured in feet. Measure to closest wall or to corner of building (for tree planted on corner).

A qualifying tree may affect up to 4 qualifying buildings; if more than 4 such buildings are within 60 ft. tally the 4 that are closest.
When trees have an associated Mother Tree, building energy data measurements will be recorded once for the Mother Tree unit, rather than for each stem. The tallest portion of the unit (all trees with the same Mother Tree Number including any boles/forks supported by the same stump that were not tallied) must reach at least 20 ft in height. Base the BUILDING DISTANCE 1-4 and BUILDING AZIMUTH 1-4 measurements on the pith of the single stump that supports the Mother Tree unit. These measurements will be recorded in the BUILDING DISTANCE 1-4 and BUILDING AZIMUTH 1-4 fields of the Mother Tree.

![Figure 80UGT. Vertical height measurement.](image)

**5.28.1 UGT BUILDING DISTANCE 1 [BU1DI]**

The shortest distance to the closest building measured in feet. Measure to closest wall or to corner of building (for tree planted on corner). Note: some trees may be within 60 feet of more than one building; in this case; add data to BUILDING DISTANCE 2 for second building, BUILDING DISTANCE 3 for third building, etc. The building the tree affects does not have to be on the plot.

When Collected: Trees ≥1.0 inch DBH/DRC and ≥ 20 ft. in height when MOTHER TREE # = null or MOTHER TREE # = URBAN TREE RECORD NUMBER

Field width: 1 digit
Tolerance: No errors
MQO: At least 90% of the time
Values:
- 0 No building within 60 feet or tree does not meet height requirements
- 1 Less than 20 feet
- 2 21 to 40 feet
- 3 41 to 60 feet

**5.28.2 UGT BUILDING AZIMUTH 1 [BU1AZ]**

Direction to building, measured in degrees. Note: some trees may be within 60 feet of more than one building; in this case; add data to BUILDING AZIMUTH 2 for second building, BUILDING AZIMUTH 3 for third building, etc. The building the tree affects does not have to be on the plot.
When Collected: Trees ≥1.0 inch DB/DRC and ≥ 20 ft. in height where BUILDING DISTANCE is >0 and MOTHER TREE # = null or MOTHER TREE # = URBAN TREE RECORD NUMBER
Field width: 3 digits
Tolerance: 5 degrees
MQO: At least 90% of the time
Values: 001 to 360

5.28.3 UGT BUILDING DISTANCE 2 [BU2DI]
Follow same procedures as BUILDING DISTANCE 1

5.28.4 UGT BUILDING AZIMUTH 2 [BU2AZ]
Follow same procedures as BUILDING AZIMUTH 1

5.28.5 UGT BUILDING DISTANCE 3 [BU3DI]
Follow same procedures as BUILDING DISTANCE 1

5.28.6 UGT BUILDING AZIMUTH 3 [BU3AZ]
Follow same procedures as BUILDING AZIMUTH 1

5.28.7 UGT BUILDING DISTANCE 4 [BU4DI]
Follow same procedures as BUILDING DISTANCE 1

5.28.8 UGT BUILDING AZIMUTH 4 [BU4AZ]
Follow same procedures as BUILDING AZIMUTH 1

5.28 UGT MAINTAINED AREA TREE [MAINA]
Record the code to indicate if the tree is located within a maintained area (tree bole must be partially or fully contained within the maintained area). Maintained areas are defined as those which are consistently being impacted by mowing, weeding, brushing, herbiciding, landscaping, etc. Examples include, but are not limited to, lawns, maintained shrub beds, Rights-of-ways, and manicured park areas. Examples of unmaintained areas are overgrown lots, small wooded areas, and riverbanks, among others.

When trees have an associated Mother Tree, MAINTAINED AREA TREE will be recorded only once for the Mother Tree unit, rather than for each stem. Base the measurement on the location of the bole of the single stump that supports the Mother Tree unit. This measurement will be recorded in the MAINTAINED AREA TREE field of the Mother Tree.
When Collected: Tally trees ≥ 1.0 inch DBH/DRC within URBAN CONDITION STATUS 2, 3, 4
where MOTHER TREE # = null or MOTHER TREE # = URBAN TREE RECORD NUMBER
Field width: 1 digit
Tolerance: No errors
MQO: At least 90% of the time
Values:
0 No, tree/Mother Tree unit is not in a maintained area
1 Yes, tree/Mother Tree unit is in a maintained area

5.30U. RIPARIAN RIVER / STREAM TREE [RIPA] Not Collected in Ground Truth

5.30N-GT GROUND TRUTH RIPARIAN TREE [RIPA]
Record the code to indicate whether the tree qualifies as a GROUND TRUTH RIPARIAN TREE. A GROUND TRUTH RIPARIAN TREE is a tree that is in close proximity to a naturally occurring or artificially created body of water or watercourse with continuous or intermittent flow. Riparian areas may be associated with but not limited to streams, rivers, lakes, sloughs, seeps, springs, marsh, bogs, beaver ponds, sink holes, cypress domes and ponds, man-made ditches and canals.

There isn't a limiting distance for how close or far a tree must be to a water source in order for a tree to qualify as a GROUND TRUTH RIPARIAN TREE. It either needs to be directly helping to protect the quality of a water source (e.g., providing shade or filtering runoff from the surrounding landscape) or benefiting directly from the presence of the water source (e.g., species that take root in periodically flooded soils).

When Collected: Tally trees ≥ 1.0 inch DBH/DRC
Field width: 1 digit
Tolerance: No tolerance
MQO: At least 90% of the time
Values:
0 No, tree is not a Ground Truth riparian tree
1 Yes, tree is a Ground Truth riparian tree

5.31UGT STREET TREE [STRT]
Record the code to indicate whether the tree qualifies as a STREET TREE. A STREET TREE is defined as a MAINTAINED AREA TREE, natural or planted, that is located within 8 ft. of the edge of a maintained surfaced road (as measured from the pith of the tree to the edge of the flat surface of the road). Trees located in the space between the edge of the road and the sidewalk, or within a median strip between roads regardless of its distance from the road are also defined as STREET TREES. In general, street trees provide shade, aesthetic values, or serve as a physical barrier between the street and adjacent property. These trees will generally have a visible, physical interaction with the street via its root system, overhanging branches, or proximity of the trunk. When unsure if a tree meets this definition code it as 0- No, this is not a street tree.

When trees have an associated Mother Tree, STREET TREE will be recorded only once for the Mother Tree unit, rather than for each stem. Base the measurement on the location of the bole of the single stump that supports the Mother Tree unit. This measurement will be recorded in the STREET TREE field of the Mother Tree.
When Collected: Tally Trees ≥1.0 inch DBH/DRC within URBAN CONDITION STATUS = 2, 3, 4 and MAINTAINED AREA TREE = 1 when MOTHER TREE # = null or MOTHER TREE # = URBAN TREE RECORD NUMBER

Field width: 1 digit
Tolerance: No tolerance
MQO: At least 90% of the time
Values:
0  No, tree/Mother Tree unit is not a street tree
1  Yes, tree/Mother Tree unit is a street tree

5.32UGT PLANTED TREE [PLTD]
Record the corresponding code to indicate whether the tree shows some evidence of being planted (include plantation trees). In some cases this may be very obvious upon initial observation. In other cases it may be hard to tell for sure, in such cases it may be helpful ask yourself the following questions:

- Does the landscaping around the tree give any clues to the trees origin?
- Is the tree of a species that is natural to the area or is it a common landscape species?
- How does the tree fit the overall landscape?
- Does the position of the tree within the overall landscape seem planned?
- Does it appear that the home, buildings, or landscape were built around the tree or does it appear that the tree was positioned based on the structures?
- Does the size or form of the tree fit the setting?

In some cases there may be no way to ascertain the trees origin, in which case use code 3 – Not Sure.

When trees have an associated Mother Tree, PLANTED TREE will be recorded only once for the Mother Tree unit, rather than for each stem. Base the measurement on the location of the bole of the single stump that supports the Mother Tree unit. This measurement will be recorded in the PLANTED TREE field of the Mother Tree.

When Collected: New or missed tally trees ≥ 1.0 inch DBH/DRC within URBAN CONDITION STATUS = 1, 2, 3, 4 when MOTHER TREE # = null or MOTHER TREE # = URBAN TREE RECORD NUMBER.

Field width: 1 digit
Tolerance: No errors
MQO: At least 70% of the time
Values:
1  Planted  Tree/Mother Tree unit appears to have been planted at some point in the past
2  Natural  Tree/Mother Tree unit appears to be of a natural origin
3  Not Sure Unable to confidently determine if the tree/Mother Tree unit was planted or not

5.34N FOREST TO NONFOREST VARIABLES Not Collected in Ground Truth
6.0 N-P2+ AND PA REGEN+GT TREE SEEDLING REGENERATION DATA

The tree seedling sample is designed to inventory and monitor the forest’s regenerative capacity. Tree seedling counts are used along with the sapling tally to estimate Tree Seedling Regeneration (Regeneration Indicator). Information for the Regeneration Indicator, specifically lengths, is required for estimating regeneration success. Regeneration Indicator data are used with estimates of competing vegetation derived from the P2 Vegetation Profile (manual Section 8.0); and data on the abundance and character of Invasive Plants life forms (manual Section 9.0). These three components form the basis for analysis of regeneration adequacy and hence, the ability of native forests to regenerate and an indication of the expected future forest composition.

NRS Note: NRS will complete Regeneration Indicator protocols during the window of May 1st through September 30th.

In 2012, Regeneration Indicator protocols will be completed on approximately 12.5% of the total field plots [including the historical Phase 3 (P3) plots] in the NRS Region. Beyond 2012, Regeneration Indicator protocols may be completed on up to approximately 12.5% of the total field plots [including the historical Phase 3 (P3) plots] in the NRS Region. Pennsylvania will collect up to approximately 25% of the total field plots as an exception.

Regeneration information is obtained by counting established live seedlings within the 6.8-foot radius microplot located 90 degrees and 12.0 feet from each subplot center within each of the four subplots. Conifer seedlings must be at least 6.0 inches in length and less than 1.0 inch at DBH/DRC in order to qualify for tallying. Hardwood and conifer seedlings must be at least 12.0 2.0 inches in length (with at least two normal-sized leaves that do not still bear cotyledons) and less than 1.0 inch at DBH/DRC in order to qualify for tallying. For woodland species, each stem on a single tree must be less than 1.0 inch in DRC. Seedlings are counted in groups by species and condition class SUBPLOT, SPECIES, CONDITION CLASS, SEEDLING SOURCE, AND LENGTH CLASS, up to five individuals per species. Counts beyond five may be estimated. Only count seedlings occurring within the microplots on GROUND TRUTH CONDITION CLASS STATUS 2, 3, 4 in accessible forest land CONDITION CLASSes.

NRS Note: A seedling is measured from the base to the tip of the terminal bud. If the minimum length requirement is met for either a hardwood or softwood, the seedling is tallied.

For a summary of seedling count criteria, see Figure 81N-P2+ and PA Regen Tree Seedling Regeneration seedling count flow chart.

6.1 SUBPLOT NUMBER

Use the same procedures described in Section 3.1.

When Collected: All counts of seedlings

6.2 U+GT URBAN / GROUND TRUTH SPECIES [UGT SPP]

Use the same procedures described in Section 5.8.

When Collected: All counts of seedlings

Field width: 4 digits
Tolerance: No errors for genus, no errors for species
MQO: At least 90% of the time for genus, at least 85% of the time for species
Values: See Appendix 3 N and Appendix 3B U+N

6.3 CONDITION CLASS NUMBER [CON#]

Use the same procedures described in Section 2.0.
When Collected: All counts of seedlings

6.4.1 U+GT URBAN / GROUND TRUTH SEEDLING COUNT [UGT SED#]

On each microplot, record the number of live tally tree seedlings, by species and condition class. Count up to five individuals by species: estimate the total count if there are more than five individuals of any given species in any given condition class. When seedlings are distributed evenly on a microplot, a suggested method of estimating is to count the number of seedlings on one quarter of the microplot and multiply by four (given that there is only one condition class on the microplot). Repeat for each species. Conifer seedlings must be at least 6.0 inches in length and less than 1.0 inch at DBH to qualify for counting. Hardwood seedlings must be at least 12.0 inches in length and less than 1.0 inch at DBH in order to qualify for counting. If water levels are excessive on the microplot the seedling tally is restricted to the seedlings visible above the water. For woodland species, each stem on a single tree must be less than 1.0 inch at DRC.

NRS (West) Note: This applies to Rocky Mountain juniper (0066) in the states of KS, NE, ND and SD.

Multiple "suckers" that originate from the same location, and stump sprouts are considered one seedling. Do not tally or count "layers" (undetached branches partially or completely covered by soil, usually at the base) as seedlings. Do not tally any seedlings that sprout from a live tally tree.

NRS Note: If snow amounts are excessive on the microplot, the seedling tally is restricted to seedlings visible above the snow. Do not excavate snow from the microplot to achieve a better measurement. This practice may compromise the integrity of the microplot by exposing seedlings and other vegetation to animal browsing; and by exposing seedlings to extreme temperatures that may lead to mortality.

When Collected: Each accessible forest land condition class on each microplot URBAN / GROUND TRUTH CONDITION CLASS STATUS: 2, 3, 4 when Advance Regeneration is not sampled on the subplot (REGENERATION MICROPLOT STATUS = 3)

Field width: 3 digits
Tolerance: No errors for 5 or less per species; +/- 20% over a count of 5
MQO: At least 90% of the time
Values: 001 through 999

6.4.1 UGT MAINTAINED AREA SEEDLING

Record this code to indicate if at least half of the seedling count for an individual species is located within a maintained area (seedling bole must be partially or fully contained within the maintained area to qualify). Maintained areas are defined as those which are consistently being impacted by mowing, weeding, brushing, herbiciding, landscaping, etc. Examples include, but are not limited to, lawns, maintained shrub beds, Rights-of-ways, and manicured park areas. Examples of unmaintained areas are overgrown lots, small wooded areas, and riverbanks, among others.
When Collected: All SEEDLING COUNTs within URBAN / GROUND TRUTH CONDITION STATUS 2, 3, 4

Field width: 1 digit
Tolerance: No errors
MQO: At least 90% of the time

Values:

0 No, < 50% of the seeding count for an individual species is in a maintained area
1 Yes, 50% or more of the seeding count for an individual species is in a maintained area

6.4.2 UGT PLANTED SEEDLING

Record the corresponding code to indicate if at least half of the seedling count for an individual species shows some evidence of being planted. In some cases this may be very obvious upon initial observation. In other cases it may be hard to tell for sure, in such cases it may be helpful ask yourself the following questions:

- Does the landscaping around the tree give any clues to the trees origin?
- Is the seedling species natural to the area or is it a common landscape species?
- How does the seedling fit the overall landscape?
- Does the position of the seedling within the overall landscape seem planted?

In some cases there may be no way to ascertain the seedling’s origin, in which case use code 3 – Not Sure.

When Collected: All SEEDLING COUNTs, URBAN / GROUND TRUTH CONDITION STATUS = 2, 3, 4

Field width: 1 digit
Tolerance: No errors
MQO: At least 70% of the time

Values:

1 Planted At least half of the seedling count for an individual species appear to have been planted at some point in the past
2 Natural At least half of the seedling count for an individual species appear to be of a natural origin
3 Not Sure Unable to confidently determine if at least half of the seedling count for an individual species was planted or are natural

6.4.3 N-P2+ and PA Regen+ GT REGENERATION SEEDLING COUNT [ARS#]

On each microplot, record the number of established live tally tree seedlings by SPECIES, CONDITION CLASS NUMBER, SEEDLING SOURCE, and LENGTH CLASS. The first five seedlings of each SUBPLOT—SPECIES—CONDITION CLASS—SEEDLING SOURCE—LENGTH CLASS combination must be counted precisely. Counts above five seedlings may be estimates if needed to save time for any given condition class. When seedlings are distributed evenly on a microplot, a suggested method of estimating is to count the number of seedlings on one quarter of the microplot and multiply by four (given that there is only one condition class on the microplot). Repeat for each SUBPLOT—SPECIES—CONDITION CLASS—SEEDLING SOURCE—LENGTH CLASS combination. Established hardwood and conifer seedlings must be at least 2.0 inches in length (with at least two normal-sized leaves that do not still bear cotyledons) and less than 1.0 inch at DBH in order to qualify for counting.

Small oak, hickory, walnut, and butternut seedlings (less than 12.0 inches in length) should be at least 6.0 inches in length or have a root-collar diameter (RCD) of at least 0.25 inches.
For a summary of seedling count criteria, see Figure 81N-P2+ and PA Regen-GT.
Figure 81N-P2+ and PA Regen-GT. Tree Seedling Regeneration seedling count flow chart.
For woodland species, each stem on a single tree must be less than 1.0 inch at DRC.

NRS (West) Note: This applies to Rocky Mountain juniper (0066) in the states of KS, NE, ND and SD.

Multiple “suckers” that originate from the same location, and stump sprouts are considered one seedling. Tally only the tallest sprout for each stump. Do not tally or count “layers” (undetached branches partially or completely covered by soil, usually at the base) as seedlings. Do not tally any seedlings that sprout from a live tally tree. Stumps must be at least 2 inches in diameter to qualify as having sprouts.

Accurate tally of all tree seedlings and saplings are required and must be completed during the leaf on window. The opening and closing of this window varies throughout the Region and from year to year, but in general begins as early as the first of May and closes as late as the end of September. The key quality assurance measure is whether the Regeneration Indicator can be repeated and remeasured over a cycle length (generally 5, 7 or 10 years).

When Collected: Each accessible nonforest land condition class (GROUND TRUTH CONDITION CLASS STATUS = 2, 3, 4) on each microplot when Advance Regeneration is sampled on the subplot (REGENERATION MICROPLOT STATUS = 1).

Field width: 3 digits
Tolerance: No errors for 5 or less per species SUBPLOT—SPECIES—CONDITION CLASS—SEEDLING SOURCE—LENGTH CLASS combination; +/- 20% over a count of 5
MQO: At least 90% of the time
Values: 001 through 999

6.4.4N-P2+ and PA Regen+GT SEEDLING SOURCE [SRCE]

Discriminate between stump sprouts and other seedlings.

A special code (3) is used for oak, hickory, walnut, and butternut that are classified as “competitive.” Research indicates that competitive seedlings are highly likely to become dominant or codominant stems in the next stand during forest succession. To be classified as competitive, stems must have a root collar diameter (RCD) > 0.75 inches or have a length of at least 3 feet. In situations with relatively high tally, it should only be necessary to check at least 10% of RCD's.

When Collected: All counts of seedlings when Advance Regeneration is sampled on the subplot (REGENERATION MICROPLOT STATUS = 1, 2, and 3).

Field width: 1 digit
Tolerance: none
MQO: At least 99% of the time
Values:
1 other seedling
2 stump sprout
3 Competitive oak, hickory, walnut, or butternut seedling

6.4.5N-P2+ and PA Regen+GT LENGTH CLASS [LNGC]

Each seedling is assigned a length class.
When Collected: All counts of seedlings when Advance Regeneration is sampled on the subplot (REGENERATION MICRO PLOT STATUS = 1, 2, and 3).

Field width: 1 digit
Tolerance: none
MQO: At least 99% of the time

Values:

1 2 inches to < 6 inches 4 3 feet to < 5 feet
2 6 inches to < 1 foot 5 5 feet to < 10 feet
3 1 foot to < 3 feet 6 Greater than or = 10 feet

Note: when using the data recorder the seedling source and the length class are combined in a table for ease of use.

6.5N-ME  SHRUB AND VINE DATA FOR THE MAINE INVENTORY  Not Collected in Ground Truth
8.0 P2+ AND PA REGEN-GT  PHASE 2 (P2) VEGETATION PROFILE (CORE OPTIONAL)

The Phase 2 (P2) Vegetation data are collected to describe vegetation structure and dominant species composition for vascular plants. The data collected provide a horizontal and vertical estimation of vegetation located within the sample area and provide information about the most abundant species found on the subplot. Information on the abundance, and structure, and species composition of understory plant communities has many uses. It can be used to assess wildlife habitat, biomass, forage availability, grazing potential, vegetation competition with tree growth, fuel loadings from understory vegetation, and potential site productivity. The most abundant species provide information to describe plant communities and to predict associated forest stand characteristics. Accurately representing the species present on a site and monitoring their change in abundance in response to forest development, disturbance, or management is therefore important to a wide variety of users. This information is also used to augment forest ecosystem health assessments from P3 plots, in terms of vegetation structure and rates of change of community vascular plant composition.

The P2 Vegetation protocols are core-optional. Each FIA unit determines whether to collect the P2 Vegetation information, and several levels of options must be determined by each unit prior to data collection. Options declared prior to field data collection include P2 VEGETATION SAMPLING STATUS and LEVEL OF DETAIL. P2 VEGETATION SAMPLING STATUS determines if P2 Vegetation is to be collected, and, if so, what lands are included; the unit may choose to collect only on accessible forested conditions or on all accessible conditions found on the plot. The LEVEL OF DETAIL determines if data are collected on structure by growth habit only; or if the most abundant species are also recorded; and whether tally tree species greater than or equal to 5 inches DBH (DRC for woodland species) are included in species records. FIA units collecting species data record information on (up to) the four most abundant species per SPECIES GROWTH HABIT per subplot. The four most abundant species must each have a total aerial canopy cover of at least 3 percent on the subplot and within the SPECIES GROWTH HABIT to be recorded. Most tally tree species greater than or equal to 5 inches DBH/DRC are already measured during tree tally, but some units may choose to also record visual estimates of canopy cover for them. Regardless of the LEVEL OF DETAIL, the protocols for the P2 Vegetation Profile will be implemented in such a way that basic structure and species data can be compared across the nation.

8.1 Vegetation Sampling Design

The core optional P2 Vegetation Profile includes measurements of Vegetation Structure (8.4) – canopy cover by layer and total aerial canopy cover of each growth habit – with additional options to collect Species Composition (8.5) data on the (up to) 4 most abundant species in each SPECIES GROWTH HABIT.

P2 Vegetation is sampled on accessible condition classes within the 24.0-foot radius subplot. Inventory units implementing the P2 Vegetation Profile determine if they will include accessible forestland conditions, or any accessible land conditions (P2 VEGETATION SAMPLING STATUS). If the area of an accessible condition class is less than 100 percent on a subplot, P2 Vegetation measurements are recorded only on the portion that is in the accessible condition class(es). If multiple accessible condition classes are present on the subplot, separate estimates are made for each accessible condition class on the subplot. Prior to implementation, inventory units must also determine the LEVEL of DETAIL they will collect, so that regional field guides and PDR programs can be customized to ensure quality data is collected in the most efficient manner possible. All units implementing the P2 Vegetation Profile will collect LEVEL OF DETAIL = 1, Vegetation Structure. LEVEL OF DETAIL = 2 and 3 are optional and include Species Composition data.

The P2 Vegetation Profile is best recorded when all plant species are fully leafed out. However, crews may end up visiting plots early in the season before leaves are fully expanded or late in the
season when plants are beginning to senesce. Notes can be added to subplot records indicating unusual phenological conditions. Crews should not collect P2 Vegetation data when snow covers the subplot (see 1.22.1 P2 VEG SUBPLOT SAMPLE STATUS).

NRS Note: NRS will complete P2 Vegetation protocols during the window of May 1st through September 30th.

8.2 General Definitions

Canopy Cover – Canopy cover is defined as the area of ground surface covered by a vertical projection of the canopy of a vascular plant. The canopy is described by a polygon surrounding the outer edges of the foliage (Figure 82), without subtracting any normal spaces occurring between the leaves of plants (Daubenmire 1959). Overlapping crowns are not double-counted (visualize the canopy cover collapsed into a 2-dimensional space); the maximum possible canopy cover is the percentage of the subplot area within the accessible condition.

All canopy cover estimates are focused on foliage within the sampled accessible condition class(es) within the subplot perimeter (24.0-foot radius, horizontal distance). Canopy cover is estimated for each sampled accessible condition of the subplot. If multiple sampled accessible conditions occur on a subplot, treat the condition boundary as a vertical wall on the plot: plant foliage is included in the condition it is hanging over, even if the plant is rooted in a different condition. However, the canopy cover value is always estimated as a percentage of an entire subplot. That is, if the canopy cover within the accessible condition is about equal to a circle with a radius of 5.3 feet, the canopy cover estimate will always be 5 percent, even if only 30 percent of the subplot is in the accessible condition on which the canopy cover is being measured.

Canopy cover is collected by height layer and as a total (aerial view) across all layers for each growth habit in Vegetation Structure (8.4). For each layer, examine the canopy cover of each Structure Growth Habit as if the other growth habits and other layers do not exist. If a Structure Growth Habit does not have foliage in a layer, enter 0 (do not count tree boles as cover). For total aerial canopy cover by Structure Growth Habit, examine each growth habit individually as if the other growth habits do not exist. Total aerial canopy cover is collected for each most abundant species in Species Composition (8.5); examine each species individually, as if the other species do not exist.

Canopy cover is estimated to the nearest 1 percent. For Vegetation Structure assessments, canopy cover >0 and <=1 percent is coded as 1 percent (i.e. trace amounts are coded as 1%). For Species Composition assessments, a species must have at least 3 percent total aerial canopy cover (i.e. do not round total aerial canopy cover <3% up to 3%).

Canopy cover is vertically projected from the outline of the foliage at the time of plot visit (do not try to estimate future or past cover). All foliage that is or was alive during the current growing season is included in the cover estimates. Canopy cover from broken tops and stems is included, unless completely detached. Do not ocularly upright leaning trees.

See tabulation below for canopy cover to area relationships for a 1/24 acre subplot and Figure 82 for additional visual calibrations.

---

Table 4-P2+. canopy cover to area relationships for a 1/24 acre subplot.

<table>
<thead>
<tr>
<th>Cover</th>
<th>Area (ft2)</th>
<th>Square length on side (ft)</th>
<th>Circle radius (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1%</td>
<td>18</td>
<td>4.3</td>
<td>2.4</td>
</tr>
<tr>
<td>3%</td>
<td>54</td>
<td>7.4</td>
<td>4.2</td>
</tr>
<tr>
<td>5%</td>
<td>90</td>
<td>9.5</td>
<td>5.4</td>
</tr>
<tr>
<td>10%</td>
<td>181</td>
<td>13.4</td>
<td>7.6</td>
</tr>
<tr>
<td>15%</td>
<td>271</td>
<td>16.5</td>
<td>9.3</td>
</tr>
<tr>
<td>20%</td>
<td>362</td>
<td>19.0</td>
<td>10.7</td>
</tr>
<tr>
<td>25%</td>
<td>452</td>
<td>21.3</td>
<td>12.0</td>
</tr>
<tr>
<td>50%</td>
<td>905</td>
<td>30.1</td>
<td>17.0</td>
</tr>
</tbody>
</table>

Table 4-P2+. canopy cover to area relationships for a 1/24 acre subplot.

Figure 82-P2+. Assessing canopy cover.

Growth Habits – P2 Vegetation data are collected by growth habits at each LEVEL OF DETAIL. In general, growth habits for vascular plants include trees, shrubs/subshrubs/woody vines, forbs, ferns and graminoids.

However, depending on the LEVEL OF DETAIL, trees are grouped in different ways. Vegetation Structure (8.4) tree Structure Growth Habits are determined by regional core/core-optional tree species lists; Species Composition (8.5) tree SPECIES GROWTH HABITs are determined by DBH/DRC. See sections 8.4 and 8.5 for more detail.

Layer Codes – Structure Growth Habits are assessed by layers in Vegetation Structure (8.4), and one of the following layer codes will be assigned to individual plant species’ SPECIES GROWTH HABITs in Species Composition (8.5). Measure the layer height from ground level; or, in the case of emergent and floating aquatic [rooted or drifting plants that float on the water surface (e.g., duckweed, water-lily) vegetation, measure the layer height from the level of the water; see Figure 83.
Figure 83-N-P2+. To determine the layer of a plant, measure the height of the layer from the ground; or, in the case of emergent and floating aquatic [rooted or drifting plants that float on the water surface (e.g., duckweed, water-lily)] vegetation, measure the height of the layer from the level of the water.

NRCS PLANTS database – The Natural Resource Conservation Service (NRCS) PLANTS Database provides standardized information about the vascular plants, mosses, liverworts, hornworts, and lichens of the U.S. and its territories. It includes names, plant symbols, checklists,
distributional data, species abstracts, characteristics (including growth habits), images, crop information, automated tools, onward Web links, and references:


FIA currently uses a stable code set downloaded in January of 2010.

**Figure 84-P2+. Example of growth habit by layer and species composition.**

<table>
<thead>
<tr>
<th>Vegetation Structure Growth Habit</th>
<th>Layer 1 (0-2.0 ft)</th>
<th>Layer 2 (2.1-6.0 ft)</th>
<th>Layer 3 (6.1-16.0 ft)</th>
<th>Layer 4 (&gt;16.0 ft)</th>
<th>Aerial</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percent canopy cover</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tally tree sp (TT)</td>
<td>005</td>
<td>013</td>
<td>019</td>
<td>008</td>
<td>022</td>
</tr>
<tr>
<td>Non-tally tree sp (NT)</td>
<td>000</td>
<td>000</td>
<td>000</td>
<td>000</td>
<td>000</td>
</tr>
<tr>
<td>Shrub/Subshrub/Woody Vine (SH)</td>
<td>000</td>
<td>000</td>
<td>000</td>
<td>000</td>
<td>000</td>
</tr>
<tr>
<td>Forb (FB)</td>
<td>002</td>
<td>000</td>
<td>000</td>
<td>000</td>
<td>002</td>
</tr>
<tr>
<td>Fern (FN)</td>
<td>000</td>
<td>000</td>
<td>000</td>
<td>000</td>
<td>000</td>
</tr>
<tr>
<td>Graminoid (GR)</td>
<td>003</td>
<td>000</td>
<td>000</td>
<td>000</td>
<td>003</td>
</tr>
</tbody>
</table>

Table 5+P2+. Estimation of canopy cover by layer and aerial view of each Structure Growth Habit in Figure 84-P2+. 
Table 6. Estimation of total aerial canopy cover by species in figure Figure 84.

Note: FRVI, estimated at 2%, was not recorded, and ABCO and POTR5 are present as two different SPECIES GROWTH HABITs (seedling/sapling and large tree) with at least 3% total aerial canopy cover within the SPECIES GROWTH HABIT on the subplot.

8.3 Vegetation Data Collection Location – Subplot-Level Variables

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

When collected: On all subplots where P2 Vegetation is being sampled (P2 VEGETATION SAMPLING STATUS = 1 or 2)
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values:
1. Center subplot
2. North subplot
3. Southeast subplot
4. Southwest subplot

8.3.2 CONDITION CLASS NUMBER
Record the number for the sampled accessible condition class in which the vegetation is found. If multiple sampled accessible conditions occur on the same subplot, data will be collected for each accessible condition separately.

When collected: Any accessible measured land condition (CONDITION CLASS STATUS = 1 or NONFOREST CONDITION CLASS STATUS = 2) when P2 vegetation is being sampled on the subplot (P2 VEG SUBPLOT SAMPLE STATUS =1)
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values: 1 to 9

8.4 Vegetation Structure
In this section, use ocular methods to estimate canopy cover by layer and aerial view cover for each Structure Growth Habit, and record to the nearest percent (canopy cover >0 and <1% is coded as 1%; i.e., trace amounts are coded as 1%).

Canopy cover by layer: Estimate the canopy cover in each Structure Growth Habit for each of the four layers. Include Structure Growth Habits with foliage present on the accessible condition and with foliage overhanging the accessible condition. For each layer canopy cover, examine the canopy cover of each Structure Growth Habit as if the other growth habits and other layers do not exist. Do not double-count overlapping crowns within a Structure Growth Habit; visualize the
canopy cover within the layer collapsed into a 2-dimensional space. If a Structure Growth Habit does not have foliage in a layer, enter 0 (do not count tree boles as cover).

Aerial View Coverage: Determine the total aerial canopy cover by Structure Growth Habit. Examine each Structure Growth Habit individually as if the other growth habits do not exist. Do not double-count overlapping crowns within a Structure Growth Habit (maximum cover = the percentage of the subplot area in the accessible condition).

The total aerial canopy cover for a Structure Growth Habit must be equal to or greater than the highest canopy cover recorded for an individual layer in that growth habit, but cannot be greater than the sum of the canopy covers recorded for all the layers in that growth habit.

Vegetation Structure Growth Habits: Apply the definitions that follow based on the species and appearance of the plants on the subplot-condition (i.e., do not put the same species in multiple Structure Growth Habits on the same subplot-condition). If a tree species has been selected as a tally tree species by the particular FIA unit, always record that species in the tally tree species growth habit (TT), even if it grows as a shrub in some environments. Woody plants not on the unit’s tally tree species list may have a tree growth habit in some environments, and these should be recorded as non-tally tree species (NT). If the growth habit is shrub in another environment, record that species as a shrub (SH). NRS Note: If a species is to be coded as a Non-tally Tree Species, there must be a specimen that is at least 13 feet in length, with a single well-defined, dominant main stem, on the respective subplot-condition combination that is being evaluated. Once it is determined a 13 foot specimen with a single well-defined, dominant main stem exists on the subplot-condition combination, all individuals of that species on the subplot-condition combination are recorded in the Non-tally Tree Species (NT) Vegetation Structure Growth Habit, even if they resemble a shrub like form. If a 13 foot specimen with a single well-defined, dominant main stem is not present on the subplot-condition combination, all individuals of that species on the subplot-condition combination are recorded in the Shrubs/Subshrubs/Woody Vines (SH) Vegetation Structure Growth Habit. The definitions (adapted from NRCS PLANTS) are:
TT  Tally Tree Species (TT): All core tree species and any core optional tree species selected by a particular FIA unit. Any plant of that species is included, regardless of its shape and regardless of whether it was tallied on the subplot or microplot during tree tally. Seedlings (any length, no minimum), saplings, and mature plants are included.

NT  Non-tally Tree Species (NT): Tree species not on a particular FIA unit's tree tally list that are woody plants with a single well-defined, dominant main stem, not supported by other vegetation or structures (not vines), and which are, or are expected to become, greater than 13 feet in height. Seedlings (any length, no minimum), saplings, and mature plants are included.

SH  Shrubs/Subshrubs/Woody Vines (SH): Woody, multiple-stemmed plants of any size, subshrubs (low-growing shrubs under 1.5 feet tall at maturity), and woody vines. Most cacti are included in this category.

FB  Forbs (FB): Herbaceous, broad-leaved plants; includes non-woody-vines, ferns, and emergent and floating aquatic [rooted or drifting plants that float on the water surface (e.g., duckweed, water-lily)] vegetation (does not include submerged aquatic vegetation, mosses and cryptobiotic crusts).

FN  Fern (FN): ferns [include ferns in Forb (FB) assessments; include only ferns (exclude other forbs) in Fern (FN) assessments]

GR  Graminoids (GR): Grasses and grass-like plants (includes rushes and sedges).

8.4.1 GT  TALLY TREE SPECIES COVER LAYER 1
Record canopy cover for all tally tree species in layer 1 (0-2.0 feet) to the nearest percent. Canopy cover includes all tally tree species present, regardless of DBH or DRC.

When Collected: Any accessible measured land condition (GROUND TRUTH CONDITION CLASS STATUS = 1, 2, 3, or 4 or NONFOREST CONDITION CLASS STATUS = 2) when P2 vegetation is being sampled on the subplot (P2 VEG SUBPLOT SAMPLE STATUS = 1)

Field Width: 3 digits
Tolerance: +/- 1 class based on the following canopy cover classes: 1%, 2-5%, 6-10%, 11-25%, 26-50%, 51-75%, 76-95%, 96-100%

MQO: at least 90% of the time
Values: 000-100

8.4.2 TALLY TREE SPECIES COVER LAYER 2
Record canopy cover for all tally tree species in layer 2 (2.1-6.0 feet) to the nearest percent. Canopy cover includes all tally tree species present, regardless of DBH or DRC. Follow the same procedures as for TALLY TREE SPECIES COVER LAYER 1.

8.4.3 TALLY TREE SPECIES COVER LAYER 3
Record canopy cover for all tally tree species in layer 3 (6.1-16.0 feet) to the nearest percent. Canopy cover includes all tally tree species present, regardless of DBH or DRC. Follow the same procedures as for TALLY TREE SPECIES COVER LAYER 1.

8.4.4 TALLY TREE SPECIES COVER LAYER 4
Record canopy cover for all tally tree species in layer 4 (16.1 feet and above) to the nearest percent. Canopy cover includes all tally tree species present, regardless of DBH or DRC. Follow the same procedures as for TALLY TREE SPECIES COVER LAYER 1.
8.5.5 **TALLY TREE SPECIES COVER – AERIAL VIEW**
Record the total aerial canopy cover for all tally tree species over all layers. Canopy cover includes all tally tree species present, regardless of DBH or DRC. Follow the same procedures as for TALLY TREE SPECIES COVER LAYER 1, but include all layers.

8.4.6 **+GT NON-TALLY TREE SPECIES COVER LAYER 1**
Record canopy cover for species not on the tally tree species list with tree growth habit in layer 1 (0-2.0 feet) to the nearest percent. Canopy cover includes all non-tally tree species present, regardless of DBH or DRC.

When Collected: Any accessible measured land condition (GROUND TRUTH CONDITION CLASS STATUS = 1, 2, 3, or 4 or NONFOREST CONDITION CLASS STATUS = 2) when P2 vegetation is being sampled on the subplot (P2 VEG SUBPLOT SAMPLE STATUS = 1)

Field Width: 3 digits
Tolerance: +/- 1 class based on the following canopy cover classes: 1%, 2-5%, 6-10%, 11-25%, 26-50%, 51-75%, 76-95%, 96-100%
MQO: at least 90% of the time
Values: 000-100

8.4.7 **NON-TALLY TREE SPECIES COVER LAYER 2**
Record canopy cover for species not on the tally tree species list with tree growth form in layer 2 (2.1-6.0 feet) to the nearest percent. Canopy cover includes all non-tally tree species present, regardless of DBH or DRC. Follow the same procedures as for NON-TALLY TREE SPECIES COVER LAYER 1.

8.4.8 **NON-TALLY TREE SPECIES COVER LAYER 3**
Record canopy cover for species not on the tally tree species list with tree growth form in layer 3 (6.1-16.0 feet) to the nearest percent. Canopy cover includes all non-tally tree species present, regardless of DBH or DRC. Follow the same procedures as for NON-TALLY TREE SPECIES COVER LAYER 1.

8.4.9 **NON-TALLY TREE SPECIES COVER LAYER 4**
Record canopy cover for species not on the tally tree species list with tree growth habit in layer 4 (16.1 feet and above) to the nearest percent. Canopy cover includes all non-tally tree species present, regardless of DBH or DRC. Follow the same procedures as for NON-TALLY TREE SPECIES COVER LAYER 1.

8.4.10 **NON-TALLY TREE SPECIES COVER – AERIAL VIEW**
Record the total aerial canopy cover for species not on the tally tree species list with tree growth habit over all layers. Canopy cover includes all non-tally tree species present, regardless of DBH or DRC. Follow the same procedures as for NON-TALLY TREE SPECIES COVER LAYER 1, but include all layers.

8.4.11 **+GT SHRUB, SUBSHRUB, AND WOODY VINE COVER LAYER 1**
Record canopy cover for shrubs/subshrubs/woody vines in layer 1 (0-2.0 feet) to the nearest percent.
When collected: Any accessible measured land condition (GROUND TRUTH CONDITION CLASS STATUS = 1, 2, 3, or 4 or NONFOREST CONDITION CLASS STATUS = 2) when P2 vegetation is being sampled on the subplot (P2 VEG SUBPLOT SAMPLE STATUS = 1)

Field width: 3 digits
Tolerance: +/- 1 class based on the following canopy cover classes: 1%, 2-5%, 6-10%, 11-25%, 26-50%, 51-75%, 76-95%, 96-100%

MQO: at least 90% of the time
Values: 000-100

8.4.12 SHRUB, SUBSHRUB, AND WOODY VINE COVER LAYER 2
Record canopy cover for shrubs/subshrubs/woody vines in layer 2 (2.1-6.0 feet) to the nearest percent. Follow the same procedures as for SHRUB, SUBSHRUB, AND WOODY VINE COVER LAYER 1.

8.4.13 SHRUB, SUBSHRUB, AND WOODY VINE COVER LAYER 3
Record canopy cover for shrubs/subshrubs/woody vines in layer 3 (6.1-16.0 feet) to the nearest percent. Follow the same procedures as for SHRUB, SUBSHRUB, AND WOODY VINE COVER LAYER 1.

8.4.14 SHRUB, SUBSHRUB, AND WOODY VINE COVER LAYER 4
Record canopy cover for shrubs/subshrubs/woody vines in layer 4 (16.1 feet and above) to the nearest percent. Follow the same procedures as for SHRUB, SUBSHRUB, AND WOODY VINE COVER LAYER 1.

8.4.15 SHRUB, SUBSHRUB, AND WOODY VINE COVER—AERIAL VIEW
Record the total aerial canopy cover for the shrub/subshrub/woody vine growth habit over all layers. Follow the same procedures as for SHRUB, SUBSHRUB, AND WOODY VINE COVER LAYER 1, but include all layers.

8.4.16.1GT FORB COVER LAYER 1
Record canopy cover for forbs in layer 1 (0-2.0 feet) to the nearest percent.

When collected: Any accessible measured land condition (GROUND TRUTH CONDITION CLASS STATUS = 1, 2, 3, or 4 or NONFOREST CONDITION CLASS STATUS = 2) when P2 vegetation is being sampled on the subplot (P2 VEG SUBPLOT SAMPLE STATUS = 1)

Field width: 3 digits
Tolerance: +/- 1 class based on the following canopy cover classes: 1%, 2-5%, 6-10%, 11-25%, 26-50%, 51-75%, 76-95%, 96-100%

MQO: at least 90% of the time
Values: 000-100

8.4.16.1N FERN COVER LAYER 1
Record a total canopy coverage for ferns in layer 1 (0-2.0 feet) to the nearest percent.

Include ferns in Forb (FB) assessments; include only ferns (exclude other forbs) in Fern (FN) assessments.
When collected: Any accessible measured land condition (CONDITION CLASS STATUS = 1 or NONFOREST CONDITION CLASS STATUS = 2) when P2 vegetation is being sampled on the subplot (P2 VEG SUBPLOT SAMPLE STATUS = 1)

Field width: 3 digits
Tolerance: +/- 1 class based on the following canopy cover classes: 1%, 2-5%, 6-10%, 11-25%, 26-50%, 51-75%, 76-95%, 96-100%
MQO: at least 90% of the time
Values: 000-100

8.4.17 FORB COVER LAYER 2
Record canopy cover for forbs in layer 2 (2.1-6.0 feet) to the nearest percent. Follow the same procedures as for FORB COVER LAYER 1.

8.4.17.1N FERN COVER LAYER 2
Record a total canopy coverage for ferns in layer 2 (2.1-6.0 feet) to the nearest percent. Follow the same procedures as for FERN COVER LAYER 1.

8.4.18 FORB COVER LAYER 3
Record canopy cover for forbs in layer 3 (6.1-16.0 feet) to the nearest percent. Follow the same procedures as for FORB COVER LAYER 1.

8.4.18.1N FERN COVER LAYER 3
Record a total canopy coverage for ferns in layer 3 (6.1-16.0 feet) to the nearest percent. Follow the same procedures as for FERN COVER LAYER 1.

8.4.19 FORB COVER LAYER 4
Record canopy cover for forbs in layer 4 (16.1 feet and above) to the nearest percent. Follow the same procedures as for FORB COVER LAYER 1.

8.4.19.1N FERN COVER LAYER 4
Record a total canopy coverage for ferns in layer 4 (16.1 feet and above) to the nearest percent. Follow the same procedures as for FERN COVER LAYER 1.

8.4.20 FORB COVER—AERIAL VIEW
Record the total aerial canopy cover for the forb growth habit over all layers. Follow the same procedures as for FORB COVER LAYER 1, but include all layers.

8.4.20.1N FERN COVER—AERIAL VIEW
Record the total canopy cover for the fern growth habit over all layers. Follow the same procedures as for FERN COVER LAYER 1, but include all layers.

8.4.21+GT GRAMINOID COVER LAYER 1
Record canopy cover for graminoids in layer 1 (0-2.0 feet) to the nearest percent.
When collected: Any accessible measured land condition (GROUND TRUTH CONDITION CLASS STATUS = 1, 2, 3, or 4 or NONFOREST CONDITION CLASS STATUS = 2) when P2 vegetation is being sampled on the subplot (P2 VEG SUBPLOT SAMPLE STATUS = 1)

Field width: 3 digits
Tolerance: +/- 1 class based on the following canopy cover classes: 1%, 2-5%, 6-10%, 11-25%, 26-50%, 51-75%, 76-95%, 96-100%

MQO: at least 90% of the time
Values: 000-100

8.4.22 GRAMINOID COVER LAYER 2
Record canopy cover for graminoids in layer 2 (2.1-6.0 feet) to the nearest percent. Follow the same procedures as for GRAMINOID COVER LAYER 1.

8.4.23 GRAMINOID COVER LAYER 3
Record canopy cover for graminoids in layer 3 (6.1-16.0 feet) to the nearest percent. Follow the same procedures as for GRAMINOID COVER LAYER 1.

8.4.24 GRAMINOID COVER LAYER 4
Record canopy cover for graminoids in layer 4 (16.1 feet and above) to the nearest percent. Follow the same procedures as for GRAMINOID COVER LAYER 1.

8.4.25 GRAMINOID COVER—AERIAL VIEW
Record the total aerial canopy cover for the graminoid growth habit over all layers. Follow the same procedures as for GRAMINOID COVER LAYER 1, but include all layers.

8.5 Species Composition Not Collected in NRS
9.0+NU+GT-P2+ AND PA REGEN INVASIVE PLANTS

The objectives of the Phase 2 (P2) Urban/Ground Truth invasive plants protocol are to document abundance and monitor changes in abundance of selected species over time. Combined with other plot data and other datasets, these data can be used to predict the future spread of selected species. Invasive plant species are having tremendous economic and ecological impacts on our nation's forests, and the impacts are increasing over time. Providing accurate, statistically valid estimates of the distribution and abundance of some of the most damaging species will give managers and policy-makers a better understanding of the problem than they would otherwise have.

Each FIA unit, in collaboration with vegetation experts, has developed lists of the most important invasive species to monitor on forested lands. Depending on local needs or forest conditions, there may be different lists of species for individual states or portions of states. Changes to the species on these lists are managed by the individual FIA units using local change procedures. However, when an FIA unit samples invasive species, they will use the field protocols contained in this chapter.

Data will be collected by crew members who have been trained and certified in the Invasive plants protocol methods. These crew members are expected to have field guides that allow for unambiguous identification of the plant species on the list they are to use, and certification in field identification and cover estimation of those species under different conditions.

Note: Avoid becoming part of the problem! There is a risk that field crews walking into plot locations could pick up seeds along roadsides or other patches of invasive plants and spread them through the forest and on to the plot. Be aware of the vegetation you are traveling through and consider stopping and removing seeds from boots and clothing before entering uninvaded lands, particularly remote areas that are rarely visited.

NRS Note: Do not divulge pest, disease or invasive species information on public or private property. See Section 0.2 of the field guide for more information.

9.1+NU+GT Invasive Species Sample Design

Phase 2 Urban/Ground Truth sampling of invasive species is most often focused on GROUND TRUTH CONDITION CLASS STATUS of 2, 3, 4 within the 24.0-foot radius subplot. If the total area of all accessible nonforest land condition classes is less than 100 percent on a subplot, invasive species measurements are done only on the portion that is in accessible forest land condition classes. If multiple accessible nonforested condition classes are present on the subplot, separate estimates are made for each condition class on the subplot. Canopy cover estimates are only made for the area within accessible forest condition(s)—for example, vegetation cover over-hanging a nonforest road condition is not included in the estimate.

NRS Note: Nonforest inventories are not conducted in our region, i.e. NONFOREST SAMPLING STATUS = 1.

However, each FIA unit has the option to also sample invasive species on accessible nonforest land conditions (condition status 2), where desired or funded by specific landowners (e.g., on some National Forests in the West). Where this is done, estimates of invasive species abundance are maintained separately on forest and nonforest conditions.

Canopy cover is estimated for any listed invasive species (Appendix 9+N) present on the measured condition(s) of a subplot, regardless of abundance (i.e., there is not minimum cover threshold for sampling). When crews are not sure about the identification of a plant that might be a listed invasive, they are encouraged to collect specimens for later identification (Appendix
Rules and expectations for plant collection and identification are specified by individual FIA units.

NRS Note: NRS will complete P2 Invasive Plants (NRS manual section 9.0) protocols during the window of May 1st through September 30th.

9.2 GT Species Records
The invasive plant recorder does a search of each measured condition on the subplot. Only listed species rooted in or overhanging (and rooted out of) this condition are included. For tree species, there are no minimum (or maximum) length limits as are required for seedling counts. All foliage that is or was alive during the current growing season is included in the cover estimates (e.g., brown Canada thistle in late summer is counted, live buds on Russian olive in late fall are used to estimate canopy cover).

Total cover is estimated on measured conditions on each 24.0 foot radius subplot for every species on the invasive plant list found. If multiple conditions are being sampled on the same subplot, separate cover estimates for every species must be made.

9.3 GT SUBPLOT NUMBER
Record the code corresponding to the number of the subplot.

When collected: On all subplots where INVASIVE PLANT SAMPLING STATUS = 1 or 2
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values:
1 Center subplot
2 North subplot
3 Southeast subplot
4 Southwest subplot

9.4 GT CONDITION CLASS NUMBER [CON#]
Record the number for the measured condition class in which the invasive plant(s) is found. If multiple measured conditions occur on the same subplot, data will be collected for each condition separately.

When collected: Any accessible measured land condition within subplots (URBAN / GROUND TRUTH CONDITION CLASS STATUS = 2) when invasive plants are being sampled on the subplot (INVASIVE PLANT SUBPLOT SAMPLE STATUS = 1 or 2)
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values: 1-9

9.5 GT SPECIES CODE [ISPP]
Record the code for any species listed in your region’s invasive plant species list (Appendix 9+N) that is found rooted in or overhanging (and rooted out of) the measured condition within the subplot. Species codes must be the standardized codes in the Natural Resource Conservation Service (NRCS) PLANTS database January 2010 version maintained by the FIA IM group (USDA, NRCS. 2010. The PLANTS database [http://plants.usda.gov/plants]. National Plant Data Center, Baton Rouge, LA 70874-4490).
In many of the invasive plant ID guides used by FIA units, some species are grouped together in the ID descriptions, and it may be difficult to distinguish between them with the information provided. In addition, some plants may be hybrids of listed species. Enter the code for the most likely species in the group, or the first one in the group if you are not sure.

If a species is suspected of being a listed invasive but cannot be identified quickly and confidently, and the FIA unit’s protocols require specimen collection, assign a NRCS PLANTS unknown code. A subset of acceptable unknown codes that can be used is listed below. Collect a specimen unless the species is locally sparse. A species is “locally sparse” if five or fewer plants are present in the entire plot (4 subplots) and immediate surrounding area.

<table>
<thead>
<tr>
<th>Unknown Code</th>
<th>Common Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>2FERN</td>
<td>Fern or Fern Ally</td>
</tr>
<tr>
<td>2FORB</td>
<td>Forb (herbaceous, not grass nor grasslike)</td>
</tr>
<tr>
<td>2GRAM</td>
<td>Graminoid (grass or grasslike)</td>
</tr>
<tr>
<td>2PLANT</td>
<td>Plant</td>
</tr>
<tr>
<td>2SHRUB</td>
<td>Shrub (&gt;0.5m)</td>
</tr>
<tr>
<td>2SUBS</td>
<td>Subshrub (&lt;0.5m)</td>
</tr>
<tr>
<td>2TREE</td>
<td>Tree</td>
</tr>
<tr>
<td>2VH</td>
<td>Vine, herbaceous</td>
</tr>
<tr>
<td>2VW</td>
<td>Vine, woody</td>
</tr>
</tbody>
</table>

When collected: Any accessible measured land condition within subplots (URBAN / GROUND TRUTH CONDITION CLASS STATUS = 2) when invasive plants are being sampled on the subplot (INVASIVE PLANT SUBPLOT SAMPLE STATUS = 1 or 2)

Field width: 8 alpha-numeric characters
Tolerance: No errors
MQO: At least 99% of the time
Values: Accepted NRCS species code from the appropriate list for the unit when the species is known, or a NRCS unknown code when the species is not known.

9.5.1N Unknown Plants and Voucher Specimen Collection

Collection of a plant specimen is required if:

1. You cannot quickly and confidently ID a plant that you think is on our invasive plants list.
2. You find one of the invasive plants on our list, but it has not been found in the State in which the plot is located. Use the field ID guide, A Guide to Nonnative Invasive Plants Inventoried in the North by Forest Inventory and Analysis, by Cassandra Olson and Anita F. Cholewa, to determine which states the invasive has not been recorded. The distribution maps in these guides are from the NRCS Plants Database.

Follow these Basic Steps:

1. Assign a valid NRCS PLANTS genus (listed in Appendix 9+N) or unknown code (listed in 9.5) and assign a unique species number (see 9.6)
2. Record if a specimen was collected or not in INVASIVE SPECIMEN COLLECTED (see 9.6)
3. When a specimen is collected, enter a SPECIMEN LABEL NUMBER (see 9.8). Place the pre-printed label with the corresponding label number in the bag with the specimen.
4. If no specimen is collected, record in INVASIVE PLANT NOTES why (see 9.10).
5. Describe the unknown species in INVASIVE PLANT NOTES (see 9.10).
6. Record the canopy cover estimates for the sample units where the plant was encountered, as for any identified species.

SPECIAL SAFETY NOTE FOR NRS: Please do not collect known hazardous plants, such as Ailanthus altissima or Heracleum mantegazzianum (Giant hogweed). These plants are known to cause blisters and/or rashes.

9.6 UNIQUE SPECIES NUMBER [UNQ#]
When any species code is entered for the first time on a plot, the UNIQUE SPECIES NUMBER assigned is "1". If more than one unidentified species is recorded that is described by the same unknown code, the next sequential number is assigned. If a previously-recorded unidentified species is encountered again elsewhere on the plot, the UNIQUE SPECIES NUMBER that corresponds to the earlier encountered specimen must be entered. For example, an unknown thistle and unknown hawkweed would both be given a species code of “2FORB” but would need to be given different UNIQUE SPECIES NUMBERs when measured.

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

9.7 +N-GT SPECIES CANOPY COVER [Cx%]
A rapid canopy cover estimate, to the nearest percent cover, is made for each species for all foliage across all layer heights. Canopy cover is based on a vertically-projected polygon described by the outline of the foliage, ignoring (i.e. without subtracting) any normal spaces occurring between the leaves of plants (Daubenmire 1959), and ignoring overlap among multiple layers of a species [i.e. overlapping crowns are not double-counted (visualize the canopy cover collapsed into a 2-dimensional space)]. For each species, cover can never exceed 100 percent; the maximum possible canopy cover is the percentage of the subplot area within the accessible forested condition. Cover is estimated for each measured condition on the subplot separately. However, the foliage cover is always estimated as a percent of an entire subplot. For example, on a subplot with two sampled conditions, a species occurs with a cover equal to a circle with a radius of 7.6 feet on the full subplot, or 10 percent cover. On condition class #1 it covers an area equal to a circle of 2.4 feet radius and is recorded as 1 percent cover. The remainder, 9 percent cover, is recorded for condition #2. If the species is only present on condition class #1 with an area equal to a circle of 2.4 - feet radius it is recorded as 1 percent. The proportion of the subplot in each condition does not matter.

NRS Note: The SPECIES CANOPY COVER percent cannot exceed the percent area represented for the forested condition

If cover is greater than 0 but less than 1.5 percent, record as 1 percent cover. 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. The following area-cover sizes may be useful in developing estimates for an entirely forested subplot:
Subplot radius = 24.0 feet, Subplot area = 1809 ft2

<table>
<thead>
<tr>
<th>Cover</th>
<th>Area (ft²)</th>
<th>Length of a side of a square(ft)</th>
<th>Radius of circular area(ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1%</td>
<td>18</td>
<td>4.3</td>
<td>2.4</td>
</tr>
<tr>
<td>3%</td>
<td>54</td>
<td>7.4</td>
<td>4.1</td>
</tr>
<tr>
<td>5%</td>
<td>90</td>
<td>9.5</td>
<td>4.1</td>
</tr>
<tr>
<td>10%</td>
<td>181</td>
<td>13.4</td>
<td>7.6</td>
</tr>
<tr>
<td>20%</td>
<td>362</td>
<td>19</td>
<td>10.7</td>
</tr>
</tbody>
</table>

Table 7-P2+. Area-cover sizes useful in developing estimates for an entirely forested subplot.

When collected: All species records
Field width: 3 digits
Tolerance: +/- 1 class based on the following canopy cover classes: 1%, 2-5%, 6-10%, 11-25%,
26-50%, 51-75%, 76-95%, 96-100%
MQO: At least 90% of the time
Values: 001 to 100

9.7.1 UGT MAINTAINED AREA SPECIES

Record the code to indicate if at least half (estimated for each measured condition on the subplot separately) of the SPECIES CANOPY COVER is located within a maintained area. Maintained areas are defined as those which are consistently being impacted by mowing, weeding, brushing, herbiciding, landscaping, etc. Examples include, but are not limited to, lawns, maintained shrub beds, Rights-of-ways, and manicured park areas. Examples of unmaintained areas are overgrown lots, small wooded areas, and riverbanks, among others.

When Collected: All SPECIES CODES with SPECIES CANOPY COVER > 0 within URBAN / GROUND TRUTH CONDITION STATUS 2, 3, 4
Field width: 1 digit
Tolerance: No errors
MQO: at least 90% of the time
Values:
0 No, species is not in a maintained area
1 Yes, species is in a maintained area

9.8 INVASIVE SPECIMEN COLLECTED [VOUC]

Record a code to indicate whether or not a specimen was collected for each species genus or unknown code entered as a new unique species. If the record is an unknown code, your unit requires specimen collection, and a plant specimen is not collected, describe the reason it was not collected in 9.10, INVASIVE PLANT NOTES.

When collected: All species records when INVASIVE PLANT SPECIMEN COLLECTION RULE = 1
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values:
0 No, a specimen was not officially collected
1 Yes, a specimen was officially collected

9.9+N SPECIMEN LABEL NUMBER [LABL]

Record the label number for the collected specimen. Where plant specimen collection is required, numbered labels are provided to each crew.
When collected: Where INVASIVE SPECIMEN COLLECTED=1
Field width: 5 digits
Tolerance: No errors
MQO: At least 99% of the time
Values: 1 to 99999, as pre-printed and assigned by FIA unit.

NRS PDR Note: MIDAS will auto populate the SPECIMEN LABEL NUMBER with a unique code, when INVASIVE SPECIMEN COLLECTED = 1.

9.9.1N Field Specimen Label
Revised data collection software auto-generates a SPECIMEN LABEL NUMBER when a specimen is collected. Write out the generated SPECIMEN LABEL NUMBER on a small piece of paper and include it in the bag with the specimen.

9.9.2N Official Specimen Label
Official specimen labels are printed from plot data and accompany the specimen as it is pressed, dried, and submitted for further identification. Labels will not include sensitive plot identification data – the unique specimen label number is sufficient identification for each specimen.

Specimen Voucher Label Resolved Species Code:
Number:
Resolved scientific name:
Resolved by (name):
Date Collected:
Unknown Code: Unique Species Nbr:
Field collected scientific name:
Collected by:
State: County:
Community type(s) where found:
Species Notes:

9.10+N INVASIVE PLANT NOTES
Notes are required for each species record with an unknown code. Enter text that describes the species or that explains why it was not collected if collection was required but not done. This text may be used on the specimen label and any spreadsheet used to track specimens.

When collected: Required for each record with an unknown code and SPECIMEN LABEL NUMBER.
Field width: Unlimited alphanumeric character field
Tolerance: N/A
MQO: N/A
Values: English language words, phrases, and numbers

NRS Note: Record this note while in the invasive species record. Press the "Ctrl"+"N".

Listed are reasons why a specimen was not collected:

- Species is locally sparse
• Species has less than 1% canopy cover on the subplot and no mature foliage or reproductive parts are present
• Hazardous situation
• Time limitation
• Already collected with previous entry of genus or unknown code with the same unique species number
• Specimen collected for immediate/local identification only
• Other (explain in notes)

9.11 References
DOWN WOODY MATERIALS (PHASE 2 – CORE OPTIONAL)

Down woody materials (DWM) are important components 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 wood components and fuels estimated by the FIA program are coarse wood, slash, fine wood, and litter and duff depth. The NRS DWM protocol includes the following three suites of measurement options:

OPTION I. BASE: The BASE option provides a minimum set of variables necessary to produce estimates for volume, biomass, carbon, and fuel load per acre on a broad scale. Base variables are required any time DWM is measured, and are labeled “BASE” in this chapter. Measurements include:

OPTION I: BASE Variables

BASE Layout: DWM SAMPLING STATUS, DWM NUMBER OF SUBPLOTS, DWM NUMBER OF TRANSECTS ON SUBPLOT, DWM TRANSECT LENGTH, DWM NOTES

BASE Transect Line Segmenting: SUBPLOT NUMBER, TRANSECT, SEGMENT CONDITION CLASS NUMBER, SEGMENT BEGINNING DISTANCE (HD), SEGMENT ENDING DISTANCE (HD), DWM TRANSECT SEGMENT SAMPLE STATUS, DWM TRANSECT NONSAMPLED REASON

BASE CWD: SUBPLOT NUMBER, TRANSECT, CWD CONDITION CLASS, PIECE ON SUBPLOT OR ANNULAR PLOT?, CWD DECAY CLASS, SPECIES, DIAMETER AT POINT OF INTERSECTION, DIAMETER OF HOLLOW AT POINT OF INTERSECTION, CWD LENGTH >=3 FEET

BASE Pile: PILE SUBPLOT NUMBER, PILE TRANSECT, PILE CONDITION CLASS NUMBER, PILE BEGINNING DISTANCE, PILE ENDING DISTANCE, COMPACTED HEIGHT OF CWD IN PILE, PILE DECAY CLASS, PILE SPECIES

BASE FWD: FWD SUBPLOT NUMBER, FWD TRANSECT, FWD CONDITION CLASS NUMBER, FWD TRANSECT SEGMENT SAMPLE STATUS, FWD TRANSECT NONSAMPLED REASON, SMALL FWD COUNT, MEDIUM FWD COUNT, LARGE FWD COUNT, HIGH COUNT REASON

BASE Duff/Litter Depth: DUFF/LITTER SUBPLOT NUMBER, DUFF/LITTER TRANSECT, DUFF/LITTER CONDITION CLASS NUMBER, DUFF/LITTER SAMPLE STATUS, DUFF/LITTER NONSAMPLED REASON, DUFF DEPTH, LITTER DEPTH, DUFF AND LITTER METHOD
OPTION II. WILDLIFE / ECOLOGICAL
This option includes all the BASE Option variables plus additional CWD structural variables. These additional measurements allow users to quantify wildlife habitat. This option is required when measuring P3 DWM.

OPTION II: WILDLIFE / ECOLOGICAL

BASE Layout Variables

BASE Transect Line Segmenting Variables

BASE CWD Variables plus the following variables required for P3 DWM: CWD HORIZONTAL DISTANCE (NRS P2+), DIAMETER AT SMALL END, DIAMETER AT LARGE END, CWD TOTAL LENGTH

BASE Pile Variables

BASE FWD Variables

BASE Duff/Litter Depth Variables

OPTION III. RAPID ASSESSMENT (CUSTOMIZED PROTOCOL) Not Collected in NRS

ADDITIONAL OPTIONAL VARIABLES Not Collected in NRS

10.1+N Definition of Down Woody Materials
Coarse Woody Debris – In this inventory, CWD includes downed, dead tree and shrub boles, large limbs, and other woody pieces that are ≥3 inches in diameter, ≥0.5 foot long, and severed from their original source of growth, and leaning > 45 degrees from vertical. CWD also includes dead tally species trees or single-stemmed woodland species trees (either self-supported by roots, severed from roots, or uprooted and supported by other objects) that are leaning >45 degrees from vertical and not considered part of the standing tree inventory. Portions of dead trees that are separated greater than 50 percent (either above or below 4.5 feet), are considered severed and are included in the CWD inventory (see discussion and diagrams in section 5.7.2 - Standing Dead). For multi-stemmed woodland non-tally tree woody species (Appendix 3) such as juniper, only tally stems that are dead and detached. Include as CWD all dead multi-stemmed woodland tree stems that do not qualify as standing dead if they meet the size and lean angle requirements for CWD pieces. Also included are non-machine processed round wood such as fence posts and cabin logs.

CWD is measured primarily using intersect diameter. In rare instances when pieces are in a pile and it is impossible to estimate the size of individual pieces, use the pile protocol described in Section 10.5.

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 (see discussion and diagrams in section 5.7.2 - Standing Dead).
3. Dead shrubs, self-supported by their roots.
4. Trees still attached and showing any signs 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.
8. A treated telephone pole. (Non-machined processed poles that originate from the general forest area are considered CWD)

Fine Woody Debris – In this inventory, FWD includes downed, dead branches, twigs, and small tree or shrub boles <3 inches in diameter that are not attached to a living or standing dead source. FWD can be connected to a larger branch, as long as this branch is on the ground and not connected to a standing dead or live tree. Only the woody branches, twigs, and fragments that intersect the transect are counted. FWD can be connected to a down, dead tree bole or down, dead shrub. FWD can be twigs from shrubs and vines. FWD must be no higher than 6 feet above the ground to be counted.

FWD does not include:

1. Woody pieces ≥3.0 inches in diameter at the point of intersection with the transect.
2. Dead branches connected to a live tree or shrub; or to a standing dead tree or dead shrub.
3. Dead foliage (i.e., pine or fir needles, or leaf petioles).
4. Bark fragments, cubical rot fragments, or other non-woody pieces that are not an integral part of a branch, twig, or small bole.
5. Small pieces of decomposed wood (i.e., chunks of cubical rot)

10.2 GT 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 nonforest or measured nonforest land condition class mapped within the 24.0-foot radius subplot (GROUND TRUTH CONDITION CLASS STATUS = 2 or NONFOREST CONDITION CLASS STATUS = 2). Transects begin at the subplot center and extend 24.0 feet to the edge of the subplot. The location of condition class boundaries are recorded along the transect, starting at the subplot center and working towards the fixed radius plot boundary. 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 QA purposes.

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, horizontal distance).

10.2.1 CWD Transects
Two transects are established that originate at the subplot center and extend out 24.0 feet horizontal distance (the radius of the subplot) (Figure 85). 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. On plots where the macroplot is measured and mapped for condition classes, FIA units have the option of extending transects up to 58.9 feet from subplot center. In addition, an optional third transect on each subplot provides the ability to add or retain transect length on P3 plots.
10.2.2 FWD Transects

On a portion of one CWD transect on each subplot, FWD is tallied within 3 size classes. Because FWD is generally present in high densities, a shorter transect will pick up an acceptable amount of tally. The transect begins at 14 feet (horizontal distance) from the subplot center and extends out either 6 or 10 feet (horizontal distance) depending on the FWD size class, as follows:

<table>
<thead>
<tr>
<th>Category of FWD</th>
<th>Size Class</th>
<th>Diameter range</th>
<th>Transect length (horizontal distance)</th>
<th>Transect location (horizontal distance)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small FWD</td>
<td>1</td>
<td>0 in to 0.24 in</td>
<td>6 feet</td>
<td>14 to 20 feet</td>
</tr>
<tr>
<td>Medium FWD</td>
<td>2</td>
<td>0.25 in to 0.9 in</td>
<td>6 feet</td>
<td>14 to 20 feet</td>
</tr>
<tr>
<td>Large FWD</td>
<td>3</td>
<td>1.0 in to 2.9 in</td>
<td>10 feet</td>
<td>14 to 24 feet</td>
</tr>
</tbody>
</table>
It is helpful to have a size gauge available until your eye is ‘trained’ to recognize the 3 FWD size classes. Examples include a plastic or cardboard card with 3 notches cut for each size class, or a set of 3 dowels representing each size class.

10.3.1N Transect Line Segmenting

Transect lines are segmented to determine the length of transect that occurs within each mapped condition class intersecting the line. These lengths determine the expansion factors for the measured DWM. It is important that any changes or corrections to condition identity, location and size mapped on the subplot/macroplot spatially match the segmentation done on the transects. A segment is a length of transect that is in one condition. Segments are identified by recording the BEGINNING DISTANCE and ENDING DISTANCE from subplot center towards the end of the transect.

If any part of the transect segment is in a measured condition but the CWD is not measurable (e.g., snow or water), do not measure any DWM (CWD, FWD, or duff/litter depth) on that transect segment and set DWM TRANSECT SEGMENT SAMPLE STATUS = 0.

NRS Note: If you encounter a small puddle or small stream continue to collect DWM only if you can do so accurately. If a portion of a transect segment is unmeasurable for one reason or another, the whole transect segment is considered unmeasurable.

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. The horizontal BEGINNING DISTANCE and ENDING DISTANCE are recorded for each condition class encountered (Figure 86). 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 last segment on all transects must have an ENDING DISTANCE of 24.0 feet horizontal distance if sampling the subplot, or up to DWM TRANSECT LENGTH if sampling on the macroplot. All condition segments on the transect must be defined and all transect length recorded and accounted for, either by condition, or by DWM TRANSECT SEGMENT SAMPLE STATUS.

Figure 86. Transects are installed across condition class boundaries.

10.3.1 SUBPLOT NUMBER (BASE)
Record the code indicating the subplot center from which the transect originates.
When collected: All transect segments on plots where DWM SAMPLING STATUS >0
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values:

1 Center subplot
2 North subplot
3 Southeast subplot
4 Southwest subplot

10.3.2 TRANSECT (BASE)
Record the transect azimuth (degrees) on which a condition class is being delineated. These transects, when being installed, have a tolerance of +/- 2 degrees.

When Collected: All transect segments where DWM SAMPLING STATUS > 0
Field width: 3 digits
Tolerance: No errors
MQO: At least 99% of the time
Values:

<table>
<thead>
<tr>
<th>Subplot</th>
<th>Transect direction (degrees) from center of subplot</th>
</tr>
</thead>
<tbody>
<tr>
<td>090</td>
<td>270</td>
</tr>
<tr>
<td>1</td>
<td>180 (Extra optional transect) <strong>Not Collected in NRS</strong></td>
</tr>
<tr>
<td>360</td>
<td></td>
</tr>
<tr>
<td>180</td>
<td>270 (Extra optional transect) <strong>Not Collected in NRS</strong></td>
</tr>
<tr>
<td>135</td>
<td></td>
</tr>
<tr>
<td>315</td>
<td>225 (Extra optional transect) <strong>Not Collected in NRS</strong></td>
</tr>
<tr>
<td>045</td>
<td></td>
</tr>
<tr>
<td>225</td>
<td>315 (Extra optional transect) <strong>Not Collected in NRS</strong></td>
</tr>
<tr>
<td>000</td>
<td></td>
</tr>
</tbody>
</table>

10.3.3 SEGMENT CONDITION CLASS NUMBER (BASE)
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 transect segments where DWM SAMPLING STATUS >0
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values: 1 to 9

10.3.4+N SEGMENT BEGINNING DISTANCE (BASE)
Record the location (using horizontal distance to nearest 0.1 foot) 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 0 ft. Each subsequent record will have a BEGINNING DISTANCE equal to the ENDING DISTANCE of the previous record.
When collected: All transect segments where DWM SAMPLING STATUS >0
Field width: 3 digits (xx.y)
Tolerance: +/- 1 ft
MQO: At least 95% of the time
Values: 00.0 to 58.9 horizontal feet

10.3.5 +N SEGMENT ENDING DISTANCE (BASE)
Record the location (using horizontal distance to nearest 0.1 foot) 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 horizontal distance) of the end of the transect line.

When collected: All transect segments where DWM SAMPLING STATUS >0
Field width: 3 digits (xx.y)
Tolerance: +/- 1 ft
MQO: At least 95% of the time
Values: 00.1 to 58.9 horizontal feet

10.3.6 DWM TRANSECT SEGMENT SAMPLE STATUS (BASE)
Record the sample status for the transect segment. If any part of the segment is in an accessible condition that would be measured (CONDITION CLASS STATUS = 1 or NONFOREST CONDITION CLASS STATUS = 2), but the CWD is not measurable due to an obstruction such as snow or water, do not measure DWM on any part of the transect segment, and set code to 0 for that segment. In all other situations, set the code to 1. For conditions on which DWM would not be measured regardless (CONDITION CLASS STATUS = 3 or NONFOREST CONDITION CLASS STATUS = 2), will automatically be coded 1; those conditions should be identified in the transect segmenting.
When Collected: All transect segments on plots where DWM SAMPLING STATUS >0
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values:
0 Transect segment not sampled
1 Transect segment sampled

10.3.7 DWM TRANSECT SEGMENT NONSAMPLED REASON (BASE)
Record the reason that DWM cannot be measured on the transect.
When Collected: All transects where DWM TRANSECT SEGMENT SAMPLE STATUS = 0
Field width: 2 digits
Tolerance: No errors
MQO: At least 99% of the time
Values:
04 Time Limitation
05 Lost data (office use only)
10 Other (for example, snow or water covering CWD that is supposed to be sampled). “Note required” when using this code.

10.4 Sampling Methods for COARSE WOODY DEBRIS (CWD)

10.4.1 +N+GT Tally Rules for Coarse Woody Debris (CWD)
1. Coarse woody debris (CWD) is sampled on accessible nonforest conditions, and on accessible nonforest conditions if they are being measured on the plot (i.e., NONFOREST CONDITION CLASS STATUS = 2). Tally CWD by starting at the subplot center and working towards the fixed radius plot boundary. Measurements should not be taken along transects moving inward toward subplot center. Tally a piece if its central longitudinal axis intersects the transect, and the condition class is measured at the point of intersection (Figure 87). The entire piece is assigned to this condition

Figure 87. 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 tall 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’ for determining what qualifies as standing and down dead trees and portions/ tops of trees. Most CWD will be laying on the ground.
Note: In order to avoid double counting or totally missing trees or portions in either protocol, once a decision is made on whether a tree or portion/top of a tree is considered standing or down it is important to include it in either one or the other protocol (standing tree or CWD), but not both. See additional diagrams in section 5.7.2 — Standing Dead.

NRS Note: If a piece is still at least 50% connected at the base, the lean angle is measured from the base to 4.5 feet to determine if it is tallied as a Standing Dead tree or as a CWD piece. If a piece is separated more than 50% from the base, the lean angle is measured from the large end to the small end to determine if it qualifies as a CWD piece or if it is not tallied due to the angle.

In Figure 87.1N, the bole of a live or dead tree contains a break of ≥ 50% resulting in a dead tree top that is still attached to the main bole. Since the break is ≥ 50% the lean angle is measured between the large end (by the break) and the small end of the piece, if this angle is > 45 degrees from vertical the dead broken top would be considered a piece of CWD.

Figure 87.1N. Determining the lean angle when ≥ 50% of the bole is broken.

In Figure 87.2N, Piece 1 is lying horizontally on the ground and qualifies as a piece of CWD. Piece 2 would not be measured because it has an angle of less than 45 degrees from vertical.
3. The minimum length for any tally piece is 0.5 feet and it needs to meet the minimum transect diameter guidelines.

**NRS Note:** A piece of material must maintain at least 3.0” for at least 0.5 feet in order to qualify as CWD.

4. Decay class of the piece determines whether or not the piece is tallied (see Section 10.4.3.6).

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 (Figure 88).

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 uphill side of the ground. 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.
Figure 88. Tally rules for CWD decay classes 1-4.

5. Tally pieces created by natural causes (examples: natural breakage or uprooting) or by human activities such as cutting. In some cases it may be impossible to measure or estimate individual pieces—for example when CWD pieces are in machine-piled slash piles or windrows, or are part of jumble from flooding, landslide or avalanche. In these situations, piles are described using the instructions in Section 10.5 ‘Sampling Residue Piles’. Because biomass estimates from piles have great uncertainty associated with them, pieces should be measured individually if at all possible.

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. Measure the diameter and length at this point.

NRS Note: In some ecosystems moss and sphagnum can cover the surfaces of pieces of CWD, this alone does not prevent them from being tallied. In cases where a portion, or the entirety, of a potential piece of CWD becomes incorporated / buried within the forest floor/soil horizons the affected portion is not measured.

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 89).

Figure 89. 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 smallest azimuth degree transect.
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 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 TOTAL LENGTH and 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 90).

NRS Note: When measuring the length of a fork to determine if it qualifies as a new piece of CWD measure from the small end to the location at the base of the fork where you can no longer see light, NOT the pith of the fork.

13. If a transect intersects a non-measured condition (e.g., a road when NONFOREST CONDITION CLASS STATUS = 5, or an inaccessible condition class, or a non-sampled code for CWD), CWD is not tallied on that portion of the transect.

Figure 90. CWD tally rules for forked trees.
10.4.2 Marking CWD (OPTIONAL) Not Collected in NRS

10.4.3 Recording Procedures for CWD

10.4.3.1 GT SUBPLOT NUMBER (BASE)
Record the code indicating the number of the subplot center from which the transect originates.

When collected: All tally pieces in GROUND TRUTH CONDITION CLASS STATUS = 2, where DWM TRANSECT SEGMENT SAMPLE STATUS = 1

Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values:
1 Center subplot
2 North subplot
3 Southeast subplot
4 Southwest subplot

10.4.3.2 TRANSECT (BASE)
Record the azimuth of the transect on which the CWD piece is sampled.

When Collected: All tally pieces where DWM TRANSECT SAMPLE STATUS = 1
Field width: 3 digits
Tolerance: No errors
MQO: At least 99% of the time
Values:
Subplot Transect direction (degrees) from center of subplot
090
1 270
180 (Extra optional transect) Not Collected in NRS
360
2 180
270 (Extra optional transect) Not Collected in NRS
135
3 315
225 (Extra optional transect) Not Collected in NRS
045
4 225
315 (Extra optional transect) Not Collected in NRS

10.4.3.3 GT CWD CONDITION CLASS (BASE)
Record the condition class number for each CWD piece at the point where the central longitudinal axis of the piece intersects the transect. If there is only one condition on the plot all CWD pieces will be assigned to CWD condition class = 1. If more than one condition has been identified and/or mapped on the plot/subplot, record the appropriate condition based on the location of the transect diameter measurement. All CWD pieces require a condition class and only classes that have been identified and/or mapped are valid. If extending the transect onto the macroplot the entire macroplot needs to be mapped for conditions.

When Collected: All tally pieces in GROUND TRUTH CONDITION CLASS STATUS = 2, where DWM TRANSECT SEGMENT SAMPLE STATUS = 1
10.4.3.4 GT PIECE ON SUBPLOT OR ANNULAR PLOT? (BASE)

Identify whether point of transect intersection with piece is on the subplot or macroplot. If not extending transects onto annular plots all pieces will be assigned code = 1.

When Collected: All tally pieces in GROUND TRUTH CONDITION CLASS STATUS = 2, where DWM TRANSECT SEGMENT SAMPLE STATUS = 1

Field width: 1 digit
Tolerance: No errors
MQO: At least 90% of the time
Values: 1 to 9

1  Central longitudinal axis of piece intersects the transect on the subplot (<= 24.0 horizontal feet)
2  Central longitudinal axis of piece intersects the transect on the macroplot (24.1 – 58.9 horizontal feet)

10.4.3.5 GT CWD HORIZONTAL DISTANCE (WILDLIFE OPTION, NRS P2+)

Record the horizontal 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 horizontal distances, record the top piece first. CWD HORIZONTAL DISTANCE may be useful for verifying condition class, for QA checks, or for studies of different transect lengths.

NRS Note: Horizontal distance to CWD piece may be difficult to collect with a single person crew. Do your best with the tools you have to measure without completing the slope calculations.

When Collected: WILDLIFE: All tally pieces in GROUND TRUTH CONDITION CLASS STATUS = 2 where DWM TRANSECT SEGMENT SAMPLE STATUS = 1 and DWM SAMPLING STATUS = 2

OPTIONAL: All tally pieces in CONDITION CLASS STATUS = 1 or NONFOREST CONDITION CLASS STATUS = 2 where DWM TRANSECT SEGMENT SAMPLE STATUS = 1 and DWM SAMPLING STATUS = 1 or 3

Field width: 3 digits (xx.y)
Tolerance: +/- 1.0 ft
MQO: At least 90% of the time
Values: 00.0 to 58.9 24.0

10.4.3.6 GT CWD DECAY CLASS (BASE)

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

When Collected: All tally pieces in GROUND TRUTH CONDITION CLASS STATUS = 2 where DWM TRANSECT SEGMENT SAMPLE STATUS = 1
<table>
<thead>
<tr>
<th>Decay Class</th>
<th>Structural Integrity</th>
<th>Texture of Rotten Portions</th>
<th>Color of Wood</th>
<th>Invading Roots</th>
<th>Branches and Twigs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Sound, freshly fallen, intact logs</td>
<td>Intact, no rot; conks of stem decay absent</td>
<td>Original color</td>
<td>Absent</td>
<td>If branches are present, fine twigs are still attached and have tight bark</td>
</tr>
<tr>
<td>2</td>
<td>Sound</td>
<td>Mostly intact; sapwood partly soft (starting to decay) but can’t be pulled apart by hand</td>
<td>Original color</td>
<td>Absent</td>
<td>If branches are present, many fine twigs are gone and remaining fine twigs have peeling bark</td>
</tr>
<tr>
<td>3</td>
<td>Heartwood sound; piece supports its own weight</td>
<td>Hard, large pieces; sapwood can be pulled apart by hand or sapwood absent</td>
<td>Reddish-brown or original color</td>
<td>Sapwood only</td>
<td>Branch stubs will not pull out</td>
</tr>
<tr>
<td>4</td>
<td>Heartwood rotten; piece does not support its own weight, but maintains its shape</td>
<td>Soft, small blocky pieces; a metal pin can be pushed into heartwood</td>
<td>Reddish or light brown</td>
<td>Through -out</td>
<td>Branch stubs pull out</td>
</tr>
<tr>
<td>5</td>
<td>None, piece no longer maintains its shape, it spreads out on ground</td>
<td>Soft; powdery when dry</td>
<td>Red-brown to dark brown</td>
<td>Through -out</td>
<td>Branch stubs and pitch pockets have usually rotted down</td>
</tr>
</tbody>
</table>

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 and ≥ 5.0 inches from the surface of the ground. 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. CWD DECAY CLASS 1 should be reserved for ‘freshly fallen’ logs that are completely intact (i.e., recent windfalls, or harvest).
NRS Note: Paper Birch, in the form of a hollow shell of bark, is coded as CWD if it meets minimum size requirements. Record as a Decay Class of 4 or 5. Decay Class 2 should be limited to case hardened logs that are hollow in the center.

10.4.3.7+GT SPECIES (BASE)
Record the code indicating the species of the piece. Since CWD pieces are not necessarily always tally species, record the most detailed available species code (see appendix 3). Some species codes are only genus specific (e.g., Prunus), or hardwood-softwood specific. Search for the species code that has the most detail for the identified piece. For shrubs or vines enter unknown softwood (0299) or hardwood (0998).

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. If all else fails, enter the unknown SPECIES code (0999).

When Collected: All tally pieces in GROUND TRUTH CONDITION CLASS STATUS = 2 where DWM TRANSECT SEGMENT SAMPLE STATUS = 1 and 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

10.4.3.8 Diameters
If possible, the best way to measure diameter is to wrap the tape perpendicular to the longitudinal axis at the point of transect intersection (Figure 91). If that is not possible 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.

**DIAMETER MEASUREMENTS**

- **Small-end diameter tapers to 3” before the end of log**
- **Small-end diameter measured at the point before the log splinters or crumbles**
- **Large-end diameter measured at the point that best represents the overall log volume. (before the wood crumbles and falls apart due to decay)**

![Figure 91. Diameter measurements.](image-url)
For pieces that cannot be taped and 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 92), and enter the average in the diameter field. This technique applies to intersect, small-end, and large-end diameters.

![Figure 92. Estimating the diameter of pieces that are not round in cross-section.](image)

If the transect intersects the log at the decayed or splintered end (Figure 93), record the diameter at this location as the intersect diameter. Record the large end and small end diameters on the same side of the transect diameter as illustrated. Record the small end diameter as 3 inches if it tapers below 3 inches. 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 93. Example of decayed end intersecting the transect

10.4.3.8.1 GT DIAMETER AT POINT OF INTERSECTION (BASE)
Record the piece's diameter at the point where the transect intersects the longitudinal center of the piece. Record the diameter to the nearest inch. 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.

When Collected: All tally pieces in GROUND TRUTH CONDITION CLASS STATUS = 2, where DWM TRANSECT SEGMENT SAMPLE STATUS = 1
Field width: 3 digits
Tolerance: Pieces <20.0 inches diameter: +/- 1 inch for decay class 1-4, +/- 2 inches for decay class 5
Pieces ≥20.0 inches diameter (decay classes 1-4): +/- 2 inches for each 20-inch increment >20.0 inches
Pieces ≥20.0 inches diameter (decay class 5): +/- 3 inches for each 20-inch increment above 20.0 inches
MQO: At least 90% of the time
Values: 003 to 200 inches

10.4.3.8.2 GT DIAMETER OF HOLLOW AT POINT OF INTERSECTION (BASE)
Record the diameter of hollow at the point of intersection. This variable contributes to reducing bias in biomass estimate and only applies to the point of intersection. If it can be ascertained that the piece is hollow at the transect diameter location, measure or estimate the diameter of hollow to the nearest inch, otherwise record as 0. Diameter of hollow must be less than the transect
diameter. Note: Record a hollow diameter only when it is obvious that a piece is hollow at the point of intersection (a hole or crack in the piece, evidence of hollow as observed from the end, etc.). Unlike 10.6.3.10, there is no hollow size requirement for this variable.

NRS Note: When determining if a piece qualifies as hollow inspect the general area around the point of intersection, only inspect the ends of the piece if they are near the intersection. In order to qualify as hollow, the hole must be at least 0.5” by 0.5”.

When Collected: All tally pieces in GROUND TRUTH CONDITION CLASS STATUS = 2, where DWM TRANSECT SEGMENT SAMPLE STATUS = 1 and CWD DECAY CLASS = 1 to 4
Field width: 3 digits
Tolerance: Pieces <20.0 inches diameter: +/- 1 inch
Pieces ≥20.0 inches diameter: +/- 2 inches for each 20-inch increment above 20.0 inches
MQO: At least 80% of the time
Values: 000, 001 to 200 inches

10.4.3.8.3 DIAMETER AT THE SMALL END (WILDLIFE OPTION) Not Collected in NRS CORE Not Collected in GROUND TRUTH

10.4.3.8.4 DIAMETER AT THE LARGE END (WILDLIFE OPTION) Not Collected in NRS CORE Not Collected in GROUND TRUTH

10.4.3.9 Length Measurements
Measure the length of the piece (to the nearest foot) along its centerline, either to the end of the piece or to the point where the diameter reaches 3 inches. If the piece tapers at both sides, due to decay or breakage, the length is measured for the 3-inch diameter cutoff at both ends, regardless of where the large end-diameter may be (see Figure 93). No length is recorded for pieces <3 feet long.

10.4.3.9.1 CWD LENGTH >= 3 FEET (BASE)
Record the code that indicates whether the CWD TOTAL LENGTH is less than 3 feet long (and at least 0.5 foot long). Distinguish length orientation by direction of the pith. Note: the diameter of a small piece may be larger than its length. Total length of the log is measured between the physical ends of the log.
When Collected: All tally pieces >0.5 foot long, where DWM TRANSECT SEGMENT SAMPLE STATUS = 1

Field width: 1 digit
Tolerance: No errors
MQO: At least 90% of the time
Values: 1 to 2

1. CWD TOTAL LENGTH ≥3 feet
2. CWD TOTAL LENGTH ≥0.5 foot and < 3 feet

10.4.3.9.2 CWD TOTAL LENGTH (WILDLIFE OPTION) Not Collected in NRS CORE Not Collected in GROUND TRUTH

10.4.3.10 IS THE PIECE HOLLOW? (OPTIONAL) Not Collected in NRS CORE Not Collected in GROUND TRUTH

10.4.3.11 PIECE INCLINATION (OPTIONAL) Not Collected in NRS CORE Not Collected in GROUND TRUTH

10.4.3.12 CWD HISTORY (OPTIONAL) Not Collected in NRS CORE Not Collected in GROUND TRUTH

10.4.3.13 PERCENT OF LOG CHARRED BY FIRE (OPTIONAL) Not Collected in NRS CORE Not Collected in GROUND TRUTH

10.4.3.14 LARGE END DIAMETER CLASS (OPTIONAL) Not Collected in NRS

10.5 Sampling Residue Piles

A pile is an accumulation of large woody material in which individual pieces are impossible to tally separately. Piles may be created by human activity or natural causes. However, loose piles created by windthrow, landslides, fires or other natural causes, or by thinning or logging operations, should be tallied using the regular CWD protocols unless it is physically impossible to separate individual pieces. The pile protocol should only be used as a last resort, when the regular CWD protocols cannot be used.

Piles are tallied only if intersected by a transect and located in an accessible forest condition class (CONDITION CLASS STATUS = 1) or a measurable nonforest condition (NONFOREST CONDITION CLASS STATUS = 2). An estimate of the length and depth of the pile, species composition and decay class are recorded:

1. Tally individual pieces along the transect until it is not possible to measure them separately and record the horizontal transect distance to this point. Then, record the horizontal transect distance to the point where individual pieces can again be tallied separately (see Figure 94).
2. If the pile straddles two condition classes, assign it to the condition class that is closest to subplot center along the transect.
3. Estimate the average height of the pile along the transect. Visually compact the pile to estimate the height of wood, excluding air, rocks, debris and pieces of wood less than 3 inches in diameter at the plane of intersection with the transect. There is a tendency to overestimate the proportion of the cross-section of the pile made of wood. Note that when packing perfect circles of equal diameter, the maximum attainable packing ratio is less than 90% (see Figure 95).
4. Record the predominant species in the pile. If it is not possible to identify the species, or if there is an even mixture of several species, record the genus, or hardwood / softwood code.
5. Record the predominant decay class of the pieces in the pile.
NRS Note: If a qualified pile lands at subplot center, the pile would be entered on both transects.

Figure 94. Example for measuring a pile. Pieces can be identified and tallied separately between points A-B and C-D, so the CWD protocols are used, even though part of the transect may be within the pile. Between points B and C, pieces cannot be tallied separately and the pile protocol is used. Enter the horizontal distance at B as the pile beginning distance, the horizontal distance at C as the predominant decay class between B and C. Assign the entire pile to condition class 1.
Figure 95. Calculating compacted height of CWD. The dashed line represents the height of the pile, the solid, thick line the compacted height of wood. Grey circles are cross sections of woody pieces greater than 3 inches of diameter and the fill represents debris, air and smaller pieces of wood.

10.5.1+GT PILE SUBPLOT NUMBER (BASE)
Record the code indicating the number of the subplot center from which the transect originates.
When collected: All sampled residue piles on transects in GROUND TRUTH CONDITION CLASS STATUS = 2, where DWM TRANSECT SEGMENT SAMPLE STATUS = 1

Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values:
1 Center subplot
2 North subplot
3 Southeast subplot
4 Southwest subplot

10.5.2 GT PILE TRANSECT (BASE)
Record the azimuth of the transect on which the pile is sampled.

When Collected: All sampled residue piles on transects in GROUND TRUTH CONDITION CLASS STATUS = 2, where DWM TRANSECT SEGMENT SAMPLE STATUS = 1

Field width: 3 digits
Tolerance: No errors
MQO: At least 99% of the time
Values:

<table>
<thead>
<tr>
<th>Subplot</th>
<th>Transect direction (degrees) from center of subplot</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>090</td>
</tr>
<tr>
<td></td>
<td>270</td>
</tr>
<tr>
<td></td>
<td>180 (Extra optional transect) Not Collected in NRS</td>
</tr>
<tr>
<td></td>
<td>360</td>
</tr>
<tr>
<td>2</td>
<td>180</td>
</tr>
<tr>
<td></td>
<td>270 (Extra optional transect) Not Collected in NRS</td>
</tr>
<tr>
<td></td>
<td>135</td>
</tr>
<tr>
<td>3</td>
<td>315</td>
</tr>
<tr>
<td></td>
<td>225 (Extra optional transect) Not Collected in NRS</td>
</tr>
<tr>
<td></td>
<td>045</td>
</tr>
<tr>
<td>4</td>
<td>225</td>
</tr>
<tr>
<td></td>
<td>315 (Extra optional transect) Not Collected in NRS</td>
</tr>
</tbody>
</table>

10.5.3 GT PILE CONDITION CLASS NUMBER (BASE)
Record the code indicating the number of the condition class. If the pile straddles two condition classes, assign it to the one closest to subplot center along the transect.

When collected: All sampled residue piles on transects in GROUND TRUTH CONDITION CLASS STATUS = 2, where DWM TRANSECT SEGMENT SAMPLE STATUS = 1

Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values: 1 to 9

10.5.4 GT PILE BEGINNING DISTANCE (BASE)
Record the horizontal length of the transect to the beginning of the pile (to the nearest 0.1 foot), defined as the point when pieces cannot be tallied individually. If the pile occupies subplot center, record 00.0 for the beginning distance.
When collected: All sampled residue piles on transects in **GROUND TRUTH CONDITION CLASS STATUS = 2**, where DWM TRANSECT SEGMENT SAMPLE STATUS = 1

Field width: 3 digits  
Tolerance: +/- 10%  
MQO: At least 90% of the time  
Values: 00.0 to 58.8  

24.0 feet

10.5.5+N GT  PILE ENDING DISTANCE (BASE)  
Record the horizontal length of the transect to the end of the pile, defined as the point when pieces can be tallied individually again. If the transect ends within the pile, record DWM TRANSECT LENGTH.

When collected: All sampled residue piles on transects in **GROUND TRUTH CONDITION CLASS STATUS = 2**, where DWM TRANSECT SEGMENT SAMPLE STATUS = 1  

Field width: 3 digits (xx:y)  
Tolerance: +/- 10%  
MQO: At least 90% of the time  
Values: 00.1 to 58.9  

24.0 feet

10.5.6+N GT  COMPACTED HEIGHT OF CWD IN PILE (BASE)  
Record average height of wood pieces greater than 3 inches in diameter at the intersection of the transect with the pile. Record value to the nearest foot. Visually compact the pile to estimate the height of wood, excluding air, debris and pieces of wood less than 3 inches in diameter at the point of intersection with the transect. If the transect starts or ends within a pile, only consider the portion of cross-section of the pile above the measured transect.

**NRS Note:** Compacted height of a pile is the average transect height, not the average for the whole pile.

When collected: All sampled residue piles on transects in **GROUND TRUTH CONDITION CLASS STATUS = 2**, where DWM TRANSECT SEGMENT SAMPLE STATUS = 1  

Field width: 2 digits  
Tolerance: +/- 10%  
MQO: At least 90% of the time  
Values: 1 to 99 feet

10.5.7+GT  PILE DECAY CLASS (BASE)  
Record a 1-digit code indicating the predominant decay class in the pile. Use the guide below to determine CWD DECAY CLASS.
When Collected: All sampled residue piles on transects in **GROUND TRUTH CONDITION**

**CLASS STATUS = 2**, where DWM TRANSECT SEGMENT SAMPLE STATUS = 1

Field width: 1 digit
Tolerance: +/- 1 decay class
MQO: At least 90% of the time

Values:

<table>
<thead>
<tr>
<th>Decay Class</th>
<th>Structural Integrity</th>
<th>Texture of Rotten Portions</th>
<th>Color of Wood</th>
<th>Invading Roots</th>
<th>Branches and Twigs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Sound</td>
<td>Mostly intact; sapwood partly soft (starting to decay) but can't be pulled apart by hand</td>
<td>Original color</td>
<td>Absent</td>
<td>If branches are present, fine twigs are still attached and have tight bark</td>
</tr>
<tr>
<td>2</td>
<td>Heartwood sound; piece supports its own weight</td>
<td>Hard, large pieces; sapwood can be pulled apart by hand or sapwood absent</td>
<td>Reddish-brown or original color</td>
<td>Sapwood only</td>
<td>If branches are present, many fine twigs are gone and remaining fine twigs have peeling bark Branch stubs will not pull out</td>
</tr>
<tr>
<td>3</td>
<td>Heartwood rotten; piece does not support its own weight, but maintains its shape</td>
<td>Soft, small blocky pieces; a metal pin can be pushed into heartwood</td>
<td>Reddish or light brown</td>
<td>Through-out</td>
<td>Branch stubs pull out</td>
</tr>
<tr>
<td>4</td>
<td>None, piece no longer maintains its shape, it spreads out on ground</td>
<td>Soft; powdery when dry</td>
<td>Red-brown to dark brown</td>
<td>Through-out</td>
<td>Branch stubs and pitch pockets have usually rotted down</td>
</tr>
</tbody>
</table>

10.5.8+GT  **PILE SPECIES (BASE)**

Record the code indicating the predominant species / species group in the pile. If it is not possible to identify the species, or if there is an even mixture of several species, record the genus, or hardwood / softwood code.
When Collected: All sampled residue piles on transects in GROUND TRUTH CONDITION CLASS STATUS = 2, where DWM TRANSECT SEGMENT SAMPLE STATUS = 1 and PILE DECAY CLASS = 1 to 4

Field width: 4 digits
Tolerance: No errors
MQO: At least 90% of the time
Values: See species codes in appendix 3

10.6+\text{N} GT Sampling Methods for Fine Woody Debris (FWD)
1. Fine Woody Debris (FWD) is only sampled on accessible nonforest conditions (NONFOREST CONDITION CLASS STATUS = 2) intersected by the transect. FWD is tallied on the outer portion of the following transects: 270° on subplot 1, 360° on subplot 2, 135° on subplot 3, and 225° on subplot 4. The length of FWD transects is measured in horizontal distance, starting at 14.0 feet and extending for 6.0 or 10.0 feet depending on FWD size class.
2. If the start of the FWD transect segment is in a measured condition (see item 1 above) but a portion of the transect segment is not visible due to the presence of snow or standing water, consider the entire transect segment not measurable. In this situation, do not sample anything on the transect segment--set FWD TRANSECT SEGMENT SAMPLE STATUS code = 0 and record the reason in FWD TRANSECT SEGMENT NONSAMPLED REASON.
3. Only sample FWD that intersects the transect in a plane from the ground to a height of 6 feet.
4. FWD is sampled in three size classes, along transect azimuths described in item 1 above (see Section 10.2 for details on transects). Pieces in two FWD size classes (0.01 to 0.24 inches and 0.25 to 0.9 inches) are counted on a 6-foot transect, from 14 to 20 feet horizontal distance. Pieces in the largest size class (1.0 to 2.9 inches) are counted on a 10-foot transect, from 14 to 24 feet. These transects overlap. Note: individual diameters are not recorded for FWD.
5. Count a piece of FWD if it intersects the transect. Be sure to count only woody material such as a twig, branch, wood fragment, or small shrub or tree bole. Do not count material that is actually litter, such as pine or fir needles, non-woody parts (e.g., petiole and rachis) of a shrub or tree, cubical rot fragments, etc.
6. Accumulate the number of pieces counted within each size class and enter the total count on one record for the subplot. If there is no tally on a transect, enter zeros for the count. If the transect is not measured (FWD TRANSECT SAMPLE STATUS = 0) the count is null.
7. Accurate counts of FWD can be conducted efficiently up to about 50 pieces for small and medium size classes, and up to 20 pieces for the large size class. After that, crews can begin estimating counts in a systematic fashion. Transects that fall on very dense FWD where counting is nearly impossible, can be sub-sampled and calculated. For example, an accurate count can be conducted on a 2.0-foot section of the transect and then multiplied by 3 to provide an estimate for the 6 foot transect, as long as the crew feels that the remaining transect has a similar density of FWD pieces.
8. If a transect intersects a large pile of material such as a wood rat's nest, recently fallen tree (with many attached fine branches), a residue pile, crews should estimate a count based on # 7 above, but also enter a code indicating that this is an unusual situation (see Section 10.5.7). In the case of a residue pile on the transect, estimate a count by looking at the transect just before and after the pile along with assessing what's inside the pile, and enter a count for the whole transect.
9. If rocks or logs are present along the transect (14- to 24-foot section) include any FWD that is present on top of these things in the respective FWD counts. If the obstructions are so large (huge boulder) that the top surface cannot be seen, assume the count is zero in this area, and continue counting if there is transect line beyond the boulder.
10. If a transect crosses a condition class boundary, record the condition class number and enter a count for each condition on separate records. Transect lengths within each condition class will be obtained from the transect segmenting data entered for the plot.
NRS Note: Only tally FWD that falls on top of the litter layer, do not dig through the litter layer looking for FWD.

NRS Note: Woodchips from a harvest operation on site would be considered FWD if it meets size requirements.

Only collect shrubs as FWM if they are detached from their root system.

10.6.1 FWD SUBPLOT NUMBER (BASE)
Record the code indicating the subplot center from which the transect originates.

When collected: All FWD transect segments where DWM TRANSECT SEGMENT SAMPLE STATUS = 1
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values:
  1 Center subplot
  2 North subplot
  3 Southeast subplot
  4 Southwest subplot

10.6.2 FWD TRANSECT (BASE)
Record the azimuth (degrees) of the transect on which FWD is sampled.

When collected: All FWD transect segments where DWM TRANSECT SEGMENT SAMPLE STATUS = 1
Field width: 3 digits
Tolerance: No errors
MQO: At least 99% of the time
Values: degrees
Subplot | Transect direction (degrees) from center of subplot
---|---
1 | 270
2 | 360
3 | 135
4 | 225

10.6.3 FWD CONDITION CLASS NUMBER (BASE)
Record the code indicating the number of the condition class at the start of the transect (14.0 feet horizontal distance from subplot center).

When collected: All FWD transect segments where DWM TRANSECT SEGMENT SAMPLE STATUS = 1
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values: 1 to 9

10.6.4 FWD TRANSECT SEGMENT SAMPLE STATUS (BASE)
Record the sample status for FWD on the transect. There may be situations where the CWD is measurable, but the FWD is hidden from view by snow or water and not measurable. If any part of the FWD transect segment is on a measured condition but the FWD is not measurable, do not
count any FWD and set the STATUS code to 0 and the FWD TRANSECT NONSAMPLED
REASON code to 10.

NRS Note: If the FWD transect extends into a nonforest condition, count the FWD pieces that are
present on the existing forested condition. The Transect Segmenting data will allow expansion of
these measurements.

In all other situations, set the code to 1. Conditions on which FWD would not be measured
regardless (CONDITION CLASS STATUS = 3 or CONDITION CLASS STATUS = 2 AND
NONFOREST CONDITION CLASS STATUS = 5) should always be coded 1.

When collected: All FWD transect segments where DWM TRANSECT SEGMENT SAMPLE
STATUS = 1
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values:
  0  FWD transect segment not sampled
  1  FWD transect segment sampled

10.6.5  FWD TRANSECT SEGMENT NONSAMPLED REASON (BASE)
Record the reason that FWD cannot be measured on the transect.

When Collected: All FWD transect segments where FWD TRANSECT SEGMENT SAMPLE
STATUS = 0
Field width: 2 digits
Tolerance: No errors
MQO: At least 99% of the time
Values:
  04  Time Limitation
  05  Lost data (office use only)
  10  Other (for example, snow or water covering CWD that is supposed to be
      sampled). “Note required” when using this code.

10.6.6+GT  SMALL FWD COUNT (BASE)
Record the number of pieces counted in this size class (0.01 to 0.24-inch diameter) along the
transect segment. An accurate count should be conducted up to 50 pieces. If the count exceeds
50, the transect can be sub-sampled to estimate a total count for the transect length (see Section
10.6, #8).

When collected: All FWD transect segments in GROUND TRUTH CONDITION CLASS STATUS
= 2 where FWD TRANSECT SEGMENT SAMPLE STATUS = 1
Field width: 3 digits
Tolerance: 0 to 50 = +/- 20% of the total count for the transect
51 to 100 = +/- 25% of the total count for the transect
100 + = +/- 50% of the total count for the transect
MQO: At least 90% of the time
Values: 000 to 999 pieces

10.6.7+GT  MEDIUM FWD COUNT (BASE)
Record the number of pieces counted in this size class (0.25 to 0.99-inch diameter) along the
transect segment. An accurate count should be conducted up to 50 pieces. If the count exceeds
50, the transect can be sub-sampled to estimate a total count for the transect segment (see Section 10.6, # 8).

When collected: All FWD transect segments in GROUND TRUTH CONDITION CLASS STATUS = 2 where FWD TRANSECT SEGMENT SAMPLE STATUS = 1

Field width: 3 digits
Tolerance: +/- 20% of the total count for the transect
MQO: At least 90% of the time
Values: 000 to 999 pieces

10.6.8+GT LARGE FWD COUNT (BASE)
Record the number of pieces counted in this size class (1.0 to 2.9 inch diameter) along the transect segment. An accurate count should be conducted up to 20 pieces. If the count exceeds 20, the transect can be sub-sampled to estimate a total count for the transect segment (see Section 10.6, # 8).

When collected: All FWD transect segments in GROUND TRUTH CONDITION CLASS STATUS = 2 where FWD TRANSECT SEGMENT SAMPLE STATUS = 1

Field width: 3 digits
Tolerance: +/- 20% of the total count for the transect
MQO: At least 90% of the time
Values: 000 to 500 pieces

10.6.9+N+GT HIGH COUNT REASON (BASE)
Enter a code that applies to the situation encountered on the transect. Enter a code if any of the counts on the transect are greater than or equal to 100 pieces.

When collected: All FWD transect segments in GROUND TRUTH CONDITION CLASS STATUS = 2 where FWD TRANSECT SEGMENT SAMPLE STATUS = 1 and (SMALL FWD COUNT ≥ 100 or MEDIUM FWD COUNT ≥100 or LARGE FWD COUNT ≥100)

Field width: 1 digit
Tolerance: No errors
MQO: At least 90% of the time
Values:
1 High count is due to an overall high density of FWD across the transect
2 Wood Rat’s nest located on transect
3 Tree or shrub laying across transect
4 Other reason
5 Residue pile

10.7 Duff and Litter Depth Measurements
Depth measurements are sampled in accessible forest land conditions (and accessible nonforest conditions, where nonforest conditions are measured). The depth of the duff layer and litter layer are important components of carbon tracking and fire models that estimate fire behavior, fire spread, fire effects, and smoke production. These measurements are taken at the 24-foot location on each transect. If an object such as a rock, log, or residue pile is present at the sample point, depths will be estimated by examining the surface of the object or the area surrounding the object. In the office, an average depth will be calculated and stored with other information about the condition class on the plot.
10.7.1 Definitions

1. Litter is 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 which is undecomposed or only partially decomposed organic material. The components of the litter layer can still be readily identified (e.g., plant leaves, twigs, and peat, etc.).

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.

NRS Note: Cubical rot fragments (small pieces of decomposing wood with no size limitations) are coded as litter if they do not already qualify as a piece of CWD Decay Class 5.

2. Duff is the layer just below litter located just above the A-horizon (or uppermost soil mineral horizon). Duff is a dark soil layer dominated by organic material derived from the decomposition of plant and animal litter (pine straw, leaves, twigs, etc.) and deposited on top of an organic or 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. You should see no recognizable plant parts. When moss is present, the top of the duff layer is just below the green portion of the moss.

If peat is present in your part of the country, record it with the duff layer. Peat is an accumulation of partially decayed vegetation matter that forms under conditions of poor drainage such as those found in wetlands or bogs. A layer of peat develops when dead plant material is inhibited from decaying fully because of acidic or anaerobic conditions. In some areas of the U.S. the depth of this layer can be extensive.

10.7.2 Overview of Measurements

Depth measurements will be taken at the 24-foot (horizontal distance) location on each transect. If a log, rock, or residue pile occurs at the sample location, record the depth of the litter on top and below these objects and estimate the duff depth as close to the object as possible. Examine the area around the object to develop an average depth for these layers.

DUFF/LITTER SAMPLE STATUS identifies whether or not the duff and litter depth could be measured or reasonably estimated. Examples of situations where measurement is not possible include the presence of snow or standing water at the sample location. In this case, the STATUS code is set to 0 with the DUFF/LITTER NONSAMPLED REASON code set to 10.

The DUFF AND LITTER METHOD variable has three options for indicating if duff and litter were measured or estimated at each sample location. The default value for this variable is 1, indicating that both depths were measured and recorded. A code of 2 means that litter depth was measured, but duff depth was estimated and a code of 3 indicates that both duff and litter depths were estimated.
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. As you dig the hole for this measurement, if you encounter a subsurface rock, root, or buried log – stop the depth measurement at this point. If there is a log, rock, or residue pile on the surface at the sample point, and there appears to be duff and litter under it (or litter on top of it), record a reasonable estimate for each depth. Most likely, the area immediately adjacent to the obstruction will have to be examined to determine an average depth. Depths of zero are perfectly valid: for example if the point falls on bedrock or on top of a log that is resting on mineral soil.

NRS Note: Duff and Litter are measured at the end of the transects even when there is an obstruction at that location.

Examples:

If the sample location lands on rock, measure litter and duff on top of the rock. If no duff or litter is present, record both as 0.

- If the sample location lands on top of log, measure litter on top and measure or estimate any litter under the log and add the two measurements together. If the log is on the ground look at Duff on each side of the log and make an estimation of what it would be under the log.

As a general rule, duff depth should rarely exceed a few inches (except when a peat layer is present). 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). If the layer includes a substantial amount of peat, stop the measurement at 2 feet.

The height of the litter should be measured at the top of the loose material located at the sample point on the transect (or nearby if an obstruction exists). 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.

10.7.3 DUFF/LITTER SUBPLOT NUMBER (BASE)
Record the code indicating the number of the subplot center from which the transect originates.

When collected: All duff/litter transects where DWM TRANSECT SEGMENT SAMPLE STATUS = 1
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values:
1  Center subplot
2  North subplot
3  Southeast subplot
4  Southwest subplot

10.7.4 DUFF/LITTER TRANSECT (BASE)
Record the azimuth (degrees) of the transect on which duff/litter is sampled.
When collected: All duff/litter transects where DWM TRANSECT SEGMENT SAMPLE STATUS = 1
Field width: 3 digits
Tolerance: No errors
MQO: At least 99% of the time

Values:

<table>
<thead>
<tr>
<th>Subplot</th>
<th>Transect direction (degrees) from center of subplot</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>090</td>
</tr>
<tr>
<td></td>
<td>270</td>
</tr>
<tr>
<td>2</td>
<td>360</td>
</tr>
<tr>
<td></td>
<td>180</td>
</tr>
<tr>
<td>3</td>
<td>135</td>
</tr>
<tr>
<td></td>
<td>315</td>
</tr>
<tr>
<td>4</td>
<td>045</td>
</tr>
<tr>
<td></td>
<td>225</td>
</tr>
</tbody>
</table>

10.7.5 DUFF/LITTER CONDITION CLASS NUMBER (BASE)
Record the code indicating the number of the condition class at the sample point (24.0 feet horizontal distance from subplot center)

When collected: All duff/litter transects where DWM TRANSECT SEGMENT SAMPLE STATUS = 1
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time

Values: 1 to 9

10.7.6 DUFF/LITTER SAMPLE STATUS (BASE)
Record the sample status for duff and litter depth on the transect. There may be situations where the CWD is measurable (e.g., shallow depth of snow or water), but the duff and litter are not measurable. If the measurement point is on a measured condition but the duff/litter is not measurable, do not measure duff/litter and set code to 0 with the DUFF/LITTER NONSAMPLED REASON code set to 10.

In all other situations (including where duff and litter depth = 0), set the code to 1. For example, conditions on which duff/litter would not be measured regardless (CONDITION CLASS STATUS = 3 or NONFOREST CONDITION CLASS STATUS = 5) should always be coded 1.

When collected: All duff/litter transects where DWM TRANSECT SEGMENT SAMPLE STATUS = 1
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time

Values:

<table>
<thead>
<tr>
<th>Values</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Duff and litter point not sampled</td>
</tr>
<tr>
<td>1</td>
<td>Duff and litter point sampled</td>
</tr>
</tbody>
</table>

10.7.7 DUFF/LITTER NONSAMPLED REASON (BASE)
Record the reason that duff/litter cannot be measured on the transect.
When Collected: All duff/litter transects where DUFF/LITTER SAMPLE STATUS = 0
Field width: 2 digits
Tolerance: No errors
MQO: At least 99% of the time
Values:

- 04 Time Limitation
- 05 Lost data (office use only)
- 10 Other (for example, snow or water covering measurement point that is supposed to be sampled). "Note required" when using this code

10.7.8 \text{N+GT} \text{ DUFF DEPTH (BASE)}
Record the code indicating the depth of the duff layer to the nearest 0.1 inch. Record 24.0 inches when DUFF DEPTH is >24.0 inches and enter Code #4 (Litter depth was measured, duff (peat) depth exceeds 24.0 inches) for 10.9.8 DUFF AND LITTER METHOD.

\text{NRS Note: If there is a trace of duff present at the end of the transect, code duff as 0.1 inches. This is in contrast to the soils measurement due to the fact DWM separates out duff as its own measurement.}

When Collected: All duff/litter transects in measureable conditions (GROUND TRUTH CONDITION CLASS STATUS = 2) where DUFF/LITTER SAMPLE STATUS = 1
Field width: 3 digits
Tolerance: +/- 0.5 inch
MQO: At least 90% of the time
Values: 00.0 to 24.0 inches

10.7.9 \text{N+GT} \text{ LITTER DEPTH (BASE)}
Record the code indicating the depth of the litter layer to the nearest 0.1 inch.

\text{NRS Note: When sphagnum moss is encountered on a plot only consider litter that rests on top of the moss – do not count the moss itself as litter.}

\text{NRS Note: For measurement of litter, consider the general height of the Litter in an area the size of a pop can top and exclude any exaggerated depths. If there is a leaf sticking way above the norm, just ignore it. If there is an unusual depression in the litter, consider the norm within the area of the pop can top.}

When Collected: All duff/litter transects in measureable conditions (GROUND TRUTH CONDITION CLASS STATUS = 2) where DUFF/LITTER SAMPLE STATUS = 1
Field width: 3 digits
Tolerance: +/- 0.5 inch
MQO: At least 90% of the time
Values: 00.0 to 99.9 inches

10.7.10 \text{GT} \text{ DUFF AND LITTER METHOD (BASE)}
Record the code indicating whether duff and litter depths were measured or estimated.
When Collected: All duff/litter transects where DUFF/LITTER SAMPLE STATUS = 1 and duff/litter transect is in a measurable condition (GROUND TRUTH CONDITION CLASS STATUS = 2)

Field width: 1 digit
Tolerance: No errors
MQO: At least 90% of the time

Values:
1. Both duff and litter depth were measured
2. Litter depth was measured, duff depth (≤ 24.0 inches) was estimated
3. Both duff and litter depth were estimated
4. Litter depth was measured, duff (peat) depth exceeds 24.0 inches (note required)

10.8 References

10.9 Contact Information
Contact information for the National Advisor for this indicator is: Chris Woodall, USDA Forest Service, Northern Research Station, 1992 Folwell Ave, St. Paul, MN 55108, cwoodall@fs.fed.us, http://www.ncrs.fs.fed.us/4801/national-programs/indicators/dwm/
http://www.nrs.fs.fed.us/fia/topics/dwm/

(Note: this web address may be revised in the future. Please visit the Northern Research Station web site for an updated link www.nrs.fs.fed.us.)
11.0 UGT NON-TALLY TREES NOT COLLECTED IN NRS CORE

11.1 UGT NON-TALLY TREE GENUS

Record the genus for each NON-TALLY TREE species encountered on the subplot.

When collected: NON-TALLY TREE PRESENT = 1
Field width: 70 characters
Tolerance: No errors
MQO: At least 70% of the time
Values: Letters

11.2 UGT NON-TALLY TREE SPECIES

Record the species of each NON-TALLY TREE GENUS recorded.

When collected: NON-TALLY TREE PRESENT = 1
Field width: 70 characters
Tolerance: No errors
MQO: At least 70% of the time
Values: Letters

11.3 UGT NON-TALLY TREE SPECIMEN COLLECTED (Urban Optional)

Record a code to indicate whether or not a specimen was collected for each NON-TALLY TREE SPECIES. If a specimen is not collected, describe the reason it was not collected in NON-TALLY TREE NOTES.

When collected: All NON-TALLY TREE SPECIES records
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values:
0  No, a specimen was not officially collected
1  Yes, a specimen was officially collected

11.4 UGT SPECIMEN LABEL NUMBER (Urban Optional)

Record the label number for the collected specimen.

When collected: Where NON-TALLY TREE SPECIMEN COLLECTED = 1
Field width: 5 digits
Tolerance: No errors
MQO: At least 99% of the time
Values: 1 to 99999, as pre-assigned by FIA unit

11.5 UGT NON-TALLY TREE NOTES

Notes are required for each NON-TALLY TREE SPECIES record. Enter text that describes the species or that explains why it was not collected if collection was required but not done. This text may be used on the specimen label and any spreadsheet used to track specimens. Use the notes section to provide any information about sources used to identify the species of the NON-TALLY TREE.
When collected: Required for each NON-TALLY TREE SPECIES record
Field width: Unlimited alphanumeric character field
Tolerance: N/A
MQO: N/A
Values: English language words, phrases, and numbers

PDR Note: Record this note while in the NON-TALLY TREE SPECIES record. Press the "Ctrl"+"N".

Listed are some examples of why a specimen may not be collected:

- Species has less than 1% canopy cover on the subplot and no mature foliage or reproductive parts are present
- Hazardous situation
- Time limitation
- Other (explain in notes)
22.0 N-P2+SOILS GT SOIL MEASUREMENTS AND SAMPLING

The objective of the P2+ soils Soils Indicator is to assess nonforest ecosystem health in terms of the physical and chemical 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 P2+ soils plots to assess (Santiago Declaration 1995):

- 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).
- carbon sequestration (the amount of carbon tied up in soil organic matter).
- deposition of toxic metals from pollution.
- acidification of the soil from deposition of pollutants.

Chemical properties of the soil are analyzed in order to develop indices for plant nutrient status, soil organic matter, and acidification. Together, these three factors largely determine the fertility and potential productivity of forest stands. Soil nutrient status refers to the concentration of plant nutrients (e.g., potassium, calcium, magnesium, and sodium) and is a key indicator of site fertility and species composition. The amount of organic matter in the soil largely determines water retention, carbon storage, and the composition of soil biota. Loss of soil organic matter as a result of management practices can alter the vitality of forest ecosystems through diminished regeneration capacity of trees, lower growth rates, and changes in species composition. Finally, increased soil acidity resulting from deposition of atmospheric pollutants has the capacity to reduce nutrient availability, decrease rates of decomposition, promote the release of toxic elements into the soil solution (e.g., aluminum), and alter patterns and rates of microbial transformations.

Nutrient and water availability to forest vegetation is also 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.

22.1 N-GT Summary Of Method

Note: This indicator is CORE OPTIONAL on all phase 2 plots.

NRS Note: NRS will complete Soil Measurements and Sampling protocols during the window of May 1st through September 30th.

The Soils protocols will be collected on all Ground Truth FIA plots with CONDITIONS STATUS 2 as long as the soils is not regularly disturbed or is located in an urban setting (as long as the current ground conditions permit soil collection).

Beginning in 2012, Soil Measurements and Sampling protocols will be completed on approximately 6.25% of the total field plots in the NRS Region [i.e. on the historical Phase 3 (P3) plots].
PDR Note: When collecting P2+ soil data, a separate file is created in the PDR for the soils data. Each P2+ soils plot with accessible non-forestland will have two data files. Remember to upload both data files. The plot is incomplete if one of the files is missing. A complete Noncensus, Census, or forest or Nonsampled P2+ soil plot will not have a soil data file.

The soil measurement and sampling procedures are divided into three parts: soil erosion, soil compaction, and soil chemistry. 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 chemical and physical properties of the soil are assessed through the collection of soil samples, which are then submitted to a regional laboratory for analysis. Soil samples are collected from the non-forest floor (subplots 2, 3, and 4) and underlying mineral soil layers (subplot 2). The entire non-forest floor layer is sampled from a known area after measuring the thickness of the duff (humus) and litter layers at four locations in a sampling frame of known area. Once the non-forest floor has been removed, mineral or organic soils are sampled volumetrically by collecting cores 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. Following soil sampling, the depth to any restrictive horizon within the top 20 inches is estimated using a soil probe. In the case of organic soils (e.g., wetland soils), samples are collected from the litter layer and the 0-4 inch and 4-8 inch organic layers.

Physical and chemical properties of the soil are determined in the laboratory. Analyses of non-forest floor samples include bulk density, water content, total carbon, and total nitrogen. Analyses of mineral soil samples include bulk density, water content, coarse fragment content, total organic and inorganic carbon, total nitrogen, plant available (extractable) phosphorus and sulfur, exchangeable cations (calcium, magnesium, sodium, potassium, and aluminum), pH, and trace metals such as manganese. These data are used to provide indexes of nutrient status, acidification, and carbon sequestration.

22.2 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.

Non-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).

Organic soil: For the purposes of FIA, an organic soil is defined as any soil in which the organic horizon is greater than 8 inches in thickness. These soils are prevalent in wetland areas such as bogs and marshes and may be frequently encountered in certain regions of the country (e.g., Maine, northern Minnesota, coastal regions).

Restrictive layer: Any soil condition which increases soil density to the extent that it may limit root growth. This limitation may be physical (hard rock) or chemical (acid layer) or both.

Sampling frame: A frame used to collect nonforest floor samples from a known area. A bicycle tire 12 inches in diameter has been selected as the national standard.

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.

22.3 Equipment And Supplies

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

22.3.1 Field Gear Unique to the Soil Indicator

- Retractable measuring tape or ruler graduated in tenths of an inch for measuring soil layer depths.
- Frame for sampling known area of surface litter material. A small bicycle tire (16 x 2.125 in tire size with an internal diameter of 12 in) has been chosen as the standard size.
- Impact-driven soil core (2-in diameter x 8-in depth) sampler with two 2-in diameter by 4-in long stainless steel core liners for obtaining mineral soil samples.
- Additional bulk density sampling equipment: crescent wrench and universal slip wrench for disassembling bulk density sampler if stuck.
- Tile probe (42 in) for measuring depth to a restrictive layer.
- Garden trowel or hand shovel for sampling nonforest floor and excavating soil sample hole where soil core sampler cannot be used.
- Small knife with sharp blade for sampling the nonforest 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.
- Indelible ink markers (black thin-line) for marking sample bags.
- Cleaning cloths or tissues.
- Soil sample bags (9 x 12 in or quart size) for mineral soil samples.
- Soil sample bags (10 x 18 in or gallon size) for nonforest floor samples.
- Soil sample labels.
22.3.2 Optional Soils Equipment

- Supplemental soil sampling equipment for organic soils: Dutch auger.
- Supplemental soil sampling equipment for saturated or wetland soils: mud auger or piston-type core sampler.
- Garden gloves.
- 1-in diameter soil tube probe to take soil samples for hand-texturing or where soil core sampler cannot be used.

22.3.3 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.
- Flagging for marking soil sample points.
- Back pack for carrying sampling equipment to the field.
- Clear plastic shipping tape to cover labels after they have been filled out.

22.4 +GT Laboratory Analyses

Non-forest floor samples are analyzed in the laboratory for:

- Bulk density.
- Water content.
- Total carbon.
- Total nitrogen.
- Phase 3 mineral soil samples are analyzed for:
  - Bulk density, water content, and coarse fragment (>0.08-in (>2-mm)) content.
  - pH in water and in 0.01 M CaCl2.
  - Total carbon.
  - Total organic carbon.
  - Total inorganic carbon (carbonates) (pH>7.5 soils only).
  - Total nitrogen.
  - Exchangeable cations (Na, K, Mg, Ca, Al, Mn).
  - Extractable sulfur and trace metals.
  - Extractable phosphorus (Bray 1 method for pH < 6 soils, Olsen method for pH > 6 soils).

Methods for preparing and analyzing the collected soil samples are available in a separate document.

22.5 Quality Assurance (QA)

The QA program for the soils indicator addresses both field and laboratory measurements. For field measurements, QA protocols are the same as those used for all other Phase 3 indicators. Tolerances have been established for each of the measurements. The tolerances are used during certification and auditing to assist with the control of data quality. Periodic re-measurements are undertaken to establish data quality attributes such as precision, bias and comparability.
This field guide only addresses aspects of QA related to the field portion of the program. Soil laboratories have another set of guidelines for ensuring data quality and are required to enroll in a national proficiency testing program. Details of the lab QA protocol may be obtained by contacting the regional lab directors.

22.5.1 Certification
Field crews are certified to make field measurements as well as take soil samples. After certification, all field crew members are tested and certified for soil indicator measurements. Each certified crew member must demonstrate the ability to conduct soil measurements within established MQOs.

22.5.2 Hot Checks, Cold Checks, and Blind Checks
QA/QC for the field portion of the soil indicator consists of three parts:

Hot Check – an inspection normally done as part of the certification process. The inspector is present on the plot with the crew and provides immediate feedback regarding data quality. Data errors are corrected. Hot checks can be done on certification plots or production plots.

Cold Check – an inspection done either as part of the certification process, or as part of the ongoing QC program. Normally the installation crew is not present at the time of inspection. The inspector has the completed data in-hand at the time of inspection. The inspection can include the whole plot or a subset of the plot. Data errors are corrected. Discrepancies between the two sets of data may be reconciled. Cold checks are done on production plots only.

Blind Check – a re-installation done by a qualified inspection crew without production crew data on hand; a full re-installation of the plot for the purpose of obtaining a measure of data quality. The two data sets are maintained separately. Discrepancies between the two sets of data are not reconciled. Blind checks are done on production plots only.

22.5.3 Reference Plots
Remeasurements of field observations by regional inspection crews occur on routine plots recently visited by a standard field crew (cold checks or hot checks) or on reference plots. All erosion and soil compaction remeasurements can be taken on the subplots as described in the soil measurement methods. Reference plots should be selected with areas of bare and compacted soil to allow for an evaluation of a crew’s ability to make these measurements.

22.5.4 Debriefing
Feedback from the field crews is critical to identifying problems with the soil indicator measurements and improving the program for subsequent field seasons. Crew members conducting soil measurements should fill out a debriefing form and submit it to the regional field coordinator prior to the end of the field season. Crew members should consider it part of their responsibility to report any problems, inconsistencies, or errors in the field guide or the method.

22.6 Plot Information

22.6.1 CURRENT DATE
Record the year, month, and day that the current plot visit was completed as described in 22.6.1.1 – 22.6.1.3.

22.6.1.1 YEAR
Record the year that the plot was completed.
When collected: All soils plots
Field width: 4 digits
Tolerance: No errors
MQO: At least 99% of the time
Values: ≥2003

22.6.1.2 MONTH
Record the month that the plot was completed.

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

<table>
<thead>
<tr>
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<th>Day</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
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<tr>
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<td>03</td>
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<td>04</td>
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<td>May</td>
<td>05</td>
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<td>September</td>
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<td>October</td>
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<tr>
<td>November</td>
<td>11</td>
</tr>
<tr>
<td>December</td>
<td>12</td>
</tr>
</tbody>
</table>

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

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

22.6.2 CREW NUMBER
Record the code to indicate the number assigned to the crew member who collected soils on this plot. The first 2 digits are for the responsible unit's station number (NRS – 24xxxx, SRS – 33xxxx, RMRS – 22xxxx, and PNW – 26xxxx)

When collected: All soils plots
Field width: 6 digits
Tolerance: No errors
MQO: At least 99% of the time
Values:

<table>
<thead>
<tr>
<th>Station</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
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<td>240001 – 249999</td>
</tr>
<tr>
<td>SRS</td>
<td>330001 – 339999</td>
</tr>
<tr>
<td>RMRS</td>
<td>220001 – 229999</td>
</tr>
<tr>
<td>PNW</td>
<td>260001 -- 269999</td>
</tr>
</tbody>
</table>

22.6.3 QA STATUS
Record the code to indicate the type of plot data collected, using the following codes:
When collected: All soils plots
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values:

1. Standard production plot
2. Cold check
3. Reference plot (off grid)
4. Certification/practice plot (off grid)
5. Botched plot file (disregard during data processing)
6. Blind check
7. Hot check (production plot)

22.6.4 NOTES
Use these fields to record notes pertaining to the soils indicator. 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 soils plots
Field width: Unlimited alphanumeric character field
Tolerance: N/A
MQO: N/A
Values: English language words, phrases and numbers

22.7 Soils 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 FIA 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 P2+ 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 four subplots. Soil texture is measured at the soil sampling site adjacent to subplot 2 during the collection of mineral and organic soil samples.

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 nonforested 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.

22.7.1 **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 other than non-forested areas, multiply the % COVER OF BARE SOIL in the nonforested part of the subplot by the % of the subplot that is in nonforested area. For example, if 50% of the subplot is nonforested and the % COVER OF BARE SOIL of the nonforested 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 nonforested condition class and soil is not regularly disturbed or in a maintained urban area

Field Width: 2 digits
Tolerance: +/- 10%
MQO: 75% of the time

Values:

<p>| | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
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<td>Absent</td>
<td>35</td>
<td>31-35%</td>
<td>75</td>
<td>71-75%</td>
</tr>
<tr>
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<td>Trace</td>
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<td>36-40%</td>
<td>80</td>
<td>76-80%</td>
</tr>
<tr>
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<td>1 to 5%</td>
<td>45</td>
<td>41-45%</td>
<td>85</td>
<td>81-85%</td>
</tr>
<tr>
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<td>6-10%</td>
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<td>46-50%</td>
<td>90</td>
<td>86-90%</td>
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<td>51-55%</td>
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</tr>
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<td>56-60%</td>
<td>99</td>
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<td>21-25%</td>
<td>65</td>
<td>61-65%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>26-30%</td>
<td>70</td>
<td>66-70%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

22.7.2 **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.

NRS Note: If the subplot includes other than non-forested areas, multiply the % PERCENT COMPACTED AREA ON THE SUBPLOT in the nonforested part of the subplot by the % of the subplot that is in nonforested area. For example, if 50% of the subplot is nonforested and the % PERCENT COMPACTED AREA ON THE SUBPLOT of the nonforested part is 30%, then the % PERCENT COMPACTED AREA ON THE SUBPLOT for the entire subplot is 15 %.

NRS Note: In strip mines areas, if available use undisturbed forest adjacent to the strip mine and compare the two soils to make the determination if compaction is present. If no undisturbed forest in near, consider the area uncompacted relative to its surrounding.
When Collected: When any portion of the subplot contains at least one accessible nonforested condition class and soil is not regularly disturbed or in a maintained urban area
Field Width: 2 digits
Tolerance: +/- 15%
MQO: 75% of the time

Values:

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>00</td>
<td>Absent</td>
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<tr>
<td>01</td>
<td>Trace</td>
</tr>
<tr>
<td>05</td>
<td>1 to 5%</td>
</tr>
<tr>
<td>10</td>
<td>6-10%</td>
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<td>16-20%</td>
</tr>
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<td>25</td>
<td>21-25%</td>
</tr>
<tr>
<td>30</td>
<td>26-30%</td>
</tr>
</tbody>
</table>

22.7.3 **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 nonforest 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:

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Present</td>
</tr>
<tr>
<td>0</td>
<td>Not present</td>
</tr>
</tbody>
</table>

22.7.4 **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:

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Present</td>
</tr>
<tr>
<td>0</td>
<td>Not present</td>
</tr>
</tbody>
</table>

22.7.5 **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

22.7.6+N  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

NRS Note: Multiple types for Compaction can be coded if present on a subplot.

22.8+N+GT  Soil Sample Collection
The chemical and physical properties of the soil are assessed through the collection of soil samples, which are then submitted to a regional laboratory for analysis. Soil samples are collected from the nonforest floor (subplots 2, 3, and 4) and underlying mineral soil layers (subplot 2). The entire nonforest floor layer is sampled from a known area after measuring the thickness at the north, south, east, and west edges of a sampling frame of known area. Once the nonforest floor has been removed, mineral and organic soils are sampled volumetrically by collecting cores 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. Following soil sampling, the depth to any restrictive horizon within the top 20 inches is estimated using a soil probe. In the case of organic soils, samples are collected from the litter layer and the 0 to 4 inch and 4 to 8 inch organic layers.

Soil samples are collected within the annular plot along soil sampling lines adjacent to subplots 2, 3, and 4 (Figure 96). 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 points (Soil Visit #1) are located:

- Subplot 2 soil measurement site: 30 feet due south (180°) from the center of subplot 2.
- Subplot 3 soil measurement site: 30 feet northwest (300°) from the center of subplot 3.
- Subplot 4 soil measurement site: 30 feet northeast (60°) from the center of subplot 4.
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.

**NRS Note:** When a subplot is nonforested and the soil visit number center location is in other than a nonforest condition, do not move the location. Code it for what is present for the location. (see section 22.8.10+N)

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**Figure 96. Location of soil sampling sites**

**NRS Note:** Pay close attention to Soil Visit Numbers and their respective location on the ground. The Soil Visit Number is found on the pre-printed soils labels.

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22.8.1+N+GT  **NonForest Floor**

NonForest floor samples are collected from soil sampling sites adjacent to subplots 2, 3, and 4. Samples are collected if, and only if, the soil sampling sites are nonforested. The nonforest floor is sampled as a complete unit using a sampling frame (Figure 97).

1. Place the sampling frame over the sampling point taking care not to compact the litter layer. Locate the points due north, due east, due south and due west on the inside of the soil sampling frame and mark these with small vinyl stake flags. Carefully remove the sampling frame.

2. Measure the thickness of the entire nonforest floor to the nearest 0.1 inch at the four flagged locations. At each sampling point, also measure the thickness of the litter layer.

**NRS Note:** Consider the general thickness and exclude any exaggerated depths or unusual depression.

In some soils, telling the difference between the bottom of the nonforest floor and the top of an organic-rich mineral horizon can be difficult. If uncertain:
a. Look for evidence of plant parts (e.g., leaves, needles). If you can see them decomposing in place, you’re still in the nonforest floor.

b. Rub the soil between your finger. Does it crumble (organic nonforest floor) or feel more like modeling clay (try pinching into a ribbon).

c. Look for shiny flecks of mica or quartz (won’t help in all soils).

d. Look for a subtle change in color. Organic horizons tend to be black; a mineral horizon will tend to be more brownish.

e. Wet a sample of the material and press it between your fingers. Note the color of the liquid that runs out. The blacker the color, the higher the organic content.

f. Check for a change in density (mineral soils are denser).

3. Replace the soil sampling frame. Using a pair of clippers, carefully remove all live vegetation from the sample area. Living mosses should be clipped at the base of the green, photosynthetic material.

4. Using a sharp knife or a pair of clippers, carefully cut through the nonforest floor along the inner surface of the frame to separate it from the surrounding soil.

5. Using inward scooping motions, carefully remove the entire volume of the nonforest floor from within the confines of the sampling frame. Discard all woody debris (including pine cones, large pieces of bark, and decomposed wood) above 0.25 inches in diameter (approximately the diameter of a pencil). Discard any rocks or pebbles collected with the nonforest floor material.

6. Working over the tarp, place the entire nonforest floor layer sample into a pre-labeled gallon sample bag. In some areas more than one bag might be required to hold the sample. If so, label the bags with identical information, then add “1 of 2” and “2 of 2” respectively.

![Cross-sectional views of sampling sites](image)

**Figure 97. Cross-sectional views of sampling sites (top view and side view).**

22.8.2 Assembly and Operation of Impact Driven Soil Corer (Bulk Density Sampler)
The impact driven core sampler (Figure 98) is used to collect a known volume of soil with a minimum of compaction and disturbance. The weight of this core is then used to determine bulk density (the mass of soil per unit volume), an important physical property of the soil. Although we usually think about the soil in terms of the mineral fraction, soils are actually a matrix of solids...
(mineral and organic), water, and air. The ratio between these fractions (pore space) determines the capacity of the soil to provide nutrients, air, and water to plant roots.

In addition, bulk density is used to convert the chemical concentrations obtained in the lab to a volumetric basis, which is more meaningful in terms of plant nutrition.

![Diagram of Impact Driven Soil Corer](image)

**Figure 98. Diagram of Impact Driven Soil Corer**

**Assembly**

- Thread the top cap of the soil coring head onto the slide hammer attachment and tighten. This connection must be tight; if not, this connection may be sheared off during use.
- Insert two 2-in diameter x 4-in long stainless steel soil core liners into the soil coring head. It may be helpful to number the core liners with an indelible marker in order to tell them apart after the sample has been collected.
- Thread the soil coring head onto the top cap and slide hammer attachment until the top rim of the coring head just contacts the top cap. Make sure that the vent hole in the top cap is kept open, so that air displaced while the coring head is driven into the soil can escape from inside the coring head.

**Maintenance**

- Take care to clean and dry the inside and outside of the soil coring head after each sample. Moisture can cause rust build-up on the inside of the core head and make it difficult to insert and remove the liners.
- Use a brush and rag to clean both the inside and outside of the core liners as well. Grit on the outside of the liner can cause damage to the inside of the coring head and make it difficult to collect samples.
- Never twist, pull, or put pressure on the core sampler while the hammer attachment is extended. This can cause the attachment to break or bend.

**22.8.3+GT 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 nonforested (Figure 97).

1. Mineral soil samples are collected from within the area of the sampling frame after the nonforest floor has been removed.
2. Place the core sampler in a vertical position and drive the sampler into the soil until the top of the coring head is about 1 inch above the mineral soil surface. At this point, the soil should be even with the top of the liner.

3. With the handle of the slide hammer down, rotate the sampler in a circular motion. This motion breaks the soil loose at the bottom of the sampler and makes it easier to remove the core. Do not extend the sliding part of the slide hammer upwards to gain additional leverage as this may bend the attachment. Remove the core sampler from the ground by pulling the slide hammer upwards in a smooth vertical motion.

4. If a complete and intact core has been collected, unscrew the coring head from the top cap and carefully slide the core liners onto the tarp (see section 22.8.5 and section 22.8.6 for techniques used in handling problem soils). If necessary, use the crescent and slip wrenches to separate the parts. Trim the top and bottom of the core even with the liner rims. Take care to avoid any loss of soil from the cores; if any material spills, you must resample.

5. Using a knife, slice through the soil core at the interface between the two liners (the 4-inch depth). Remove the soil from the 0-4 inch stainless steel liner and place it into a pre-labeled soil sample bag. Repeat for the 4-8 inch core. Be sure to place all of the material in the liner (including coarse fragments, roots, soil, etc.) into the sample bags.

6. For each plot, you should have a maximum of five samples:
   a. Three labeled gallon bags containing the nonforest floor samples from the sampling sites adjacent to subplots 2, 3, and 4. Additional bags may be needed for deep soils.
   b. One labeled quart bag containing the 0-4 inch mineral soil sample from the soil sampling site adjacent to subplot 2.
   c. One labeled quart bag containing the 4-8 inch mineral soil sample from the soil sampling site adjacent to subplot 2.

7. Clean all soil sampling equipment thoroughly before sampling soil at the next plot.

22.8.4 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.

22.8.5 Alternate Sampling Methods for “Problem” Soils
In some cases, the soil coring procedure outlined above will not work. For example, in saturated organic soils, use of the core sampler may cause significant compaction of the sample. Very sandy soils or dry soils may tend to fall out of the liners, while in soils with a high rock content or a shallow depth to bedrock, it may not be possible to drive the core sampler into the ground. Approaches to handling these specific problems are addressed in section 22.8.6.

In general, make at least three attempts to collect a sample using the core sampler. If these attempts are unsuccessful, then use one of the following techniques to collect a sample.
1. Excavation method (hand shovel) – Dig a shallow hole whose width is at least 1.5 times the length of your knife. Starting at the top of the mineral soil, measure down 8 inches. Make a mark on the side of the hole at 4 and 8 inches. Use your hand shovel to collect material from the 0-4 and 4-8 inch depth increments. Collect a sufficient volume of soil from the sides of the hole at each depth increment to approximately equal the volume of a soil core liner and place each depth increment sample in separate soil sample bags. Be sure to collect material from throughout the entire depth increment to avoid biasing the sample.

2. Tube probe – Remove the nonforest floor from an area and use the tube probe to collect samples from the 0-4 inch depth at a number of locations. Composite these samples until you have a sample volume approximately equal to that of the soil core liner. Repeat the subsampling and compositing for the 4-8 inch layer by returning to the points sampled previously and pushing the tube probe into the soil an additional 4 inches.

3. Dutch auger – Dutch augers can be very useful in wetland or saturated soils. In an area where the nonforest floor has been removed, drill into the soil with the auger and use a tape measure to help you collect material from the 0-4 and 4-8 inch depth increments.

For all of these methods, make sure to collect approximately the same amount of soil material [< 0.08 inch (< 2 mm)] that would have been needed to fill the core liner. Completion of the laboratory analyses requires at least 5 ounces (150 g) of mineral soil.

In soils with a large number of small rocks and pebbles, this means that you will need to collect a larger amount of sample so that the lab will have enough material to analyze once the rocks have been removed. In these soils, collect enough material to fill two core liners.

Be certain to circle “Other” on the label under sampler type and note method used on the shipping form.

22.8.6 GT Commonly Encountered Problems

It may not always be possible to obtain soil core samples using the soil core sampler. The following section provides some suggestions on how to overcome these problems.

1. Rocky soils

In soils containing a high percentage of rocks, it may not be possible to drive the core sampler in to the required depth of 8 inches. If this occurs, remove any soil within the sampler, test for the presence of an obstruction using a plot stake pin or the tile probe, and make a second attempt either within the area where the nonforest floor has been removed or within the available soil sampling area (within a 5-foot radius of the original soil sampling location). Make a maximum of five attempts. If a complete sample from the 0-4 inch depth can be obtained, collect that sample. Otherwise, use the excavation or soil tube probe approaches outlined above (section 22.8.5).

2. Very sandy soils (or very dry soils) – sample falls out of the core

If the soil will not stay in the core liner, use the shovel to dig around the soil coring head while it is still in place. Tilt the soil corer to one side and insert the blade of the shovel underneath the base of the core. Use the base of the shovel to hold the sample in place as you remove the corer from the soil. Depending on the soil type, this technique may require some practice and/or the use of a partner.

3. Saturated or wetland soils

Attempt to collect a sample using the soil corer. If this is not possible, or if compaction occurs, use one of the three alternate methods outlined in section 22.8.5
4. Buried Soils

In areas located adjacent to rivers or other bodies of water, sediment transport and periodic flooding may result in the formation of buried soils. Buried soils may be identified by alternating layers of mineral soil and non-forest floor material. To confirm the presence of a buried soil, excavate a small hole near the soil sampling site with a shovel and look for the presence of non-forest floor and litter materials buried between layers of mineral soil.

Collect only the litter and organic matter currently on the soil surface as a non-forest floor sample following the standard protocol. Attempt to collect 0-4 and 4-8 inch samples using the bulk density corer. If this is not possible, or if the cores do not fill completely, collect a sample using a shovel following the excavation method outlined in section 22.8.5. Place a star on the upper right corner of the sampling label, circle “Other” for sampler type, and make a clear note on the shipping form to indicate that this sample represents a buried soil.

5. Other situations in which a complete 8 inch core cannot be collected

If a complete core cannot be obtained in one sample, but is cohesive enough to collect a second sample from the same hole, try the following. Collect a partial sample and measure the length of the collected core. Reinsert the sampler and drive it into the soil to an additional depth close to the length of the collected core. Remove the new core from the sampler. When placed together, the two cores should exceed 8 inches in length. With a knife, cut the cores at the 4-inch and 8-inch lengths. Replace the additional soil into the soil hole.

In some soil types, the 0-4 inch core may not fill completely, although the 4-8 inch core appears to be full. In this instance, attempt to collect a second core by driving the core deeper into the soil. In terms of the soil chemistry, it is better to slightly overcompact the sample than to under fill the core. Make three attempts to completely fill the core, driving the corer deeper each time. If you are still unable to obtain a complete 0-4 inch core, collect the 0-4 inch sample and mark “Other” under sampler type. An under filled core cannot be used as a bulk density sample. If the 4-8 inch sample is full, it should be collected as a bulk density sample (mark “Bulk Density” under sampler type).

22.8.7 Organic soils

These soils are prevalent in certain regions of the country (e.g., Maine, northern Minnesota, coastal regions) and proper sampling requires modification of the above procedures.

Due to the large thickness of the underlying organic soil, sampling is restricted to the litter layer. Measure the entire thickness of the non-forest floor to a maximum depth of 20 inches. However, only collect a sample of the litter layer (see section 22.8.1).

Attempt to collect a soil sample using the impact driven corer. In many cases, this will not be possible without severe compaction of the sample. If compaction occurs, or if you have difficulty in obtaining a complete core, samples may be collected at the 0 - 4 inch and 4 - 8 inch depth increments using a Dutch auger or shovel (see section 22.8.5).

22.8.8 SUBPLOT NUMBER

Record the number of the subplot adjacent to the soil sampling site.
When Collected: All soil sample locations
Field Width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values: 2 to 4

22.8.9 VISIT NUMBER
Record the number of the location where the soil sample is being attempted (Figure 96)

When Collected: All soil sample locations
Field Width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values: 1 to 9

22.8.10 +N +GT SOIL SAMPLE STATUS
Record whether or not a nonforest floor or mineral soil sample is being collected at the soil sampling location. For both nonforest 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 nonforested condition. In rare instances, the soil sampling site may occur in a nonforested condition that has not been sampled on any of the 4 subplots. If this is the case, then use SOIL SAMPLE STATUS code 11 to indicate that a sample has been collected for a nonforest condition that is not otherwise represented on the plot.

NRS Note: When the sample location falls in an inclusion of a nonforested condition, collect the soil sample if possible. Use codes “Not Sample” Soil Sample Status codes 03 through 09 if the soil sample could not be collect. Use non sample code 09 if the inclusion’s soil is tilled and planted with crops or regularly disturbed or maintained urban area.

When Collected: All soil sample locations (mineral soil on subplot 2 and nonforest floor on subplots 2, 3, and 4) and soil is not regularly disturbed or in a maintained urban area
Field Width: 2 digits
Tolerance: No errors
MQO: At least 99% of the time
Values:
01 Sampled: nonforest that has been identified as a condition on the plot
02 Not sampled: other than 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 (regularly disturbed or maintained urban area)
11 Sampled: nonforest that has NOT been identified as a condition on the plot

22.8.11 GT CONDITION CLASS NUMBER
Record the nonforested 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 nonforest 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

22.8.12 GT NONFOREST FLOOR (Litter/Duff) THICKNESS – NORTH
Record the thickness (to the nearest 0.1 inch) of the nonforest floor measured from the top of the litter layer to the boundary between the nonforest floor and mineral soil.

In some soils, telling the difference between the bottom of the nonforest floor and the top of an organic-rich mineral horizon can be difficult. If uncertain:

- Look for evidence of plant parts (e.g., leaves, needles). If you can see them decomposing in place, you’re still in the nonforest floor.
- Rub the soil between your finger. Does it crumble (organic nonforest floor) or feel more like modeling clay (try pinching into a ribbon).
- Look for shiny flecks of mica or quartz (won’t help in all soils).
- Look for a subtle change in color. Organic horizons tend to be black; a mineral horizon will tend to be more brownish.
- Wet a sample of the material and press it between your fingers. Note the color of the liquid that runs out. The blacker the color, the higher the organic content.
- Check for a change in density (mineral soils are denser).

Measure to a maximum depth of 20.0 inches. If the thickness of the nonforest floor is greater than 20.0 inches, then code “20.0”. For locations where bare soil or bedrock material is exposed, enter “00.0" inches depth. On organic soils, measure the entire thickness of the nonforest floor (to 20.0 inches) even though you will only sample the litter layer.
When Collected: When SOIL SAMPLE STATUS = 1
Field Width: 3 digits
Tolerance: +/- 2 in
MQO: 90% of the time
Values: 00.0 to 20.0

22.8.13

**GT** NONFOREST FLOOR (Litter/Duff) THICKNESS – EAST

Record the thickness (to the nearest 0.1 inch) of the nonforest floor measured from the top of the litter layer to the boundary between the nonforest floor and mineral soil.

Measure to a maximum depth of 20.0 inches. If the thickness of the nonforest floor is greater than 20.0 inches, then code “20.0”. For locations where bare soil or bedrock material is exposed, enter “00.0” inches depth. On organic soils, measure the entire thickness of the nonforest floor (to 20 inches) even though you will only sample the litter layer.

When Collected: When SOIL SAMPLE STATUS = 1
Field Width: 3 digits
Tolerance: +/- 2 inches
MQO: 90% of the time
Values: 00.0 to 20.0

22.8.14

**GT** NONFOREST FLOOR (Litter/Duff) THICKNESS – SOUTH

Record the thickness (to the nearest 0.1 inch) of the nonforest floor measured from the top of the litter layer to the boundary between the nonforest floor and mineral soil.

Measure to a maximum depth of 20.0 inches. If the thickness of the nonforest floor is greater than 20.0 inches, then code “20.0”. For locations where bare soil or bedrock material is exposed, enter “00.0” inches depth. On organic soils, measure the entire thickness of the nonforest floor (to 20.0 inches) even though you will only sample the litter layer.

When Collected: When SOIL SAMPLE STATUS = 1
Field Width: 3 digits
Tolerance: +/- 2 in
MQO: 90% of the time
Values: 00.0 to 20.0

22.8.15

**GT** NONFOREST FLOOR (Litter/Duff) THICKNESS – WEST

Record the thickness (to the nearest 0.1 inch) of the nonforest floor measured from the top of the litter layer to the boundary between the nonforest floor and mineral soil.

Measure to a maximum depth of 20.0 inches. If the thickness of the nonforest floor is greater than 20.0 inches, then code “20.0”. For locations where bare soil or bedrock material is exposed, enter “00.0” inches depth. On organic soils, measure the entire thickness of the nonforest floor (to 20.0 inches) even though you will only sample the litter layer.
When Collected: SOIL SAMPLE STATUS = 1
Field Width: 3 digits
Tolerance: +/- 2 in
MQO: 90% of the time
Values: 00.0 to 20.0

22.8.16 GT THICKNESS OF THE LITTER LAYER - NORTH
Record the thickness of the litter layer (to the nearest 0.1 inch) at the north location within the sampling frame. The bottom of the litter layer can be distinguished as the boundary where plant parts (such as leaves or needles) are no longer recognizable as such because of decomposition. Another criterion is that the organic layer may contain plant roots, but the litter layer will probably not. At some locations, the depth of the nonforest floor and the litter layer may be the same. For locations where bare soil or bedrock material is exposed, enter “00.0” inches depth.

When Collected: SOIL SAMPLE STATUS = 1
Field Width: 3 digits
Tolerance: +/- 2 in
MQO: 90% of the time
Values: 00.0 to 20.0

22.8.17 GT THICKNESS OF THE LITTER LAYER - EAST
Record the thickness of the litter layer (to the nearest 0.1 inch) at the east location within the sampling frame. The bottom of the litter layer can be distinguished as the boundary where plant parts (such as leaves or needles) are no longer recognizable as such because of decomposition. Another criterion is that the organic layer may contain plant roots, but the litter layer will probably not. At some locations, the depth of the nonforest floor and the litter layer may be the same. For locations where bare soil or bedrock material is exposed, enter “00.0” inches depth.

When Collected: SOIL SAMPLE STATUS = 1
Field Width: 3 digits
Tolerance: +/- 2 in
MQO: 90% of the time
Values: 00.0 to 20.0

22.8.18 GT THICKNESS OF THE LITTER LAYER - SOUTH
Record the thickness of the litter layer (to the nearest 0.1 inch) at the south location within the sampling frame. The bottom of the litter layer can be distinguished as the boundary where plant parts (such as leaves or needles) are no longer recognizable as such because of decomposition. Another criterion is that the organic layer may contain plant roots, but the litter layer will probably not. At some locations, the depth of the nonforest floor and the litter layer may be the same. For locations where bare soil or bedrock material is exposed, enter “00.0” inches depth.

When Collected: SOIL SAMPLE STATUS = 1
Field Width: 3 digits
Tolerance: +/- 2 in
MQO: 90% of the time
Values: 00.0 to 20.0

22.8.19 GT THICKNESS OF THE LITTER LAYER - WEST
Record the thickness of the litter layer (to the nearest 0.1 inch) at the west location within the sampling frame. The bottom of the litter layer can be distinguished as the boundary where plant parts (such as leaves or needles) are no longer recognizable as such because of decomposition. Another criterion is that the organic layer may contain plant roots, but the litter layer will probably
not. At some locations, the depth of the nonforest floor and the litter layer may be the same. For locations where bare soil or bedrock material is exposed, enter “00.0” inches depth.

When Collected: SOIL SAMPLE STATUS = 1
Field Width: 3 digits
Tolerance: +/- 2 in
MQO: 90% of the time
Values: 00.0 to 20.0

22.8.20 DEPTH TO RESTRICTIVE HORIZON

Insert the tile probe into five locations within the soil sampling area (center, north, east, south and west edges) to identify if a restrictive horizon exists. Record the median depth to a restrictive layer (to the nearest 0.1 inch). The maximum depth for testing for a restrictive horizon is 20.0 inches. If a restrictive layer is encountered within the 20.0 inches, record the median depth (to the nearest 0.1 inch) to the restrictive horizon of the five locations probed. Record:

- 20.0 if a restrictive horizon is not encountered.
- 00.0 if superficial bedrock is present.
- 99.9 if too many rock fragments or cobbles prevent inserting soil probe.

When Collected: SOIL SAMPLE STATUS = 1
Field Width: 3 digits
Tolerance: +/- 6 in
MQO: 90% of the time
Values: 00.0 to 20.0, 99.9

NRS QAQC Reminder: Depth to Restrictive Layer is measured to the nearest tenth of an inch, so if you are entering the maximum depth of 20 inches, enter 200. If you enter in only one zero instead of two, you are recording a restrictive layer depth of 2 inches.

22.8.21 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.
22.8.22 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).

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

22.9 Sample Labels
Pre-printed labels will be provided to each field crew. Completion of all items on the soil label is essential for proper processing of the sample by the laboratories. In past years, numerous samples have had to be discarded due to mistakes or inconsistencies on the labels. If you encounter a situation where you need to make additional notes on the sample (e.g., a sample which was particularly unusual or required significant deviation from the standard methods), place a star on the upper right corner of the label and make a note on the sample shipping form. An example label is presented in Figure 99.
### Figure 99. Example soil label

**STATE:** The 2-digit FIPS (Federal Information Processing Standard) code for the State (see Appendix 1 in the P2 field guide). This will be used by the soil analysis laboratory for batching of samples (should be pre-printed on labels).

**COUNTY:** The 3-digit FIPS (Federal Information Processing Standard) code identifying the county, parish, or borough (or unit in AK). See Appendix 1 in the P2 field guide. This will be used by the soil analysis laboratory for batching of samples (should be pre-printed on labels).

**PLOT NUMBER:** The P2 plot number (should be pre-printed on label)

**SOIL VISIT NUMBER:** Record the soil visit number as described in Figure 96. For the first soil sample collected along a soil sampling line, this number will be “1”. All subsequent visits to a plot will have higher numbers.

**DATE SAMPLED:** Enter the date that soils were sampled on this plot.

**CREW NUMBER:** Enter your field crew identification number. If you have not been assigned a number, enter your last name.

**LAYER TYPE:** Circle the type of sample collected and the depth increment of the sample.

- **SUBPLOT NUMBER:** Circle the subplot adjacent to the soil sampling site.
- Subplot 2 Soil sample is from a soil sampling site adjacent to subplot 2
- Subplot 3 Soil sample is from a soil sampling site adjacent to subplot 3
- Subplot 4 Soil sample is from a soil sampling site adjacent to subplot 4
- **SAMPLER:** For mineral or organic soils, circle the method used to collect the sample
  - Bulk density Impact-driven soil core sampler
  - Other Soil tube probe, excavation method, mud auger, or Dutch auger

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<thead>
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<th>Soil Sample Collected by Regular Field Crew</th>
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<tbody>
<tr>
<td>State:</td>
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<td>County:</td>
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<td>P2 Plot:</td>
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<td>Soil Visit #: _ Crew #: _________________</td>
</tr>
<tr>
<td>Date: _____/<strong><strong>/</strong></strong> Subplot#: 2 3 4</td>
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<tr>
<td>Layer: Forest Floor 0–4 in 4–8 in</td>
</tr>
<tr>
<td>Sampler: Bulk density Other</td>
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22.10 Sample Shipping
After samples have been collected, changes in the oxygen and moisture content within the bag can cause significant alteration of sample chemistry. To prevent this from occurring, samples are to be shipped on a weekly basis to the regional soil lab designated for your state. Do not keep soil samples longer than a week unless they can be stored in a refrigerated area. Ship samples using the most economical rate. There is no need to ship soil samples using expensive overnight delivery rates.

22.10.1 Shipping Forms
All crews will be provided with shipping forms for forwarding soil samples to a regional laboratory that has been approved to receive soil samples from regulated areas. The addresses for the regional labs are listed at the bottom of the shipping form. An example shipping form is provided in Figure 100.

Forms may be submitted either in hard copy or electronically. Electronic versions are preferred by the lab since this greatly increases the efficiency of sample inventory.

The hard copy version of the shipping form consists of a triplicate copy. Prior to shipping samples, crews should completely fill out the shipping form and:

Send the original with the soil samples to the laboratory.

Mail one copy immediately to the laboratory in a separate envelope along with a copy of the shipping (tracking) information from the shipping service. The separate mailing of shipping forms will serve to notify the laboratory if a shipment of samples has been misplaced during transport.

Send the third copy to the regional field supervisor for their records.

Electronic versions may be filled out on a computer and electronic copies sent to the lab and your regional field supervisor. NRS Note: NRS will use the electronic version of the soils shipping forms and email. Lab email addresses are provided at the bottom of the shipping form. Print out a hard copy of the form and enclose this in the box prior to shipping. NRS Note: a hard copy of the form is required in the shipping box. The hard copy is required as a QA check on sample inventory. One hand written and one typed or printed is not acceptable, the copies must be identical. These shipping forms are official documents used for tracking purposes in the lab.

NRS Note: If faxing a copy of the shipping form to the Lab, either email or call them to let them know you sent it.

A separate line must be completed for each sample collected. Information on the sample shipping form is used by the laboratory to create an inventory of samples, to assign lab numbers, and to help resolve inconsistencies on the sample label. A complete and accurate inventory of samples is critical to efficient and cost-effective processing of samples.

If a sample was not collected do not list this on the shipping form.
**NRS FIA Soil Samples Shipping Form**

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<th>Name:</th>
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<td>Crew #:</td>
<td>Production crew QAQC crew</td>
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<th>State</th>
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<th>Plot Number</th>
<th>Date Sampled</th>
<th>Layer Type (Forest Floor, 0-4 in, or 4-8 in)</th>
<th>Subplot Number (2, 3, or 4)</th>
<th>Bags/Sample</th>
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**Total Number of Bags Sent __________**

Please provide all information and ship samples WEEKLY to the appropriate lab for the region in which the samples were collected. Place all soil samples in a larger plastic bag for shipping.

Northern Research Station:

**John Larson**  
Forestry Sciences Lab  
1831 Highway 169 East  
Grand Rapids, MN 55744  
Phone: 218-326-7113  
Email: jlarson@fs.fed.us

**Instructions:**
1. Fill out form completely. Save or scan form, naming file with the state number and date.
2. Make certain all soil sample bag labels are correct and complete.
3. Print and send completed form with soil samples.
4. Email a copy to the soils lab, with the State Designation and date in Subject line.
5. Email a copy to the Field Supervisor or COR and keep a copy for your records.
6. Regular field crews: Please check “Production crew” box at top of form.
7. QA crews: Please use a separate form for QA audit samples and check QAQC crew” box above.
8. Label box “FIA SOILS REFRIGERATE UPON Arrival”

**Figure 100+N. NRS FIA Phase 3 soil samples shipping form.**

NAME: Enter your name here.
SHIPPED VIA: Enter the method used to ship the sample (e.g., UPS, Priority mail, regular mail).

SIGNATURE: Sign your name here.

TRACKING NUMBER: Enter the tracking number assigned to the shipment. This information is used by regional supervisors and the laboratories to locate lost or missing shipments.

STATE CODE: Enter the two-digit FIPS code for the state in which the samples were collected.

DATE: Enter the date on which samples were shipped.

CREW NUMBER: If you have been assigned a crew number, enter it here.

QA STATUS: Indicate whether this sample was collected as part of a standard plot or as part of an audit/QA plot. Unless you are conducting a hot, cold, or blind check, the option for “standard” should be checked.

STATE: The 2-digit FIPS (Federal Information Processing Standard) code for the State (see Appendix 1 in the P2 field guide). This will be used by the soil analysis laboratory for batching of samples (should be pre-printed on labels).

NRS Note: When collecting soils in multiple states, use a separate shipping form for each state.

COUNTY: The 3-digit FIPS (Federal Information Processing Standard) code identifying the county, parish, or borough (or unit in AK). See Appendix 1 in the P2 field guide. This will be used by the soil analysis laboratory for batching of samples (should be pre-printed on labels).

PLOT NUMBER: The P2 plot number (should be pre-printed on label).

DATE SAMPLED: Enter the date that the soil sample was collected.

LAYER TYPE: Indicate the soil layer from which this sample was collected. Choices are: forest floor, 0-4 inches, and 4-8 inches.

SUBPLOT NUMBER: Enter the subplot adjacent to the soil sampling line from which this sample was collected.

BAGS/SAMPLE: Enter the number of bags associated with a sample. For some nonforest floor samples, more than 1 bag may be needed to collect all of the material. The lab uses this information to make certain that samples consisting of multiple bags are processed together.

TOTAL NUMBER OF BAGS SENT: Enter the total number of bags contained in the shipment. The laboratory staff will compare the number on this shipping form to the number of bags that they receive in order to make sure that no samples are missing.

22.10.2 Government Regulations For Pest-Regulated States (Southern Region, NY, AZ, NM, CA, and HI)

In order to limit the movement of agricultural pests (e.g., fire ant, corn cyst nematode, golden nematode, witchweed, and Mexican fruit fly), the shipment of soil samples across state boundaries is strictly regulated by the USDA. States with these pests are primarily located in the southern United States and include AL, AR, FL, GA, LA, MD, MS, NC, OK, SC, TN, and TX); soil shipments are also regulated in AZ, NM, CA, HI, and NY. In order to receive a permit to accept
soil samples from these areas, the soil labs have had to sign a compliance agreement with the
Plant Protection and Quarantine program of the USDA Animal and Plant Health Inspection
Service (APHIS) and pass an inspection.

The burden for meeting APHIS shipping regulations falls on the field crews. Crews must:

- Double bag or enclose all samples from a shipment within a larger plastic bag (i.e., trash
  bag).
- Attach a shipping label to the outside of the box.
- Attach a regulated soils label showing the regional lab’s APHIS permit number to the box.
- After analysis, all soil samples must be stored or disposed of in the prescribed manner.

22.11 Tasks That Can Be Performed By Other Crew Members

- In order to maximize efficiency on the plot, crew members not certified in the soil indicator
  may be asked to assist with certain tasks related to sample collection. These tasks include:
  - Locating the sampling site (with instruction from certified crew member).
  - Assembling the impact driven corer.
  - Filling in bag labels and sample shipping forms (Note: these should be checked by certified
    crew member prior to leaving the plot to ensure completeness and accuracy).
  - Cleaning the core liners and the coring head.
  - Disassembling the impact driven corer.

22.12 References

http://www.for.gov.bc.ca/tasb/legsregs/fpc/fpcguide/SOILSURV/soil-toc.htm

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Pollution. 1994. Manual on Methods and Criteria for Harmonized Sampling, Assessment,
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22.13 Acknowledgements

The West Advisor for this indicator may be contacted at: Michael Amacher, USDA Forest Service, Rocky Mountain Research Station, 860 N. 1200 E, Logan UT 84321, via phone at (435) 755-3560 or via email at mamacher@fs.fed.us. The East Advisor may be contacted at: Charles H. (Hobie) Perry, USDA Forest Service, Northern Research Station, 1992 Folwell Avenue, St. Paul MN 55108, via phone at (651) 649-5191 or via email at charleshperry@fs.fed.us
Example Data Sheets

Soil Data Sheet 1

FIA P2+Soils

Soil Sampling Site Measurements

State: ___ ___ County: _________ P2 Plot #: _________ ___ ___ ___ ___ ___ ___ ___

Soil Visit #: ___ Date: ___/___/_____ Crew Number(s): _______________________________________

<table>
<thead>
<tr>
<th>Soil Sampling Site Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soil Sampling Site Adjacent Condition</td>
</tr>
<tr>
<td>To: Class Code</td>
</tr>
<tr>
<td>Subplot 2: _______</td>
</tr>
<tr>
<td>Subplot 3: _______</td>
</tr>
<tr>
<td>Subplot 4: _______</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Non-Forest Floor Thickness (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>N</em></td>
</tr>
<tr>
<td>Subplot 2 Soil Sampling Site:</td>
</tr>
<tr>
<td>Subplot 3 Soil Sampling Site:</td>
</tr>
<tr>
<td>Subplot 4 Soil Sampling Site:</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Litter Layer Thickness (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>N</em></td>
</tr>
<tr>
<td>Subplot 2 Soil Sampling Site:</td>
</tr>
<tr>
<td>Subplot 3 Soil Sampling Site:</td>
</tr>
<tr>
<td>Subplot 4 Soil Sampling Site:</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Depth to Subsoil Restrictive Layer (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subplot 2 Soil Sampling Site:</td>
</tr>
<tr>
<td>Subplot 3 Soil Sampling Site:</td>
</tr>
<tr>
<td>Subplot 4 Soil Sampling Site:</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Field Texture Determination</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soil Texture Codes</td>
</tr>
<tr>
<td>Subplot 2 Soil Sampling Site: Mineral 1 (0-4 in)</td>
</tr>
<tr>
<td>Subplot 2 Soil Sampling Site: Mineral 2 (4-8 in)</td>
</tr>
<tr>
<td>Subplot 3 Soil Sampling Site: Mineral 1 (0-4 in)</td>
</tr>
<tr>
<td>Subplot 3 Soil Sampling Site: Mineral 2 (4-8 in)</td>
</tr>
<tr>
<td>Subplot 4 Soil Sampling Site: Mineral 1 (0-4 in)</td>
</tr>
</tbody>
</table>

Note to regular field crews: Collect mineral 1 and mineral 2 samples from forested sampling sites adjacent to subplot 2 only.

Soil Data Sheet 2
FIA P2+Soils Soil Erosion and Compaction Measurements

State: ___ ___  County: ___ ___ ___  P2 Plot #: ___ ___ ___ ___

Soil Visit #: ___

Date: ___/___/_____  Crew Number(s): __________________________________________

Soil Erosion Measurements:

<table>
<thead>
<tr>
<th>Subplot</th>
<th>Bare Soil*(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
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<tr>
<td>3</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>

*Percent area estimate for forested portion of subplot

Soil Compaction Measurements:

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Subplot 1</th>
<th>Subplot 2</th>
<th>Subplot 3</th>
<th>Subplot 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>% Non-Forested Area Compacted</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type - Rutted Trail</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Type - Compacted Trail</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type - Compacted Area</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type - Other (Explain)*</td>
<td></td>
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</tbody>
</table>

*Explanations:
____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________

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Section 23. Crowns: Measurements and Sampling

23.0+N-P2++GT CROWNS MEASUREMENTS AND SAMPLING

23.1+N-P2++GT Crowns 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 ecosystems.

VIGOR CLASS, UNCOMPACTED LIVE CROWN RATIO, CROWN LIGHT EXPOSURE and CROWN POSITION and CROWN DIEBACK are determined for each sapling. Foliage below the point used for UNCOMPACTED LIVE CROWN RATIO is not considered in VIGOR CLASS determination. All sapling measurements are done during plot establishment and whenever plot remeasurement occurs.

Crown evaluations, including UNCOMPACTED LIVE CROWN RATIO, LIGHT EXPOSURE, POSITION, DENSITY, and DIEBACK, and TRANSPARENCY are made on all trees with DBH/DRC (DRC in the West) 5.0 inches or larger. Trees with high scores for UNCOMPACTED LIVE CROWN RATIO and DENSITY, and low scores for DIEBACK and FOLIAGE TRANSPARENCY have increased potential for carbon fixation, nutrient storage and increased potential for survival and reproduction. Crown evaluations allow for the quantitative assessment of current tree conditions and provide an integrated measure of site conditions, stand density and influence of external stresses. All crown measurements are taken during plot establishment and whenever plot remeasurement occurs.

Note: This indicator is CORE OPTIONAL for all phase 2 plots.

NRS Note: NRS will complete Crowns Measurements and Sampling protocols during the window of May 1st through September 30th.

It is preferred that two persons make all crown measurements, but this is not a requirement and is not always possible. If two people are evaluating crowns, 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 103). 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.

NRS Note: If a plot is completed by one individual, the person should view the tree from two different locations similar to the instructions explained above.

If the numbers for a crown measurement estimated by two crew members, or the individual’s two measurements, 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).

Ground Truth Note: There may be cases where it is not possible to have two persons on the site; in these situations it is recommended that the person rating the crowns does so from two separate vantage points in order to get the same perspective as a two person crew would have.
23.2 - 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 101).
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.

**Determining Crown Base & Use of 5' Rule**

![Diagram of determining crown base](image)

**Figure 101. 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.

23.3-P2+ Crown Density-Foliage Transparency Card

Front

Crown Density Scale

Back

Density of Tree, Present

Figure 102. Density-Transparency card

The crown density - foliage transparency card (Figure 102) should be used as a certification 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 certification, 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 CROWN DENSITY, hold the card so that "Crown Density" is right-side up ("Foliage Transparency" should be upside down). Use the numbers that are right-side up. Conversely, for FOLIAGE TRANSPARENCY, make sure that "Foliage Transparency" is right-side up. Crews should refer to specific CROWN DENSITY or FOLIAGE TRANSPARENCY sections for a definition of aspects that are included in the crown rating.

The back of the crown density - foliage transparency card has two uses: for CROWN DENSITY when a portion of the crown is missing and a general scale for estimating UNCOMPACTED LIVE CROWN RATIO. Crews should refer to the CROWN DENSITY and UNCOMPACTED LIVE CROWN RATIO sections for the use of this side of the card.
23.4 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: If two people are evaluating tree crowns, 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 103). 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.
VIEWING THE CROWN

Figure 103. Crew positions for viewing crowns.

NRS Note: If a plot is completed by one individual, the person should view the tree from two different locations, similar to the instructions explained above.

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

23.5-P2+ UNCOMPACTED LIVE CROWN RATIO Not Collected on PA Regeneration plots

UNCOMPACTED LIVE CROWN RATIO is a percentage determined by dividing the live crown length by the ACTUAL LENGTH (Figure 104). 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%.
Figure 104. UNCOMPACTED LIVE CROWN RATIO examples.

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 105).

When the two estimates do not agree, follow the guidelines listed at the end of section 23.1 Overview.
Figure 105. Sapling UNCOMPACTED LIVE CROWN RATIO determination 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 106). 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 101). 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. Note that if a tree with a broken top has new growth that is too small to qualify as a new leader, then the new growth is NOT counted as part of the live crown length or ACTUAL LENGTH and is thus not included in UNCOMPACTED LIVE CROWN RATIO. A live crown top may not extend beyond the upper bound that defines a tree’s ACTUAL LENGTH.

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 102). 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 23.1 Overview.
Figure 106. UNCOMPACTED LIVE CROWN RATIO outline and rating examples

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

23.6 GT CROWN LIGHT EXPOSURE [CRLE] Not Collected in NRS P2+
As illustrated in Figure 105, visually divide the crown vertically into four equal quarters (25 percent of the crown circumference.) Rate the UNCOMPACTED LIVE CROWN RATIO for each quarter separately using the criteria for estimating total UNCOMPACTED LIVE CROWN RATIO. In order for an individual quarter to be tallied, that quarter must have an uncompacted live crown ratio of at least 35 percent. Additionally for a quarter to be counted as receiving full light, a continuous portion of live crown (at least 35 percent of the actual tree length) would be completely exposed to direct light if the sun were directly above the tree. Try to divide the crown in such a way that as many quarters as possible receive full light. Count the number of quarters that qualify as receiving full light. Add one if the tree receives direct light from the top.

When trees have an associated mother tree only one CROWN LIGHT EXPOSURE measurement will be taken for all trees with the same Mother Tree Number (aka "unit" or "Mother Tree Unit"). In these cases the CROWN LIGHT EXPOSURE measurement will be determined using the crowns of all boles, forks and branches as a single unit (including any boles/forks/branches supported by the same stump that were not tallied) and recorded in the CROWN LIGHT EXPOSURE field of the Mother Tree.

For this measurement, crown shape cannot result in a tree shading itself (e.g., umbrella-shaped trees) Buildings can shade a tree. For down trees or trees with severe lean, do not count any quarters that face the ground.
Figure 107. Dividing the crown.

Note: A sliver of a quarter receiving light does not qualify (Figure 108). Trees with all quarters having less than a 35 percent UNCOMPACTED LIVE CROWN RATIO can have a maximum crown exposure of one. Individual quarters with less than 35 percent UNCOMPACTED LIVE CROWN RATIO should not be counted (Figure 108).

Figure 108. Crown light exposure.
When collected: All live trees ≥ 1.0 inch DBH/DRC when MOTHER TREE # = null or MOTHER TREE # = URBAN TREE RECORD NUMBER

Field width: 1 digit
Tolerance: within 1 if > 0
MQO: At least 85% of the time

Values:

0  The tree/Mother Tree unit receives no full light because it is shaded by trees, vines, or other vegetation; the tree has no crown by definition.
1  The tree/Mother Tree unit receives full light from the top or 1 quarter.
2  The tree/Mother Tree unit receives full light from the top and 1 quarter (or 2 quarters without the top).
3  The tree/Mother Tree unit receives full light from the top and 2 quarters (or 3 quarters without the top).
4  The tree/Mother Tree unit receives full light from the top and 3 quarters.
5  The tree/Mother Tree unit receives full light from the top and 4 quarters.

23.7  CROWN POSITION Not Collected in NRS

23.8  CROWN VIGOR CLASS Not Collected in NRS

23.9  CROWN DENSITY Not Collected in NRS

23.10  CROWN DIEBACK [CRDB] Not Collected on PA Regeneration plots

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 (Figure 109 and Figure 110). Code FOLIAGE ABSENT when CROWN DIEBACK is >0.

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 23.1 Overview. The estimate is placed into one of 21 percentage classes.

When trees have an associated mother tree only one CROWN DIEBACK measurement will be taken for all trees with the same MOTHER TREE NUMBER (aka "unit" or "Mother Tree Unit"). In these cases the CROWN DIEBACK measurement will be determined using the crowns of all boles, forks and branches (including any boles/forks supported by the same stump that were not tallied) as a single unit and recorded in the CROWN DIEBACK field of the Mother Tree.
Figure 109. CROWN DIEBACK rating outline examples.
Figure 110. Dieback outline and rating examples.

When collected: All live trees ≥ 5.0 inches DBH/DRC when MOTHER TREE # = null or MOTHER TREE # = URBAN TREE RECORD NUMBER

Field width: 2 digits
Tolerance: +/- 10% (2 classes)
MOO: At least 90% of the time

Values:

<table>
<thead>
<tr>
<th>Class</th>
<th>0%</th>
<th>35</th>
<th>31-35%</th>
<th>70</th>
<th>66-70%</th>
</tr>
</thead>
<tbody>
<tr>
<td>00</td>
<td>0%</td>
<td>35</td>
<td>31-35%</td>
<td>70</td>
<td>66-70%</td>
</tr>
<tr>
<td>05</td>
<td>1-5%</td>
<td>40</td>
<td>36-40%</td>
<td>75</td>
<td>71-75%</td>
</tr>
<tr>
<td>10</td>
<td>6-10%</td>
<td>45</td>
<td>41-45%</td>
<td>80</td>
<td>76-80%</td>
</tr>
<tr>
<td>15</td>
<td>11-15%</td>
<td>50</td>
<td>46-50%</td>
<td>85</td>
<td>81-85%</td>
</tr>
<tr>
<td>20</td>
<td>16-20%</td>
<td>55</td>
<td>51-55%</td>
<td>90</td>
<td>86-90%</td>
</tr>
<tr>
<td>25</td>
<td>21-25%</td>
<td>60</td>
<td>56-60%</td>
<td>95</td>
<td>91-95%</td>
</tr>
<tr>
<td>30</td>
<td>26-30%</td>
<td>65</td>
<td>61-65%</td>
<td>99</td>
<td>96-100%</td>
</tr>
</tbody>
</table>

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

23.11 FOLIAGE TRANSPARENCY Not Collected in NRS

23.12 Contacts

National Crown Indicator Advisor: KaDonna Randolph, USDA Forest Service, Southern Research Station, FIA, 4700 Old Kingston Pike, Knoxville, TN 37919, phone: 865-862-2024; fax: 865-862-0262, email: krandolph@fs.fed.us
ICE GROUND TRUTH (IMAGE-BASED CHANGE ESTIMATION)

5 points will be established on the ground representing 5 of the points that are interpreted during Photo Interpretation of the ICE plots. Each of these 5 points will receive a Land Use and Land Cover assignment that corresponds with the PI values.

ICE points need to be established on the ground with monumentation, if accessible, regardless of the apparent Land Use and Land Cover observed from another location. We will be observing change in the future which will require each of these points to be monumented.

Minimum Mapping Unit (MMU) -- the smallest measurement criteria an area must meet in order to be considered its own unit.
Figure 111GT.
26.1N-GT  ICE Point Monumentation
   Record a witness object for each of the ICE points. Witness objects should be within 60 feet of each ICE point. These objects could be, but are not limited to, trees, utility poles, mail boxes, or the corner of a building. Include additional notes in the PLOT NOTES section if needed.

26.1.1N-GT  ICE Point Number
   Record the code to indicate which ICE Point is being monumented.

   When Collected:
   Field width: 1 digits
   Tolerance: No tolerance
   MQO: At least 99% of the time
   Values:
   1  Subplot (PC)
   2  Northeast
   3  Southeast
   4  Southwest
   5  Northwest

   Navigation to ICE Points if Plot Center is not accessible:
   • Subplot 2 to ICE Point 2 – 78 feet at 93 degrees
   • Subplot 2 to ICE Point 5 – 123 feet at 250 degrees
   • Subplot 3 to ICE Point 2 – 178 feet at 352 degrees
   • Subplot 3 to ICE Point 3 – 22 feet at 146 degrees
   • Subplot 3 to ICE Point 4 – 191 feet at 253 degrees
   • Subplot 4 to ICE Point 4 – 62 feet at 155 degrees
   • Subplot 4 to ICE Point 5 – 139 feet at 355 degrees

26.1.2N-GT Witness Object Type
   Indicate the type of reference used to monument the ICE point. Choose a Witness Object that is most likely to still be present when the plot is remeasured in the future.
When Collected:
Field width: 2 digits
Tolerance: No tolerance
MQO: At least 99% of the time
Values:

0  No Witness Object within 60 feet
1  Tally species
2  Corner of House /Building
3  Electric Meter
4  Fire Hydrant
5  Gas Meter
6  Mailbox
7  Fence Post
8  Street Sign
9  Utility Pole
10 Sewer / Storm Cover
11 Sewer / Storm Drain
12 Street Lamp
13 Sprinkler Box
14 Utility Box
99 Other Object

26.1.3N-GT WITNESS OBJECT SPECIES
Indicate the species used as a monument.

When Collected: Record for WITNESS OBJECT TYPE=1
Field width: 4 digits
Tolerance: No tolerance
MQO: At least 99% of the time
Values: See Appendix 3+N

26.1.4N-GT OBJECT DESCRIPTION
Describe the reference used to monument the SUBPLOT / MICROPLOT. Be as descriptive as needed. For example, if there is more than one Fence Post in the area, state that it is the third post south of the driveway (Ctr. E on the PDR).

When Collected: Record for WITNESS OBJECT TYPE 2-14 and 99
Field width: 240 characters
Tolerance: No tolerance
MQO: At least 99% of the time
Values: Letters, numbers, and special characters

26.1.5N-GT WITNESS OBJECT AZIMUTH
Record the MONUMENT AZIMUTH from the ICE point to the center of the WITNESS OBJECT. Record the AZIMUTH to the nearest degree. Use 360 for north.
26.1.6N-GT WITNESS OBJECT HORIZONTAL DISTANCE
Record the measured HORIZONTAL DISTANCE, to the nearest 0.1 foot, from the center (or corner if monumenting a building) of the Witness Object to the corresponding ICE point.

When Collected:
Field width: 3 digits
Tolerance: +/- 10 degrees
MQO: At least 90% of the time
Values: 001 to 360

26.1.7N-GT WITNESS OBJECT DBH/DRC
Record the MONUMENT DBH / DRC when a tree is used as a monument.

When Collected: WITNESS OBJECT TYPE = 1
Field width: 4 digits (xxx.y)
Tolerance: +/- 0.1 inch per 20.0 inch increment of measured diameter
For woodland species: +/- 0.2 inch per stem
MQO: At least 95% of the time.
Values: 001.0 to 999.9

26.1.8N-GT ICE POINT STATUS
A status code will be assigned to each of the 5 ICE points. These may correspond to the Conditions that have been defined on the 4 Subplots or a separate evaluation may be required to determine the Condition Status located at the ICE point.

When Collected: All ICE Points
Field width: 1 digit
Tolerance: No Errors
MQO: At least 99% of the time
Values:
1 Accessible forest land
2 Accessible Nonforest land
3 Noncensus water
4 Census water
5 Nonsampled

26.2N-GT ICE NONSAMPLED REASON
For ICE points that cannot be sampled (ICE POINT STATUS = 5), record one of the following reasons.

When Collected: ICE POINT STATUS = 5
Field width: 1 digit
Tolerance: No Errors
MQO: At least 99% of the time
### Values:

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>01</td>
<td>Outside U.S. boundary – Assign this code to condition classes beyond the U.S. border.</td>
</tr>
<tr>
<td>02</td>
<td>Denied access area – Any area within the sampled area of a plot to which access is denied by the legal owner, or to which an owner of the only reasonable route to the plot denies access. There are no minimum area or width requirements for a condition class delineated by denied access. Because a denied-access condition can become accessible in the future, it remains in the sample and is re-examined at the next occasion to determine if access is available.</td>
</tr>
<tr>
<td>03</td>
<td>Hazardous situation – Any area within the sampled area on plot that cannot be accessed because of a hazard or danger, for example cliffs, quarries, strip mines, illegal substance plantations, temporary high water, etc. Although the hazard is not likely to change over time, a hazardous condition remains in the sample and is re-examined at the next occasion to determine if the hazard is still present. There are no minimum size or width requirements for a condition class delineated by a hazardous condition.</td>
</tr>
<tr>
<td>05</td>
<td>Lost data – Plot data file was discovered to be corrupt after a panel was completed and submitted for processing. Used for the single condition that is required for this plot. Applied at the time of processing and used only in conjunction with PLOT NONSAMPLED REASON code 05. This code is for office use only. Not Collected in Ground Truth</td>
</tr>
<tr>
<td>06</td>
<td>Lost plot – Entire plot cannot be found. Used for the single condition that is required for this plot. Used only in conjunction with PLOT NONSAMPLED REASON code 06. Can be either generated by the data recorder or in the office. Not Collected in Ground Truth</td>
</tr>
<tr>
<td>07</td>
<td>Wrong location – Previous plot can be found, but its placement is beyond the tolerance limits for plot location. Used for the single condition that is required for this plot. Used only in conjunction with PLOT NONSAMPLED REASON code 07. Can be either generated by the data recorder or in the office. Not Collected in Ground Truth</td>
</tr>
<tr>
<td>08</td>
<td>Skipped visit – Entire plot skipped. Used for the single condition that is required for this plot. Applied at the time of processing and used only in conjunction with PLOT NONSAMPLED REASON code 08. This code is for office use only. Not Collected in Ground Truth</td>
</tr>
<tr>
<td>09</td>
<td>Dropped intensified plot – Used for the single condition that is required for this plot. Used only by units engaged in intensification. Applied at the time of processing and used only in conjunction with PLOT NONSAMPLED REASON code 09. This code is for office use only. Not Collected in Ground Truth</td>
</tr>
<tr>
<td>10</td>
<td>Other – This code is used whenever a condition class is not sampled due to a reason other than one of the specific reasons listed. A field note is required to describe the situation.</td>
</tr>
<tr>
<td>11</td>
<td>Ocean – Condition falls in ocean water below mean high tide line.</td>
</tr>
</tbody>
</table>

### 26.3N-GT ICE Land Cover

LC is assessed to determine what type of cover is present at each of the designated sample points. Evaluate each point and determine which LC represents what is present at the time of the field visit. Evaluate the point as you would when looking at an areial image, from the top down.

LC is determined for each plot by assessing and recording the LC for 5 sample points systematically placed. No MMU is assigned to the LC. Therefore, whatever LC a point falls upon is quickly assigned and recorded. A variety of LCs can be recorded for each plot.

If a sample point lands on a temporary or movable object (i.e. any type of vehicle), evaluate the surrounding area and assign the LC that exists below that object.
When Collected: URBAN / GROUND TRUTH CONDITION CLASS STATUS = 1, 2, 3, 4
Field width: 3 digits
Tolerance: No tolerance
MQO: At least 99% of the time

Values:

110  Tree - Live - a live tree that is either deciduous or evergreen.
120  Tree - Standing Dead - a dead tree that is either deciduous or evergreen. Tree must be standing. Trees that have died and are no longer standing upright should be coded as 150-Down and Dead Woody Debris.
130  Shrub - a woody, dead or alive, perennial plant with a persistent woody stem. A shrub differs from a tree due to a lack of a central bole and/or reduced size. A shrub differs from a perennial herb due to the presence of a woody stem.
140  Other Vegetation - includes herbaceous vegetation that has leaves and stems that predominantly die down at the end of the growing season to the soil level. They have no persistent woody stem above ground. An herbaceous plant may be annual, biennial, or perennial. This includes agricultural and developed vegetation. This class also includes non-vascular and emergent wetland vegetation like seasonally flooded grasslands, cattail marshes, etc. As long as the vegetation is emergent, standing water can be present. Water surface vegetation such as Lilly pads, hydrilla, duckweed, and algae blooms would be classified as water since they are not emergent from the water.
150  Down and Dead Woody Debris - any down and dead woody debris that does not qualify as a standing dead tree. This includes any point that falls on course wood, slash, fine wood, litter, and duff.
210  Barren - land that is void of vegetation due to the removal of, or inability to sustain, vegetation. Areas that may have this LC are thinned/harvested forests, tilled agricultural lands, arid deserts, beaches, severely burnt landscapes, clearings for development, non-paved roads, and possibly industrial sites.
220  Impervious - a natural or manmade surface that does not allow the penetration of water. This class includes constructed, horizontal surfaces made from brick, concrete, metals or asphalt. Also included in this class are naturally occurring aggregates of solid minerals, void of vegetation. This may be boulder fields, talus slopes or rock outcroppings.
310  Water - any area that is covered by water. This may be a swimming pool, stream, river, canal, pond, lake, reservoir, ocean, or a seasonally flooded area. Water can be either permanent or temporary.
320  Ice and Snow – specified when an area is covered by frozen water. Ice and snow can be either permanent or temporary.

26.4N-GT ICE Land Use
LU is assessed to determine what type of use is present at each of the designated sample points. Evaluate each point and determine which LU represents the condition that is present on the ground at the time of the imagery.

LU is assigned to each of the 5 sample points by assessing and recording the LU that each point falls upon. The MMU must be met in order for select LUs to be recorded for each point. If a given point falls within an inclusion that does not meet the MMU, define the LU by the surrounding LU that meets the MMU. Example: When a point lands on a small pond (that is less than an acre) that is surrounded by Forest, LU is assigned 110-Forest LU.

The MMU varies between LUs. Reference the respective definitions to determine the required dimensions for each MMU.
A variety of LU Classes can be coded on each plot depending on what LU each point falls upon. LUs must meet the required MMU in order for a specific LU to be defined for each individual point.

Temporary Water, Ice, or Snow will be classified by the LU that is below the temporary situation.

When Collected: URBAN / GROUND TRUTH CONDITION CLASS STATUS = 1, 2, 3, 4
Field width: 3 digits
Tolerance: No tolerance
MQO: At least 99% of the time
Values:

110 Forest- includes areas in which planted or naturally occurring trees provide 10% or greater canopy cover, must be 1.0 acre in size and 120 feet wide or greater, and is part of the dominate (uppermost) vegetation layer. Developed sites, even when they meet the tree cover criteria for Forest, are not put into this class. Sites that have been harvested and now contain less than 10% canopy cover maintain a Forest Use designation unless they have been converted to another LU.

120 Wetland/Riparian - includes areas where the soil maintains a high relative moisture content which supports lush vegetation differing in species and/or composition from its surroundings. Typically found adjacent to water bodies of all types including rivers, lakes, seeps, springs, and any other area where water is accumulated. Area must be 1.0 acre in size and 120 feet wide or greater.

130 Non-forest Chaparral - areas covered with heavily branched dwarfed trees or shrubs, usually evergreen, with a canopy of which covers 10% of the ground in non-tall tree species. Non-forest Chaparral is normally found in the far southwestern part of the US. Use the LU code 110-Forest, if there is 10% or greater canopy cover in tall tree species. Area must be 1.0 acre in size and 120 feet wide or greater.

210 Non-census Water – this includes lakes, reservoirs, ponds, and similar bodies of water 1.0 acre to 4.5 acres in size; and rivers, streams, canals, etc., 30.0 feet to 200 feet wide. The banks of a lake, reservoir, pond, and river that fall within the average high water mark, as well as the banks of a canal including the constructed features, are included in this class assuming water is preventing the normal establishment of vegetation.

220 Census Water – this includes lakes, reservoirs, ponds, and similar bodies of water 4.5 acres in size and larger; and rivers, streams, canals, etc., more than 200 feet wide (1990 U.S. Census definition). The banks of a lake, reservoir, pond, and river that fall within the average high water mark, as well as the banks of a canal including the constructed features, are included in this class assuming water is preventing the normal establishment of vegetation.

310 Farmland - includes land that at some point has been altered from its natural vegetative condition to grow crops and/or support animals. Farmland includes cropland, pasture, confined feeding operations, – including the associated buildings – land maintained as a permanent opening of primarily herbaceous vegetation within woodland areas (e.g., wildlife opening) and other idle farmland. Area must be 1.0 acre in size and 120 feet wide or greater.

320 Agricultural Woody Cropland- includes area dominated with trees or other woody vegetation that are being used for something other than forest tree cover. Orchards, groves, nurseries, vineyards and Christmas tree plantations are all considered to be part of this class. Area must be 1.0 acre in size and 120 feet wide or greater.
Windbreak / Shelterbelt - must be less than 120 feet wide and/or less than 1 acre in size, planted or natural, and should appear to act as a shelter for agriculture lands. Windbreak / Shelterbelts are planned plantings of single or multiple rows of trees or shrubs that are established for environmental purposes. Windbreaks or shelterbelts are generally established to protect or shelter nearby leeward areas from troublesome winds. Such plantings are used to reduce wind erosion, protect growing plants (crops and forage), manage snow, and improve irrigation efficiency. Windbreaks also protect structures and livestock, provide wildlife habitat, and provide tree or shrub products. There are no MMU requirements.

Cultural - This is an extensive LU class that includes the following uses which do not require a MMU:
Residential - LUs range from high density multi-unit structures located in urban centers to low density single family homes, where houses are on lots greater than one acre located on the periphery of suburban expansion. Rural residential and recreational subdivisions are also included in this category since this type of land is typically almost entirely committed to residential LU. This class also includes driveways that are primarily used for accessing residential housing.
Commercial and Services and Utility/Communication Facilities - Commercial Facilities include central business districts, shopping centers, and commercial strips. Parking lots and entrances to commercial facilities are also included in this class. Services facilities include institutional LUs, such as educational, religious, health, correctional, and cemeteries. Utility/Communication facilities (not including right-of-ways) include military facilities, municipal works areas (excludes areas of water within water treatment plants that can qualify as 210-Non-Census Water or 220-Census Water), and communication towers for radio, radar, television, and phone.
Industrial Facilities - areas include light manufacturing facilities designed for assembly, finishing, processing, and packaging, to heavy manufacturing facilities that use raw materials such as iron ore, timber or coal. These heavy-manufacturing facilities can include mills, tank farms, chemical plants and stockpiles. Also included are natural gas extraction sites.

Right of Way - This is an extensive LU class that includes the following uses which do not require a MMU:
Road - a transportation classification that includes highways, roads, and parking lots (not adjacent to commercial space). Unless clearly another class, the land adjacent, such as medians, is also included in this class. Do not include hiking trails, ATV trails, Off-Road trails, or any unmaintained roads.
Railway - includes railroad tracks, rail stations, and rail yard.
Utility/Communication Lines - Utilities can include the transportation of water, oil, gas, and electricity. Communication lines include lines used for radio, radar, or television and phone transmission. Unless clearly another class, the land adjacent to utility/communication lines is also included in this class. Do not record Utility/Communication Lines if the land that is above or below is being used as something other than the Utility/Communication Line (e.g., a corn field or residential area that a power line crosses would be defined as the Cropland or Residential respectively).
Maintained Canal - a manmade channel of water that has a water-width of less than 30 feet. The banks of the canal, including the constructed features, are also included in this class once it is determined the mean high water mark is less than 30 feet.
Airport Facility - includes airport runways, terminals, tarmacs, hangers, parking facilities and all areas within the airport property. This includes both commercial and military airports.
Recreation - includes parks, ski areas, golf courses, athletic fields, and camp grounds. There are no MMU requirements.

Park - a recreation area usually within or adjacent to an urban area where people gather for outdoor events.

Ski Area - an area used for either downhill or cross country skiing. This includes all facilities and parking lots within the property. The trees in between runs are included with the Ski Area unless they are 1.0 acre in size and 120 feet wide or greater.

Golf Course - an area used for golfing. This includes all facilities and parking lots within the property. The trees in between fairways are included with the Golf Course unless they are an acre in size and 120 feet wide or greater.

Athletic Fields and Tracks - used for many types of athletic events. This includes all facilities and parking lots within the property. Trees within the property are included unless they are an acre in size and 120 feet wide and or greater.

Athletic fields and tracks are coded separately even if they are within a larger LU such Commercial/Services.

Camp Ground - an area developed for camping and recreation. This includes all facilities and parking lots within the property. The trees in between camp sites are included with the Camp Ground unless they are an acre in size and 120 feet wide or greater.

Strip Mines, Quarries, and Gravel Pits - includes mining activities that have significant surface disturbance. Vegetation cover and overburden are removed to expose such deposits as coal, iron ore, limestone, copper, etc. Quarrying of building and decorative stone and recovery of sand and gravel deposits also result in large open surface pits and are included in this classification.

Associated structures such as conveyor systems, settling ponds, roads and refining facilities are included in this class. Current mining activity is not always distinguishable, and inactive, un-reclaimed, and active strip mines, quarries, borrow pits, and gravel pits are included in this category until other cover or use has been established. There are no MMU requirements.

Rangeland - any extensive area of natural/semi-natural grassland or shrubland (10% or greater vegetation combined) that is suitable for domestic or wild animal grazing. They may or may not contain temporary or permanent trails or access roads. Rangeland is normally found in the western part of the US (generally from ND, then south to TX, and then west) where annual precipitation levels are low. Area must be 1.0 acre in size and 120 feet wide or greater. It is often difficult to differentiate between Pasture and Rangeland. Rangeland will generally exceed 40 acres. Pastured Farmland can also exceed 40 acres, but once a grazed area falls below 40 acres, consider defining as Farmland instead of Rangeland.

Other Non-Vegetated Land - an area that has less than 10% vegetation cover and can’t be classified as another LU. This includes areas covered by permanent Ice or Snow and sandy or pebbly shores associated with a river, lake, or ocean (outside of the average high water mark). Area must be 1.0 acre in size and 120 feet wide or greater.

26.5N-GT ICE PRESENT NONFOREST LAND USE

Land Use is assessed to determine what type of use is present at each of the designated sample points. Evaluate each point and determine which LU represents the condition that is present on the ground at the time of measurement.

The core PRESENT NONFOREST LAND USE values will be used for the ICE Ground Truth LU codes. See section 2.5.29+N for value definitions.
The MMU (size requirements) must be met in order for select LUs to be recorded for each point. If a given point falls within an inclusion that does not meet the MMU, define the LU by the surrounding LU that meets the MMU.

The Land Use present at each ICE point may not be defined as a condition record on any of the 4 subplots. It will be necessary to delineate, but not record, conditions off the 4 subplots when determining the ICE NFLU. A variety of LUs can be recorded for each plot.

Temporary Water, Ice, or Snow will be classified by the LU that is below the temporary situation.

When Collected: ICE POINT STATUS = 2
Field width: 2 digits
Tolerance: No tolerance
MOQ: At least 99% of the time
Values:

10 Agricultural land - Land managed for crops, pasture, or other agricultural use. The area must be at least 1.0 acre in size and 120.0 feet wide (with the exception of windbreak/shelterbelt, which has no minimum width.). A windbreak or shelterbelt can be less than 120.0 feet wide and less than 1 acre. If a windbreak or shelterbelt qualifies and meets the definition of accessible forest land, then it is not considered nonforest. At times a CONDITION CLASS STATUS 2 condition may be made up of multiple nonforest land uses, some of which may not be an acre in size. In this case record the first nonforest land use that you encounter, regardless of size. Use the 10 code only for cases not better described by one of the following:

11 Cropland
12 Pasture (improved through cultural practices)
13 Idle farmland
14 Orchard / Nursery
15 Christmas tree plantation
16 Maintained wildlife opening
17 Windbreak / Shelterbelt

20 Rangeland - Land primarily composed of grasses, forbs, or shrubs. This includes lands vegetated naturally or artificially to provide a plant cover managed like native vegetation and does not meet the definition of pasture. The area must be at least 1.0 acre in size and 120.0 feet wide

30 Developed - Land used primarily by humans for purposes other than forestry or agriculture. Use the 30 code only for land not better described by one of the following:

31 Cultural: business (industrial/commercial), residential, and other places of intense human activity.
32 Rights-of-way: improved roads, railway, power lines, maintained canal
33 Recreation: parks, skiing, golf courses
34 Mining and wasteland NRS Note: Code 34 must be at least 1 acre in size and 120.0 feet in width.

40 Other - Land parcels greater than 1.0 acre in size and greater than 120.0 feet wide, which do not fall into one of the uses described above. Examples include undeveloped beaches, barren land (rock, sand), marshes, bogs, ice, and snow. Use the 40 code only for cases not better described by one of the following:

41 Nonvegetated
42 Wetland
43 Beach
45 Nonforest-Chaparral
## PDR PROMPT INDEX

<table>
<thead>
<tr>
<th>Abbrev</th>
<th>Page</th>
<th>Abbrev</th>
<th>Page</th>
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