

**FOREST INVENTORY AND ANALYSIS  
SOUTHERN RESEARCH STATION FIELD GUIDE**

**VOLUME 1: FIELD DATA COLLECTION PROCEDURES  
FOR PHASE 2 PLOTS**

**VERSION 2.0**

**October 1, 2003**



**BASED ON  
FOREST INVENTORY AND ANALYSIS  
NATIONAL CORE FIELD GUIDE  
VERSION 2.0**

**April 2003**

**This field guide is subject to revision.  
Responsibility of keeping this field guide updated resides  
with the user. To determine the latest version go to  
[www.srs.fs.usda.gov/fia/manual](http://www.srs.fs.usda.gov/fia/manual)**



## TABLE OF CONTENTS

<b>INTRODUCTION</b> .....	<b>0-7</b>
<b>FIELD GUIDE LAYOUT</b> .....	<b>0-8</b>
<b>REVIEW OF FIELD SAMPLING IN PREVIOUS INVENTORY</b> .....	<b>0-9</b>
<b>UNITS OF MEASURE</b> .....	<b>0-12</b>
0.0 GENERAL DESCRIPTION .....	0-12
0.1 PLOT SETUP .....	0-14
0.2 PLOT INTEGRITY .....	0-14
0.3 OWNERSHIP INFORMATION .....	0-15
0.4 LOCATING SAMPLE PLOTS .....	0-16
0.5 COUNTY EDIT PROCEDURES .....	0-21
<b>1.0 PLOT LEVEL DATA</b> .....	<b>1-1</b>
ITEM 101 STATE .....	1-1
ITEM 102R CYCLE .....	1-1
ITEM 103R PANEL .....	1-1
ITEM 104 COUNTY .....	1-1
ITEM 105 PLOT NUMBER .....	1-2
ITEM 106R PHASE .....	1-2
ITEM 107 PLOT STATUS .....	1-2
ITEM 108 SAMPLE KIND .....	1-3
ITEM 109 FIELD GUIDE VERSION .....	1-3
ITEM 110 P3 HEXAGON NUMBER .....	1-4
ITEM 111 P3 PLOT NUMBER .....	1-4
ITEM 112R PLOT IN CORRECT COUNTY? .....	1-4
CURRENT DATE .....	1-4
ITEM 113 YEAR .....	1-4
ITEM 114 MONTH .....	1-5
ITEM 115 DAY .....	1-5
PAST DATE .....	1-5
ITEM 116R PAST YEAR .....	1-5
ITEM 117R PAST MONTH .....	1-5
ITEM 118R PAST DAY .....	1-5
ITEM 119 QA STATUS .....	1-6
ITEM 120 CREW TYPE .....	1-6
ITEM 121R CRUISER NUMBER .....	1-6
ITEM 122R NUMBER OF ACCESSIBLE FORESTLAND CONDITIONS .....	1-6
ITEM 123R NUMBER OF TREE ENTRIES .....	1-7
ITEM 124R NUMBER OF PRISM POINTS REMEASURED .....	1-7
ITEM 125R NUMBER OF SUBPLOT CENTERS REVERTED .....	1-7
ITEM 126R HUMAN DEBRIS .....	1-7
ITEM 127 WATER ON PLOT .....	1-8
ITEM 128 HORIZONTAL DISTANCE TO IMPROVED ROAD .....	1-9
ITEM 129R HORIZONTAL DISTANCE TO URBAN .....	1-9
ITEM 130R HORIZONTAL DISTANCE TO AGRICULTURAL LAND .....	1-10
ITEM 131R SIZE OF CONTIGUOUS FOREST LAND .....	1-10
GPS Coordinates .....	1-11
GPS Unit Settings, Datum, and COORDINATE SYSTEM .....	1-11
Collecting Readings .....	1-11
Correction for "Offset" Location .....	1-11
ITEM 132 GPS UNIT .....	1-11
ITEM 133 SERIAL NUMBER .....	1-12
ITEM 134 LATITUDE .....	1-12

ITEM 135	LONGITUDE.....	1-12
ITEM 136	GPS ELEVATION.....	1-12
ITEM 137	GPS ERROR.....	1-13
ITEM 138	NUMBER OF READINGS.....	1-13
ITEM 139	AZIMUTH TO PLOT CENTER.....	1-13
ITEM 140	DISTANCE TO PLOT CENTER.....	1-13
ITEM 141	PLOT-LEVEL NOTES.....	1-14

## **2.0 CONDITION CLASS ..... 2-1**

### **2.1 DETERMINATION OF CONDITION CLASS ..... 2-1**

2.1.1 Step 1: Delineate the plot area by CONDITION CLASS STATUS ..... 2-1

2.1.2 Step 2: Further subdivide Accessible Forest Land ..... 2-1

### **2.2 CONDITION CLASS STATUS DEFINITIONS ..... 2-2**

### **2.3 CONDITION CLASS ATTRIBUTES ..... 2-5**

### **2.4 DELINEATING CONDITION CLASSES DIFFERING IN CONDITION STATUS ..... 2-5**

### **2.5 DELINEATING CONDITION CLASSES WITHIN ACCESSIBLE FORESTLAND ..... 2-8**

ITEM 201	CONDITION CLASS NUMBER .....	2-10
ITEM 202R	PRESENT LAND USE.....	2-10
ITEM 203	CONDITION CLASS STATUS.....	2-12
ITEM 204	CONDITION NONSAMPLED REASON.....	2-12
ITEM 205R	NEW PAST LAND USE .....	2-13
ITEM 206	RESERVED STATUS.....	2-13
ITEM 207	OWNER CLASS.....	2-13
ITEM 208	OWNER GROUP.....	2-14
ITEM 209	PRIVATE OWNER INDUSTRIAL STATUS.....	2-14
ITEM 210R	TRACT SIZE.....	2-15
ITEM 211R	TRACT SIZE (PERCENT FOREST) .....	2-15
ITEM 212	FOREST TYPE.....	2-16
ITEM 213	STAND SIZE CLASS.....	2-16
ITEM 214	REGENERATION STATUS.....	2-17
ITEM 215	ARTIFICIAL REGENERATION SPECIES.....	2-18
ITEM 216	TREE DENSITY .....	2-18
ITEM 217	STAND AGE.....	2-19
ITEM 218R	STAND STRUCTURE .....	2-20
ITEM 219	DISTURBANCE 1 .....	2-21
ITEM 220	DISTURBANCE YEAR 1 .....	2-22
ITEM 221	DISTURBANCE 2.....	2-22
ITEM 222	DISTURBANCE YEAR 2 .....	2-22
ITEM 223	DISTURBANCE 3.....	2-22
ITEM 224	DISTURBANCE YEAR 3 .....	2-22
ITEM 225	TREATMENT 1.....	2-22
ITEM 226	TREATMENT YEAR 1 .....	2-24
ITEM 227	TREATMENT 2.....	2-24
ITEM 228	TREATMENT YEAR 2.....	2-24
ITEM 229	TREATMENT 3.....	2-24
ITEM 230	TREATMENT YEAR 3.....	2-24
ITEM 231	PHYSIOGRAPHIC CLASS .....	2-24
ITEM 232R	OPERABILITY .....	2-26
ITEM 233R	WATER SOURCE .....	2-26
ITEM 234R	DISTANCE TO WATER SOURCE.....	2-27
ITEM 235R	SITE CLASS.....	2-27
ITEM 236R	FIRE .....	2-27
ITEM 237R	GRAZING .....	2-28

<b>3.0 SUBPLOT INFORMATION .....</b>	<b>3-1</b>
ITEM 301 SUBPLOT NUMBER .....	3-1
ITEM 302 SUBPLOT STATUS.....	3-1
ITEM 303 SUBPLOT NONSAMPLED REASON .....	3-2
ITEM 304 SUBPLOT CENTER CONDITION .....	3-2
ITEM 305 MICROPLOT CENTER CONDITION.....	3-2
ITEM 306 SUBPLOT CONDITION LIST .....	3-3
ITEM 307 SUBPLOT SLOPE .....	3-3
ITEM 308 SUBPLOT ASPECT.....	3-4
ITEM 309 SNOW/ WATER DEPTH .....	3-4
ITEM 310R, 312R, 314R, 316R NONNATIVE INVASIVE PEST PLANTS OF THE SOUTH.....	3-5
ITEM 311R, 313R, 315R, 317R NONNATIVE INVASIVE PERCENT COVER.....	3-8
<b>4.0 BOUNDARY REFERENCES.....</b>	<b>4-1</b>
4.1 REFERENCE PROCEDURE.....	4-1
4.2 BOUNDARY DATA.....	4-3
ITEM 401 SUBPLOT NUMBER .....	4-3
ITEM 402 PLOT TYPE.....	4-3
ITEM 403R BOUNDARY STATUS .....	4-4
ITEM 404 BOUNDARY CHANGE .....	4-4
ITEM 405 CONTRASTING CONDITION.....	4-4
ITEM 406 LEFT AZIMUTH.....	4-5
ITEM 407 CORNER AZIMUTH .....	4-5
ITEM 408 CORNER DISTANCE .....	4-5
ITEM 409 RIGHT AZIMUTH .....	4-5
<b>5.0 TREE AND SAPLING DATA.....</b>	<b>5-1</b>
5.1 OLD MICROPLOT REMEASUREMENT PROCEDURES.....	5-2
5.2 PRISM POINT REMEASUREMENT PROCEDURES.....	5-4
ITEM 501R ENTRY NUMBER.....	5-5
ITEM 502 SUBPLOT NUMBER .....	5-5
ITEM 503 TREE RECORD NUMBER .....	5-5
ITEM 504R PRISM POINT #/TREE#.....	5-6
ITEM 505 CONDITION CLASS NUMBER .....	5-6
ITEM 506 AZIMUTH .....	5-7
ITEM 507 HORIZONTAL DISTANCE.....	5-7
ITEM 508 PRESENT TREE STATUS .....	5-8
ITEM 509R OLD MICROPLOT STATUS .....	5-8
ITEM 510R PRISM TREE STATUS.....	5-9
ITEM 511 PREVIOUS TREE STATUS.....	5-9
ITEM 512 RECONCILE.....	5-10
ITEM 513 STANDING DEAD .....	5-11
ITEM 514 SPECIES.....	5-13
ITEM 515 DIAMETER.....	5-13
ITEM 516 PREVIOUS DIAMETER.....	5-19
ITEM 517 DIAMETER CHECK.....	5-19
ITEM 518 LENGTH TO DIAMETER MEASUREMENT POINT .....	5-19
ITEM 519R TREE CLASS .....	5-20
ITEM 520 CROWN CLASS.....	5-21
ITEM 521 UNCOMPACTED LIVE CROWN RATIO .....	5-22
ITEM 522 COMPACTED CROWN RATIO .....	5-24
ITEM 523R TREE GRADE .....	5-25
ITEM 524R PERCENT BOARD FOOT CULL.....	5-26

ITEM 525	ROTTEN/MISSING CULL.....	5-26
ITEM 526	TOTAL LENGTH .....	5-27
ITEM 527	ACTUAL LENGTH.....	5-27
ITEM 528	LENGTH METHOD.....	5-28
ITEM 529R	FUSIFORM/HARDWOOD DIEBACK.....	5-28
ITEM 530R	DIEBACK SEVERITY .....	5-29
ITEM 531	CAUSE OF DEATH .....	5-29
ITEM 532	MORTALITY YEAR .....	5-30
ITEM 533	DECAY CLASS .....	5-31
ITEM 534R	UTILIZATION CLASS.....	5-32
ITEM 535	TREE NOTES.....	5-32

## **6.0 SEEDLING DATA ..... 6-1**

ITEM 601	SUBPLOT NUMBER .....	6-1
ITEM 602	CONDITION CLASS NUMBER .....	6-1
ITEM 603	SPECIES.....	6-1
ITEM 604	SEEDLING COUNT.....	6-2

## **7.0 SITE TREE INFORMATION ..... 7-1**

7.1	SITE TREE SELECTION.....	7-1
7.2	SITE TREE DATA VARIABLES.....	7-1
ITEM 701R	SITE TREE NUMBER.....	7-1
ITEM 702	CONDITION CLASS LIST .....	7-1
ITEM 703	SPECIES.....	7-2
ITEM 704	DIAMETER.....	7-2
ITEM 705	SITE TREE LENGTH.....	7-2
ITEM 706	TREE AGE AT DIAMETER.....	7-2
ITEM 707R	SITE CLASS.....	7-3
ITEM 708	SITE TREE NOTES .....	7-3
ITEM 709	SUBPLOT NUMBER (OPTIONAL) .....	7-3
ITEM 710	AZIMUTH (OPTIONAL) .....	7-3
ITEM 711	HORIZONTAL DISTANCE (OPTIONAL) .....	7-3

## **8.0 NONFOREST/NONSAMPLED PLOTS ..... 8-1**

8.1	OVERVIEW .....	8-1
8.2	PROCEDURE.....	8-1
8.3	DATA RECORDED.....	8-2
ITEM 801	STATE .....	8-2
ITEM 802R	CYCLE .....	8-2
ITEM 803R	PANEL.....	8-2
ITEM 804	COUNTY .....	8-2
ITEM 805	PLOT NUMBER.....	8-2
ITEM 806R	PHASE .....	8-3
ITEM 807	PLOT STATUS.....	8-3
ITEM 808	PLOT NONSAMPLED REASON .....	8-3
ITEM 809	SAMPLE KIND .....	8-4
ITEM 810	FIELD GUIDE VERSION .....	8-4
ITEM 811	P3 HEXAGON NUMBER.....	8-5
ITEM 812	P3 PLOT NUMBER .....	8-5
ITEM 813R	PLOT IN CORRECT COUNTY? .....	8-5

	CURRENT DATE.....	8-5
ITEM 814	YEAR.....	8-5
ITEM 815	MONTH .....	8-6
ITEM 816	DAY.....	8-6

	PAST DATE .....	8-6
ITEM 817R	PAST YEAR .....	8-6
ITEM 818R	PAST MONTH.....	8-6
ITEM 819R	PAST DAY.....	8-7
ITEM 820	QA STATUS .....	8-7
ITEM 821	CREW TYPE .....	8-7
ITEM 822R	CRUISER NUMBER.....	8-7
ITEM 823R	PRESENT LAND USE.....	8-8
ITEM 824	CONDITION CLASS STATUS 1 .....	8-9
ITEM 825R	NEW PAST LAND USE .....	8-9
	GPS Coordinates .....	8-9
	GPS Unit Settings, Datum, and COORDINATE SYSTEM.....	8-9
	Collecting Readings .....	8-10
	Correction for "Offset" Location .....	8-10
ITEM 826	GPS UNIT .....	8-10
ITEM 827	SERIAL NUMBER .....	8-10
ITEM 828	LATITUDE .....	8-11
ITEM 829	LONGITUDE.....	8-11
ITEM 830	GPS ELEVATION.....	8-11
ITEM 831	GPS ERROR.....	8-11
ITEM 832	NUMBER OF READINGS.....	8-12
ITEM 833	AZIMUTH TO PLOT CENTER.....	8-12
ITEM 834	DISTANCE TO PLOT CENTER.....	8-12
ITEM 835	PLOT-LEVEL NOTES.....	8-12

**APPENDICES**

<b>Appendix 1: State, County and Parish FIPS Codes .....</b>	<b>App1-1</b>
Alabama (01) .....	App 1-3
Arkansas (05) .....	App 1-5
Florida (12) .....	App 1-7
Georgia (13) .....	App 1-9
Kentucky (21) .....	App 1-13
Louisiana (22) .....	App 1-17
Mississippi (28).....	App 1-19
North Carolina (37) .....	App 1-21
Oklahoma (40).....	App 1-23
South Carolina (45) .....	App 1-25
Tennessee (47) .....	App 1-27
Texas (48) .....	App 1-29
Virginia (51) .....	App 1-31
Puerto Rico (72) .....	App 1-33
Virgin Islands (78).....	App 1-33
 <b>Appendix 2: FIA Forest Type Codes .....</b>	 <b>App 2-1</b>
 <b>Appendix 3: FIA Tree Species Codes.....</b>	 <b>App 3-1</b>
 <b>Appendix 4: Site Tree Selection Criteria and Species List .....</b>	 <b>App 4-1</b>
Southern U.S. Site Tree Selection Criteria.....	App 4-3
Site Class Curves .....	App 4-4

**Appendix 5: Cubic Foot Cull, Board Foot Cull, Tree Grades..... App 5-1**  
Cubic Foot Cull..... App 5-3  
Board Foot Cull..... App 5-4  
Tree Grades ..... App 5-8

**Appendix 6: Determination of Stocking Values for Land Use Classification  
..... App 6-1**

**Appendix 7: Glossary..... App 7-1**

**Appendix 8: Tolerance/ MQO/ Value/ Units/ Factors Table..... App 8-1**

**SOUTHERN REGION FIELD MANUAL SUPPLEMENTS**

- A. ILLUSTRATIONS
- B. GPS INSTRUCTIONS
- C. DATA RECORDER MANUAL
- D. QA MANUAL
- E. OFFICE ITEMS AND PROCEDURES

## FOREST INVENTORY AND ANALYSIS NATIONAL CORE FIELD GUIDE

### VOLUME I: FIELD DATA COLLECTION PROCEDURES FOR PHASE 2 PLOTS

Version 2.0

#### Version History:

- 1.1: March 1999 (first version implemented, Maine, 1999)
- 1.2: August 1999
- 1.3: September 1999 (revised from Bangor, ME Data Acquisition Band meeting, Aug 1999)
- 1.4: February 2000 (revised from Charleston, SC Data Acquisition Band meeting, Dec 1999)
- 1.5: January 2001 (revised from Portland, OR Data Acquisition Band meeting, Sept 2000)
- 1.6: March 2002 (revised from Tucson, AZ Joint Band meeting, Jan 2002)
- 1.7: February 2003 (revised from Charleston, SC Joint Band Meeting, Feb 2003)
- 2.0: April 2003 (revised from Atlantic City, NJ, Data Acquisition Band Meeting, March 2003)

Mention of trade names or commercial products does not constitute endorsement or recommendation for use.

## 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 field procedures that are consistent and uniform across all FIA units. **This CORE is the framework for regional FIA programs; individual programs may add variables, but may not change the CORE requirements.** Unless otherwise noted, the items in this field guide are considered CORE, that is, the information will be collected by all FIA Units as specified. Items or codes specified as CORE 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 Volume I can be measured by a two-person field crew in less than one day, including travel time to and from the plot.

This document also describes additional regional standards, methods, and definitions for the southern FIA unit. This serves to enhance the National CORE, not change it. All regional items and clarifying text are shaded in the same manner as this paragraph.

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; vegetation diversity and structure; and down woody material. 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
- 2 Condition
- 3 Subplot
- 4 Boundary
- 5 Tree Measurements
- 6 Seedling
- 7 Site Tree
- 8 Nonforest/Nonsampled/Intensification Plots

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.

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).

MQO's state the percentage of time when 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.

## REVIEW OF FIELD SAMPLING IN PREVIOUS INVENTORY

Kentucky is currently all SAMPLE KIND 1

Texas is remeasuring the National Manual plot design (SAMPLE KIND 2)

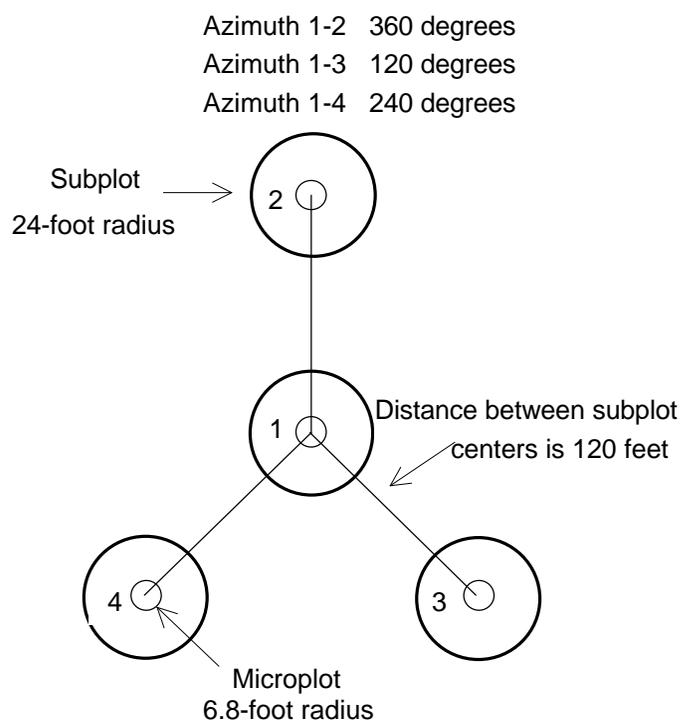
### SOUTHERN RESEARCH STATION INVENTORY

(AL, GA, NC, SC, TN, and VA)

Sample Locations

The Southern Research Station plot design consisted of four subplots approximately 1/24 acre in size with a radius of 24.0 feet. Subplots 2, 3, and 4 are located 120.0 ft. horizontal at azimuths 360, 120 and 240 degrees respectively, from the center of subplot 1. Each subplot contains a microplot of approximately 1/300 acre in size with a radius of 6.8 feet. The microplot and subplot share the same subplot/microplot center.

#### Plot Layout



## SOUTHEASTERN RESEARCH STATION PRISM PLOT INVENTORY (FL)

### Sample Locations

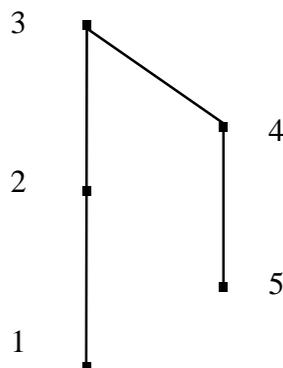
Sample locations were located randomly on aerial photography. One forest plot location was a cluster of 5 points.

At each location determined to meet the definitions for forestland, five points were sampled using a 37.5 basal area factor to sample live trees 5.0 inches diameter at breast height (DBH) and larger. Additionally, all live trees 1.0 through 4.9 inches DBH within a 6.8 ft radius plot were measured at each sample point.

### Plot Layout

The standard plot layout was:

5-POINT CLUSTER DESIGN						
<u>Azimuth</u>	<u>and</u>	<u>Distance</u>	<u>from</u>	<u>Point</u>	<u>to</u>	<u>Point</u>
000		70 ft		1		2
000		70 ft		2		3
120		70 ft		3		4
180		70 ft		4		5



## SOUTHERN RESEARCH STATION PRISM PLOT INVENTORY (AR, LA, MS, OK)

### Sample Locations

Sample locations were taken at the intersections of a 3-mile grid. At this sampling intensity, a plot location represented approximately 5,760 similar acres. One forest plot location was a cluster of ten points systematically spaced within the boundaries of an acre.

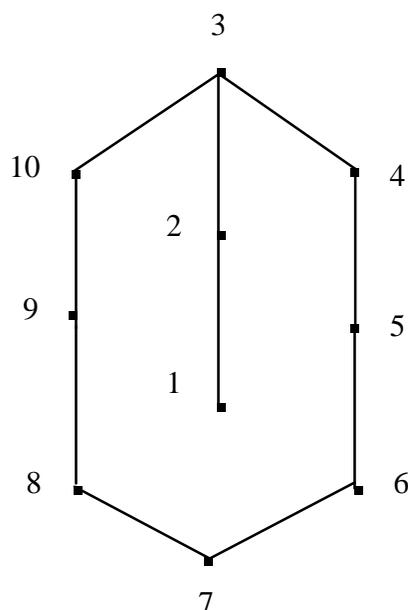
At each forested location, ten points were sampled using a 37.5 basal area factor prism to select live trees 5.0 inches DBH and larger. Additionally, all live trees 1.0 through 4.9 inches DBH within a 7.1-foot radius plot were tallied at points 1, 2, and 3. At points 4-10, up to the four most dominant 1.0 to 4.9 inch trees were tallied if fewer than two live variable plot trees were tallied at the point. If there were no live trees or live saplings on any point, then up to the four most dominant seedlings were tallied at the point.

### Plot Layout

The spacing and orientation of the point cluster results in equilateral triangles, with sides 66 feet in length, between points.

#### 10-POINT CLUSTER DESIGN

<u>Azimuth</u>	and	<u>Distance</u>	from	<u>Point</u>	to	<u>Point</u>
000		66 ft		1		2
000		66 ft		2		3
120		66 ft		3		4
180		66 ft		4		5
180		66 ft		5		6
240		66 ft		6		7
300		66 ft		7		8
000		66 ft		8		9
000		66 ft		9		10



## UNITS OF MEASURE

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

### Plot Dimensions:

Subplot - for selecting trees with diameter  $\geq 5.0$  inch (in)

Radius = 24.0 feet

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

Microplot - for counting seedlings and selecting saplings

Radius = 6.8 feet

Area = 145.27 square feet or approximately 0.003 acre or approximately 1/300 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 120.0 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

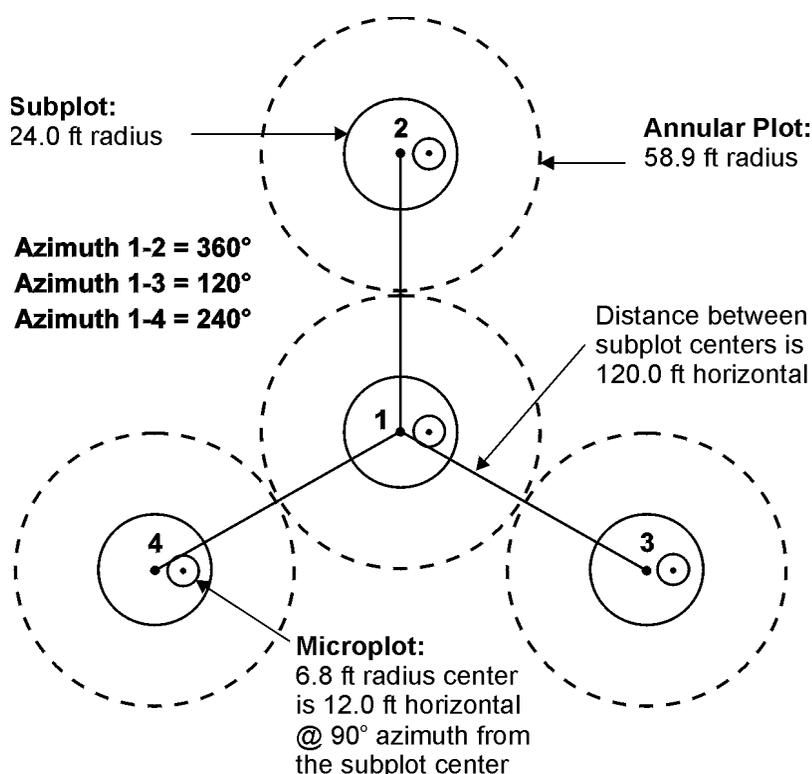
## 0.0 GENERAL DESCRIPTION

The CORE field plot consists of four subplots approximately 1/24 acre in size with a radius of 24.0 feet. 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, respectively, from the center of subplot 1 (see Figure 1). 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. Throughout this field guide, use of the word "plot" refers to the entire set of four subplots. "Plot center" is defined as the center of subplot 1.

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 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 0.5 foot in length (all conifers, except Longleaf) or greater than 1.0 foot in length (hardwoods)]. Longleaf pine must be at least 0.5 in at the root collar. Planted seedlings must meet the same size requirements as listed above.

Data are collected on field plots at the following levels:

Plot	Data that describe the entire cluster of four subplots.
Subplot	Data that describe a single subplot of a cluster.
Condition Class	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.
Boundary	An approximate description of the demarcation line between two condition classes that occur on a single subplot, microplot, or annular plot. There is no boundary recorded when the demarcation occurs beyond the fixed radius plots.
Tree	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
Seedling	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).
	Longleaf pine must be at least 0.5 in at the root collar. Planted seedlings must meet the same size requirements as listed above.
Site Tree	Data describing site index trees.



**Figure 1. FIA Phase 2 plot diagram. See individual Phase 3 chapters for Phase 3 plot figures.**

## 0.1 PLOT SETUP

Mark each subplot and microplot center with a wire pin. Bend the subplot center pin in a “horseshoe” shape. Bend the microplot pin in a “pig tail” shape. Place pins at all subplot and microplot centers that contain an accessible forest condition, even if there is no tally on the subplot or microplot.

Plots will be established according to the regional guidelines of each FIA unit. 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. (i.e. Census water, denied access, hazardous, etc.).**

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

Subplot From	Subplot Numbers To	Azimuth <i>degrees</i>	Back sight	Distance <i>feet</i>
2	3	150	330	207.8
2	4	210	030	207.8
3	4	270	090	207.8

If a subplot was installed incorrectly at the previous visit, the current crew should remeasure the subplot in its present location. Record the azimuth and distance from subplot 1 to the misplaced subplot on the draw page to aid future crews in locating it.

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

## 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 annular plots to determine tree age, site index, stand age, or for other reasons.
- Nailing and tagging trees on microplots, subplots, and annular plots so that these trees can be identified and relocated efficiently and positively at times of remeasurement.
- Nailing, scribing, or painting microplot, subplot, and annular plot 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 (i.e., the initiation of infection or callusing).
- 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.

### 0.3 OWNERSHIP INFORMATION

Ownership information is recorded on all accessible forest land conditions. Prior to actual fieldwork in a county, ownership data is collected from county courthouse records. It is important to gather as much information as possible on the initial visit to the courthouse to avoid a return visit while the fieldwork is occurring.

**NOTE: If the ownership has changed either from or to National Forest, the state coordinator or field supervisor must be notified.**

#### **SURVEY SYSTEMS**

There are two primary boundary surveys: metes-and-bounds and Public Land Survey (PLS). The metes-and-bounds method uses map and parcel whereas the PLS uses section, township, and range to describe boundaries. Field crews should become familiar with the method used in the state.

#### **INITIAL COUNTY OVERVIEW**

Review the county materials to determine which plots were forested on the previous survey. Also, determine if any of the plots were recorded as idle farmland, which may have reverted since the last inventory. In addition, examine the aerial photographs/imagery to determine other plot locations that may have reverted and/or partially sample forest land. Be sure to collect ownership information on these plots. Owner data is not required on nonforest plots.

#### **COUNTY RECORDS**

Record keeping systems varies both between and within states. Some counties are highly computerized, while some rely totally on paper. Some counties have up-to-date information, while others are outdated. It is always advisable to ask for help from courthouse employees. They are there to help the public and are generally eager to assist people. They can also be invaluable sources of information for local forest industries.

**GENERAL OWNERSHIP PROCEDURES:**

1. Determine if the plot location samples forest land. Keep in mind the plot layout. One or more of the subplots may sample forest land. This is where preliminary work is beneficial.
2. Locate the plot location on county courthouse tax maps using the aerial photograph. When available, rely primarily on the old photograph to locate the plot on the county tax maps. Also use the plot sketch from the previous survey. It may show distinguishing physical characteristics that may help delineate the ownership boundaries. If there is more than one parcel in the vicinity of the plot, record information for each possible parcel. The adjacent tract may be in another owner category or may help you gain access to the plot.
3. Record the name, address, and owner class for the owner of each parcel. Cross check the owner with the past survey to verify an actual ownership change or if either the current or previous assignment was in error.
4. Determine the total acreage of each parcel and the number of forest acres, if required. Woodland acres are broken out of the total acreage in some states and can be used to determine percent forest. In other states, however, pine plantations are included in the agriculture category. In these cases, use the aerial photograph/imagery and the field visit to estimate the percent forest of the tract. Field check the percent forest information when the plot appears to have been planted, naturally reverted, or land cleared.
5. Record all pertinent ownership information on the "Forest Land Ownership Classification" sheets and the "Sample Location Reference Page."

**0.4 LOCATING SAMPLE PLOTS**

Each crew should always consider weather forecasts, water levels, plot access, and state and corporate cooperation when working a county. Each county should be worked in the most efficient manner possible. Always contact National Forest System (NFS) district and county forest offices, and county sheriff, as soon as you enter the county. Contact the landowner and always let local people know who you are and what you are doing when leaving an official vehicle near a residential area.

**STOP AT HOUSES, KNOCK ON DOORS, ETC. DO NOT DRIVE ACROSS CROPLAND, WILDLIFE CLEARINGS, YARDS, ETC. UNLESS YOU HAVE PERMISSION FROM THE LANDOWNER. PARK THE VEHICLE AND WALK. "POPPING" A LOCK OR USING A MASTER KEY WILL NOT BE TOLERATED. IF A ROAD HAS WATER-BARS OR A CABLE WITH A LOCK DO NOT DRIVE ON IT.**

Fill out a sample location sheet (draw sheet) for all forested plots and non-forest plots whenever a non-forest plot has adjacent forestland close to the

plot. This will insure that all 4 subplots are completely and totally within the non-forest condition. This will aid cruisers in the next survey to identify those plots that may have started to revert, but did not meet the required minimum stocking. In addition, this will allow check cruisers to know exactly where PC was located in relation to the adjacent forestland. A sample location sheet is not required for intensification plots, although data from intensification plots are recorded in the data recorder or on hardcopy.

Each crew will be furnished with both new and old photos (when available), plot sheets, ownership and field classification sheets, county maps, and National Forest ownership maps. All non-forest plots and possible reversions (a sample location or a portion of a sample location that was non-forest in the previous inventory but now forest) must be chained in using the old photo pinprick. Correct the pinprick on the new photo/imagery after the field visit if needed. For intensification plots, only use the new photos/imagery. Do not make any corrections to the new photo/imagery for an intensification plot.

#### ACCESS TO STARTING POINT (SP)

In the Sample Location Reference page section "SP Location Sketch Map" sketch the route used to access the SP. Include location of the landowners' house, road names and numbers, obvious landmarks, and other prominent features that will aid the next field crew to locate the SP.

#### Starting Point

Select a permanent landmark or physical feature as the SP for locating the sample location. Intersections or sharp bends in roads, streams, or drainage ditches, field corners, prominent trees, and other features which can be readily identified both on the ground and on the photo make good starting points. The ideal starting point tree is a healthy, unique species, with unusual form, in a prominent location. At remeasurement relocations, the starting point on the old location sheet can often be used again. Scribe the SP tree with an "X" well above DBH (or well below depending on topography) and tag the tree at ground level, facing plot center.

Complete a new location sheet with the prior starting point information on land clearings, possible reversions that are chained into that do not meet minimum stocking levels, and on non-forest plots that are close to being partial plots. Copy the starting point information off the old sheets for any non-forest plots when the previous cruiser recorded the information. A starting point is not necessary if the plot center was non-forest during the past survey and all four subplots are obviously non-forest at the present time.

Note: No mark is needed on an SP if the point is permanent and readily identifiable, such as the corner of a building or a road intersection. Reference a tree when possible. **Do not scribe an SP in peoples yards, on hiking trails or elsewhere where unsuitable. In these situations scribe the backside of the SP if possible and put a note stating that the SP was either placed on the backside of the tree or not scribed at all.**

## **PHOTO WORK/IMAGERY**

A reference azimuth, angle of intersection, and azimuth to plot center are drawn on the photograph/imagery to aid in the establishment of an accurate course to sample location, verify placement of the pinprick, and ground check the office photo interpretation.

Imagery (Digital Ortho Photos or DOQ/DOQQ) is currently being printed on paper using an inkjet printer. For this reason, crews should place these in Ziploc baggies to prevent damage to the imagery and/or printed ink. Also, when recording the reference azimuth, angle of intersection and azimuth to plot center a ball point pen must be used, the use of felt tip type pens should be avoided.

All plots except intensification plots must be drawn up on the new photograph/imagery to verify correct plot location. Note any corrected pinpricks on the front and back of the new photo.

### **Reference Azimuth**

For a reference azimuth, select a straight road section, drainage ditch, field edge, or draw a line between two well-spaced landmarks. Avoid standing near metal objects, e.g., railroads or power line towers, since they can influence the compass reading.

If no linear features exist on the photo/imagery, GPS coordinates of two point features can be used to obtain a reference azimuth. Prior to driving to the sample location, identify two distinct features on the photo/imagery within a reasonable distance (usually 1-2 miles) from the sample location. At each point feature, record 180 fixes in averaging mode on the GPS receiver (GPS can only be utilized when error falls below +/- 70 feet). The reference azimuth, based on magnetic north, is determined by using the distance feature in the WP menu of the PLGR.

Measure the reference azimuth with a compass to the nearest degree and record on the tally sheet under starting point notes, disregarding magnetic declination. If the reference azimuth line and the azimuth to plot center do not intersect on the photo/imagery, draw a line perpendicular to the reference azimuth line making it cross the azimuth to plot center. Use the perpendicular as the new reference azimuth line after adding or subtracting 90.

### **Angle of Intersection**

With a protractor measure the interior angle between the reference azimuth and azimuth to plot center arrows to the nearest degree. The interior angle should be between 20 degrees and 90 degrees. Record on the tally sheet under starting point notes.

### **Photo/Imagery Notation**

Note the following information on the **front** of the new photograph/imagery using a fine point marker (for imageries use a ball point pen) for all plots:

- a. Reference azimuth line with an arrow indicating direction and azimuth noted.

- b. Course to plot azimuth line with an arrow indicating direction and azimuth noted.
- c. Starting Point circled and indicated as SP.
- d. GPS Way Point circled and indicated as WP for completely non-forest plots only.
- e. Interior angle noted with arrows drawn to the azimuth lines.
- f. Note which plots have corrected pinpricks.

Note the following information on the **back** of new photographs/imagery when plot center is nonforest (e.g., partials and completely nonforest plots), if the plot is completely inaccessible, and intensification plots:

- a. Plot number, if not already noted.
- b. Land use code at plot center. If land use is a hayfield, record cropland land use (11) and write “hay” next to the code number. If the land use is Agricultural Land(10), developed(30-34) or Other Nonforest(40), then write a short description of the type of development, e.g., “back yard”, “grocery store”, “barn”, etc. This will aid the next crew to ensure the same area is re-evaluated.
- c. Date (mm/dd/yyyy).
- d. Cruiser and assistant initials and codes.
- e. Circle and note the “correct” pinprick if a correction has been made (do not move intensification pinpricks).
- f. Recording GPS coordinates of non-forest plots on the back of the photo/imagery is optional.
- g. Note on the back of the new photograph/imagery if plot center is reverted or landcleared.

Also, if a plot is nonforest but a draw sheet is filled out due to the proximity of forest land to one or more subplots, then record ‘See Nonforest Aid’ on back of photo.

#### Course to plot

The course to sample location can be determined by measurements from the photo/imagery for new plot locations, reversions, partials, or land clearings and lost plots when the SP has been removed. The azimuth and distance can be determined using GPS or compass and chain. Pacing to most locations is possible unless underbrush, water, or rough topography make pacing impractical. Pacing between SP and PC can be used to verify a previously reported course to sample location, but not for establishing a plot.

When old starting points are used at remeasurement locations, use the same distance and azimuth recorded in the previous survey with corrections necessary to account for declination and errant distances recorded by the previous crew. Accurate measurement of azimuth and distance from SP to PC can be by GPS navigation or by traversing on the ground.

## ESTABLISHMENT OF SAMPLE KIND 1 LOCATIONS USING GPS

To begin, manually enter the plot coordinates in the GPS unit. The following list will walk you through the buttons to push to enter the coordinates:

1. WP
2. Use the right/left arrows to highlight ENTER and press the down arrow.
3. Note the WP number in the upper left corner of the screen. This will be the waypoint the coordinates are stored as and to which you will be navigating, so it is an important number. It is a good idea to change the waypoint number to coincide with the number of the plot you are installing. To do this, right arrow until the number is blinking. Hit NUM LOCK and using the keypad, enter the plot number. Hit NUM LOCK again to turn it off. Right arrow to the next line.
4. Right arrow over N to 90. Hit NUM LOCK and enter the coordinates for North/latitude. Once these numbers have been entered, hit NUM LOCK and right arrow to the next line. **Down arrow to change the E to a W. This is critical!** The GPS default is East. If you do not change this designation, you will be putting in and navigating to coordinates in the eastern hemisphere and unless you can swim really fast and really well, you don't want to do that! Once you have changed the E to a W, right arrow to the 000 and hit NUM LOCK. Enter the West/longitudinal coordinates.
5. Once the coordinates have been entered, turn off NUM LOCK and right arrow to the P. Down arrow to store the waypoint. It will be saved as the waypoint you designated earlier.

Next, click on NAV. Make sure that you are using either the CUSTOM or 2D FAST navigating method. The other word should be DIRECT. Right arrow to WP and enter the waypoint you want to navigate to. Right arrow to P and down arrow. The next screen will tell you where you need to go. The variables may not be the same for everyone, but you need to at least have AZ and RNG to tell you where you need to go and how far it is.

Using the GPS, navigate to within 100' – 150' of the plot. If possible, locate a good SP. Set the GPS down and press and hold down the POS button until the screen says AVG and the unit begins taking hits. Again, you must collect at least 180 points for the coordinates to be accurate. Once the GPS has reached at least 180, store the current position as a waypoint. Next, hit WP. Right arrow to DIST and down arrow. This screen will allow you to calculate an azimuth and horizontal distance between two waypoints. As the first waypoint, put in the coordinates you collected at the SP. The second waypoint is the plot coordinates. Once both have been entered, the GPS calculates the RNG and AZ from the first WP to the second WP. At this point, chain the horizontal distance and azimuth to establish plot center. Once you are at PC, put the GPS down and press

and hold the POS key to begin averaging. Again, take at least 180 hits. Record these coordinates as the new plot coordinates.

### **WITNESS TREES**

Reference two witness trees to subplot 1 when at all possible. In the absence of trees, use distinct objects such as fence corners, boulders, etc. If another subplot is referenced, be sure to note which subplot is monumented with witness trees.

#### Witness trees should be:

- a. Close to the pin and spaced approximately at right angles from the pin,
- b. Not likely to die or be cut within 5-7 years, e.g., pine sawtimber,
- c. A species easily located in the stand,
- d. At least 5 inches DBH (At least 2 inches DBH if no 5 inch DBH trees are present).
- e. If there are no witness trees, use whatever is available near the subplot center and describe its' relationship to the pin (e.g., large down log that you can tag, a large rock, etc.) and describe these on the sample location reference page.

#### Witness tree data:

- a. Species
- b. DBH to the last 0.1 inch
- c. Azimuth from pin to center of tree at ground level
- d. Horizontal distance to 0.1 ft from pin to center of tree

Mark the base of each witness tree with a metal tag (3 to 4 inches long) facing plot center. Scribe an "X" well above DBH facing the pin and be careful not to penetrate the cambium. **Do not scribe or place a white tag on trees in peoples yards, picnic areas, etc. Note on the draw page if you did not scribe and/or tag the trees.**

Mark one of the witness trees with a designated tag (Venetian blind material) by nailing the tag at approximately six feet facing the line of approach from the SP. Record the color of the tag on the sample location page.

## **0.5 COUNTY EDIT PROCEDURES**

The field is the most critical place to edit data for errors. Correcting the data in the field is more precise and accurate than doing so after being submitted to the office. For this reason, a careful field edit is a vital part of data collection.

Count all county materials and complete the Office Summary Sheet. Ensure that all materials are accounted for before starting the county. If anything is missing when you receive the county materials (i.e., old maps, any photos/imagery, plots sheets, etc.) let your field coordinator know.

Make sure all items are filled in on the Sample Location record. Check for starting point notes, azimuth and slope distance to the sample location, and that the SP description and Sketch to Sample Location match. Check

completeness of the plot layout diagram, Location Sketch Map, and Sketch to Sample Location. Make sure all plots have a North arrow and the Ownership is recorded. Check the witness tree information for completeness.

Check the photographs/imagery making sure that all the SP's are marked, the photographs/imagery are drawn-up, and all required information is recorded on the back of the photographs/imagery. Check math on course to plot azimuth, reference azimuth and angle of intersection.

Count all county materials and complete the Office Summary Sheet when finished. Ensure that all materials are accounted for before they are sent to the state coordinator or field supervisor for editing

## 1.0 PLOT LEVEL DATA

All variables listed in Section 1.0 are collected on plots with at least one accessible forested condition (PLOT STATUS = 1). Some of the variables in Section 1.0 are collected on landcleared plots (PLOT STATUS = 4). For all NONFOREST/NONSAMPLED/INTENSIFICATION plots, see Section 8. In general, plot level data apply to the entire plot and they are recorded from the center of subplot 1.

### ITEM 101 STATE (CORE 1.1)

Record the unique FIPS (Federal Information Processing Standard) code identifying the State where the plot center is located. (FIPS codes are located in Appendix 1).

When collected: All plots  
 Field width: 2 digits  
 Tolerance: No errors  
 MQO: At least 99% of the time  
 Values: See Appendix 1

### ITEM 102R CYCLE

Record the cycle number of the current plot.

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

### ITEM 103R PANEL

Record the panel number of the plot.

When collected: All plots  
 Field width: 1 digit  
 Tolerance: No errors  
 MQO: At least 99% of the time  
 Values: 1 to 5

### ITEM 104 COUNTY (CORE 1.2)

Record the unique FIPS (Federal Information Processing Standard) code identifying the county or parish, where the plot center is located. (FIPS codes are located in Appendix 1).

When collected: All plots  
 Field width: 3 digits  
 Tolerance: No errors  
 MQO: At least 99% of the time  
 Values: See Appendix 1

**ITEM 105 PLOT NUMBER (CORE 1.3)**

Record the identification number, unique within a county or parish for each plot. If SAMPLE KIND = 3, the plot number will be assigned by the National Information Management System (NIMS).

Plot numbers in the south adhere to the following numbering system:

0001-0999	Standard field plots
4001-4999	Intensification plots (see Section 8.2)
9000-9999	Temporary and supplemental plots
Rxxx	Certification plot

All other plot ranges are only used for training plots.

When collected: SAMPLE KIND = 1, 2, 8, 9

Field width: 4 digits

Tolerance: No errors

MQO: At least 99% of the time

Values: 0001 to 9999

**ITEM 106R PHASE**

Record the phase number of the plot

When collected: All plots

Field width: 1 digit

Tolerance: No errors

MQO: At least 99% of the time

Values:

- 2 Standard field plot (measured year-round)
- 3 Standard field plot with forest health variables (measured only during specified time frame)

**ITEM 107 PLOT STATUS (CORE 1.4)**

Record the code that describes the sampling status of the plot.

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
- 4 Landcleared – there was at least one accessible forest land condition at the last inventory, but is now completely nonforest

**ITEM 108 SAMPLE KIND (CORE 1.5)**

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

When collected: All plots

Field width: 1 digit

Tolerance: No errors

MQO: At least 99% of the time

Values:

- 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
- 2 Remeasurement – remeasurement of a national design plot that was sampled at the previous inventory. **The previous microplot was at the offset location (previous FIELD GUIDE VERSION = 1.x or 2.x).**
- 3 Replacement plot - a replacement plot for a previously established plot. Assign **SAMPLE KIND = 3** if a plot is installed at a location other than the previous location (i.e., plots that have been lost, moved, or otherwise replaced).
- 8 Remeasurement – remeasurement of a Southern Research Station **fixed radius subplot** design and initial establishment of the National design plot, field visited or remotely classified (remeasurement of microplot at subplot center).
- 9 Prism plot remeasurement/Initial fixed plot establishment – remeasurement of an established Southern or Southeastern Research Station **prism plot** design and initial establishment of the National design plot, field visited or remotely classified.

**ITEM 109 FIELD GUIDE VERSION (CORE 1.7)**

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.

When collected: All plots

Field width: 2 digits (x.y)

Tolerance: No errors

MQO: At least 99% of the time

Values: 2.0

**ITEM 110 P3 HEXAGON NUMBER (CORE 1.16)**

Record the unique code assigned to each Phase 3 (former FHM) hexagon.

When collected: All Phase 3 plots

Field width: 7 digits

Tolerance: No errors

MQO: At least 99% of the time

Values: N/A

**ITEM 111 P3 PLOT NUMBER (CORE 1.17)**

Record the Phase 3 PLOT NUMBERS that are used to identify individual plots within the same Phase 3 (former FHM) hexagon.

When collected: All Phase 3 plots

Field width: 4 digits

Tolerance: No errors

MQO: At least 99% of the time

Values: N/A

**ITEM 112R PLOT IN CORRECT COUNTY?**

Record the code that states if the plot center is in the correct county. This item will automatically default to '1' in the data recorder. If plot center lands in a county other than the county that it is assigned to, then enter code '0'. A screen will appear where the correct county is entered. This information will be automatically forwarded to FIA office staff when the plot is transmitted.

When collected: All plots

Field width: 1 digit

Tolerance: No errors

MQO: At least 99% of the time

Values:

0 Plot center is **not** in the county the plot is assigned to

1 Plot center is in the county the plot is assigned to

**CURRENT DATE (CORE 1.8)**

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

**ITEM 113 YEAR (CORE 1.8.1)**

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:  $\geq 2003$

**ITEM 114 MONTH (CORE 1.8. 2)**

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:

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

**ITEM 115 DAY (CORE 1.8.3)**

Record the day 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

**PAST DATE**

Record the year, month, and day that the current plot visit was last inventoried in the same format as CURRENT DATE:

**ITEM 116R PAST YEAR**

When collected: SAMPLE KIND = 2,8 and 9

Field width: 4 digits

Tolerance: No errors

MQO: At least 99% of the time

Values:  $\leq$  2003

**ITEM 117R PAST MONTH**

When collected: SAMPLE KIND = 2,8 and 9

Field width: 2 digits

Tolerance: No errors

MQO: At least 99% of the time

Values:

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

**ITEM 118R PAST DAY**

Record the day of the month that the plot was last inventoried.

When collected: SAMPLE KIND = 2,8 and 9

Field width: 2 digits

Tolerance: No errors

MQO: At least 99% of the time

Values: 01 to 31

**ITEM 119 QA STATUS (CORE 1.12)**

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 (QA reviews collected data while checking plot; may be done with or without standard field crew)
- 3 Reference plot (off grid - SRS QA certification plot answer key)
- 4 Training/practice plot (off grid-SRS Field Crew certification plot)
- 5 Botched plot file (disregard during data processing)
- 6 Blind check (QA crew remeasures the plot without reviewing the standard field crew's data; standard field crew is not present)
- 7 Hot check (production plot, QA members observing standard field crew)

**ITEM 120 CREW TYPE (CORE 1.13)**

Record the code to specify what type of crew is measuring the plot.

When collected: All plots

Field width: 1 digit

Tolerance: No errors

MQO: At least 99% of the time

Values:

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

**ITEM 121R CRUISER NUMBER**

Record the unique code assigned to identify individual cruisers.

When collected: All plots

Field width: 3 digits

Tolerance: No errors

MQO: At least 99% of the time

Values: 001-999

**ITEM 122R NUMBER OF ACCESSIBLE FOREST LAND CONDITIONS**

Record the number of accessible forest land conditions that are sampled on the plot.

When collected: PLOT STATUS = 1

Field width: 1 digit

Tolerance: No errors

MQO: At least 99% of the time

Values: 1-9

**ITEM 123R NUMBER OF TREE ENTRIES**

Record the total number of entries for the tree and sapling tally. This count includes entries to indicate no tally on a subplot or microplot.

When collected: PLOT STATUS = 1 or 4

Field width: 3 digits

Tolerance: No errors

MQO: At least 99% of the time

Values: 000-999

**ITEM 124R NUMBER OF PRISM POINTS REMEASURED**

Record the number of prism points remeasured on subplots that were forested at the previous inventory.

When collected: SAMPLE KIND = 9 when previous PLOT STATUS = 1

Field width: 1 digit

Tolerance: no errors

MQO: At least 99% of the time

Values: 1-5

**ITEM 125R NUMBER OF SUBPLOT CENTERS REVERTED**

Record the number of subplot centers that fall in a naturally reverted condition. Do not include land use changes due to procedural changes or previous cruiser errors.

When collected: SAMPLE KIND = 9, PLOT STATUS = 1 and previous PLOT STATUS = 2.

Field width: 1 digit

Tolerance: no errors

MQO: At least 99% of the time

Values: 0-4

**ITEM 126R HUMAN DEBRIS**

Record the presence or absence of human debris on the forested portions of the 24 ft radius subplots. Do not code boundary paint and tree marking paint. If more than one category of debris is discovered on the plot, then record the lowest numbered item below.

This item codes debris type to assess dispersal characteristics and degree of permanence: materials that decay slowly, or rapidly, and light-weight materials that disperse farther from deposition areas. The item helps classify areas with and without human intrusions for scenic values and potential recreational experiences.

When collected: PLOT STATUS = 1

Field width: 1 digit

Tolerance: no errors

MQO: At least 80% of the time

Values:

- 0 None—No debris on the forested portion of the plot.
- 1 Noncombustible synthetic — includes glass, metal, aluminum beverage or food containers, discarded metal machinery, metal pesticide containers, metal fence, etc.
- 2 Combustible synthetics — includes plastics, styrofoam, tires, treated wood, nursery shade cloth, etc.
- 3 Combustible organic material from man-caused activities— includes yard waste, compost piles, livestock feed, wood debris from land clearing activity, slash from logging operations, etc.

#### ITEM 127 WATER ON PLOT (CORE 1.11)

Record the water source that has the greatest impact on the area within the accessible forest land portion of any of the four subplots. The coding hierarchy is listed in order from large permanent water to temporary water. This variable can be used for recreation, wildlife, hydrology, and timber availability studies. This item is limited to water that is too small to qualify as non-census or census water. Census and non-census water are delineated as separate conditions on the plot, so they are not included in this section.

When collected: All plots with at least one accessible forest land condition class (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 land CONDITON CLASS on the four subplots
- 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 with standing trees and is within an accessible forest land condition on four subplots
- 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 (mud puddles, stump holes, ruts, etc.)

**ITEM 128 HORIZONTAL DISTANCE TO IMPROVED ROAD (CORE 1.10)**

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.

When collected: All plots with at least one accessible forest land condition class (PLOT STATUS = 1)

Field width: 1 digit

Tolerance: No errors

MQO: At least 90% of the time

Values:

- 1 100 ft or less
- 2 101 to 300 ft
- 3 301 to 500 ft
- 4 501 to 1000 ft
- 5 1001 ft to 1/2 mile
- 6 >1/2 to 1 mile
- 7 >1 to 3 miles
- 8 >3 to 5 miles
- 9 Greater than 5 miles

**ITEM 129R HORIZONTAL DISTANCE TO URBAN OR BUILT-UP LAND**

Record the straight-line distance from plot center (subplot 1) to the nearest evidence of urban or built-up land. Only examine the single photo that includes the plot pin-prick.

Urban or built-up land — Land that is 10 acres or more in size and comprised of areas of intensive human use with much of the land covered by manmade structures and associated clearings. Included are towns, villages, strip-developments along highways, power and communication facilities (excluding rights-of-way), industrial complexes, and institutions.

Urban or built-up land is further defined as any 10-acre area (660 x 660 feet) composed of a mixture of land uses where urban or built-up land uses comprise more than 50 percent of the land area. Included are residential or commercial strips. Residential or commercial strips are at least 100 feet wide and 10 acres in size (4400 x 100, 2200 x 200, 1500 x 300, 1100 x 400, 900 x 500, etc.) with uniform spacing of structures, often with lawns, driveways, and parking lots.

Active surface mines, active sand and gravel pits, and other areas TEMPORARILY devoid of vegetation due to man's activities are NOT considered urban or built-up land. Similarly, naturally formed talus slopes and rock outcrops, mine tailings and soil pushed aside from surface mine operations, and bare soil associated with crop tillage are not urban or built-up land. Buildings, permanent product storage bins, and equipment parking areas are considered urban or built-up land.

The presence or absence of a store in a strip development has no bearing on this classification. Where a strip development consists of a mixture of farmsteads and residences, or farmsteads or other urban or built-up land, then consider farmsteads as built-up land. (Farmstead—a tract of land,

usually with a house, barn, etc., on which crops or livestock are raised.) A farmstead is otherwise considered agricultural land.

When collected: PLOT STATUS = 1

Field width: 1 digit

Tolerance: no errors

MQO: At least 90% of the time

Values: Use same values listed under HORIZONTAL DISTANCE TO IMPROVED ROAD

### ITEM 130R HORIZONTAL DISTANCE TO AGRICULTURAL LAND

Record the straight-line distance from the plot center (subplot 1) to the nearest evidence of agricultural land. Only examine the single photo that includes the plot pin-prick.

Agricultural Land — Land that is 10 acres or more in size and used primarily for the production of crops or livestock. Evidence includes geometric field and road patterns and the traces produced by livestock or mechanized equipment. Included are cropland, idle farmland, improved pasture, and other farmland (e.g., confined feeding areas, horse farms, farmsteads, nurseries, orchards, and vineyards).

When collected: PLOT STATUS = 1

Field width: 1 digit

Tolerance: no errors

MQO: At least 90% of the time

Values: Use same values listed under HORIZONTAL DISTANCE TO IMPROVED ROAD

### ITEM 131R SIZE OF CONTIGUOUS FOREST LAND

Record the category below that indicates the size of the contiguous forest land around plot center (subplot 1). Only examine the single photo that includes the plot pin-prick to determine the size of the contiguous forest. If plot center is nonforest, then record 0.

Contiguous Forest Land — Forested areas that are at least 120 feet wide and 1.0 ac in size. Boundaries are nonforest areas that are at least 120 feet wide. Right-of-ways (e.g., power lines, pipe lines, woods roads, improved roads) are not boundaries unless the cleared area between the trees is at least 120 feet wide.

When collected: PLOT STATUS = 1

Field width: 1 digit

Tolerance: no errors

MQO: At least 90% of the time

Values:

- 0 Plot center is non-forest
- 1 1 – 10 acres
- 2 11 – 50 acres
- 3 51 – 100 acres
- 4 101 – 500 acres
- 5 501 - 2,500 acres
- 6 2,501 – 5000 acres
- 7 > 5,000 acres

**GPS Coordinates (CORE 1.14)**

Use a global positioning system (GPS) unit to determine the plot coordinates and elevation of all field-visited plot locations.

**GPS Unit Settings, Datum, and COORDINATE SYSTEM (CORE 1.14.1)**

The Southern Research Station uses the North American Datum 1983 (NAD 83). The Southern Research Station collects coordinates in degrees, minutes and seconds of latitude and longitude.

**Collecting Readings (CORE 1.14.2)**

Collect at least 180 GPS readings at the plot center. These may be collected in a file for post-processing or may be averaged by the GPS unit. Each individual position should have an error of less than 70 feet if possible (the error of all the averaged readings is far less).

Soon after arriving at plot center, use the GPS unit to attempt to collect coordinates. If suitable positions (180 readings at error less than or equal to 70 feet) 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 a PLGR unit is used, use the Rng-Calc function in the PLGR 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 **ITEM 139** and **ITEM 140**

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 a PLGR unit is used, use the Rng-Calc function in the PLGR 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 Section **ITEM 139** and **ITEM 140**.

In all cases try to obtain at least 180 positions before recording the coordinates.

**Correction For "Offset" Location (CORE 1.14.11)**

As described in **Collecting Readings (CORE 1.14.2)**, coordinates may be collected at a location other than the plot center (an "offset" location). If a PLGR unit is used all offset coordinates will be "corrected" back using the Rng/Calc function. If a GPS unit other than a PLGR is used, then record **ITEM 139** and **ITEM 140**.

**ITEM 132 GPS UNIT (CORE 1.14.3)**

Record the kind of GPS unit used to collect coordinates. If suitable coordinates cannot be obtained, record 0.

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
- 1 Rockwell Precision Lightweight GPS Receiver (PLGR)
- 2 Other brand capable of field-averaging
- 3 Other brands capable of producing files that can be post-processed (ex. Trimble Geoexplorer, Pathfinder Pro)
- 4 Other brands not capable of field-averaging or post-processing (ex. Garmin, Magellan, etc.)

**ITEM 133 SERIAL NUMBER (CORE 1.14.4)**

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

**ITEM 134 LATITUDE (1.14.6)**

Record the latitude of the plot center to the nearest hundredth second, as determined by GPS. Record the latitude of the off-set point if the coordinates cannot be calculated.

When collected: When COORDINATE SYSTEM = 1

Field width: 8 digits (DDMMSSSS)

Tolerance: +/- 140 ft

MQO: At least 99% of the time

Values: Dependent on location

**ITEM 135 LONGITUDE (CORE 1.14.7)**

Record the longitude of the plot center, to the nearest hundredth second, as determined by GPS. Record the longitude of the off-set point if the coordinates cannot be calculated.

When collected: When COORDINATE SYSTEM = 1

Field width: 9 digits: (DDDMMSSSS)

Tolerance: +/- 140 ft

MQO: At least 99% of the time

Values: Dependent on location

**ITEM 136 GPS ELEVATION (CORE 1.14.14)**

Record the elevation above mean sea level of the plot center, in feet, as determined by GPS. Record the elevation of the off-set point if the coordinates cannot be calculated. If the coordinates can be calculated, then record 99999 because it cannot calculate elevation.

When collected: When GPS UNIT = 1, 2 or 4

Field width: 6 digits

Tolerance:

MQO: At least 99% of the time

Values: -00100 to 20000, 99999

**ITEM 137 GPS ERROR (CORE 1.14.15)**

Record the error as shown on the GPS unit to the nearest foot. As described in **Collecting Readings (CORE 1.14.2)**, make every effort to collect readings only when the error is less than or equal to 70 feet. However, if after trying several different times during the day, at several different locations, this is not possible, record readings with an error of up to 999 feet.

When collected: When GPS UNIT = 1 or 2

Field width: 3 digits

Tolerance: No errors

MQO: At least 99% of the time

Values: 000 to 070 if possible

071 to 999 if an error of less than 70 cannot be obtained

**ITEM 138 NUMBER OF READINGS (CORE 1.14.16)**

Record a 3-digit code indicating how many readings were averaged by the GPS unit to calculate the plot coordinates. Collect at least 180 readings if possible.

When collected: When GPS UNIT = 1 or 2

Field width: 3 digits

Tolerance: No errors

MQO: At least 99% of the time

Values: 001 to 999

**ITEM 139 AZIMUTH TO PLOT CENTER (CORE 1.14.12)**

Record the azimuth from the location where coordinates were collected to actual plot center. If coordinates are collected at 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

**ITEM 140 DISTANCE TO PLOT CENTER (CORE 1.14.13)**

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, record 000. As described in **Collecting Readings (CORE 1.14.2)**, 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

**ITEM 141 PLOT-LEVEL NOTES (CORE 1.15)**

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

When collected: All plots

Field width: 256 characters

Tolerance: N/A

MQO: N/A

Values: English language words, phrases and numbers

## 2.0 CONDITION CLASS

The Forest Inventory and Analysis (FIA) plot is 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 Step 1: Delineate the plot area by CONDITION CLASS STATUS

The first attribute considered when defining a condition class is CONDITION CLASS STATUS. The area sampled by a plot is assigned to condition classes based upon the following differences in CONDITION CLASS STATUS:

- 1 Accessible forest land
- 2 Nonforest land
- 3 Noncensus water
- 4 Census water
- 5 Nonsampled

Accessible forest land defines the population of interest for FIA purposes. This is the area where most of the data collection is conducted. **Only delineate between conditions 2-5 above on subplots that have at least one accessible forest land condition. (SUBPLOT STATUS = 1) Do not delineate between nonforest conditions 2-5 above on completely nonforest subplots (SUBPLOT STATUS = 2 or 3).**

#### 2.1.2 Step 2: Further subdivide Accessible Forest Land by 6 delineation variables

Any condition class sampled as accessible forest land may 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. RESERVED STATUS
2. OWNER GROUP
3. FOREST TYPE
4. STAND SIZE CLASS
5. REGENERATION STATUS
6. TREE DENSITY

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.

## 2.2 CONDITION CLASS STATUS DEFINITIONS

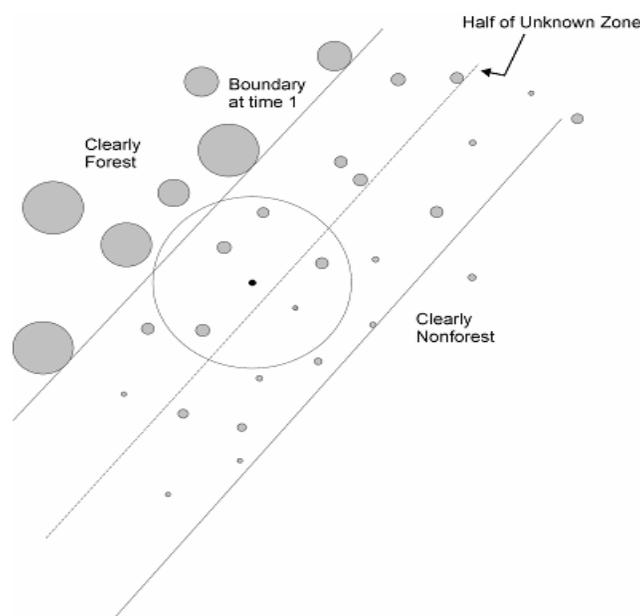
### 1. Accessible Forest Land

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 at the two following criteria:

- (a) the condition is at least 10-percent stocked by trees of any size or has been at least 10-percent stocked in the past. Additionally, the condition is not subject to nonforest use(s) that prevent normal tree regeneration and succession such as regular mowing, recreation activities, or managed grazing where direct human intervention is actively suppressing regeneration.
- (b) in several western woodland species where stocking cannot be determined, and the condition has at least 5 percent crown cover by trees of any size, or has had at least 5 percent cover in the past. Additionally, the condition is not subject to nonforest use that prevents normal regeneration and succession such as regular mowing, chaining, or recreation activities.

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.

Transition zones and forest/nonforest encroachment – When an accessible forest land condition encroaches into a nonforest condition, the border between forest and nonforest is often a gradual change in tree cover or stocking with no clear and abrupt boundary. In addition, it may be difficult to determine exactly where the forested area meets the minimum stocking criteria and where it does not. For these cases, determine where the land clearly meets the 10 percent minimum forest land stocking, and where it clearly is less than required stocking; 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 2).

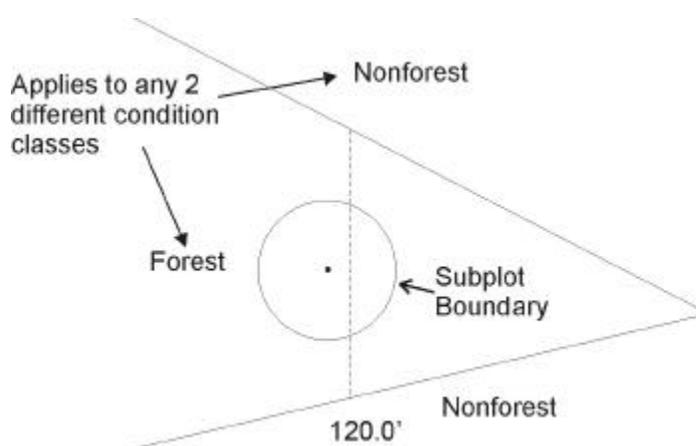


**Figure 2. Example of classifying the condition class of the subplot in a transition zone with forest/nonforest encroachment.**

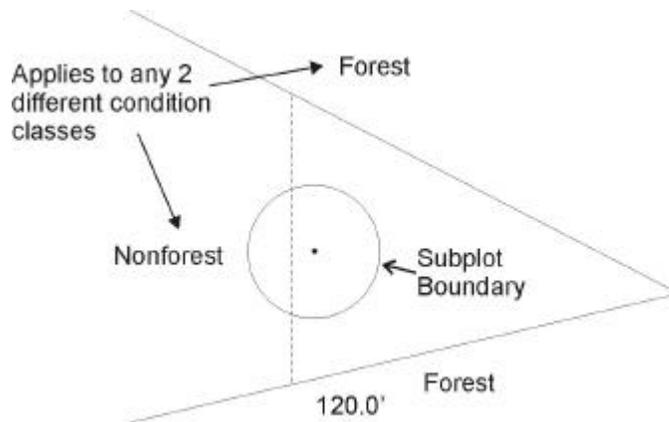
For example, at measurement time 1, a clear and distinct boundary existed between the forest and nonforest condition classes. At time 2, however, there now exists a zone of regeneration or small diameter trees between the previous forest condition and where the nonforest clearly remains. If the zone of encroachment is clearly stocked 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 stocked (forest) and where it is clearly not stocked (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.

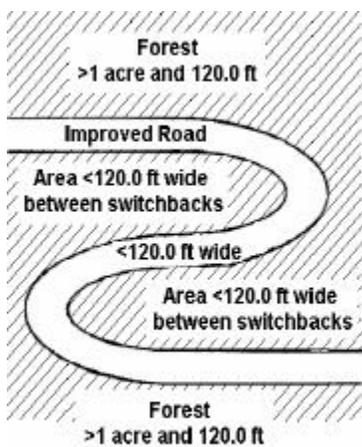
Indistinct boundary due to the condition minimum-width definition – Do not subdivide subplots where a condition class may change due only to the forest vs. nonforest minimum width (120.0 feet) definition. Although the point where the definition changes from forest to nonforest creates an invisible “line” between conditions, **this definitional boundary is not distinct and obvious.** See Figures 3 and 4. 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.



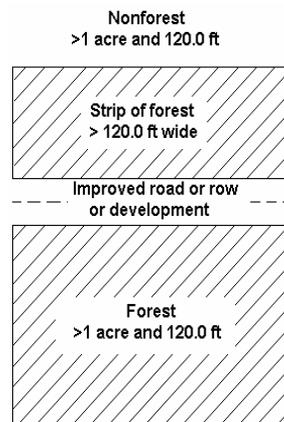
**Figure 3. Forest condition narrows within a nonforest condition. Examine the location of the subplot center in reference to the approximate line where the forest narrows to 120.0 ft wide. In this example, the entire subplot is classified as forest.**



**Figure 4. Nonforest 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**



**Figure 5. Example of a switchback road.**



**Figure 6. Example of nonforest and forest strips.**

**2. Nonforest Land**

Nonforest land is any land within the sample that does not meet the definition of accessible forest land or any of the CONDITION CLASS STATUS values defined in #'s 3, 4 and 5 in Section 2.2. To qualify, the area must be at least 1.0 acre in size and 120.0 feet wide; five exceptions are discussed at the beginning of Section 2.4. Do not consider evidence of "possible" or future development or conversion. A nonforest land condition will remain in the sample and will be examined at the next plot visit to see if it has become forest land.

**3. 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.

**4. 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).

- 5. Nonsampled  
Land that cannot be sampled because it is located in a different country or state, is in a hazardous situation, access has been denied or other reasons where plot cannot be accessed, regardless of size.

### 2.3 CONDITION CLASS ATTRIBUTES

A CONDITION CLASS NUMBER and a classification for CONDITION CLASS STATUS are required for every condition class sampled on a plot. For each condition class classified as accessible forest land, a classification is required for each of the following attributes:

ITEM 205	RESERVED STATUS	}	Attributes where a change causes a separate condition class
ITEM 207	OWNER GROUP		
ITEM 211	FOREST TYPE		
ITEM 212	STAND SIZE CLASS		
ITEM 213	REGENERATION STATUS		
ITEM 215	TREE DENSITY		
ITEM 206	OWNER CLASS	}	Ancillary Changes do not delineate a new condition class
ITEM 208	PRIVATE OWNER INDUSTRIAL STATUS		
ITEM 214	ARTIFICIAL REGENERATION SPECIES		
ITEM 216	STAND AGE		
ITEM 218	DISTURBANCE (up to 3 coded)		
ITEM 219	DISTURBANCE YEAR (1 per disturbance)		
ITEM 224	TREATMENT (up to 3 coded)		
ITEM 227	TREATMENT YEAR (1 per treatment)		
ITEM 230	PHYSIOGRAPHIC CLASS		
ITEM 202R	PRESENT LAND USE	}	SRS Regional Items
ITEM 209R	TRACT SIZE (TOTAL ACRES)		
ITEM 210R	TRACT SIZE (PERCENT FOREST)		
ITEM 217R	STAND STRUCTURE		
ITEM 231R	OPERABILITY		
ITEM 232R	WATER SOURCE		
ITEM 233R	DISTANCE TO WATER SOURCE		
ITEM 234R	SITE CLASS		
ITEM 235R	FIRE		
ITEM 236R	GRAZING		

When classifying CONDITION CLASS STATUS, OWNER GROUP, RESERVED STATUS, and PRESENT NONFOREST USE, base the classification on what is present within the area defined by the fixed radius subplot. When classifying all other condition class variables, base the classification on a 60.0 ft. radius.

### 2.4 DELINEATING CONDITION CLASSES DIFFERING IN CONDITION 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 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 condition class.

**Five exceptions** to these size and width requirements apply:

1. Developed nonforest 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 conditions that do not have to meet area or width requirements
  - a) 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 roads.
  - b) 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.
  - c) 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.
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 conditions that are not listed under #1, e.g., improved roads, maintained rights-of-way, and developments.**

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

For two alternating strips of forest and nonforest between two qualifying areas of nonforest land and forest land, see Figure 7. Figure 7 delineates the boundary between the forest and nonforest 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.

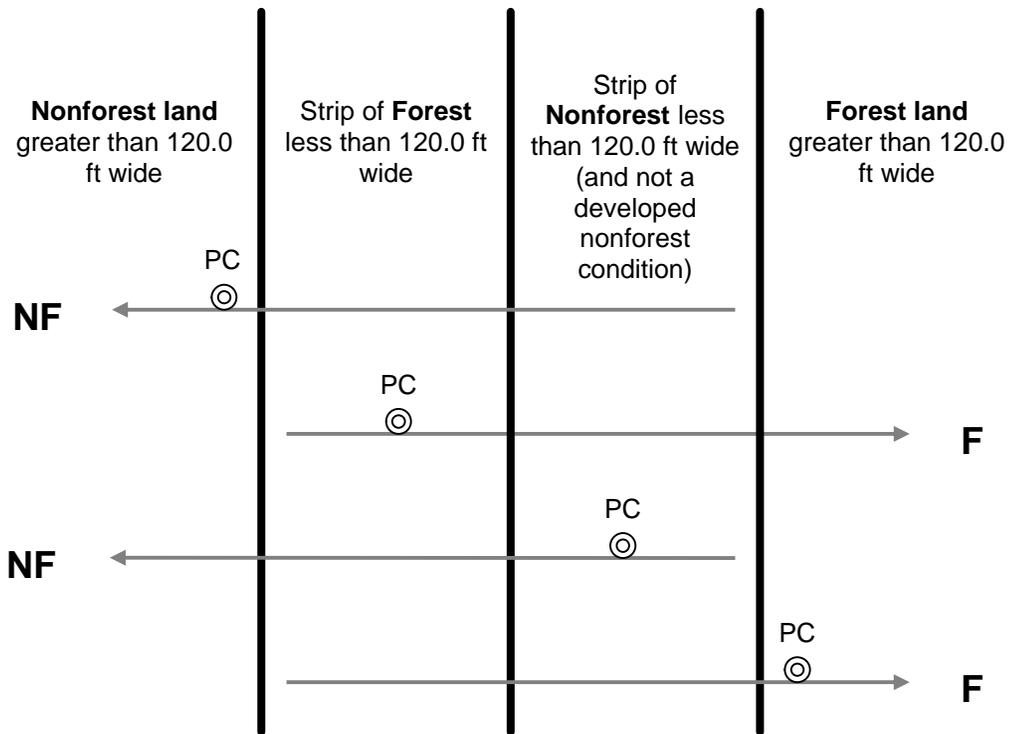


Figure 7. Example of alternating strips of forested and nonforested conditions. PC is the plot center (center of subplot 1).

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

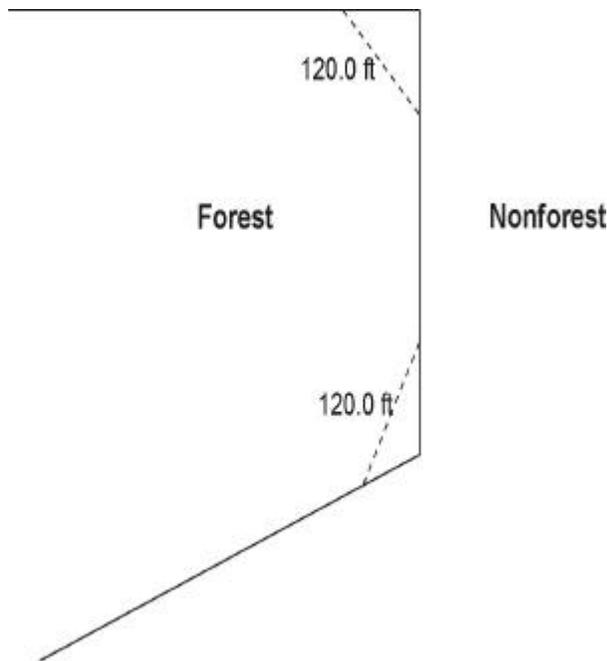


Figure 8. Illustration of the 90 degree corner rule. The dotted lines do not create nonforest conditions.

- 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.

5. Nonsampled conditions within accessible forest land are delineated, regardless of size, as a separate condition.

## 2.5 DELINEATING CONDITION CLASSES WITHIN ACCESSIBLE FOREST LAND:

Accessible forest land is subdivided into condition classes that are based on differences in RESERVED STATUS, 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 ITEMS 206, 208, 212, 213, 214, and 216. “Stands” are defined by plurality of stocking for all live trees that are not overtopped.

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.

General instructions for delineating condition classes within accessible forest lands:

1. Distinct boundary within an annular plot (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.
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.

3. A boundary or transition zone between fixed radii plots that sample distinctly different condition classes – Separate condition classes are recognized and recorded when a valid attribute obviously differs between two fixed radius plots, 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 at least 10-percent tree stocking. Two condition classes are sampled: accessible forest land sampled on subplot 2, and nonforest land sampled on the other subplots.

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, beaver ponds, sink holes, cypress domes and ponds, man-made ditches and canals. 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. Figures 9-14 provide examples of when to delineate riparian forest area as a separate condition class.

Note: When the width of forest adjacent to a stream 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.

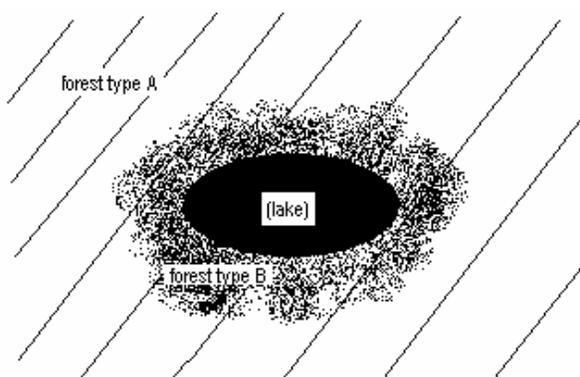


Figure 9. Forest type B is a separate condition class (riparian) if the band of it is between 30.0 feet and 120.0 feet wide, and is  $\geq$  1.0 acre in size.

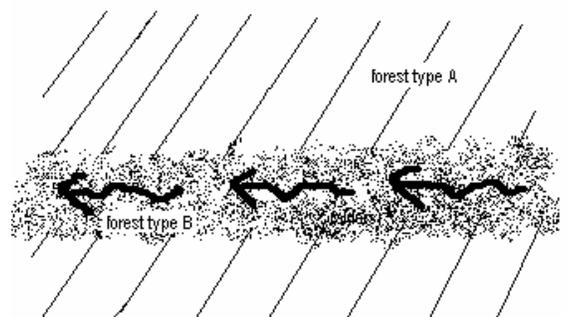
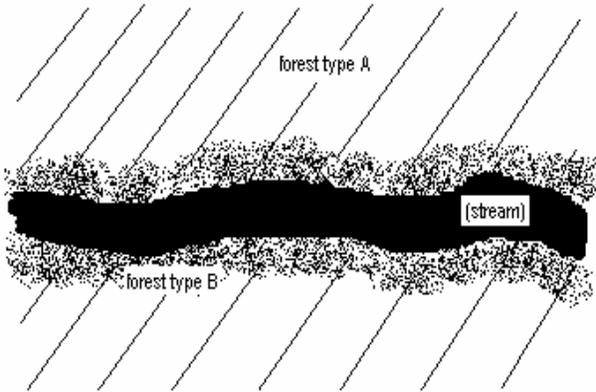
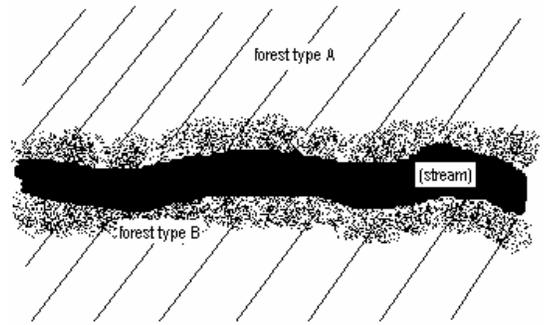


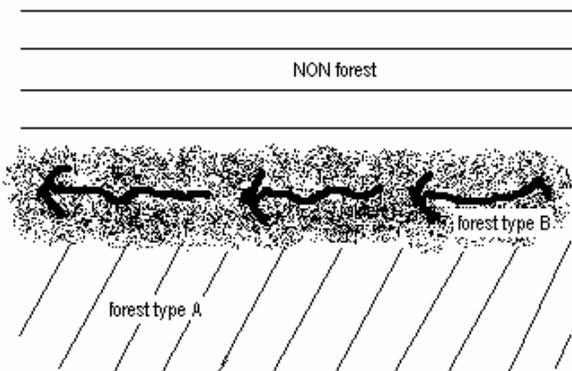
Figure 10. Forest type B is a separate condition class (riparian) if the band of it is between 30.0 feet and 120.0 feet wide, and is  $\geq$  1.0 acre in size.



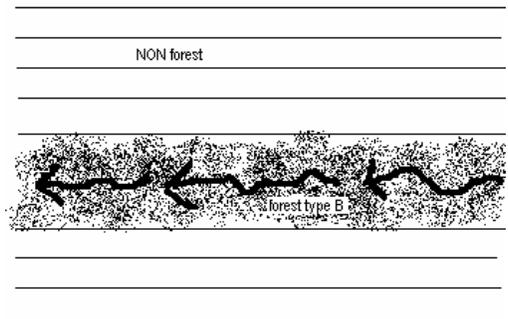
**Figure 11.** If the stream is < 30.0 feet wide, forest type B is a separate condition class (riparian) if the sum of the two widths of the bands falls between 30.0 feet and 120.0 feet wide, and is  $\geq 1.0$  acre in size.



**Figure 12.** 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  $\geq 1.0$  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  $\geq 1.0$  acre in size.



**Figure 14.** In a non-forested 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.

**ITEM 201 CONDITION CLASS NUMBER (CORE 2.4.1)**

On a plot, assign and record a number for each condition class. The condition class at plot center (the center of subplot 1) is always designated condition class 1. Other condition classes are assigned numbers sequentially at the time each condition class is delineated.

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

**ITEM 202R PRESENT LAND USE**

Record the classification that indicates the land use of the condition. Use codes 10, 30, 40 and 99 only for land not better described by one of the more detailed codes within each category.

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

Accessible Forestland (CONDITION CLASS STATUS = 1)

Forestland - See section 2.2 for complete definition.

- 01 Accessible timber land (SITE CLASS = 1- 6)
  - 02 Accessible other forest land (SITE CLASS = 7)
- 10 Agricultural land (CONDITION CLASS STATUS = 2) - 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. 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
  - 15 Christmas tree plantation
  - 16 Maintained wildlife openings
- 20 Rangeland (CONDITION CLASS STATUS = 2) - 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 Other developed (CONDITION CLASS STATUS = 2) - 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, 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
- 40 Other Nonforest (CONDITION CLASS STATUS = 2) - Land parcels greater than 1.0 acre in size and greater than 120.0 feet wide, that do not fall into one of the uses described above. Examples include barren land (rock, sand), bogs, ice, and snow.
- 41 Marsh
  - 42 Beach
- 91 Census water (CONDITION CLASS STATUS = 4)  
see section 2.2
- 92 Noncensus water (CONDITION CLASS STATUS = 3)  
see section 2.2
- 99 Nonsampled (CONDITION CLASS STATUS = 5)  
see section 2.2

**ITEM 203 CONDITION CLASS STATUS (CORE 2.4.2)**

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 CONDITION CLASS STATUS.

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 Nonforest land
- 3 Noncensus water
- 4 Census water
- 5 Nonsampled

**ITEM 204 CONDITION NONSAMPLED REASON (CORE 2.4.3)**

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

When collected: When 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. Texas border counties only.
- 02 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. In some regions denied access plots may be replaced; check with the field supervisor regarding regional protocols for plot replacement.
- 03 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. In some regions hazardous plots may be replaced; check with the field supervisor regarding regional protocols for plot replacement.

**ITEM 205R NEW PAST LAND USE**

Record the code that best describes the past land use of the condition if the current procedures had been used to install the plot 5 years ago. Record this item on all Initial and Replacement plots. Excludes Intensifications.

When collected: SAMPLE KIND 1, 3 or 9

Field width: 2 digits

Tolerance: No errors

MQO: At least 99% of the time

Values: Use same codes for PRESENT LAND USE listed above (except Land Use 99 is **not** valid for Sample Kind's 1 and 3)

**ITEM 206 RESERVED STATUS (CORE 2.5.1)**

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.

When collected: All accessible forestland condition classes (CONDITION CLASS STATUS = 1)

Field width: 1 digit

Tolerance: No errors

MQO: At least 99% of the time

Values:

- 0 Not reserved
- 1 Reserved

**ITEM 207 OWNER CLASS (CORE 2.5.7)**

Record the 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 owner class. If multiple owner classes within a group occur on a single condition class, record the owner class closest to the plot center.

When collected: All accessible forestland condition classes (CONDITION CLASS STATUS = 1)

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
- 13 Other Forest Service

**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
- 25 Other Federal

**Owner Classes in State and Local Government lands (Owner Group 30)**

- 31 State
- 32 Local (County, Municipality, etc.)
- 33 Other Non Federal Public

**Owner Classes within Private lands (Owner Group 40)**

- 41 Corporate
- 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, etc.
- 44 Native American (Indian) – within reservation boundaries
- 45 Individual

**ITEM 208 OWNER GROUP (CORE 2.5.2)**

Record the 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 OWNER GROUP only; separate conditions due to changes in OWNER GROUP are recognized only where differences can be clearly identified on the ground when visiting the plot.

When collected: All accessible forestland condition classes (CONDITION CLASS STATUS = 1)

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

**ITEM 209 PRIVATE OWNER INDUSTRIAL STATUS (CORE 2.5.8)**

Record the code identifying the status of the owner with regard to being considered industrial as determined by whether or not they own and operate a primary wood processing plant. A primary wood processing plant is any commercial operation which originates the primary processing of wood on a regular and continuing basis. Examples include: pulp or paper mill, sawmill, panel board mill, post or pole mill, etc. Cabinet shops, “mom & pop” home-operated businesses, etc., should not be considered as industrial plants. If any doubt exists with the determination by the field crew about the owner’s industrial status due to name, commercial plant size, type plant, etc., choose code 0.

**NOTE:** FIA unit or State headquarters may have to maintain a list of recognized industrial owners within a State for crews to use when making these determinations.

When collected: All accessible forestland condition classes (CONDITION CLASS STATUS = 1) when the owner group is private (OWNER GROUP 40)

Field width: 1 digit

Tolerance: No errors

MQO: At least 99% of the time

Values:

- 0 Land **is not** owned by industrial owner with a wood processing plant
- 1 Land **is** owned by industrial owner with wood processing plant

#### ITEM 210R TRACT SIZE (TOTAL ACRES)

Tract size is recorded when the OWNER GROUP is 40 **and** the PRIVATE OWNER INDUSTRIAL STATUS is 0. Include both forest and non-forest acres of the parcel. Do not include separate parcels that the landowner may own elsewhere. If more than one private landowner owns a sample location, record the tract size information for the first forest condition for subsequent forest conditions classified as a private, non-industrial landowner, even though they may be a different owner. See Ownership Procedures in Section 0.3.

Tract size often affects whether a forest stand is likely to be managed and the likelihood of its becoming a source of timber supplies. Very small parcels of land in primarily urban settings are often perceived to be unavailable for timber harvest and many users of FIA data have requested that these areas be identified to eliminate them from the resource base when assessing timber availability. Tract size also provides the ability to track timber removals for parcels of different sizes over time.

When collected: CONDITION CLASS STATUS = 1, OWNER GROUP = 40, and PRIVATE OWNER INDUSTRIAL STATUS = 0

Field width: 5 digits

Tolerance: No errors

MQO: At least 99% of the time

Values: 00001-99999

#### ITEM 211R TRACT SIZE (PERCENT FOREST)

Record the percentage of the tract that is forested. See Ownership Procedures in Section 0.3.

When collected: TRACT SIZE (TOTAL ACRES) is collected

Field width: 3 digits

Tolerance: No errors

MQO: At least 99% of the time

Values: 001-100

**ITEM 212 FOREST TYPE (CORE 2.5.3)**

Record the code corresponding to the FOREST TYPE (from Appendix 2) that best describes the species with the plurality of stocking for all live trees in the condition class that are not overtopped.

If STAND SIZE CLASS is nonstocked, then FOREST TYPE is determined by the following hierarchy:

- For SAMPLE KIND = 2 plots, record the FOREST TYPE of the condition at the previous inventory.
- For all other plots:
  1. Evaluate any seedlings available to determine the FOREST TYPE.
  2. If no seedlings exist, use adjacent stands and your best professional judgment to determine FOREST TYPE.

When collected: All accessible forestland condition classes (CONDITION CLASS STATUS = 1)

Field width: 3 digits

Tolerance: No errors in group or type

MQO: At least 99% of the time in group; at least 95% of the time in type. No MQO when STAND SIZE CLASS = 0.

Values: See Appendix 2

**ITEM 213 STAND SIZE CLASS (CORE 2.5.4)**

Record the code that best describes the predominant size class of all live trees in the condition class.

When collected: All accessible forestland condition classes (CONDITION CLASS STATUS = 1)

Field width: 1 digit

Tolerance: No errors

MQO: At least 99% of the time

Values:

0 Nonstocked:

Meeting the definition of accessible forest land, and one of the following applies:

- (a) less than 10 percent stocked by trees of any size, or
- (b) for several western woodland species where stocking standards are not available, less than 5 percent **crown cover** of trees of any size.

1 < 4.9 inches (seedlings / saplings)

At least 10 percent stocking (or 5 percent crown cover if stocking standards are not available) in trees of any size; and at least 2/3 of the crown cover is in trees less than 5.0 inches DBH/DRC.

2 5.0 – 8.9 inches (softwoods) / 5.0 – 10.9 inches (hardwoods)

At least 10 percent stocking (or 5 percent crown cover if stocking standards are not available) in trees of any size; and at least 1/3 of the crown cover is in trees greater than 5.0 inches DBH/DRC **and** the plurality of the crown cover is in softwoods between 5.0 – 8.9 inches diameter and/or hardwoods between 5.0 – 10.9 inches DBH, and/or western woodland trees 5.0 – 8.9 inches DRC.

- 3 9.0 – 19.9 inches (softwoods) / 11.0 – 19.9 inches (hardwoods)  
At least 10 percent stocking (or 5 percent crown cover if stocking standards are not available) in trees of any size; and at least 1/3 of the crown cover is in trees greater than 5.0 inches DBH/DRC **and** the plurality of the crown cover is in softwoods between 9.0 – 19.9 inches diameter and/or hardwoods between 11.0 – 19.9 inches DBH, and for western woodland trees 9.0 – 19.9 inches DRC.
- 4 20.0 – 39.9 inches  
At least 10 percent stocking (or 5 percent crown cover if stocking standards are not available) in trees of any size; and at least 1/3 of the crown cover is in trees greater than 5.0 inches DBH/DRC **and** the plurality of the crown cover is in trees between 20.0 – 39.9 inches DBH.
- 5 40.0 + inches  
At least 10 percent stocking (or 5 percent crown cover if stocking standards are not available) in trees of any size; and at least 1/3 of the crown cover is in trees greater than 5.0 inches DBH/DRC **and** the plurality of the crown cover is in trees  $\geq$  40.0 inches DBH.

Within the sampled area on microplot or subplot, recognize only very obvious contrasting stands of different mean diameter with an abrupt boundary. Example: an obvious abrupt boundary exists within the sampled (fixed-radius) area of a subplot and demarcates a STAND SIZE CLASS change. Use tree stocking of all live trees that are not overtopped to differentiate between stand-size classes; for most western woodland forest types (e.g., pinyon, juniper, gambel oak) where stocking standards are not readily available, use percent tree cover to represent stocking.

Use crown cover as the surrogate for stocking to determine STAND SIZE CLASS. View the plot from the top down and examine crown cover. The stand must have at least 5 percent of the crown cover in STAND SIZE CLASSES of 1, 2, 3, 4, or 5 or any combination of these STAND SIZE CLASSES; otherwise the STAND SIZE CLASS is 0. If 2/3 of the crown cover is STAND SIZE CLASS = 1, classify the condition as STAND SIZE CLASS = 1. If less than 2/3 of the crown cover is STAND SIZE CLASS = 1, classify the condition as STAND SIZE CLASS = 2, 3, 4, or 5, based on which of these STAND SIZE CLASSES has the most crown cover.

#### **ITEM 214 REGENERATION STATUS (CORE 2.5.5)**

Record the code that best describes the artificial regeneration that occurred in the condition.

When collected: All accessible forestland condition classes (CONDITION CLASS STATUS = 1)

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 stand origin.

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

#### **ITEM 215 ARTIFICIAL REGENERATION SPECIES (CORE 2.5.9)**

Record the species code of the predominant tree species for which evidence exists of artificial regeneration in the stand. This attribute is ancillary; that is, contrasting condition classes are never delineated based on variation in this attribute.

When collected: All unique accessible forestland condition classes (CONDITION CLASS STATUS = 1, and SIMILAR CONDITION CLASS NUMBER = 0) with evidence of artificial regeneration (REGENERATION STATUS = 1)

Field width: 4 digits

Tolerance: No errors

MQO: At least 99% of the time

Values: See Appendix 3

#### **ITEM 216 TREE DENSITY (CORE 2.5.6)**

Record a code to indicate the relative tree density classification. Base the classification on the number of stems/unit area, basal area, tree cover, or stocking of all live trees in the condition that are not overtopped, compared to any previously defined condition class TREE DENSITY.

The instructions in Sections 2.1 and 2.4 apply when delineating, within accessible forest land, contrasting conditions based on differences in TREE DENSITY.

Codes 2 and higher are used ONLY when all other attributes used to delineate separate condition classes are homogenous, i.e., when a change in density is the ONLY difference within what would otherwise be treated as only one forest condition. Otherwise, code 1 for all condition classes. Codes 2 and higher are usually, but not always, used to demarcate areas that differ from an adjacent area due to forest disturbance, e.g., a partial harvest or heavy, but not total tree mortality due to a ground fire. Delineation by density should only be done when the less-dense condition is 50 percent or less as dense as the more dense condition.

Do not distinguish between low-stocked stands or stands of sparse and patchy forest.

When collected: All accessible forestland condition classes (CONDITION CLASS STATUS = 1)

Field width: 1 digit

Tolerance: No errors

MQO: At least 99% of the time

Values:

- 1 Initial density class
- 2 Density class 2 - density different than 1
- 3 Density class 3 - density different than 1 and 2

In order to qualify as a separate condition based on density, there **MUST** be a distinct, easily observed change in the density of an area's tree cover or basal area.

Examples of valid contrasting conditions defined by differences in tree density are:

- the eastern half of an otherwise homogeneous, 20-acre stand has many trees killed by a bark beetle outbreak,
- one portion of a stand is partially cut over (with 40 square feet basal area per acre) while the other portion is undisturbed (with 100 square feet basal area per acre).

NOTE: In these examples, RESERVED STATUS, OWNER GROUP, FOREST TYPE, STAND SIZE CLASS, and REGENERATION STATUS are the same.

#### **ITEM 217 STAND AGE (CORE 2.5.10)**

Record the average total age, to the nearest year, of the trees (plurality of all live trees not overtopped) in the predominant STAND SIZE CLASS of the condition, determined using local procedures. Record 000 for non-stocked stands.

An estimate of STAND AGE is required for every forest land condition class defined on a plot. Stand age is usually highly correlated with stand size and should reflect the average age of all trees that are not overtopped. Unlike the procedure for site tree age (TREE AGE AT DIAMETER), estimates of STAND AGE should estimate the time of tree establishment (e.g., not age at the point of diameter measurement). Note: For planted stands, estimate age based on the year the stand was planted (e.g., do not add in the age of the planting stock).

To estimate STAND AGE, select two or three dominant or codominant trees from the overstory. If the overstory covers a wide range of tree sizes and species, try to select the trees accordingly, but it is not necessary to core additional trees in such stands. The variance associated with mean stand age increases with stand heterogeneity, and additional cores are not likely to improve the estimate. Core each tree at the point of diameter measurement and count the rings between the outside edge and the core to the pith. Add in the number of years that passed from germination until the tree reached the point of core extraction to determine the total age of the tree. Add: longleaf – 7 years; other pines – 3 years; hardwoods – 2 years. Assign a weight to each core by visually estimating the percentage of total overstory trees it represents. Make sure the weights from all cores add up to 1.0, compute the weighted average age, and record. For example, if three trees aged 34, 62, and 59 years

represent 25 percent, 60 percent, and 15 percent of the overstory, respectively, the weighted stand age should be:

$$(34 \times 0.25) + (62 \times 0.60) + (59 \times 0.15) = 55 \text{ years.}$$

In some cases, it may be possible to avoid coring trees to determine age. If a stand has not been seriously disturbed since the previous survey, simply add the number of years since the previous inventory to the previous STAND AGE. In other situations, cores collected from site trees can be used to estimate STAND AGE.

If a condition class is nonstocked, assign a STAND AGE of 000.

If all of the trees in a condition class are of a species which, by regional standards, cannot be bored for age (e.g., mountain mahogany, tupelo) record 998. This code should be used in these cases only.

When collected: All accessible forestland condition classes (CONDITION CLASS STATUS = 1)

Field width: 3 digits

Tolerance: +/- 10%

MQO: At least 95% of the time

Values: 000 to 199, 998

#### **ITEM 218R STAND STRUCTURE**

Record the code that best describes the predominant canopy structure for the condition. When determining canopy structure, only consider the vertical position of the dominant and codominant trees in the stand. Do not consider trees that are intermediate or overtopped crown class. As a rule of thumb, a different story should comprise 25% of the stand.

When collected: If CONDITION CLASS STATUS = 1

Field width: 1 digit

Tolerance: No errors

MQO: At least 99% of the time

Values:

- 1 Single-storied - Most of the dominant/codominant tree crowns form a single canopy (i.e., most of the trees are approximately the same height).
- 2 Two-storied - The dominant/codominant tree crowns form two distinct canopy layers or stories.
- 3 Multi-storied - More than two recognizable levels characterize the crown canopy. Dominant/codominant trees of many sizes (diameters and heights) for a multilevel canopy.
- 4 Non-stocked - The condition is less than 10% stocked.

**ITEM 219 DISTURBANCE 1 (CORE 2.5.11)**

Record the code corresponding to the presence of the following disturbances. Disturbance can connote positive or negative effects. The area affected by any natural or human-caused disturbance must be at least 1.0 acre in size. Record up to three different disturbances per condition class from most important to least important as best as can be determined. This attribute is ancillary; that is, contrasting conditions are never delineated based on variation in this attribute.

For initial forest plot establishment (initial grid activation or newly forested plots), the disturbance must be within the last 5 years. For remeasured plots recognize only those disturbances that have occurred since the previous inventory.

The following disturbance codes require "significant threshold" damage, which implies mortality and/or damage to 25 percent of all trees in a stand or 50 percent of an individual species' count. Additionally, some disturbances affect forests but initially may not affect tree growth or health (e.g., grazing, browsing, flooding, etc.). In these cases, a disturbance should be coded when at least 25 percent of the soil surface or understory vegetation has been affected.

When collected: All accessible forestland condition classes (CONDITION CLASS STATUS = 1)

Field width: 2 digits

Tolerance: No errors

MQO: At least 99% of the time

Values:

<u>Code</u>	<u>Definition</u>
00	None - no observable disturbance
10	Insect damage (to both understory veg. and trees)
11	insect damage to understory vegetation
12	insect damage to trees, including seedlings and saplings
20	Disease damage (to both understory veg. and trees)
21	disease damage to understory vegetation
22	disease damage to trees, including seedlings and saplings
30	Fire (from crown and ground fire, either prescribed or natural)
31	ground fire
32	crown fire
40	Animal damage (other than listed below)
41	beaver (includes flooding caused by beaver)
42	porcupine
43	deer/ungulate
44	bear
45	rabbit
46	domestic animal/livestock (includes grazing):
50	Weather damage (other than listed below)
51	ice
52	wind (includes hurricane, tornado)
53	flooding (weather induced)
54	drought
55	earth movement/avalanches
60	Vegetation (suppression, competition, vines):
70	Unknown/not sure/other (include in PLOT - LEVEL NOTES)
80	Human-caused damage – any significant threshold of human-caused damage not described in the DISTURBANCE codes listed or in the TREATMENT codes listed. Must include a plot-level note to describe further.

**ITEM 220 DISTURBANCE YEAR 1(CORE 2.5.12)**

Record the year in which DISTURBANCE 1 occurred. If the disturbance occurs continuously over a period of time, record 9999.

When collected: All unique accessible forestland condition classes (CONDITION CLASS STATUS = 1, and SIMILAR CONDITION CLASS NUMBER = 0) When DISTURBANCE 1 > 00

Field width: 4 digits

Tolerance: +/- 1 year for measurement cycles of 5 years  
+/- 2 years for measurement cycles of > 5 years

MQO: At least 99% of the time

Values: **Since the previous plot visit, or the past 5 years for plots visited for the first time.**

**ITEM 221 DISTURBANCE 2 (CORE 2.5.13)**

If a stand has experienced more than one disturbance, record the second disturbance here. See DISTURBANCE 1 for coding instructions.

**ITEM 222 DISTURBANCE YEAR 2 (CORE 2.5.14)**

Record the year in which DISTURBANCE 2 occurred. See DISTURBANCE YEAR 1 for coding instructions.

**ITEM 223 DISTURBANCE 3 (CORE 2.5.15)**

If a stand has experienced more than two disturbances, record the third disturbance here. See DISTURBANCE 1 for coding instructions.

**ITEM 224 DISTURBANCE YEAR 3 (CORE 2.5.16)**

Record the year in which DISTURBANCE 3 occurred. See DISTURBANCE YEAR 1 for coding instructions.

**ITEM 225 TREATMENT 1(CORE 2.5.17)**

Forestry treatments are a form of disturbance. These human disturbances are recorded separately here for ease of coding and analysis. The term treatment further implies that a silvicultural application has been prescribed. This does not include occasional stumps of unknown origin or sparse removals for firewood, Christmas trees, or other miscellaneous purposes. The area affected by any treatment must be at least 1.0 acre in size. Record up to three different treatments per condition class from most important to least important as best as can be determined. This attribute is ancillary; that is, contrasting conditions are never delineated based on variation in this attribute.

For initial forest plot establishment (initial grid activation or newly forested plots), the treatment must be within the last 5 years. For remeasured plots recognize only those treatments that have occurred since the previous inventory.

When collected: All accessible forestland condition classes (CONDITION CLASS STATUS = 1)

Field width: 2 digits

Tolerance: No errors

MQO: At least 99% of the time

## Values:

<u>Code</u>	<u>Definition</u>
00	None - No observable treatment that meets the 25% threshold.
11	Clearcut harvest – The removal of the majority of the merchantable trees in a stand; residual stand stocking is under 50 percent.
12	Partial harvest – Removal primarily consisting of highest quality trees. Residual consists of lower quality trees because of high grading or selection harvest. (Ex. uneven aged, group selection, high grading, species selection)
13	Seed-tree/shelterwood harvest – Crop trees are harvested leaving seed source trees either in a shelterwood or seed tree. Also includes the final harvest of the seed trees.
14	Commercial thinning – The removal of trees (usually poletimber sized) from poletimber-sized stands leaving sufficient stocking of growing stock trees to feature in future stand development. Also included are thinning in sawtimber-sized stands where poletimber-sized (or log-sized) trees have been removed to improve quality of those trees featured in a final harvest.
15	Timber Stand Improvement (cut trees only) – The cleaning, release, or other stand improvement <b>involving non-commercial cutting</b> applied to an immature stand that leaves sufficient stocking. Use code 50 for herbicide, girdling, and other TSI treatments that <b>do not involve cutting</b> . Use code 14 for commercial thinnings.
20	Site preparation - Clearing, slash burning, chopping, disking, bedding, or other practices clearly intended to prepare a site for either natural or artificial regeneration.
30	Artificial regeneration - Following a disturbance or treatment (usually cutting), a new stand where at least 50% of the live trees present resulted from planting or direct seeding.
40	Natural regeneration - Following a disturbance or treatment (usually cutting), a new stand where at least 50% of the live trees present (of any size) were established through the growth of existing trees and/or natural seeding or sprouting.
50	Other silvicultural treatment - The use of fertilizers, herbicides, girdling, pruning, or other activities (not covered by codes 11-40) designed to improve the commercial value of the residual stand, or chaining, which is a practice used on western woodlands to encourage wildlife forage.

**ITEM 226 TREATMENT YEAR 1 (CORE 2.5.18)**

Record the year in which TREATMENT 1 occurred.

When collected: All accessible forestland condition classes (CONDITION CLASS STATUS = 1) when TREATMENT 1 > 00

Field width: 4 digits

Tolerance: +/- 1 year for measurement cycles of 5 years  
 +/- 2 years for measurement cycles of > 5 years

MQO: At least 99% of the time

Values: **Since the previous plot visit, or the past 5 years for plots visited for the first time.**

**ITEM 227 TREATMENT 2 (CORE 2.5.19)**

If a stand has experienced more than one treatment, record the second treatment here. See TREATMENT 1 for coding instructions; code 00 if none.

**ITEM 228 TREATMENT YEAR 2 (CORE 2.5.20)**

Record the year in which TREATMENT 2 occurred. See TREATMENT YEAR 1 for coding instructions.

**ITEM 229 TREATMENT 3 (CORE 2.5.21)**

If a stand has experienced more than two treatments, record the third treatment here. See TREATMENT 1 for coding instructions; code 00 if none.

**ITEM 230 TREATMENT YEAR 3 (CORE 2.5.22)**

Record the year in which TREATMENT 3 occurred. See TREATMENT YEAR 1 for coding instructions.

**ITEM 231 PHYSIOGRAPHIC CLASS (CORE 2.5.23)**

Record the code that best describes the PHYSIOGRAPHIC CLASS of the condition within the plot area; land form, topographic position, and soil generally determine physiographic class.

When collected: All accessible forestland condition classes (CONDITION CLASS STATUS = 1)

Field width: 2 digits

Tolerance: No errors

MQO: At least 80% of the time

Values:

**Xeric** Sites that are normally low or deficient in moisture available to support vigorous tree growth. These areas may receive adequate precipitation, but experience a rapid loss of available moisture due to runoff, percolation, evaporation, etc

11 Dry Tops - Ridge tops with thin rock outcrops and considerable exposure to sun and wind.

12 Dry Slopes - Slopes with thin rock outcrops and considerable exposure to sun and wind. Includes most steep slopes with a southern or western exposure.

- 13 Deep Sands - Sites with a deep, sandy surface subject to rapid loss of moisture following precipitation. Typical examples include sand hills, sites along the beach and shores of lakes and streams, and many deserts.
- 19 Other Xeric - All dry physiographic sites not already described.

**Mesic** Sites that have moderate but adequate moisture available to support vigorous tree growth except for periods of extended drought. These sites may be subjected to occasional flooding during periods of heavy or extended precipitation.

- 21 Flatwoods - Flat or fairly level sites outside flood plains. Excludes deep sands and wet, swampy sites.
- 22 Rolling Uplands - Hills and gently rolling, undulating terrain and associated small streams. Excludes deep sands, all hydric sites, and streams with associated flood plains.
- 23 Moist Slopes and Coves - Moist slopes and coves with relatively deep, fertile soils. Often these sites have a northern or eastern exposure and are partially shielded from wind and sun. Includes moist mountain tops and saddles.
- 24 Narrow Flood plains/Bottomlands - Flood plains and bottomlands less than 1/4-mile in width along rivers and streams. These sites are normally well drained but are subjected to occasional flooding during periods of heavy or extended precipitation. Includes associated levees, benches, and terraces within a 1/4 mile limit. Excludes swamps, sloughs, and bogs.
- 25 Broad Flood plains/Bottomlands - Flood plains and bottomlands 1/4 mile or wider in width along rivers and streams. These sites are normally well drained but are subjected to occasional flooding during periods of heavy or extended precipitation. Includes associated levees, benches, and terraces. Excludes swamps, sloughs, and bogs with year-round water problems.
- 29 Other Mesic - All moderately moist physiographic sites not already described.

**Hydric** Sites that generally have a year-round abundance or over-abundance of moisture. Hydric sites are very wet sites where excess water seriously limits both growth and species occurrence.

- 31 Swamps / Bogs - Low, wet, flat forested areas usually quite extensive that are flooded for long periods of time except during periods of extreme drought. Excludes cypress ponds and small drains.
- 32 Small Drains - Narrow, stream-like, wet strands of forest land often without a well-defined stream channel. These areas are poorly drained or flooded throughout most of the year and drain the adjacent higher ground.

- 33 Bays and wet pocosins - Low, wet, boggy sites characterized by peaty or organic soils. May be somewhat dry during periods of extended drought. Examples include sites in the Lake States with lowland swamp conifers or the Carolina bays in the southeast US.
- 34 Beaver ponds
- 35 Cypress ponds
- 39 Other hydric - All other hydric physiographic sites.

#### ITEM 232R OPERABILITY

This variable focuses on the viability of operating logging equipment in the vicinity of the condition. Record the most limiting class code that occurs on each forest condition.

When collected: If CONDITION CLASS STATUS = 1

Field width: 1 digit

Tolerance: No errors

MQO: At least 99% of the time

Values:

- |   |   |
|---|---|
| 0 | No problems.  |
| 1 | Seasonal access due to water conditions in wet weather.   |
| 2 | Mixed wet and dry areas typical of multi-channeled streams punctuated with dry islands.                   |
| 3 | Broken terrain, cliffs, gullies, outcroppings, etc., which would severely limit equipment, access or use. |
| 4 | Year-round water problems (includes islands).   |
| 5 | Slopes of 20 percent or more.   |

#### ITEM 233R WATER SOURCE

Record the code that best describes the water source that has the greatest impact on the condition. The water source must be within 1000 ft of the lowest numbered subplot center containing that condition in order to be coded.

When collected: If CONDITION CLASS STATUS = 1

Field width: 1 digit

Tolerance: No errors

MQO: At least 90% of the time

Values:

- |   |  |
|---|--|
| 0 | None - no water source within 1,000 feet   |
| 1 | Intermittent water – seasonal and well-defined stream channel or body of water that is dry for long periods, but generally flows or contains water throughout the wet season |
| 2 | Permanent streams or canals less than 30 feet in width   |
| 3 | Permanent streams or canals 30 – 199 feet in width   |
| 4 | Permanent streams or canals 200 feet or larger in width  |
| 5 | Permanent water in the form of deep swamps, bogs, or marshes less than 4.5 acres in size   |

- |   |  |
|---|--|
| 6 | Permanent water in the form of deep swamps, bogs, or marshes 4.5 acres or larger in size |
| 7 | Permanent lakes or ponds less than 4.5 acres in size                                     |
| 8 | Permanent lakes or ponds 4.5 acres or larger in size                                     |
| 9 | Other permanent water (includes ocean)   |

**ITEM 234R DISTANCE TO WATER SOURCE**

Record the distance to the water source from the lowest numbered subplot center containing that condition. Distances greater than 100 feet can be measured on the photo.

When collected: If CONDITION CLASS STATUS = 1

Field width: 3 digits

Tolerance: <100' +/-10', >100' +/- 100'

MQO: At least 90% of the time

Values:

000 – 100	Distance to nearest foot (taped on site)
150	101 – 200 feet
250	201 – 300 feet
*	*
*	*
950	901 – 1,000 feet
999	None within 1,000 feet

**ITEM 235R SITE CLASS**

Record the site class of the condition. If a site tree is collected for the condition, then the site class will be calculated by the data recorder. If no site tree is collected, then the field crew will estimate the site class.

When collected: If CONDITION CLASS STATUS = 1

Field width: 1 digit

Tolerance: +/- 1 class

MQO: At least 99% of the time

Values: 1-7

**ITEM 236R FIRE**

Record the presence or absence of fire on the condition since the last survey. Evidence of fire must occur within the subplot.

When collected: If CONDITION CLASS STATUS = 1

Field width: 1 digit

Tolerance: No errors

MQO: At least 99% of the time

Values:

- |   |   |
|---|---|
| 0 | No evidence of fire since last survey               |
| 1 | Evidence of burning (either prescribed or wildfire) |

**ITEM 237R GRAZING**

Record the presence or absence of domestic animal grazing on the condition since the last survey. Evidence of grazing must occur within the subplot.

When collected: If CONDITION CLASS STATUS = 1

Field width: 1 digit

Tolerance: No errors

MQO: At least 99% of the time

Values:

- 0 No evidence of livestock use (by domestic animals)
- 1 Evidence of grazing (including dung, tracks, trails, etc.)

### 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.

#### ITEM 301 SUBPLOT NUMBER (CORE 3.1)

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 Center subplot
- 2 North subplot
- 3 Southeast subplot
- 4 Southwest subplot

#### ITEM 302 SUBPLOT STATUS (CORE 3.2)

Indicate whether or not this subplot currently has at least one accessible forested condition class.

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 (remeasured trees on SK 2 & 8 are relocated)
- 2 Sampled – no accessible forest land condition present on subplot
- 3 Nonsampled
- 9 Replacement – SAMPLE KIND 2 & 8 only, previous subplot could not be relocated. Does not include subplots that fall in clearcuts or have no remeasurement trees. Must have at least one accessible forest land condition present on subplot at both present and previous inventory

**ITEM 303 SUBPLOT NONSAMPLED REASON (CORE 3.3)**

For entire subplots that cannot be sampled, record one of the following reasons.

When collected: When SUBPLOT STATUS = 3

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. Texas border counties only.
- 02 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. In some regions denied access plots may be replaced; check with the field supervisor regarding regional protocols for plot replacement.
- 03 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. In some regions hazardous plots may be replaced; check with the field supervisor regarding regional protocols for plot replacement.

**ITEM 304 SUBPLOT CENTER CONDITION (CORE 3.4)**

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

**ITEM 305 MICROPLOT CENTER CONDITION (CORE 3.5)**

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

**ITEM 306 SUBPLOT CONDITION LIST (CORE 3.9)**

This is a listing of all condition classes located within the 24.0-foot radius around the subplot center. A maximum of four conditions is permitted at any individual subplot. If a condition class has already been defined at a previously completed subplot, 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 condition classes occur on this subplot, complete the remainder of this field with zeros. For example, if condition 1 is the only condition class on a subplot, record 1000.

When collected: All forested subplots (SUBPLOT STATUS = 1 or 9)

Field width: 4 digits

Tolerance: No errors

MQO: At least 99% of the time

Values: 1000 to 9876

**ITEM 307 SUBPLOT SLOPE (CORE 3.6)**

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 each subplot. 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 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.

When collected: All subplots with at least one accessible forest land condition present on subplot (SUBPLOT STATUS = 1 or 9)

Field width: 3 digits

Tolerance: +/- 10%

MQO: At least 90% of the time

Values: 000 to 155

**ITEM 308 SUBPLOT ASPECT (CORE 3.7)**

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 falls 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.

When collected: All subplots with at least one accessible forest land condition present on subplot (SUBPLOT STATUS = 1 or 9)

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

**ITEM 309 SNOW/ WATER DEPTH (CORE 3.8)**

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.

When collected: All subplots with at least one accessible forest land condition present on subplot (SUBPLOT STATUS = 1 or 9)

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

**ITEM 310R, 312R, 314R, 316R NONNATIVE INVASIVE PLANTS**

Identify and code the occurrence of up to four nonnative invasive plants listed below that are found on any accessible forest portion of the subplot. Do not record on nonforest conditions.

If more than four plants are found on a subplot, code in order of most cover to least. Stop at four species per subplot. If five species are found on subplot 1, record only four species, even if subplot 2 has none.

The species below are known to cause ecological problems. All are displacing native forest communities. The impact of invasive species is locally well known, but their abundance, regional impact, range and rate of spread in the environment are not well known. Nomenclature follows USDA NRCS PLANTS National Database (<http://plants.usda.gov/>). The most common synonyms are in parentheses.

The first digit of the code identifies the lifeform of the species in question:

0=tree	4=grass
2=shrub	5=fern
3=vine	6=forbs, herbs, and other nonwoody species.

When collected: All subplots with at least one accessible forest land condition present on subplot (SUBPLOT STATUS = 1 or 9)

Field width: 4 digits

Tolerance: no errors

MQO: At least 90% of the time

Values: see below; use 0000 for none

**Southern Region Nonnative Invasive Plants** Choose up to four species from this list before recording species off of any applicable state species list. Species with an asterisk (\*) have been recommended as prohibited from introduction on National Forest land.

CODE	COMMON NAME	SCIENTIFIC NAME
<b>TREES</b>		
0341	Tree-of-heaven	<u><i>Ailanthus altissima</i></u> *
0345	Silktree, Mimosa	<u><i>Albizia julibrissin</i></u> *
0712	Princesstree, Royal Paulownia	<u><i>Paulownia tomentosa</i></u> *
0993	Chinaberry	<u><i>Melia azedarach</i></u>
0994	Tallowtree, Popcorn tree	<u><i>Triadica sebifera</i></u> <u><i>(Sapium sebiferum)</i></u> *
0997	Russian Olive	<u><i>Elaeagnus angustifolia</i></u>
<b>SHRUBS</b>		
2037	Silverthorn, Thorny Olive	<u><i>Elaeagnus pungens</i></u>
2038	Autumn olive	<u><i>Elaeagnus umbellata</i></u>
2042	Winged Burning Bush	<u><i>Euonymus alata</i></u>
2103	Chinese/European privet	<u><i>Ligustrum sinense</i></u> */ <u><i>L. vulgare</i></u>
2104	Japanese/glossy privet	<u><i>Ligustrum japonicum</i></u> */ <u><i>L. lucidum</i></u>
2105	Bush honeysuckles	<u><i>Lonicera</i></u> spp.*
2113	Sacred bamboo, Nandina	<u><i>Nandina domestica</i></u>
2160	Nonnative roses	<u><i>Rosa</i></u> spp.
<b>VINES</b>		
3026	Oriental or Asian bittersweet	<u><i>Celastrus orbiculatus</i></u>
3030	Nonnative climbing yams – air yam/chinese yam	<u><i>Dioscorea bulbifera</i></u> */ <u><i>D. oppositifolia</i></u>
3042	Wintercreeper	<u><i>Euonymus fortunei</i></u>
3071	English Ivy	<u><i>Hedera helix</i></u>
3101	Japanese honeysuckle	<u><i>Lonicera japonica</i></u> *
3123	Kudzu	<u><i>Pueraria montana</i></u> var. <u><i>lobata</i></u> <u><i>(Pueraria lobata)</i></u> *
3211	Nonnative Vincas, Periwinkles	<u><i>Vinca minor</i></u> / <u><i>V. major</i></u>
3251	Chinese/Japanese wisteria	<u><i>Wisteria sinensis</i></u> */ <u><i>W. floribunda</i></u>
<b>GRASSES</b>		
4008	Giant reed	<u><i>Arundo donax</i></u>
4051	Tall fescue	<u><i>Lolium arundinaceum</i></u> *
4055	Cogongrass	<u><i>Imperata cylindrica</i></u> *
4080	Nepalese browntop	<u><i>Microstegium vimineum</i></u> *
4085	Chinese silvergrass	<u><i>Miscanthus sinensis</i></u> *
4130	Nonnative bamboos	<u><i>Phyllostachys</i></u> spp. <u><i>Bambusa</i></u> spp.
<b>FERNS</b>		
5171	Japanese climbing fern	<u><i>Lygodium japonicum</i></u> *
<b>FORBS/HERBS/OTHER HERBACEOUS</b>		
6002	Garlic mustard	<u><i>Alliaria petiolata</i></u> *
6052	Shrubby lespedeza	<u><i>Lespedeza bicolor</i></u>
6053	Chinese lespedeza	<u><i>Lespedeza cuneata</i></u> *
6095	Tropical soda apple	<u><i>Solanum viarum</i></u> *

### Florida Nonnative Invasive Plants

The following nonnative invasive plants are only tallied in Florida. Use this list only after first exhausting the regional list to record four plants per subplot. For example: If there are no nonnative species from the regional list above on the subplot, then up to four species from the Florida list can be recorded.

CODE	COMMON NAME	SCIENTIFIC NAME
<b>TREES</b>		
FL02	Australian pine	<u>Casuarina equisetifolia</u>
FL03	Camphor tree	<u>Cinnamomum camphora</u>
FL04	Carrotwood	<u>Cupaniopsis anacardioides</u>
FL06	Melaleuca	<u>Melaleuca quinquenervia</u>
FL08	Schefflera	<u>Schefflera actinophylla</u>
FL09	Java plum	<u>Syzygium cumini</u>
<b>SUBSHRUBS</b>		
FL11	Coral ardisia	<u>Ardisia crenata</u>
FL15	Lantana	<u>Lantana camara</u>
<b>SHRUBS</b>		
FL22	Surinam cherry	<u>Eugenia uniflora</u>
FL26	Common guava	<u>Psidium guajava</u>
FL27	Downy rose myrtle	<u>Rhodomyrtus tomentosa</u>
FL28	Brazilian pepper	<u>Schinus terebinthifolius</u>
FL29	Wetland nightshade	<u>Solanum tampicense</u>
<b>VINES</b>		
FL31	Rosary pea	<u>Abrus precatorius</u>
FL35	Cat's-claw vine	<u>Macfadyena unguis-cati</u>
FL37	Skunk vine	<u>Paederia foetida</u>
<b>GRASSES</b>		
FL46	Napier grass	<u>Pennisetum purpureum</u>
<b>FERNS</b>		
FL54	Old World Climbing fern	<u>Lygodium microphyllum</u>
FL56	Sword fern	<u>Nephrolepis cordifolia</u>
<b>FORBS/HERBS/OTHER HERBACEOUS</b>		
FL64	Hairy indigo	<u>Indigofera hirsuta</u>

**ITEM 311R, 313R, 315R, 317R NONNATIVE INVASIVE PERCENT COVERAGE**

Record the code that best describes the abundance of each nonnative invasive plant recorded on the subplot.

Rate winter vegetation as if it were in a "leaf-on" condition.

One percent cover of the 24-foot radius subplot is equivalent to a square 4.2 feet on each side, or a circle with a radius of 2.4 feet. Ten percent cover is equivalent to a square 13.4 feet on each side, or a circle with a radius of 7.6 feet.

Only record the coverage on the forested portion of the subplot. For example, 70% of a subplot is nonforest and 30% is forested. If the entire subplot was covered by kudzu, then the NONNATIVE INVASIVE PLANT PERCENT COVERAGE is code 3 (11-50% coverage) for 30%.

When collected: NONNATIVE INVASIVE PLANTS > 0000

Field width: 1 digit

Tolerance: no errors

MQO: At least 90% of the time

Values:

- |   |             |
|---|-------------|
| 1 | Trace < 01% |
| 2 | 01-10%      |
| 3 | 11-50%      |
| 4 | 51-90%      |
| 5 | 91-100%     |

## 4.0 BOUNDARY REFERENCES

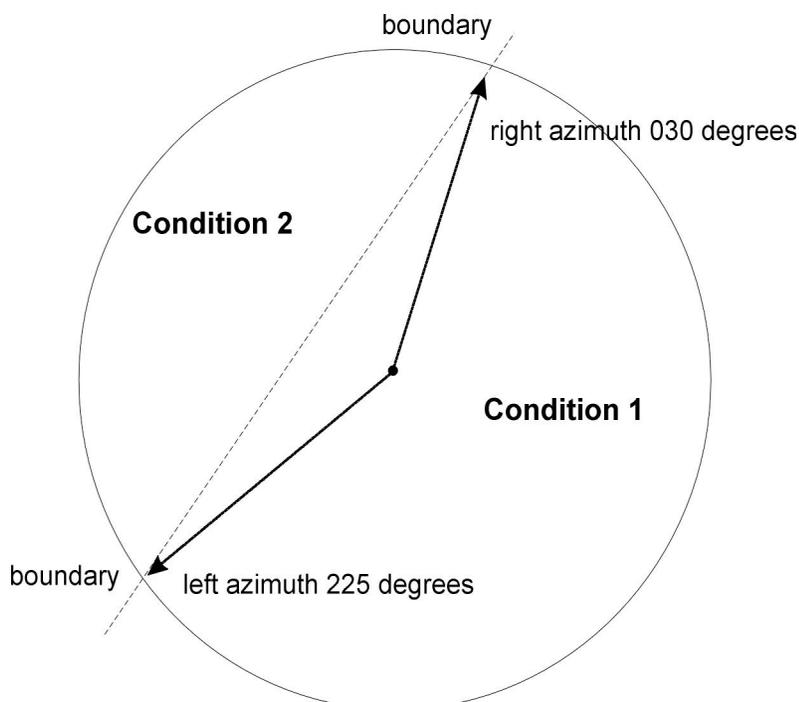
Boundary reference data are used to compute the area for the condition classes sampled on a plot and to remeasure plots. Record all boundaries between condition classes that occur within the sampled (fixed-radius) area on subplots and the offset microplots. Boundaries outside sampled (fixed-radius) areas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

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.

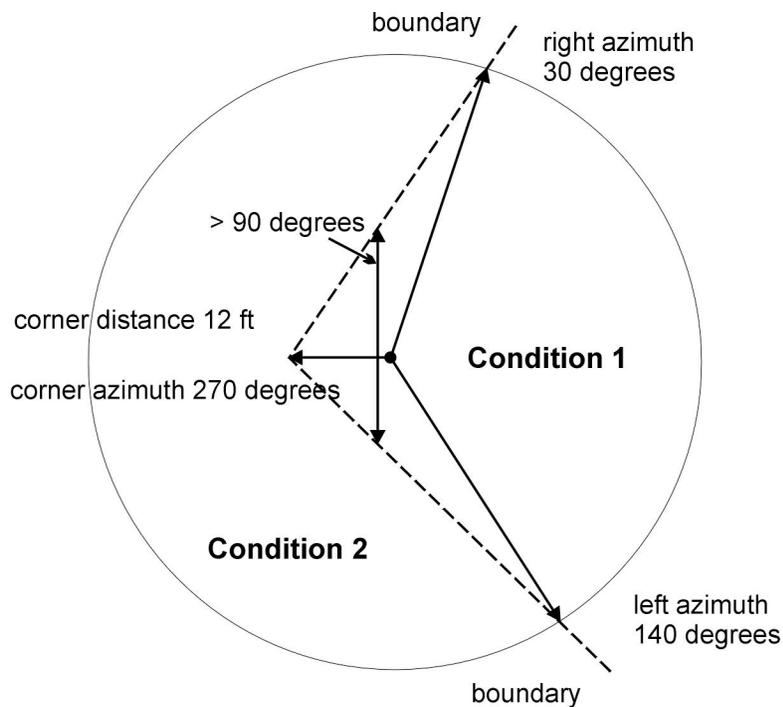
### 4.1 REFERENCE PROCEDURE

Reference, within the sampled area on each offset microplot, subplot, 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.

Boundary referencing is done by recording azimuths and distances from subplot center for subplot reference points and from microplot center for microplot reference points (Figures 15 and 16). 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 15. How to measure a straight boundary on a microplot, subplot, or annular plot.**



**Figure 16. How to measure a boundary with a corner on a subplot or annular plot.**

Microplot boundaries are referenced to the microplot center, 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 Sections 2.1 and 2.4 for general condition class delineation guidelines. The following additional rules apply when referencing a boundary within a subplot, microplot, or annular plot:

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, relative to subplot center, of the inclusion.
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 MQO's are specified for the azimuths and distances, in practice a crew will be considered 'correct' when the difference in areas as mapped by the original 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.
6. Define and map between nonforest land features, census and noncensus water only on **subplots** with some accessible forest land on a subplot. (SUBPLOT STATUS = 1)

## 4.2 BOUNDARY DATA

Record the appropriate values for each boundary mapped on the subplot, microplot, or annular plot as follows:

### ITEM 401 SUBPLOT NUMBER (CORE 4.2.1)

Record the code corresponding to the number of the subplot.

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

### ITEM 402 PLOT TYPE (CORE 4.2.2)

Record the code to specify whether the boundary data are for a subplot, microplot, or annular plot.

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

**ITEM 403R BOUNDARY STATUS**

On SAMPLE KIND = 2 and 8 plots only, record the appropriate code indicating if the previous boundary is to be deleted, retained, changed or is new.

When collected: All boundaries on SAMPLE KIND = 2 and 8

Field width: 1 digit

Tolerance: No errors

MQO: At least 99% of the time

Values:

- |   |   |
|---|---|
| 0 | Delete boundary (BOUNDARY CHANGE code required)   |
| 1 | Retain boundary with no changes   |
| 2 | Change boundary (BOUNDARY CHANGE code required)   |
| 3 | New boundary on remeasured subplot or on the offset microplot (BOUNDARY CHANGE code required) |

**ITEM 404 BOUNDARY CHANGE (CORE 4.2.3)**

Remeasurement (SAMPLE KIND = 2 and 8) locations only. Record the appropriate code to indicate the relationship between previously recorded and current boundary information.

When collected: All boundaries on SAMPLE KIND = 2 and 8

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. (BOUNDARY STATUS = 1)  |
| 1 | Real change - New, changed, or deleted boundary to reflect an actual on-the-ground physical change resulting in a difference from the boundaries recorded. (BOUNDARY STATUS = 0, 2, 3) |
| 2 | Cruiser error - New, changed, or deleted boundary to correct an error from previous crew. (BOUNDARY STATUS = 0, 2, 3)  |
| 3 | Procedural change - New, changed, or deleted boundary to reflect a change in variable definition. (BOUNDARY STATUS = 0, 2, 3)  |

**ITEM 405 CONTRASTING CONDITION (CORE 4.2.4)**

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 annular plot) 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

**ITEM 406 LEFT AZIMUTH (CORE 4.2.5)**

Record the azimuth from the subplot, microplot, or annular plot center to the farthest left point (facing the contrasting condition class) where the boundary intersects the subplot, microplot, or annular plot circumference.

When collected: All boundaries

Field width: 3 digits

Tolerance: +/- 10 degrees

MQO: At least 90% of the time

Values: 001 to 360

**ITEM 407 CORNER AZIMUTH (CORE 4.2.6)**

Record the azimuth from the subplot, microplot, or annular plot 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

**ITEM 408 CORNER DISTANCE (CORE 4.2.7)**

Record the horizontal distance, to the nearest 1 foot, from the subplot, microplot, or annular plot center to a boundary corner point.

When collected: All boundaries when CORNER AZIMUTH > 000

Field width: 2 digits

Tolerance: +/- 1 ft

MQO: At least 90% of the time

Values:

Microplot 01 to 07 ft (actual limiting distance is 6.8 ft)

Subplot 01 to 24 ft

**ITEM 409 RIGHT AZIMUTH (CORE 4.2.8)**

Record the azimuth from subplot, microplot, or annular plot center to the farthest right point (facing the contrasting condition) where the boundary intersects the subplot, microplot, or annular plot circumference.

When collected: All boundaries

Field width: 3 digits

Tolerance: +/- 10 degrees

MQO: At least 90% of the time

Values: 001 to 360



## 5.0 TREE AND SAPLING DATA

Trees at least 5.0 inches in diameter are sampled within the subplot. ‘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. ‘Tally saplings’ are defined as all live 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 24.0-foot subplot and referenced (new AZIMUTH and HORIZONTAL DISTANCE taken) to the subplot center.

Trees are alive if they have any living parts (leaves, buds, cambium) at or above the point of diameter measurement (DBH). Trees that have been temporarily defoliated are still alive.

Once tallied, dead trees over 5.0 inches 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 attached to the ground, be at least 5.0 inches in diameter, have a bole which has an unbroken ACTUAL LENGTH of at least 4.5 feet, and lean less than or equal to 45 degrees from vertical.
- “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 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 Phase 3 Down Woody Materials (DWM) if they otherwise meet DWM tally criteria.

Trees that have been cut above DBH qualify as tally trees, provided they meet the size requirement. Trees cut below DBH do not qualify as tally trees. High stumps on naturally swell butted trees (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, delete one tree and correct the diameter for the remaining tree. Record an explanation in TREE NOTES.

- 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 new tree. Record an explanation in TREE NOTES.

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

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.

## 5.1 OLD MICROPLOT REMEASUREMENT PROCEDURES

This describes the tree level variables that are recorded when remeasuring the old microplot on the Southern FIA unit's fixed radius subplot design (SAMPLE KIND = 8). Only account for the saplings recorded at the last inventory, missed saplings, and through growth trees. Do not tally any new ingrowth saplings.

### No status

For stems that are not presently in the sample, either due to shrinkage, are moved off the microplot, previous cruiser error, definitional or procedural change, or are now in a Nonforest/Nonsampled condition class, retain the same TREE RECORD NUMBER, then do the following:

- record OLD MICROPLOT STATUS = 0
- record the appropriate RECONCILE CODE

If a live sapling has been physically moved off the old microplot, is now on the new off-set microplot, and is still less than 5.0 inches DBH, and is:

- record OLD MICROPLOT STATUS = 0
- record PRESENT TREE STATUS = 1
- record RECONCILE = 6

If a live sapling has moved off the old microplot, has grown up to 5.0 inches or greater, and is now on the subplot:

- record OLD MICROPLOT STATUS = 0
- record PRESENT TREE STATUS = 1
- record RECONCILE = 6

If a sapling has grown up to 5.0 inches or greater, has been physically moved off the old microplot, is now on the subplot, but has since died:

- record OLD MICROPLOT STATUS = 0
- record PRESENT TREE STATUS = 2
- record RECONCILE = 6.

#### Live stems

For live saplings on the old microplot that were recorded as saplings at the previous inventory and are currently still less than 5.0 inches DBH:

- retain the same TREE RECORD NUMBER recorded at the previous inventory
- record OLD MICROPLOT STATUS = 1

For live saplings that are on both the previous old microplots and the new off-set microplots:

- retain the same TREE RECORD NUMBER recorded at the previous inventory
- record PRESENT TREE STATUS = 1, and record OLD MICROPLOT STATUS = 1
- record the required sapling tally items
- be sure to get an azimuth and distance to the new off-set microplot

For live stems on the old microplot that were recorded as saplings at the previous inventory and have grown to 5.0 inches or greater since the previous inventory:

- retain the same TREE RECORD NUMBER recorded at the previous inventory
- record PRESENT TREE STATUS = 1, and record OLD MICROPLOT STATUS = 1
- record the required tree tally items
- be sure to get an azimuth and distance to subplot center

#### Through growth trees

For live stems on the old microplot that were seedlings at the previous inventory and have grown to 5.0 inches or greater since then:

- record the next available TREE RECORD NUMBER
- record PRESENT TREE STATUS = 1
- record RECONCILE = 2 (through growth)
- record the required tree tally items described in Section 5.0
- be sure to get an azimuth and distance to subplot center

#### Missed trees

Be wary of recording saplings as missed trees. Unless it is obvious that the previous cruiser was in error, give the benefit of the doubt. However, if it is determined that the tree definitely should have been tallied as a sapling at the previous inventory but was not tallied, then do the following:

- record the next available TREE RECORD NUMBER
- record OLD MICROPLOT STATUS = 1 if alive
- also record PRESENT TREE STATUS = 1 if alive AND  $\geq 5.0$  in DBH
- record OLD MICROPLOT STATUS = 2 if dead
- also record PRESENT TREE STATUS = 2 if dead AND  $\geq 5.0$  in DBH
- record RECONCILE = 3 (missed live)

**Dead trees**

For dead stems that were recorded as live saplings at the previous inventory and are currently less than 5.0 inches DBH:

- retain the same TREE RECORD NUMBER recorded at the previous inventory
- record OLD MICROPLOT STATUS = 2

For dead stems on the old microplot that were recorded as live saplings at the previous inventory but are currently 5.0 inches or greater:

- retain the same TREE RECORD NUMBER recorded at the previous inventory
- record PRESENT TREE STATUS = 2
- record OLD MICROPLOT SAPLING STATUS = 2

**Utilized trees**

- retain the same TREE RECORD NUMBER recorded at the previous inventory
- record OLD MICROPLOT SAPLING STATUS = 3

**5.2 PRISM POINT REMEASUREMENT PROCEDURES**

This describes the tree level variables that are recorded when remeasuring both the previous Southern FIA unit's 10-point variable radius plots and the previous Southeastern FIA unit's 5-point variable radius plots (SAMPLE KIND = 9).

**Remeasurement tally**

All trees 1.0 inch and larger on the previous inventory will be accounted for on prism points 1 through 3. Only those trees that were 5.0 inches or larger last inventory are remeasured on prism points 4 and 5. Additionally, trees within the 6.8-foot radius on prism points 1 through 3 that were less than 1.0 inch at the last inventory and have now grown to 5.0 inches or larger are recorded as through growth trees. Otherwise, never remeasure trees that were less than 1.0 inch at the previous survey.

**NOTE:** The previous Southern station measured all saplings within a 7.1-foot radius plot at all points. Ignore all saplings on points 4-5. Check all previous distances on saplings that were recorded between 6.8 and 7.1 feet. Only remeasure the saplings that are within a 6.8-foot radius on prism points 1-3. If a sapling was recorded within 6.8 feet at the last survey and now is beyond 6.8 feet, then code PRISM TREE STATUS = 0. Ignore any sapling measured beyond 6.8 feet in both the previous and current inventory.

Trees that are on both the old prism plot and the new mapped plot are tallied as a single tree entry. Record all required items listed here as well as all required mapped tree level variables for trees that are common to both plots.

## TREE TALLY ITEMS

### ITEM 501R ENTRY NUMBER

The entry number is pre-printed on tally sheets and is automatically created in Data Recorder.

When collected: All tally trees and entries to label no tally on subplot

Field width: 3 digits

Tolerance: no errors

MQO: At least 99% of the time

Values: 001 to 999

### ITEM 502 SUBPLOT NUMBER (CORE 5.1)

Record the subplot number where the tree occurs.

Also record for subplots that have no tally on the subplot or on the microplot either due to a nonforest land use or a forested land use with low stocking. This is done to indicate to the edit check program that the subplot was accounted for and that the data was not lost during the transmission.

When Collected: All tally trees on the four subplots, all saplings on the off-set microplots and all saplings on the old SK 8 microplots; entry to record no tally on subplot

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

### ITEM 503 TREE RECORD NUMBER (CORE 5.2)

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. New and missed trees 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.

When Collected: All tally trees on the four subplots, all saplings on the off-set microplots and all saplings on the old SK 8 microplots; entry to record no tally on subplot

Field width: 3 digits

Tolerance: No errors

MQO: At least 99% of the time

Values: 000 or 001 to 999

**ITEM 504R PRISM POINT#/TREE #**

Record the 1 digit point number and the unique 2-digit tree number that was recorded in the previous survey. Never change the old point number or old tree number. Record the point number and two zeros for the tree number when there are no remeasurement trees on a prism point. Use the next available tree number when assigning new numbers to missed and volume ingrowth trees. Also, record the point#/tree#, azimuth and distance of missed and volume ingrowth trees in the Tree Notes item for check cruise purposes.

When collected: Sample Kind 9, all prism tally; entry to record no tally on prism point

Field width: 3 digits

Values: 100-599

**ITEM 505 CONDITION CLASS NUMBER (CORE 5.3)**

Record the CONDITION CLASS NUMBER in which each tree is located. Often, a referenced boundary is approximate, and trees selected for tally are assigned to the actual condition in which they lie regardless of the recorded approximate boundary (Figure 17).

Also record for subplots that have no tally on the subplot or on the microplot either due to a nonforest land use or a forested land use with low stocking. This is done to indicate to the edit check program that the subplot was accounted for and that the data was not lost during the transmission.

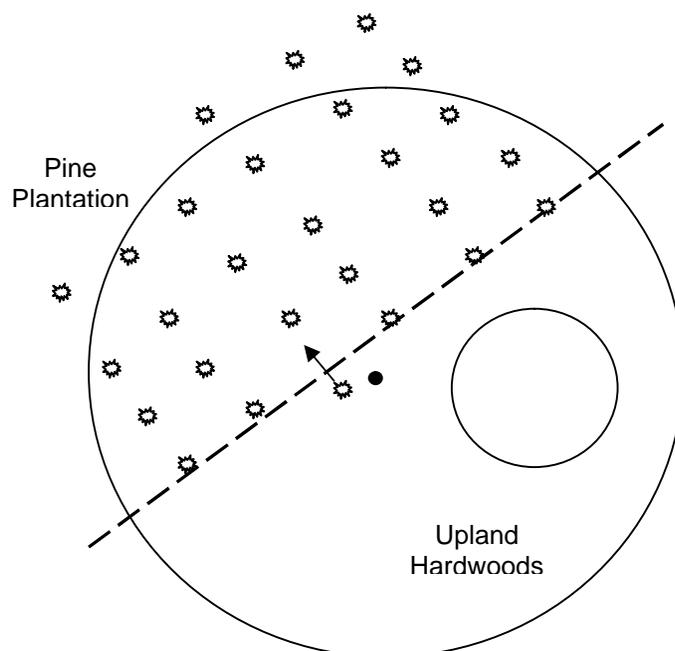
When Collected: All tally trees on the four subplots, all saplings on the off-set microplots and all saplings on the old SK 8 microplots; entry to record no tally on subplot

Field width: 1 digit

Tolerance: No errors

MQO: At least 99% of the time

Values: 1 to 9



**Figure 17. Ragged CONDITION CLASS boundary and tree condition class designation.**

**ITEM 506 AZIMUTH (CORE 5.4)**

Record the AZIMUTH from the subplot center (for trees greater than or equal to 5.0 inches DBH) or the microplot center (for trees greater than or equal to 1.0 inch and less than 5.0 inches DBH), sight the center of the base of each tree with a compass. Record AZIMUTH to the nearest degree. Use 360 for north.

NOTE: When SAMPLE KIND = 2, for microplot saplings that become subplot trees, crews must collect new azimuth and distance information from the subplot center.

When Collected: All live tally trees  $\geq 1.0$  in DBH and standing dead tally trees  $\geq 5.0$  in DBH (PRESENT TREE STATUS = 1 or 2) on the four subplots and off-set microplots

Field width: 3 digits

Tolerance: +/- 10 degrees

MQO: At least 90% of the time

Values: 001 to 360

**ITEM 507 HORIZONTAL DISTANCE (CORE 5.5)**

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) or microplot center (for trees greater than or equal to 1.0 inch and less than 5.0 inches DBH) to the pith of the tree at the base.

NOTE: When SAMPLE KIND = 2, for microplot saplings that become subplot trees, crews must collect new azimuth and distance information from the subplot center.

When Collected: All live tally trees  $\geq 1.0$  in DBH and standing dead tally trees  $\geq 5.0$  in DBH (PRESENT TREE STATUS = 1 or 2) on the four subplots and off-set microplots

Field width: 3 digits (xx.y)

Tolerance: Microplot: +/- 0.2 ft

Subplot: +/- 1.0 ft

MQO: At least 90% of the time

Values: Microplot: 00.1 to 06.8; Subplot: 00.1 to 24.0

**ITEM 508 PRESENT TREE STATUS (CORE 5.7)**

Record a current 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 utilized. This information is needed to correctly assign volume information to the proper component of volume change.

When Collected: All trees on the subplots and off-set microplots

Field width: 1 digit

Tolerance: No errors

MQO: At least 95% of the time

Values:

- 0 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, is not tallied due to natural causes (physically moved off the plot), or is no longer in accessible forest land due to landclearing or is in a nonsampled area (CONDITION STATUS = 2-5). Requires RECONCILE code = 5-9.
- 1 Live tree -- any live tree (new, remeasured or ingrowth) with in an accessible forestland condition class.
- 2 Dead tree -- any dead tree (new, remeasured, or ingrowth) within an accessible forestland condition class, regardless of cause of death. Includes all previously standing dead trees that no longer qualify as standing dead, as well as trees killed by silvicultural activity, and are assumed **not** to have been utilized.
- 3 Utilized - a tree that has been cut and removed by direct human activity related to harvesting, or silviculture within an accessible forestland condition class. (remeasurement plots only). The tree is assumed to have been utilized

**ITEM 509R OLD MICROPLOT STATUS**

Record a status code for each sapling on the old microplot.

When Collected: SAMPLE KIND 8 only: All previously tallied saplings and missed live saplings on the old microplot.

Field width: 1 digit

Values:

- 0 No status -- tree is not presently in the sample. Tree was incorrectly tallied at the previous inventory, currently is not tallied due to definition or procedural change, is not tallied due to natural causes (physically moved off the plot), or is no longer in accessible forest land due to landclearing or is in a nonsampled area (CONDITION STATUS = 2-5). Requires RECONCILE code = 5-9.
- 1 Live tree --live, remeasured or missed tree (RECONCILE =3)
- 2 Dead tree -- dead tree, regardless of cause of death. Includes trees killed by silvicultural activity, and are assumed not to have been utilized.
- 3 Utilized - a tree that has been cut and removed by direct human activity related to harvesting, or silviculture. The tree is assumed to have been utilized.

**ITEM 510R PRISM TREE STATUS**

Record a status code for each prism point tree; this code is used to track the status of sample trees over time. This information is needed to correctly assign volume information to the proper component of volume change.

Note: For any prism point tree that is now on the new mapped plot, crews must collect new azimuth and distance information.

When Collected: SAMPLE KIND 9 only: All previously tallied prism trees, through growth and missed live trees

Field width: 1 digit

Values:

- 0 No status — tree is not presently in the sample. Tree was incorrectly tallied at the previous inventory, currently is not tallied due to definition or procedural change, is not tallied due to natural causes (physically moved off the plot), or is no longer in accessible forest land due to landclearing or is in a nonsampled area (CONDITION STATUS = 2-5). Requires RECONCILE code = 5-9.
- 1 Live tree –live, remeasured or Through growth tree (RECONCILE = 2 or 3)
- 2 Dead tree -- dead tree (remeasured), regardless of cause of death. Includes all trees killed by silvicultural activity, and are assumed not to have been utilized.
- 3 Utilized - a tree that has been cut and removed by direct human activity related to harvesting, or silviculture. The tree is assumed to have been utilized.

**ITEM 511 PREVIOUS TREE STATUS (CORE 5.6)**

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 volume information to the proper component of volume change.

When collected: All previously tallied trees on remeasurement plots (SAMPLE KIND = 2, 8 and 9)

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

**ITEM 512 RECONCILE (CORE 5.7.1)**

For remeasurement locations only, record a RECONCILE code for any new tally tree that was not tallied in the previous inventory, and for all no status remeasurement trees (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: SAMPLE KIND = 2 and 8: All new live tally trees  $\geq 1.0$  in DBH (PRESENT TREE STATUS = 1 or OLD MICROPLOT STATUS = 1), all new dead tally trees  $\geq 5.0$  in (PRESENT TREE STATUS = 2 and no PREVIOUS TREE STATUS), all no status trees (PRESENT TREE STATUS = 0);

SAMPLE KIND = 9: missed prism trees  $\geq 5.0$  on prism points 1 – 5, missed prism trees  $\geq 1.0$  on prism points 1 – 3 and through growth prism trees  $\geq 5.0$  on prism points 1 – 3

Field width: 1 digit

Tolerance: No errors

MQO: At least 95% of the time

Values:

For SAMPLE KIND 2 plots, codes 1 and 3 are valid for new trees  $\geq 1.0$  in. DBH on the plot. Codes 2 and 4 are only valid for trees  $\geq 5.0$  in.

For SAMPLE KIND 8 plots, code 0 is only valid on new saplings that are only on the off-set microplot. Codes 1, 2 and 4 are valid on trees  $\geq 5.0$  in. DBH, 3 is valid for trees  $\geq 1.0$  in. DBH.

For SAMPLE KIND 9 plots, code 2 is valid on trees  $\geq 1.0$  in. DBH. Code 3 is valid on trees  $\geq 5.0$  in. DBH. Codes 0, 1 and 4 are not valid on SAMPLE KIND 9

- 0 New off-set microplot sapling only (SAMPLE KIND = 8 plot)
- 1 Ingrowth – new tally tree not qualifying as through growth (includes reversions).
- 2 Through growth – new tally tree 5.0 inches DBH and larger, within the remeasured microplot, which was not missed at the previous inventory. (i.e. went from seedling to pole between samples)
- 3 Missed live – a live tree missed at previous inventory and that is live or dead now.
- 4 Missed dead – a dead tree missed at previous inventory that is dead now.

Codes 5-9 are valid for remeasured trees that no longer qualify as tally:  
(Sample Kind = 2, 8 and 9)

- 5 Shrank – live tree that shrank below threshold diameter on microplot/subplot
- 6 Missing – tree was tallied in previous inventory, but is now missing due to natural causes such as landslide, fire, etc.

- 7 Cruiser error – erroneously tallied at previous inventory (Includes Lost Subplots, see section 0.1 Plot Setup)
- 8 Procedural change – tree was tallied at the previous inventory, but is no longer tallied due to a definition or procedural change
- 9 Nonforest/nonsampled - Landcleared trees (live, dead, or cut) or trees that are located in a nonsampled condition class.

Code 5 is used to indicate live trees that shrink below the diameter threshold on the microplot or subplot. For example, if a live remeasurement tree shrinks below the 5.0 inch DBH, then record the following combination of codes: PREVIOUS TREE STATUS = 1, PRESENT TREE STATUS = 0, 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 off-set microplot, then record PREVIOUS TREE STATUS = 1, PRESENT TREE STATUS = 1. Record azimuth and distance to microplot center. Record all required items for a tally sapling.

Code 9 is used to indicate trees that are in a landcleared condition or nonsampled condition. All landcleared and nonsampled trees would receive PRESENT TREE STATUS=0 and RECONCILE=9. CAUSE OF DEATH code = 81, 82, 83 or 99.

#### **ITEM 513 STANDING DEAD (CORE 5.7.2)**

Record the code that describes whether the tree qualifies as standing dead or not. To qualify as a standing dead tally tree, dead trees must be at least 5.0 inches 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. See Figures 18-20 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 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 Materials (DWM) if they otherwise meet DWM tally criteria.

When collected: SAMPLE KIND = 2 and 8 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
- 1 Yes – tree does qualify as standing dead

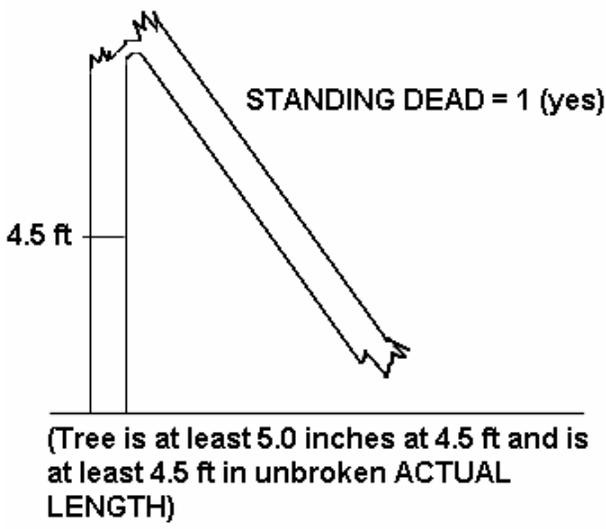
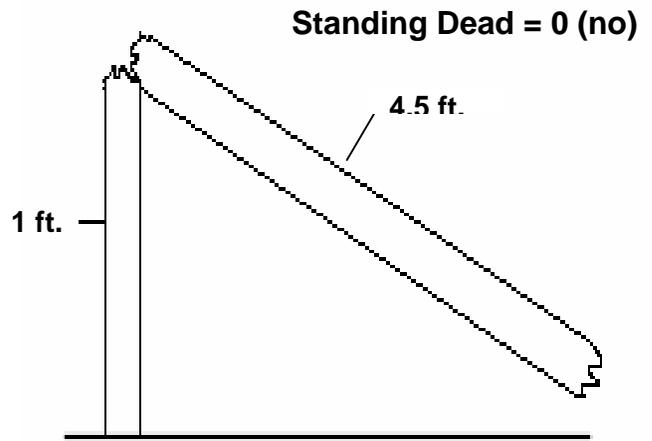


Figure 18. Example of an unbroken bole to 4.5 feet.



(Tree is at least 5.0 inches at 4.5 ft, but does not have 4.5 ft in unbroken ACTUAL LENGTH)

Figure 19. Example of an unbroken length of < 1.5 feet.

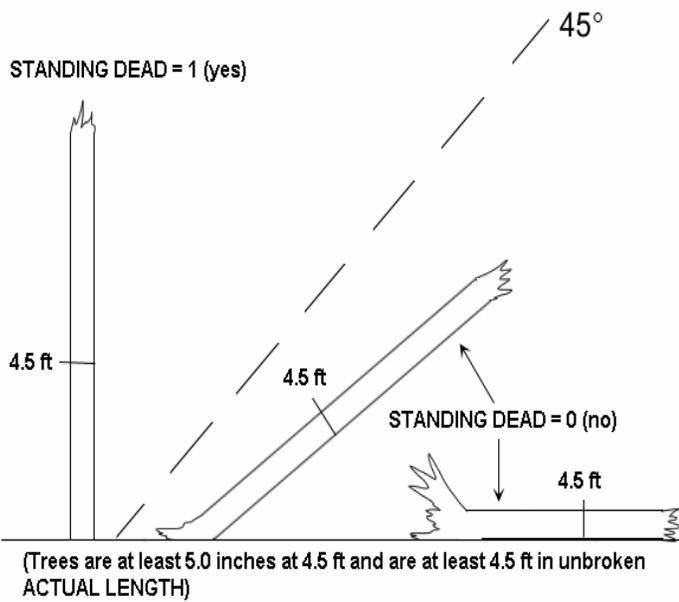
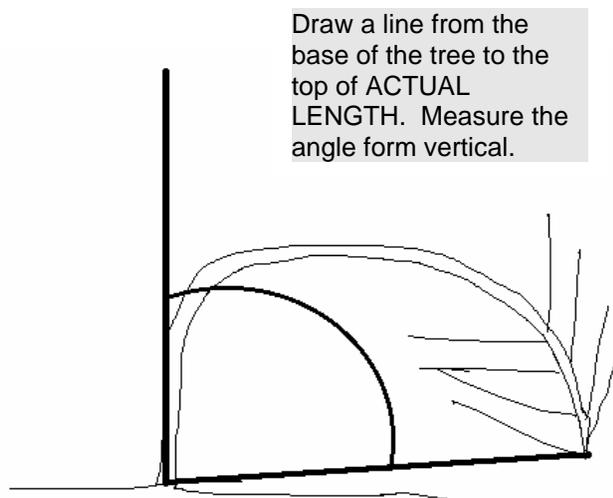


Figure 20. Other examples of dead trees.



**ITEM 514 SPECIES (CORE 5.8)**

Record the appropriate SPECIES code from the list in Appendix 3. If you encounter a species not listed in Appendix 3 and are not sure if it should be tallied as a tree, consult your Field Supervisor. If the species cannot be determined in the field, tally the tree, but bring branch samples, foliage, cones, flowers, bark, etc. to your supervisor for identification. If possible, collect samples outside the subplots from similar specimens and make a note to correct the SPECIES code later. Use code 0299 for unknown dead conifer and 0999 for unknown dead hardwood when the genus or species codes cannot be used. The generic 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.

When Collected: All tally trees

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

**ITEM 515 DIAMETER (CORE 5.9)**

Diameters are measured at breast height (DBH). 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.

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). Assign a DIAMETER CHECK code of 2 whenever the point of measurement is moved.

When Collected: SAMPLE KIND 1, 2, 3 and 8: All live tally trees  $\geq 1.0$  in DBH and standing dead tally trees  $\geq 5.0$  in DBH;  
SAMPLE KIND 9: All live prism trees  $\geq 1.0$  in DBH

Field width: 4 digits (xxx.y)

Tolerance: +/- 0.1 in per 20.0 in increment of measured diameter on all live trees and dead trees with DECAY CLASS = 1, 2  
+/- 1.0 in per 20.0 in increment of measured diameter on dead trees with DECAY CLASS = 3, 4, 5

MQO: At least 95% of the time. For example: a tree with a diameter of 41.0 in would have a tolerance of plus or minus 0.3 in. (Note: the MQO for point of measurement is +/- 0.2 in when the tree is first measured and within 1 ft of the location established by the previous crew when the tree is remeasured.)

Values: 0001 to 9999

## DIAMETER AT BREAST HEIGHT (DBH) (CORE 5.9.2)

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.

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 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.

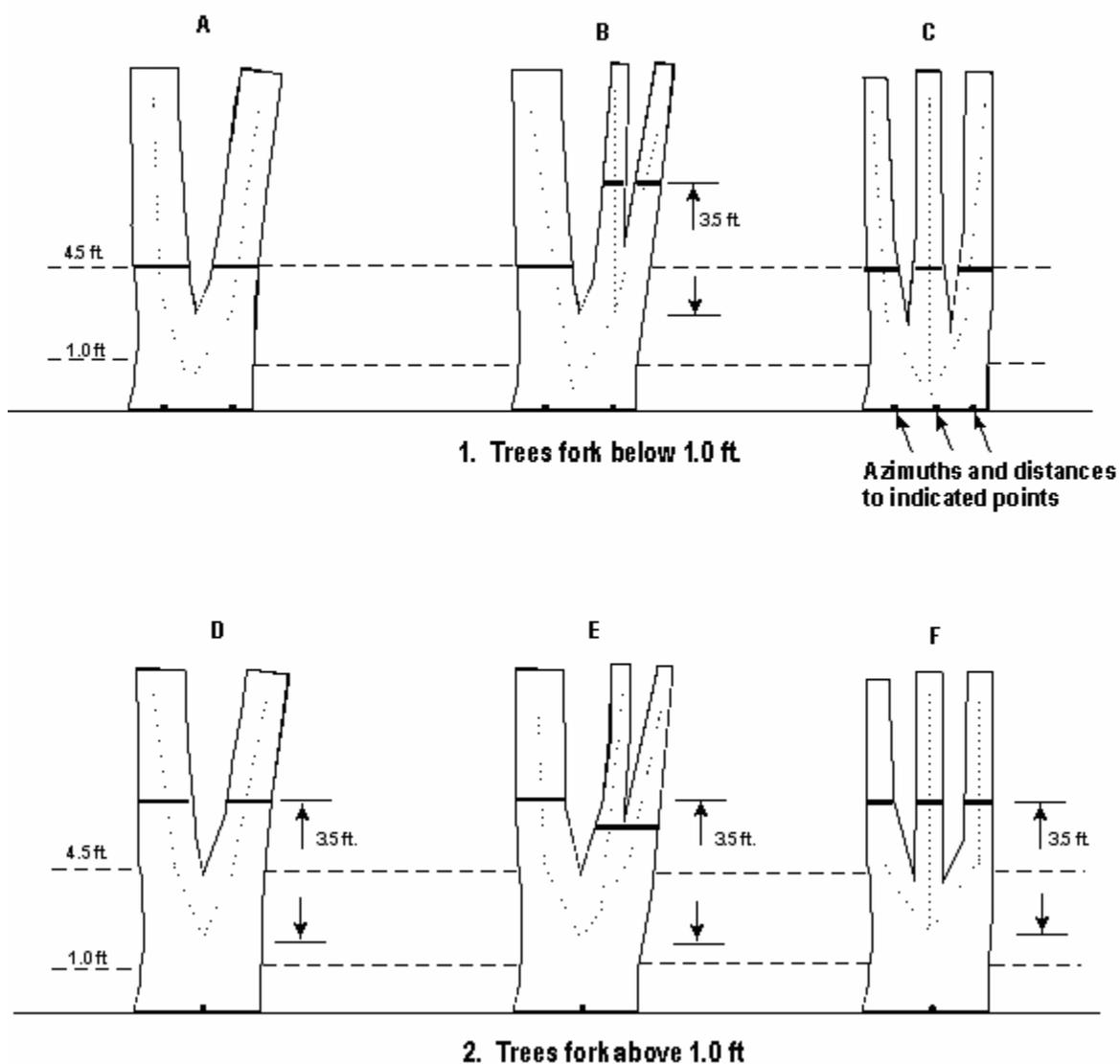


Figure 24. Summary of where to measure DBH, distance, and azimuth on forked trees, only applies to trees  $\geq 5.0$  in.

- **Trees forked below 1.0 foot.** Trees forked in this region are treated as distinctly separate trees (Figure 21). Distances and azimuths are measured individually to the center of each stem where it splits from the stump (Figure 24 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 24-E), the rules in the next paragraph apply.

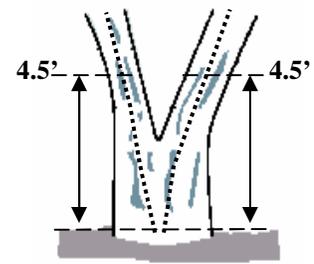


Figure 21. Forked below 1.0 ft.

- **Trees forked between 1.0 foot and 4.5 feet.** Trees forked in this region are also counted as separate trees (Figure 22), but only one distance and azimuth (to the central stump) is used for all (Figure 24 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.

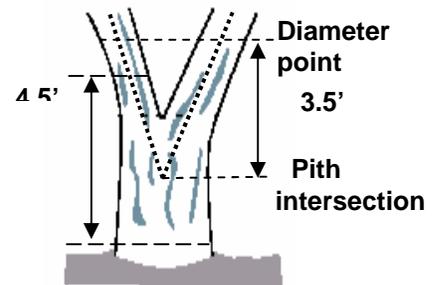


Figure 22. Forked between 1.0-4.5 ft.

- **Trees forked at or above 4.5 feet.** Trees forked in this region count as one single tree (Figure 23). If a fork occurs at or immediately above 4.5 feet, measure diameter below the fork just beneath any swelling that would inflate DBH.

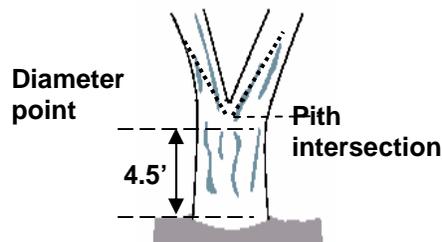


Figure 23. One tree.

- **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 24-F).

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.

- On trees that are  $\geq 5.0$  in. measure the diameter of such stems just below the base of stem separation as shown in Figure 24-E (i.e., do not move the point of diameter the entire 3.5 feet above the first fork).
- On saplings, measure diameter at 3.5' above the first pith intersection and use the largest two stems for diameters.

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 below 1.0 foot are measured at 4.5 feet from ground line. 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.
  
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 25). Use a prism with a known BAF to determine diameter on trees where diameter is too high to reach. See coding summary for complete directions.

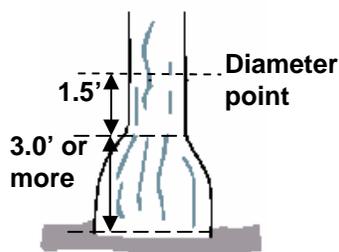


Figure 25. Bottleneck tree.

2. **Tree with irregularities at DBH:** On trees with swellings (Figure 26), bumps, depressions, and branches (Figure 27) at DBH, diameter will be measured immediately above the irregularity at the place it ceases to affect normal stem form.

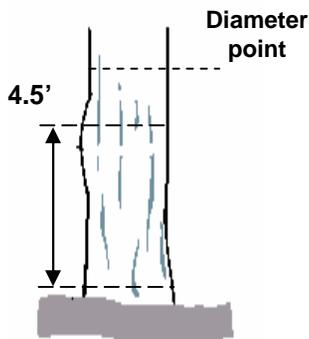


Figure 26. Tree with swelling.

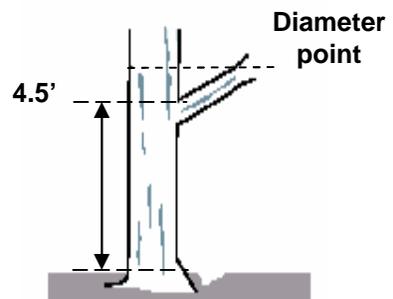


Figure 27. Tree with branch.

5. **Tree on slope:** Measure diameter at 4.5 feet from the ground along the bole on the uphill side of the tree (Figure 28).

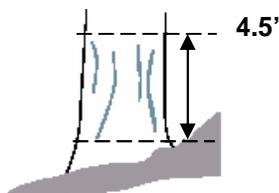


Figure 28. Tree on a slope.

3. 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 29).

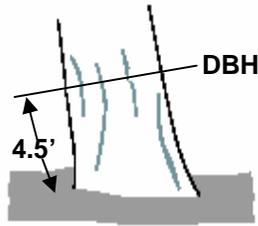


Figure 29. Leaning tree.

4. 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.
5. 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.
6. Missing wood or bark. Do not reconstruct the DBH of a tree that is missing wood or bark or 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 30). If a tree has a localized abnormality (gouge, depression, etc.) at the point of point of DBH, apply the procedure described for trees with irregularities at DBH (Figure 26 and 27).

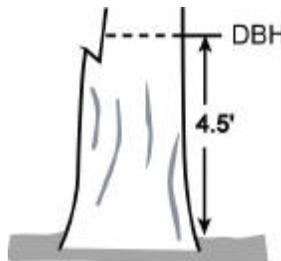


Figure 30. Tree with part of stem missing.

10. Live wind thrown tree: Measure from the top of the root collar along the length to 4.5 feet (Figure 31).

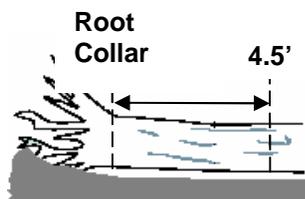
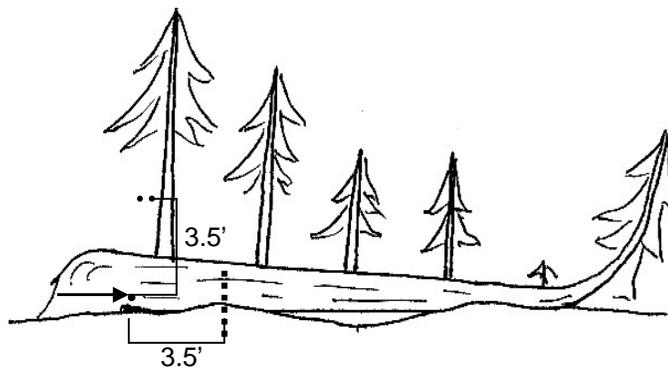


Figure 31. Tree on the ground.

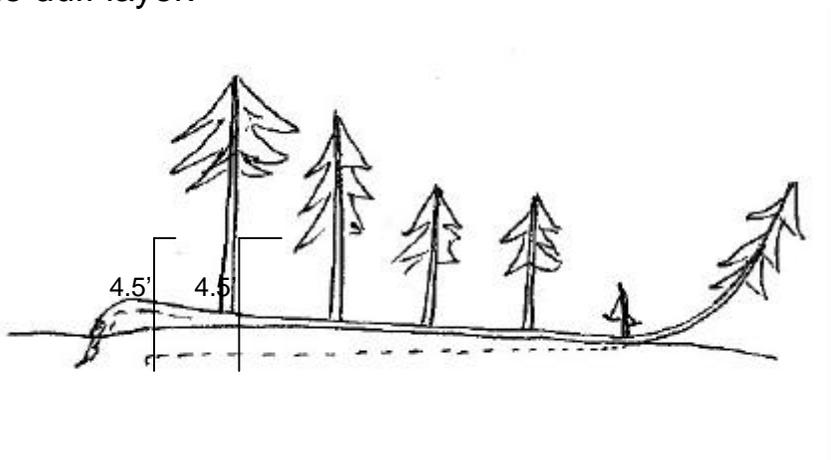
11. Down live tree with tree-form branches growing vertical from main bole. When a down live tree, touching the ground, has vertical (less than 45 degrees from vertical) tree-like branches coming off the main bole, first determine whether or not the pith of the main bole (averaged along the first log of the tree) is above or below the duff layer.

- If the pith 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 32).
- 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.



**Figure 32. Down tree above duff.**

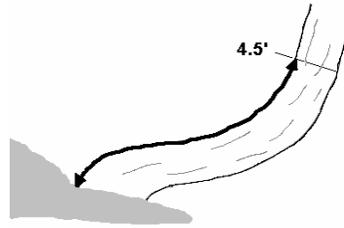
- If the intersection between the main down bole and the tree-like branch occurs beyond the 4.5 feet point from the stump along the main bole, treat that branch as part of the main down bole.
- If the pith of main tree bole is below the duff layer, ignore the main bole, and treat each tree-like branch as a separate tree; take DBH and length measurements from the ground, not necessarily from the top of the down bole (Figure 33). 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.



**Figure 33. Down tree below duff.**

12. Tree with curved bole (pistol butt tree): Measure along the bole on the uphill side (upper surface) of the tree (Figure 34).

Figure 34. Tree with curved bole (pistol butt tree).



**ITEM 516 PREVIOUS DIAMETER (CORE 5.9.1)**

This is the DBH assigned at the previous survey. It has been downloaded from the previous inventory.

When Collected: All remeasurement tally trees

Field width: 4 digits

Tolerance: No errors

MQO: At least 99% of the time

Values: 0001 to 9999

**ITEM 517 DIAMETER CHECK (CORE 5.10)**

Record this code to identify any irregularities in diameter measurement positions (e.g., abnormal swellings, diseases, damage, new measurement positions, etc.) that may affect use of this tree in diameter growth/change analyses.

When Collected: When PRESENT DIAMETER is > 0

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.

**ITEM 518 LENGTH TO DIAMETER MEASUREMENT POINT (CORE 5.22)**

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.

When Collected: When PRESENT DIAMETER is > 0

Field width: 3 digits

Tolerance: +/- 0.2 ft

MQO: At least 90% of the time

Values: 00.1 – 15.0

**ITEM 519R TREE CLASS**

Record the code that indicates the tree class. All palm species are coded TREE CLASS = 3.

When collected: All SAMPLE KINDS: All live tally trees  $\geq 1.0$  in DBH; SAMPLE KIND = 2 and 8: All TREE STATUS = 2 and RECONCILE = 1-3.

Field width: 1 digit

MQO: at least 90% of the time

Tolerance: no errors

Values: 2 – 4

- 2 Growing stock — Trees with one-third or more of the gross board foot volume in the entire sawlog section with commercial logs meeting grade, soundness, and size requirements or the potential to do so for poletimber-sized trees. A tree class 2 tree must have one 12-foot log or two 8-foot logs, now or prospectively, for live poletimber-sized trees to qualify as growing stock.
- 3 Rough cull — Trees that do not contain at least one 12-foot sawlog or two 8-foot logs now or prospectively, primarily because of roughness or poor form. Less than 1/3 of its gross board-foot volume meets size, soundness, and grade requirements and less than 1/2 of the cubic-foot cull is rotten or unsound.
- 4 Rotten cull — Trees that do not contain at least one 12-foot sawlog or two 8-foot logs now or prospectively and/or do not meet grade specifications for percent sound primarily because of rot. All species not having 1/3 or more of its gross board-foot volume meeting size, soundness, and grade requirements, and over 1/2 of the cubic-foot cull is rotten or unsound.

**ITEM 520 CROWN CLASS (CORE 5.15)**

Rate tree crowns in relation to the sunlight received and proximity to neighboring trees (Figure 36). Base the assessment on the position of the crown at the time of observation. Example: a formerly overtopped tree which is now dominant due to tree removal is classified as dominant.

When Collected: All live tally trees  $\geq 1.0$  in DBH on the four subplots and the off-set microplots (PRESENT TREE STATUS = 1)

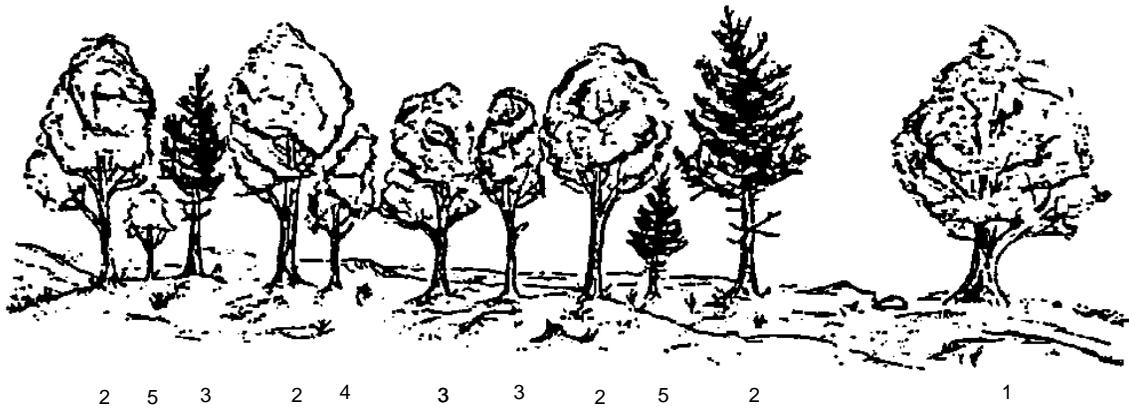
Field width: 1 digit

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 36. Examples of CROWN CLASS code definitions (numbers are the CROWN CLASS codes).**

**ITEM 521 UNCOMPACTED LIVE CROWN RATIO (Phase 3 – CORE 5.16)**

Record the UNCOMPACTED CROWN RATIO to the nearest one percent. UNCOMPACTED LIVE CROWN RATIO is the percentage of total tree height 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 top of live crown (Figure 37). 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.

**Southern Research Station collects UNCOMPACTED LIVE CROWN RATIO, on Phase 3 plots only.**

When collected: Phase 3 plots  
 Field width: 2 digits  
 Tolerance: +/- 10%  
 MQO: At least 90% of the time  
 Values: 00 to 99 percent

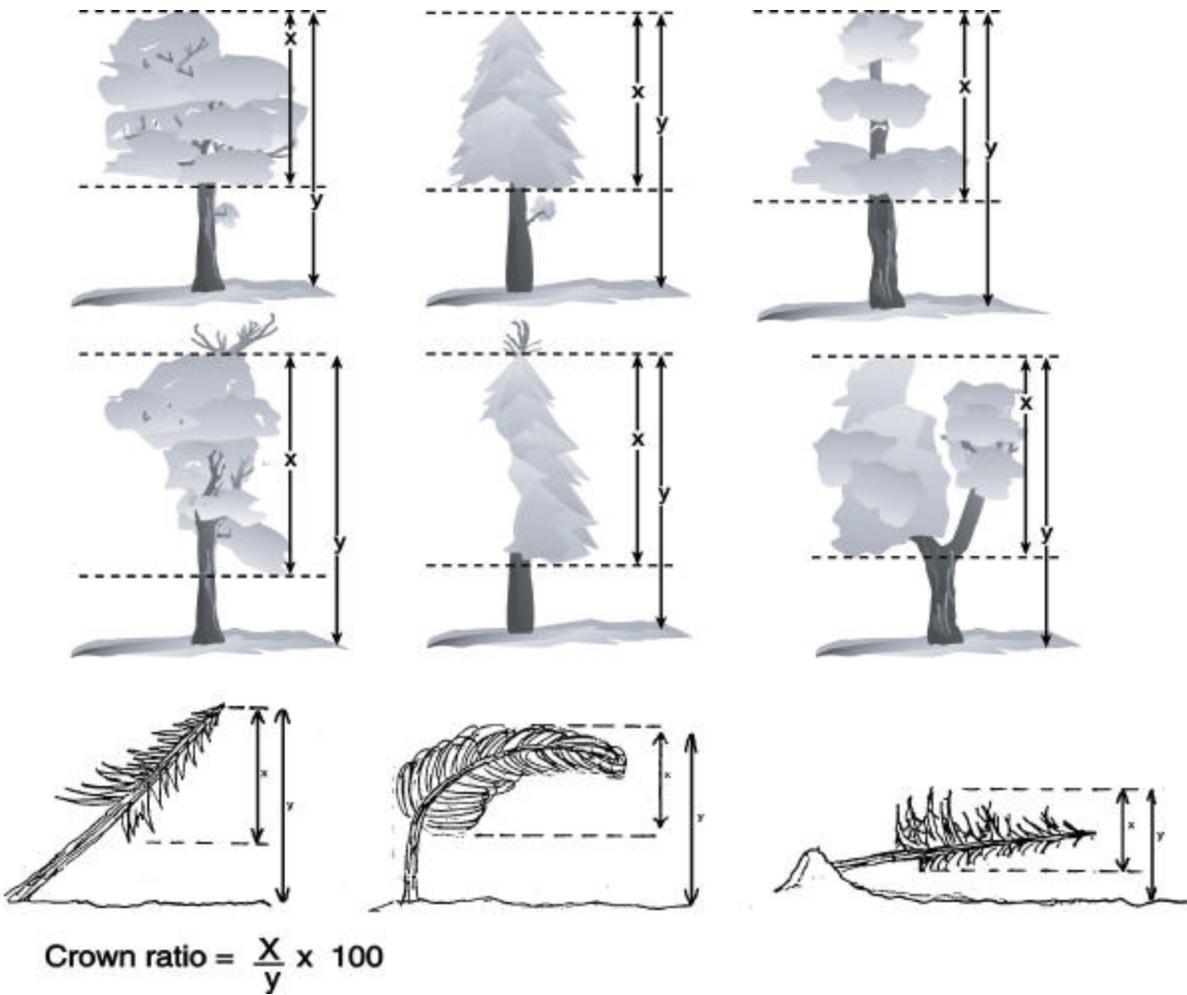


Figure 37. UNCOMPACTED LIVE CROWN RATIO examples.

Determine sapling UNCOMPACTED LIVE CROWN RATIO by dividing the live crown length by total tree height to the live crown top. 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 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 38).

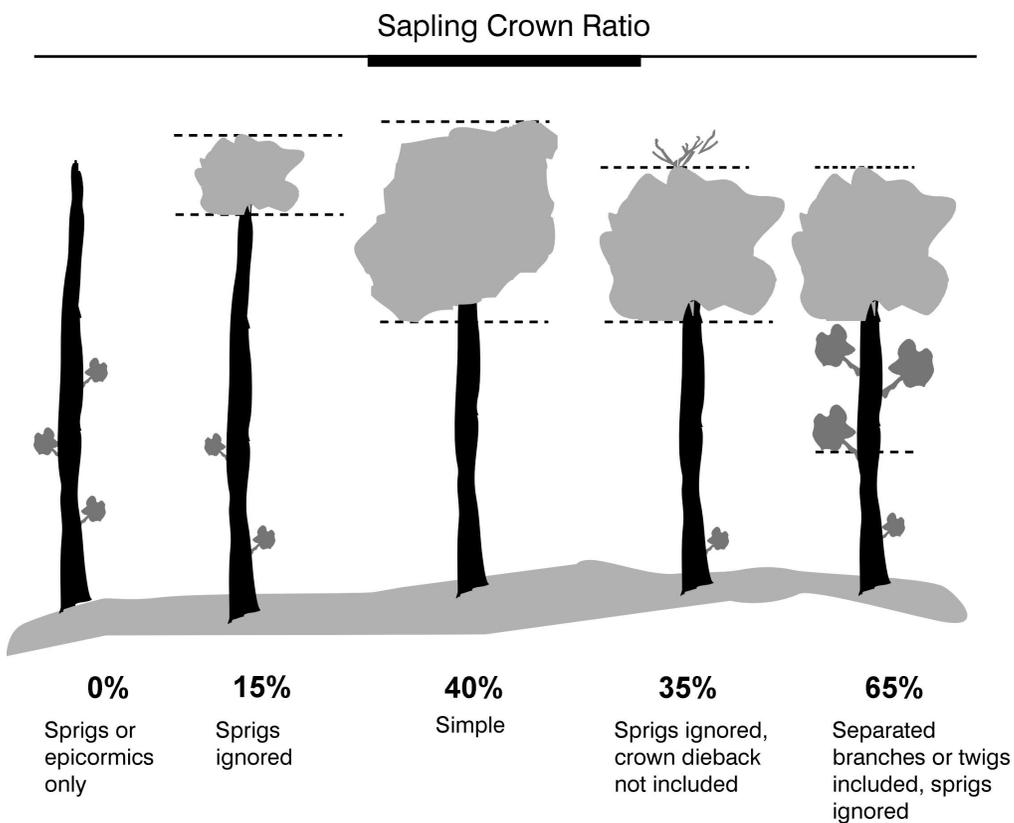


Figure 38. Sapling ratio determination examples.

**ITEM 522 COMPACTED CROWN RATIO (CORE 5.17)**

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 actual tree 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 39). Figure 40 shows an example of COMPACTED CROWN RATIO on a leaning tree.

When Collected: All live tally trees  $\geq 1.0$  in DBH on the four subplots and the off-set microplots (PRESENT TREE STATUS = 1)

Field width: 2 digits

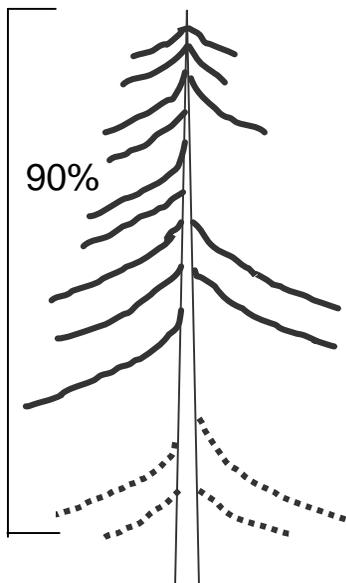
Tolerance: +/- 10 %

MQO: At least 80% of the time

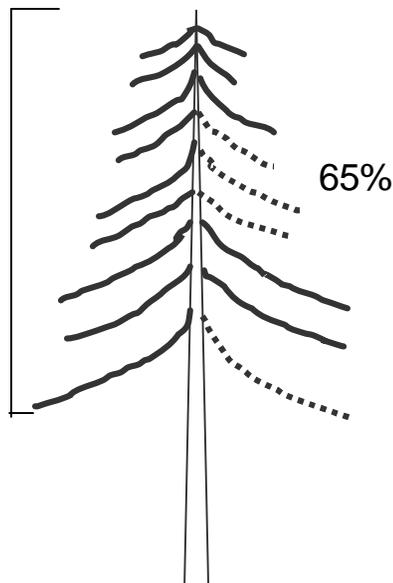
Values: 00 to 99

Open-crown conifer (e.g., ponderosa pine) –

Uncompacted:

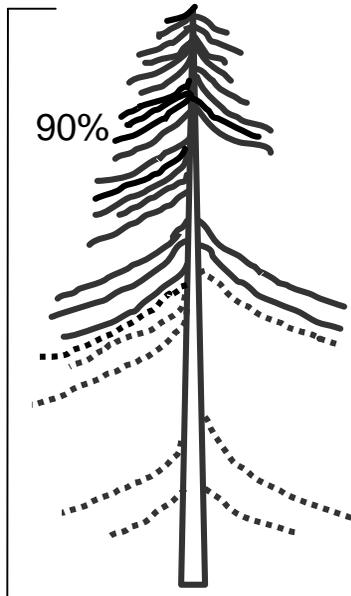


Compacted:



Dense-crown conifer (e.g., subalpine fir) –

Uncompacted:



Compacted:

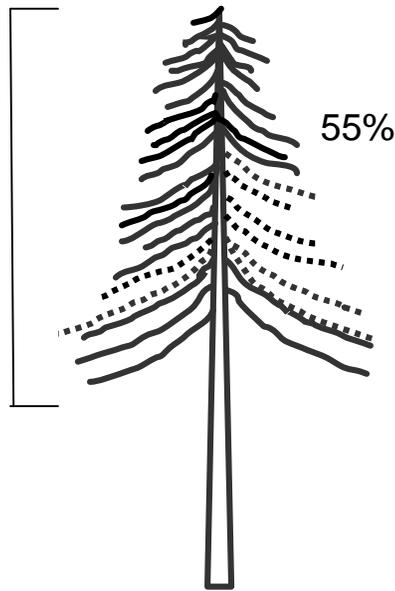


Figure 39. Examples of and comparison between COMPACTED LIVE CROWN RATIO and UNCOMPACTED LIVE CROWN RATIO of conifers.

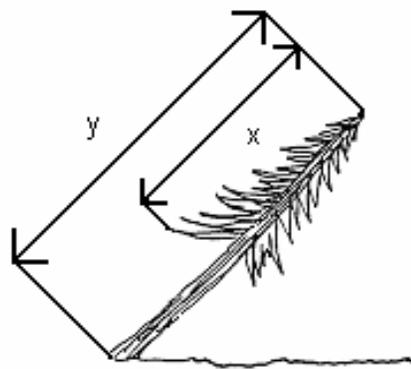


Figure 40. COMPACTED CROWN RATIO on a leaning tree. CROWN RATIO =  $(x/y)100$ .

### ITEM 523R TREE GRADE

Record the code indicating the grade of the tree. See Appendix 5 for full description of procedures.

When collected: PRESENT TREE STATUS = 1 and TREE CLASS = 2;  
DBH  $\geq$  11.0 in for hardwoods or DBH  $\geq$  9.0 in for softwoods

Field width: 1 digit

Tolerance: No errors

MQO: At least 90% of the time

Values: 1 to 5

**ITEM 524R PERCENT BOARD FOOT CULL**

Record the percentage of sound and unsound board-foot volume, to the nearest 1 percent. See Appendix 5 for complete procedures and board foot volume tables.

When collected: PRESENT TREE STATUS = 1 and TREE CLASS = 2;  
DBH  $\geq$  11.0 in for hardwoods or DBH  $\geq$  9.0 in for softwoods

Field width: 2 digits

Tolerance: +/- 10%

MQO: At least 90% of the time

Values: 00-67

**ITEM 525 ROTTEN/MISSING CULL (CORE 5.11)**

Record the percent rotten and/or missing cubic-foot cull for all live tally trees greater than or equal to 5.0 inches DBH, mortality trees with a PREVIOUS DIAMETER  $\geq$  5.0 inches, and all new dead trees when RECONCILE = 1-3.

Record the percentage of rotten and missing cubic-foot volume, to the nearest 1 percent. 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 top. Do not include any cull estimate above ACTUAL LENGTH.

For mortality trees with a PREVIOUS DIAMETER  $\geq$  5.0 inches that are NOT at least 5 feet in length or have  $\geq$  50% ROTTEN/MISSING CULL, then record ROTTEN/MISSING CULL = 99.

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.
- 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 in tree (ex. signs, deerstands, fences, etc.)

Cull portions of the tree that contain embedded metal objects (e.g., fencing, nails) and sections between metal objects that are less than 4 feet in length from the stump to the 4 inch top (aluminum is okay).

See Appendix 5 for cubic foot cull tables

When Collected: All live tally trees  $\geq$  5.0 in DBH; all mortality trees with a PREVIOUS DIAMETER  $\geq$  5.0 inches; and PRESENT TREE STATUS = 2 and RECONCILE = 1-3

Field width: 2 digits

Tolerance: +/- 10 %

MQO: At least 90% of the time

Values: 00 to 99

**ITEM 526 TOTAL LENGTH (CORE 5.12)**

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 on the uphill side of the tree. For live trees that have 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, measure the tallest stem.

When Collected: SAMPLE KIND 1, 2, 3 and 8: All live tally trees  $\geq 1.0$  in DBH and all standing dead tally trees  $\geq 5.0$  in DBH with intact top (not broken); SAMPLE KIND 9: same as other SAMPLE KINDS, except not required on dead prism trees

Field width: 3 digits

Tolerance: +/- 10 % of true length

MQO: At least 90% of the time

Values: 005 to 400

**ITEM 527 ACTUAL LENGTH (CORE 5.13)**

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). If the top is intact, 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, measure the tallest stem.

When Collected: SAMPLE KIND 1, 2, 3 and 8: All live tally trees  $\geq 1.0$  in DBH and all standing dead tally trees  $\geq 5.0$  in DBH with broken or missing tops; SAMPLE KIND 9: same as other SAMPLE KINDS, except not required on dead prism trees

Field width: 3 digits

Tolerance: +/- 10 % of true length

MQO: At least 90% of the time

Values: 005 to 400

**ITEM 528 LENGTH METHOD (CORE 5.14)**

Record the code that indicates the method used to determine tree lengths.

When Collected: When TOTAL and/or ACTUAL LENGTHS are > 0

Field width: 1 digit

Tolerance: No errors

MQO: At least 99% of the time

Values:

- 1 Total and actual lengths are field measured with a measurement instrument (e.g., clinometer, relascope, tape)
- 2 Total length is visually estimated, actual length is measured with an instrument
- 3 Total and actual lengths are visually estimated
- 4 Total is generated by office, actual is measured with an instrument (Standing dead trees with broken tops only)

**ITEM 529R FUSIFORM/COMANDRA RUST/ HARDWOOD DIEBACK INCIDENCE**

Record the incidence of fusiform, comandra rust and dieback.

When collected: All live hardwoods and SPECIES = 111, 131 on the four subplots when DBH is  $\geq 5.0$

Field width: 1 digit

Tolerance: No errors

MQO: At least 80% of the time

Values:

<u>Code</u>	<u>Agent</u>	<u>Description/Threshold</u>
0	None	
1	Fusiform, Comandra Rust	SPECIES 111, 131 ONLY: Record only those cankers that occur on the main stem or on a live branch within 12 inches of the stem. Many older galls appear as cankers with sunken rotten centers encircled by callus ridges. Witch's broom is common at galls. Masses of yellow-orange spores in the spring on the galls and canker margins.
2	Dieback	HARDWOODS ONLY: Record if 10% or more of the crown area is affected. Do not code for overtopped trees. Branches dieback from the tips. Just a few branches are affected at first with whole branches dying in the advanced stages. Frequently associated with stress caused by unfavorable environment, especially drought.

**ITEM 530R DIEBACK SEVERITY**

Record the severity of hardwood crown dieback.

When collected: HARDWOOD DIEBACK INCIDENCE = 2

Field width: 1 digit

Tolerance: +/- 1 class

MQO: At least 80% of the time

Values: 1 to 9

<u>Code</u>	<u>Class in percent</u>	<u>Code</u>	<u>Class in percent</u>	<u>Code</u>	<u>Class in percent</u>
1	10-19	4	40-49	7	70-79
2	20-29	5	50-59	8	80-89
3	30-39	6	60-69	9	90-99

**ITEM 531 CAUSE OF DEATH (CORE 5.19)**

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. If the tree is in a landcleared condition (RECONCILE = 9), then record CAUSE OF DEATH = 81 - 83.

If TREE STATUS = 3 then CAUSE OF DEATH = 80

When Collected: SAMPLE KIND 2 and 8 plots: All PAST TREE STATUS = 1 and PRESENT TREE STATUS = 2 or 3; PRESENT TREE STATUS = 2 and RECONCILE = 1, 2, or 3; all PAST TREE STATUS = 1 and OLD MICROPLOT STATUS = 2 or 3;  
SAMPLE KIND 9 plots: All PRISM TREE STATUS = 2 or 3;  
SAMPLE KIND 2, 8, and 9: When RECONCILE CODE = 9

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 activity (accidental, random, etc.). TREE NOTES required.
- 80 Silvicultural or landclearing activity (death caused by harvesting or other silvicultural activity, including girdling, chaining, etc. ).

The following codes are valid only if TREE RECONCILE = 9

- 81 Live landcleared tree
- 82 Dead landcleared tree
- 83 Utilized landcleared tree
- 99 Nonsampled condition – status not known

**ITEM 532 MORTALITY YEAR (CORE 5.20)**

Record the estimated year that remeasured trees died or were cut. For each remeasured tree that has died or been cut since the previous inventory, record the 4-digit year in which the tree died. Mortality year is also recorded for trees on land that has been converted to a nonforest land use. Record the year the tree was converted to a nonforest land use, or the year the tree was cut or died, whichever was first.

When Collected: When CAUSE OF DEATH is > 0

Field width: 4 digits

Tolerance: +/- 1 year for remeasurement cycles of 5 years

+/- 2 years for remeasurement cycles of > 5 years

MQO: At least 70% of the time

Values: 1995 or higher

**ITEM 533 DECAY CLASS (CORE 5.21)**

Record for each standing dead tally tree, 5.0 inches in diameter and larger.

When Collected: All standing dead tally trees on the four subplots  $\geq 5.0$  in DBH

Field width: 1 digit

Tolerance: +/- 1 class

MQO: At least 90% of the time

Values: Use the following table for guidelines:

\*Characteristics are for Douglas-fir. Dead trees of other species may vary somewhat. Use this only as a guide.

Decay class stage (code)	Limbs and branches	Top	% Bark Remaining	Sapwood presence and condition*	Heartwood condition*
1	All present	Pointed	100	Intact; sound, incipient decay, hard, original color	Sound, hard, original color
2	Few limbs, no fine branches	May be broken	Variable	Sloughing; advanced decay, fibrous, firm to soft, light brown	Sound at base, incipient decay in outer edge of upper bole, hard, light to reddish brown
3	Limb stubs only	Broken	Variable	Sloughing; fibrous, soft, light to reddish brown	Incipient decay at base, advanced decay throughout upper bole, fibrous, hard to firm, reddish brown
4	Few or no stubs	Broken	Variable	Sloughing; cubical, soft, reddish to dark brown	Advanced decay at base, sloughing from upper bole, fibrous to cubical, soft, dark reddish brown
5	None	Broken	Less than 20	Gone	Sloughing, cubical, soft, dark brown, OR fibrous, very soft, dark reddish brown, encased in hardened shell

**ITEM 534R UTILIZATION CLASS**

Record the code to identify the utilization class of utilized trees. The default code on data recorder = 1.

When collected: PRESENT TREE STATUS, OLD MICROPLOT STATUS or PRISM TREE STATUS = 3; or CAUSE OF DEATH = 83

Field width: 1 digits

Tolerance: No errors

MQO: At least 99% of the time

Values:

- 1 Commercial utilization – some portion of the tree removed for commercial purposes. Commercial uses include sawlogs, pulpwood, veneer logs, poles, and other products such as firewood cut by commercial firewood operations.
- 2 Non-commercial utilization – some portion of the tree removed for non-commercial purposes. Non-commercial uses include domestic firewood use, barn poles, fence posts, domestic landscaping, rough slabs, etc.

**ITEM 535 TREE NOTES (CORE 5.25)**

Record notes pertaining to an individual tree as called for to explain or describe another variable.

When collected: All trees

Field width: 256 characters

Tolerance: N/A

MQO: N/A

Values: English language words, phrases and numbers

## 6.0 SEEDLING DATA

Stocking and regeneration information are obtained by counting 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 in order to qualify for tallying, except Longleaf pine must be at least 0.5 in at the root collar. Hardwood seedlings must be at least 12.0 inches in length and less than 1.0 inch at DBH in order to qualify for tallying. Seedlings are counted in groups by species and condition class, up to five individuals per species. Counts beyond five are estimated. Only count seedlings occurring in accessible forest land condition classes.

### ITEM 601 SUBPLOT NUMBER (CORE 6.1)

Use the procedures outlined in Item 301.

When Collected: All counts of seedlings

Tolerance: No errors

MQO: At least 99% of the time

Values: 1-4

### ITEM 602 CONDITION CLASS NUMBER (CORE 6.3)

Use the procedures outlined in Section 2.0.

When Collected: All counts of seedlings

Field width: 1 digit

Tolerance: No errors

MQO: At least 99% of the time

Values: 1-9

### ITEM 603 SPECIES (CORE 6.2)

Use the procedures outlined in Item 514.

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

**ITEM 604 SEEDLING COUNT (CORE 6.4)**

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, except Longleaf pine must be at least 0.5 in at the root collar. 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.

Multiple “suckers” that originate from the same location, and stump sprouts are considered one seedling. Do not tally or count “layers” (und detached 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 or sapling.

When Collected: Each accessible forest land condition class on each microplot

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

## 7.0 SITE TREE INFORMATION

Site trees are a measure of site productivity expressed by the height to age relationship of dominant and co-dominant trees. If suitable site trees are available, site tree data are required for every accessible forest land condition class defined on a plot. An individual site tree may be used for more than one condition class where differences in condition classes are not the result of differences in site productivity. For example, when different condition classes are caused solely due to differences in reserved status, owner class, and/or disturbance-related differences in density (e.g., heavily thinned vs. unthinned), a site tree may be used for more than one condition class. When in doubt, do not use a site tree for more than one condition class.

### 7.1 SITE TREE SELECTION

Select at least one site tree for each accessible forest land condition class; select site tree based on the criteria listed in Appendix 4. Use only trees that have remained in a dominant or co-dominant crown position throughout their entire life span. If possible, trees should be 5.0 inches in diameter, or larger, and at least 20 years old. Trees that are visibly damaged, trees with ring patterns that exhibit signs of suppression, and trees with rotten cores should be rejected. If there are no acceptable site trees, record that in the plot notes and leave this section blank.

### 7.2 SITE TREE DATA VARIABLES

#### ITEM 701R SITE TREE NUMBER

Record a number to uniquely identify each site tree on a plot. The SITE TREE NUMBER is pre-printed on tally sheets and is automatically created in the data recorder.

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

#### ITEM 702 CONDITION CLASS LIST (CORE 7.2.1)

List all CONDITION CLASSES that the site index data from this tree represent.

When Collected: All site trees  
 Field width: 5 digits  
 Tolerance: No errors  
 MQO: At least 99% of the time  
 Values: 1 to 9 or 10000 to 98765

**ITEM 703 SPECIES (CORE 7.2.2)**

Use the same procedures described in Section 5.8 (Appendix 4 lists preferred site tree species by region).

When Collected: All site trees

Field width: 3digits

Tolerance: No errors

MQO: At least 99% of the time for genus

At least 95% of the time for species

Values: See Appendix 4

**ITEM 704 DIAMETER (CORE 7.2.3)**

Use the same procedures described in Section 5.9.

When Collected: All site trees

Field width: 3 digits (xx.y)

Tolerance: +/-0.1 inch per 20 inches of diameter on trees with a measured diameter

MQO: At least 95% of the time

Values: 050 to 300

**ITEM 705 SITE TREE LENGTH (CORE 7.2.4)**

With a clinometer or other approved instrument, measure the total length of the site tree from the ground to the top of the tree. Record to the nearest 1.0 foot. SITE TREE LENGTH must be measured; no estimates are permitted on site trees.

When Collected: All site trees

Field width: 3 digits

Tolerance: +/- 10% of true length

MQO: At least 90% of the time

Values: 005 to 175

**ITEM 706 TREE AGE AT DIAMETER (CORE 7.2.5)**

Record the tree age as determined by an increment sample. Bore the tree at the point of diameter measurement (DBH/DRC) with an increment borer. Count the rings between the outside edge of the core and the pith. Do not add years to get total age.

When Collected: All site trees

Field width: 3 digits

Tolerance: +/- 5 years

MQO: At least 95% of the time

Values: 015 to 120,  
013 to 120 for longleaf pine

**ITEM 707R SITE CLASS**

This item will be derived by the data recorder.

When collected: All site trees

Field width: 1 digit

Values: 1-7 (calculated by the data recorder)

Site class 1-6: ACCESSIBLE FORESTLAND

Site class 7: ACCESSIBLE OTHER FORESTLAND

**ITEM 708 SITE TREE NOTES (CORE 7.2.6)**

Record notes pertaining to an individual site tree.

When collected: All site trees as necessary

Field width: alphanumeric character field

Tolerance: N/A

MQO: N/A

Values: 256 characters

**ITEM 709 SUBPLOT NUMBER (OPTIONAL) (CORE 7.2.7)**

Record the subplot number to which the site tree is referenced.

When Collected: All site trees

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

**ITEM 710 AZIMUTH (OPTIONAL) (CORE 7.2.8)**

Record the AZIMUTH from the subplot center; sight the center of the base of each tree with a compass. Record AZIMUTH to the nearest degree. Use 360 for north.

When Collected: All site trees

Field width: 3 digits

Tolerance: +/- 10 degrees

MQO: At least 90% of the time

Values: 001 to 360

**ITEM 711 HORIZONTAL DISTANCE (OPTIONAL) (CORE 7.2.9)**

Record the measured HORIZONTAL DISTANCE, to the nearest 0.1 foot, from the subplot center to the pith of the tree at the base.

When Collected: All site trees

Field width: 4 digits (xxx.y)

Tolerance: +/- 5 ft

MQO: At least 90% of the time

Values: 0001 to 2000



## 8.0 NONFOREST/NONSAMPLED/INTENSIFICATION PLOTS

### 8.1 OVERVIEW

This section describes field procedures for attempted, field-visited nonforest/nonsampled plots. These plots are of interest from the standpoint that they may revert to forest or become accessible in the future. Thus, they are monitored to account for lands that move into and out of the forest land base. Only basic plot identification data are recorded on these plots.

A new plot is considered nonforest if no part of it is currently located in forest land. A remeasured plot is considered nonforest if no part of it is currently or previously located in forest land. A plot is nonsampled if the entire plot is not sampled for one of the reasons listed in PLOT NONSAMPLED REASON.

Intensifications are additional ground checks of the photo interpretation completed in the office. Detailed plot, condition, and tree data are not collected. These additional plots are used to strengthen the forest area adjustment. They are numbered in the 4000 series.

### 8.2 PROCEDURE

If a forest plot has been converted to nonforest the previous data are reconciled in the field using the procedures outlined in Sections 1-7. If a forest plot becomes a nonsampled plot, the previous data are reconciled in the office 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.

There is a distinction between plots that have been clearcut, and plots that have been converted to another land use (landcleared). A clearcut plot is considered to be forest land until it is actively converted to another land use. The procedures in this section do not apply to clearcuts or landclearings. Additional information concerning land use classifications is contained in Section 2.3.

In cases where a plot is inaccessible, but obviously contains no forest land, record PLOT STATUS = 2. In cases where a plot is access-denied or hazardous land use and has the possibility of forest, record PLOT STATUS = 3.

Intensification plots are photo interpreted in the office and ground checked in the field. The photo interpretation (PI) categories are forest, nonforest, census water, and noncensus water. The land use codes recorded in the field are the same as the standard production plots (see Section 2.5). Do not move the pinprick on intensification plots or change the PI category on any plot. Photo work and GPS data are not required. These are assigned Plot Status = 5.

### 8.3 DATA RECORDED

#### ITEM 801 STATE (CORE 8.3.1)

Record the unique FIPS (Federal Information Processing Standard) code identifying the State where the plot center is located. (FIPS codes are located in Appendix 1)

When Collected: All plots  
 Field width: 2 digits  
 Tolerance: No errors  
 MQO: At least 99% of the time  
 Values: See Appendix 1

#### ITEM 802R CYCLE

Record the cycle number of the current plot.

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

#### ITEM 803R PANEL

Record the panel number of the plot.

When collected: All plots  
 Field width: 1 digit  
 Tolerance: No errors  
 MQO: At least 99% of the time  
 Values: 1 to 5

#### ITEM 804 COUNTY (CORE 8.3.2)

Record the unique FIPS (Federal Information Processing Standard) code identifying the county or parish where the plot center is located. (FIPS codes are located in Appendix 1)

When Collected: All plots  
 Field width: 3 digits  
 Tolerance: No errors  
 MQO: At least 99% of the time  
 Values: See Appendix 1

#### ITEM 805 PLOT NUMBER (CORE 8.3.3)

Record the identification number for each plot, unique within a county or parish.

When Collected: SAMPLE KIND = 1, 2, 8 or 9  
 Field width: 4 digits  
 Tolerance: No errors  
 MQO: At least 99% of the time  
 Values: 0001 to 9999

**ITEM 806R PHASE**

Record the phase number of the plot

When collected: All standard field plots

Field width: 1 digit

Tolerance: No errors

MQO: At least 99% of the time

Values:

- 2 Standard field plot (measured year-round)
- 3 Standard field plot with forest health variables (measured only during specified time frame)

**ITEM 807 PLOT STATUS (CORE 8.3.4)**

Record the code that describes the sampling status of the plot.

When collected: All plots

Field width: 1 digit

Tolerance: No errors

MQO: At least 99% of the time

Values:

- 2 Sampled – no accessible forest land condition present on plot and no previously accessible forest land condition on plot
- 3 Nonsampled
- 5 Intensification

**ITEM 808 PLOT NONSAMPLED REASON (CORE 8.3.5)**

For entire plots that cannot be sampled, record one of the following reasons.

When collected: When PLOT STATUS = 3

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. Entire plots would only be assigned this code if it is determined that a previously measured plot is currently beyond the U.S. border. Texas border counties only.
- 02 Denied access area – Any 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. 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 situation – Any 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 plot remains in the sample and is re-examined at the next occasion to determine if the hazard is still present.
- 11 Out of state boundary – any plot where PC that falls outside of state boundary. State border counties only.

**ITEM 809 SAMPLE KIND (CORE 8.3.6)**

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

When collected: PLOT STATUS = 1- 3

Field width: 1 digit

Tolerance: No errors

MQO: At least 99% of the time

Values:

- 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
- 2 Remeasurement – remeasurement of a national design plot that was sampled at the previous inventory. The previous microplot was at the offset location (previous FIELD GUIDE VERSION = 1.x or 2.x).
- 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, 8 or 9 PLOT STATUS = 3, and the appropriate NONSAMPLED REASON code. The plot number for the new (replacement) plot is assigned by NIMS.
- 8 Remeasurement – remeasurement of a Southern Research Station **fixed radius subplot** design and initial establishment of the National design plot, field visited or remotely classified. (remeasurement of microplot at subplot center)
- 9 Prism plot remeasurement/Initial fixed plot establishment – remeasurement of an established Southern or Southeastern Research Station **prism plot** design and initial establishment of the National design plot, field visited or remotely classified.

**ITEM 810 FIELD GUIDE VERSION (CORE 8.3.8)**

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.

When collected: All plots

Field width: 2 digits (x.y)

Tolerance: No errors

MQO: At least 99% of the time

Values: 2.0

**ITEM 811 P3 HEXAGON NUMBER (CORE 8.3.19)**

Record the unique code assigned to each Phase 3 (former FHM) hexagon.

When collected: All Phase 3 plots

Field width: 7 digits

Tolerance: No errors

MQO: At least 99% of the time

Values: N/A

**ITEM 812 P3 PLOT NUMBER (CORE 8.3.20)**

Record the Phase 3 PLOT NUMBERS that are used to identify individual plots within the same Phase 3 (former FHM) hexagon.

When collected: All Phase 3 plots

Field width: 1 digit

Tolerance: No errors

MQO: At least 99% of the time

Values: 1 to 9

**ITEM 813R PLOT IN CORRECT COUNTY?**

Record the code that states if Plot Center (PC) falls in the correct county. This item will automatically default to '1' in the data recorder. If the county is incorrect, then enter code '0'. A screen will appear where the correct county is to be entered. This information will be automatically forwarded to FIA office staff when the plot is transmitted.

When collected: All plots

Field width: 1 digit

Tolerance: No errors

MQO: At least 99% of the time

Values:

0 County is **not** correct

1 County is correct

**CURRENT DATE (CORE 8.3.9)**

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

**ITEM 814 YEAR (CORE 8.3.9.1)**

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:  $\geq$  2003

**ITEM 815 MONTH (CORE 8.3.9.2)**

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:

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

**ITEM 816 DAY (CORE 8.3.9.3)**

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

**PAST DATE**

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

**ITEM 817R PAST YEAR**

Record the year that the plot was completed.

When collected: SK = 2, 8 or 9 and PLOT STATUS = 2 or 3

Field width: 4 digits

Tolerance: No errors

MQO: At least 99% of the time

Values:  $\leq 2003$

**ITEM 818R PAST MONTH**

Record the month that the plot was completed.

When collected: SK = 2, 8 or 9 and PLOT STATUS = 2 or 3

Field width: 2 digits

Tolerance: No errors

MQO: At least 99% of the time

Values:

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

**ITEM 819R PAST DAY**

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

When collected: SK = 2, 8 or 9 and PLOT STATUS = 2 or 3

Field width: 2 digits

Tolerance: No errors

MQO: At least 99% of the time

Values: 01 to 31

**ITEM 820 QA STATUS (CORE 8.3.11)**

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(QA reviews collected data while checking plot; may be done with or without standard field crew)
- 3 Reference plot (off grid - SRS QA certification plot answer key)
- 4 Training/practice plot (off grid- SRS Field Crew certification plot)
- 5 Botched plot file (disregard during data processing)
- 6 Blind check (QA crew remeasures the plot without reviewing the standard field crew's data; standard field crew is not present)
- 7 Hot check (production plot, QA members present during data collection with standard field crew)

**ITEM 821 CREW TYPE (CORE 8.3.12)**

Record the code to specify what type of crew is measuring the plot.

When collected: All plots

Field width: 1 digit

Tolerance: No errors

MQO: At least 99% of the time

Values:

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

**ITEM 822R CRUISER NUMBER**

Record the unique code assigned to identify individual cruisers.

When collected: All plots

Field width: 3 digits

Tolerance: No errors

MQO: At least 99% of the time

Values: 001-999

**ITEM 823R PRESENT LAND USE**

Record the classification at plot center that indicates the land use of plot center. Use codes 10, 30, 99 only for land not better described by one of the more detailed codes within each category.

When collected: All condition classes

Field width: 2 digits

Tolerance: No errors

MQO: At least 99% of the time

Values:

Forest land – see section 2.2

- 01 Forest land (CONDITION CLASS STATUS = 1). Code 01 is valid only for PLOT STATUS = 5. Note: site class not determined for intensifications.
- 10 Other agricultural land (CONDITION CLASS STATUS = 2) - 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. 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
  - 15 Christmas tree plantation
  - 16 Wildlife opening
- 20 Rangeland (CONDITION CLASS STATUS = 2) - 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 Other developed (CONDITION CLASS STATUS = 2) - 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, 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
- 40 Other nonforest land (CONDITION CLASS STATUS = 2) - Land parcels greater than 1.0 acre in size and greater than 120.0 feet wide, that do not fall into one of the uses described above. Examples include undeveloped beaches, barren land (rock, sand), noncensus water, marshes, bogs, ice, and snow.
  - 41 Marsh
  - 42 Beach

- 91 Census water (CONDITION CLASS STATUS = 4) - see section 2.2
- 92 Noncensus water (CONDITION CLASS STATUS = 3) – see section 2.2
- 99 Nonsampled (CONDITION CLASS STATUS = 5) - see section 2.2 . Item 825 is required.

#### **ITEM 824 CONDITION CLASS STATUS 1 (CORE 8.3.14)**

Record the **CONDITION CLASS STATUS** at the center of Subplot 1. Record the code that describes the status of the condition. The instructions in Section 2.2 and 2.3 apply when delineating condition classes that differ by **CONDITION CLASS STATUS**.

When collected: All plots

Field width: 1 digit

Tolerance: No errors

MQO: At least 99% of the time

Values:

- 1 Accessible forestland (only valid if PLOT STATUS = 5)
- 2 Nonforest land
- 3 Noncensus water
- 4 Census water
- 5 Nonsampled

#### **ITEM 825R NEW PAST LAND USE**

Record the code that best describes the past land use of the plot center if the current procedures had been used to install the plot 5 years ago. Record this item on all initial and replacement plots.

When collected: SAMPLE KIND 1 and 3

Field width: 2 digits

Tolerance: No errors

MQO: At least 99% of the time

Values: Use same codes for **PRESENT LAND USE** listed above (except Land Use 99 is **not** valid for SAMPLE KIND'S 1 and 3)

#### **GPS Coordinates (CORE 8.3.13)**

Use a global positioning system (GPS) unit to determine the plot coordinates and elevation of all field visited plot locations.

#### **GPS Unit Settings, Datum, and COORDINATE SYSTEM (CORE 8.3.13.1)**

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.

The Southern Research Station uses the North American Datum 1983 (**NAD 83**).

The Southern Research Station uses a Geographic coordinate system which collects coordinates in Degrees, Minutes and Seconds of Latitude and Longitude.

**Collecting Readings (CORE 8.3.13.2)**

Collect at least 180 GPS readings at the plot center. These may be collected in a file for post processing or may be averaged by the GPS unit. Each individual position should have an error of less than 70 feet if possible (the error of all the averaged readings is far less).

Soon after arriving at plot center, use the GPS unit to attempt to collect coordinates. If suitable positions (180 readings at error less than or equal to 70 feet) 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 a PLGR unit is used, use the Rng-Calc function in the PLGR to compute the coordinates of the plot center. If another type of GPS unit is used, record the azimuth and horizontal distance in **ITEM 833** and **ITEM 834**. Coordinates may be collected further than 200 feet away 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 a PLGR unit is used, use the Rng-Calc function in the PLGR to compute the coordinates of the plot center. If another type of GPS unit is used, record the azimuth and horizontal distance in **ITEMS 833** and **ITEM 834**. **In all cases try to obtain at least 180 positions before recording the coordinates.**

**Correction for "Offset" Location (CORE 8.3.13.11)**

As described in **Collecting Readings (CORE 8.3.13.2)**, coordinates may be collected at a location other than the plot center (an "offset" location). If a PLGR unit is used all offset coordinates will be "corrected" back using the Rng/Calc function. If a GPS unit other than a PLGR is used, then record **ITEM 833** and **ITEM 834**.

**ITEM 826 GPS UNIT (CORE 8.3.13.3)**

Record the kind of GPS unit used to collect coordinates. If suitable coordinates cannot be obtained, record 0.

When collected: PLOT STATUS = 1- 3

Field width: 1 digit

Tolerance: No errors

MQO: At least 99% of the time

Values:

- 0 GPS coordinates not collected
- 1 Rockwell Precision Lightweight GPS Receiver (PLGR)
- 2 Other brand capable of field-averaging
- 3 Other brands capable of producing files that can be post-processed
- 4 Other brands not capable of field-averaging or post-processing

**ITEM 827 GPS SERIAL NUMBER (CORE 8.3.13.4)**

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

**ITEM 828 LATITUDE (CORE 8.3.13.6)**

Record the latitude of the plot center to the nearest hundredth second, as determined by GPS. Record the latitude of the off-set point if the coordinates cannot be calculated.

When collected: When COORDINATE SYSTEM = 1  
 Field width: 8 digits (DDMMSSSS)  
 Tolerance: +/- 140 ft  
 MQO: At least 99% of the time  
 Values:

**ITEM 829 LONGITUDE (CORE 8.3.13.7)**

Record the longitude of the plot center to the nearest hundredth second, as determined by GPS. Record the longitude of the off-set point if the coordinates cannot be calculated.

When collected: When COORDINATE SYSTEM = 1  
 Field width: 9 digits: (DDDMMSSSS)  
 Tolerance: +/- 140 ft  
 MQO: At least 99% of the time  
 Values:

**ITEM 830 GPS ELEVATION (CORE 8.3.13.14)**

Record the elevation above mean sea level of the plot center, in feet, as determined by GPS. Record the elevation of the off-set point if the coordinates cannot be calculated. If coordinates are calculated, then record 99999 for because it cannot be calculated.

When collected: When GPS UNIT = 1, 2 or 4  
 Field width: 6 digits  
 Tolerance:  
 MQO: At least 99% of the time  
 Values: -00100 to 20000, 99999

**ITEM 831 GPS ERROR (CORE 8.3.13.15)**

Record the error as shown on the GPS unit to the nearest foot. As described in **Collecting Readings (CORE 8.3.13.2)**, make every effort to collect readings only when the error less than or equal to 70 feet. However, if after trying several different times during the day, at several different locations, this is not possible, record readings with an error of up to 999 feet.

When collected: When GPS UNIT =1 or 2  
 Field width: 3 digits  
 Tolerance: No errors  
 MQO: At least 99% of the time  
 Values: 000 to 070 if possible  
 071 to 999 if an error of less than 70 cannot be obtained

**ITEM 832 NUMBER OF READINGS (CORE 8.3.13.16)**

Record a 3-digit code indicating how many readings were averaged by the GPS unit to calculate the plot coordinates. Collect at least 180 readings if possible.

When collected: When GPS UNIT = 1 or 2

Field width: 3 digits

Tolerance: No errors

MQO: At least 99% of the time

Values: 001 to 999

**ITEM 833 AZIMUTH TO PLOT CENTER (CORE 8.3.13.12)**

Record the azimuth from the location where coordinates were collected to actual plot center. If coordinates are collected at 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

**ITEM 834 DISTANCE TO PLOT CENTER (CORE 8.3.13.13)**

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, record 000. As described in **Collecting Readings (CORE 8.3.13.2)**, 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**

**ITEM 835 PLOT-LEVEL NOTES (CORE 8.3.18)**

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

When collected: All plots

Field width: 256 characters

Tolerance: N/A

MQO: N/A

Values: English language words, phrases and numbers

**APPENDIX 1**

**State, County and Parish FIPS Codes**



**ALABAMA – 01**

Autauga	001	Jackson	071
Baldwin	003	Jefferson	073
Barbour	005	Lamar	075
Bibb	007	Lauderdale	077
Blount	009	Lawrence	079
Bullock	011	Lee	081
Butler	013	Limestone	083
Calhoun	015	Lowndes	085
Chambers	017	Macon	087
Cherokee	019	Madison	089
Chilton	021	Marengo	091
Choctaw	023	Marion	093
Clarke	025	Marshall	095
Clay	027	Mobile	097
Cleburne	029	Monroe	099
Coffee	031	Pickens	107
Colbert	033	Pike	109
Conecuh	035	Russell	113
Coosa	037	Montgomery	101
Covington	039	Morgan	103
Crenshaw	041	Perry	105
Cullman	043	Pickens	107
Dale	045	Pike	109
Dallas	047	Randolph	111
De Kalb	049	Russell	113
Elmore	051	St. Clair	115
Escambia	053	Shelby	117
Etowah	055	Sumter	119
Fayette	057	Talladega	121
Franklin	059	Tallapoosa	123
Geneva	061	Tuscaloosa	125
Greene	063	Walker	127
Hale	065	Washington	129
Henry	067	Wilcox	131
Houston	069	Winston	133



**ARKANSAS - 05**

Arkansas	001	Lee	077
Ashley	003	Lincoln	079
Baxter	005	Little River	081
Benton	007	Logan	083
Boone	009	Lonoke	085
Bradley	011	Madison	087
Calhoun	013	Marion	089
Carroll	015	Miller	091
Chicot	017	Mississippi	093
Clark	019	Monroe	095
Clay	021	Montgomery	097
Cleburne	023	Nevada	099
Cleveland	025	Newton	101
Columbia	027	Ouachita	103
Conway	029	Perry	105
Craighead	031	Phillips	107
Crawford	033	Pike	109
Crittenden	035	Poinsett	111
Cross	037	Polk	113
Dallas	039	Pope	115
Desha	041	Prairie	117
Drew	043	Pulaski	119
Faulkner	045	Randolph	121
Franklin	047	St. Francis	123
Fulton	049	Saline	125
Garland	051	Scott	127
Grant	053	Searcy	129
Greene	055	Sebastian	131
Hempstead	057	Sevier	133
Hot Spring	059	Sharp	135
Howard	061	Stone	137
Independence	063	Union	139
Izard	065	Van Buren	141
Jackson	067	Washington	143
Jefferson	069	White	145
Johnson	071	Woodruff	147
Lafayette	073	Yell	149
Lawrence	075		



**FLORIDA – 12**

Alachua	001	Lake	069
Baker	003	Lee	071
Bay	005	Leon	073
Bradford	007	Levy	075
Brevard	009	Liberty	077
Broward	011	Madison	079
Calhoun	013	Manatee	081
Charlotte	015	Marion	083
Citrus	017	Martin	085
Clay	019	Monroe	087
Collier	021	Nassau	089
Columbia	023	Okaloosa	091
Dade	025	Okeechobee	093
De Soto	027	Orange	095
Dixie	029	Osceola	097
Duval	031	Palm Beach	099
Escambia	033	Pasco	101
Flagler	035	Pinellas	103
Franklin	037	Polk	105
Gadsden	039	Putnam	107
Gilchrist	041	St. Johns	109
Glades	043	St. Lucie	111
Gulf	045	Santa Rosa	113
Hamilton	047	Sarasota	115
Hardee	049	Seminole	117
Hendry	051	Sumter	119
Hernando	053	Suwannee	121
Highlands	055	Taylor	123
Hillsborough	057	Union	125
Holmes	059	Volusia	127
Indian River	061	Wakulla	129
Jackson	063	Walton	131
Jefferson	065	Washington	133
Lafayette	067		



**GEORGIA - 13**

		Emanuel	107
		Evans	109
Appling	001		
Atkinson	003		
Bacon	005	Fannin	111
Baker	007	Fayette	113
Baldwin	009	Floyd	115
Banks	011	Forsyth	117
Barrow	013	Franklin	119
Bartow	015	Fulton	121
Ben Hill	017	Gilmer	123
Berrien	019	Glascocock	125
Bibb	021	Glynn	127
Bleckley	023	Gordon	129
Brantley	025	Grady	131
Brooks	027	Greene	133
Bryan	029	Gwinnett	135
Bulloch	031	Habersham	137
Burke	033	Hall	139
Butts	035	Hancock	141
Calhoun	037	Haralson	143
Camden	039	Harris	145
Candler	043	Hart	147
Carroll	045	Heard	149
Catoosa	047	Henry	151
Charlton	049	Houston	153
Chatham	051	Irwin	155
Chattahoochee	053	Jackson	157
Chattooga	055	Jasper	159
Cherokee	057	Jeff Davis	161
Clarke	059	Jefferson	163
Clay	061	Jenkins	165
Clayton	063	Johnson	167
Clinch	065	Jones	169
Cobb	067	Lamar	171
Coffee	069	Lanier	173
Colquitt	071	Laurens	175
Columbia	073	Lee	177
Cook	075	Liberty	179
Coweta	077	Lincoln	181
Crawford	079	Long	183
Crisp	081	Lowndes	185
Dade	083	Lumpkin	187
Dawson	085	Mc Duffie	189
Decatur	087	Mc Intosh	191
De Kalb	089	Macon	193
Dodge	091	Madison	195
Dooly	093	Marion	197
Dougherty	095	Meriwether	199
Douglas	097	Miller	201
Early	099	Mitchell	205
Echols	101	Monroe	207
Effingham	103	Montgomery	209
Elbert	105	Morgan	211

Murray	213	Telfair	271
Muscogee	215	Terrell	273
Newton	217	Thomas	275
Oconee	219	Tift	277
Oglethorpe	221	Toombs	279
Paulding	223	Towns	281
Peach	225	Treutlen	283
Pickens	227	Troup	285
Pierce	229	Turner	287
Pike	231	Twiggs	289
Polk	233	Union	291
Pulaski	235	Upson	293
Putnam	237	Walker	295
Quitman	239	Walton	297
Rabun	241	Ware	299
Randolph	243	Warren	301
Richmond	245	Washington	303
Rockdale	247	Wayne	305
Schley	249	Webster	307
Screven	251	Wheeler	309
Seminole	253	White	311
Spalding	255	Whitfield	313
Stephens	257	Wilcox	315
Stewart	259	Wilkes	317
Sumter	261	Wilkinson	319
Talbot	263	Worth	321
Taliaferro	265		
Tattnall	267		
Taylor	269		





**KENTUCKY - 21**

		Hickman	105
		Hopkins	107
Adair	001		
Allen	003		
Anderson	005	Jackson	109
Ballard	007	Jefferson	111
Barren	009	Jessamine	113
Bath	011	Johnson	115
Bell	013	Kenton	117
Boone	015	Knott	119
Bourbon	017	Knox	121
Boyd	019	Larue	123
Boyle	021	Laurel	125
Bracken	023	Lawrence	127
Breathitt	025	Lee	129
Breckinridge	027	Leslie	131
Bullitt	029	Letcher	133
Butler	031	Lewis	135
Caldwell	033	Lincoln	137
Calloway	035	Livingston	139
Campbell	037	Logan	141
Carlisle	039	Lyon	143
Carroll	041	McCracken	145
Carter	043	McCreary	147
Casey	045	McLean	149
Christian	047	Madison	151
Clark	049	Magoffin	153
Clay	051	Marion	155
Clinton	053	Marshall	157
Crittenden	055	Martin	159
Cumberland	057	Mason	161
Daviess	059	Meade	163
Edmonson	061	Menifee	165
Elliott	063	Mercer	167
Estill	065	Metcalfe	169
Fayette	067	Monroe	171
Fleming	069	Montgomery	173
Floyd	071	Morgan	175
Franklin	073	Muhlenberg	177
Fulton	075	Nelson	179
Gallatin	077	Nicholas	181
Garrard	079	Ohio	183
Grant	081	Oldham	185
Graves	083	Owen	187
Grayson	085	Owsley	189
Green	087	Pendleton	191
Greenup	089	Perry	193
Hancock	091	Pike	195
Hardin	093	Powell	197
Harlan	095	Pulaski	199
Harrison	097	Robertson	201
Hart	099	Rockcastle	203
Henderson	101	Rowan	205
Henry	103	Russell	207

Scott	209	Union	225
Shelby	211	Warren	227
Simpson	213	Washington	229
Spencer	215	Wayne	231
Taylor	217	Webster	233
Todd	219	Whitley	235
Trigg	221	Wolfe	237
Trimble	223	Woodford	239





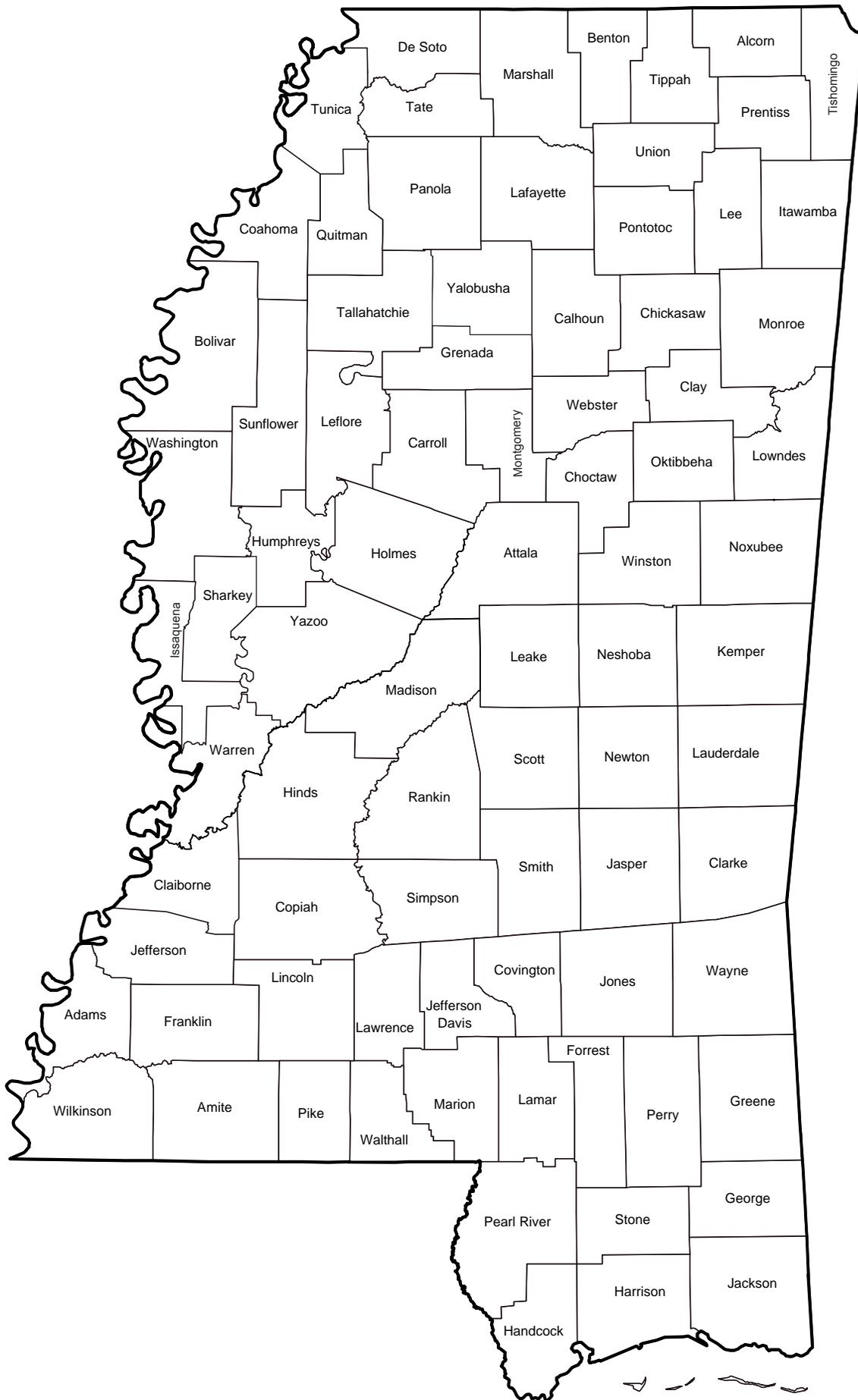
**LOUISIANA - 22**

Acadia	001	Madison	065
Allen	003	Morehouse	067
Ascension	005	Natchitoches	069
Assumption	007	Orleans	071
Avoyelles	009	Ouachita	073
Beauregard	011	Plaquemines	075
Bienville	013	Pointe Coupee	077
Bossier	015	Rapides	079
Caddo	017	Red River	081
Calcasieu	019	Richland	083
Caldwell	021	Sabine	085
Cameron	023	St. Bernard	087
Catahoula	025	St. Charles	089
Claiborne	027	St. Helena	091
Concordia	029	St. James	093
De Soto	031	St. John the Baptist	095
East Baton Rouge	033	St. Landry	097
East Carroll	035	St. Martin	099
East Feliciana	037	St. Mary	101
Evangeline	039	St. Tammany	103
Franklin	041	Tangipahoa	105
Grant	043	Tensas	107
Iberia	045	Terrebonne	109
Iberville	047	Union	111
Jackson	049	Vermilion	113
Jefferson	051	Vernon	115
Jefferson Davis	053	Washington	117
Lafayette	055	Webster	119
LaFourche	057	West Baton Rouge	121
La Salle	059	West Carroll	123
Lincoln	061	West Feliciana	125
Livingston	063	Winn	127



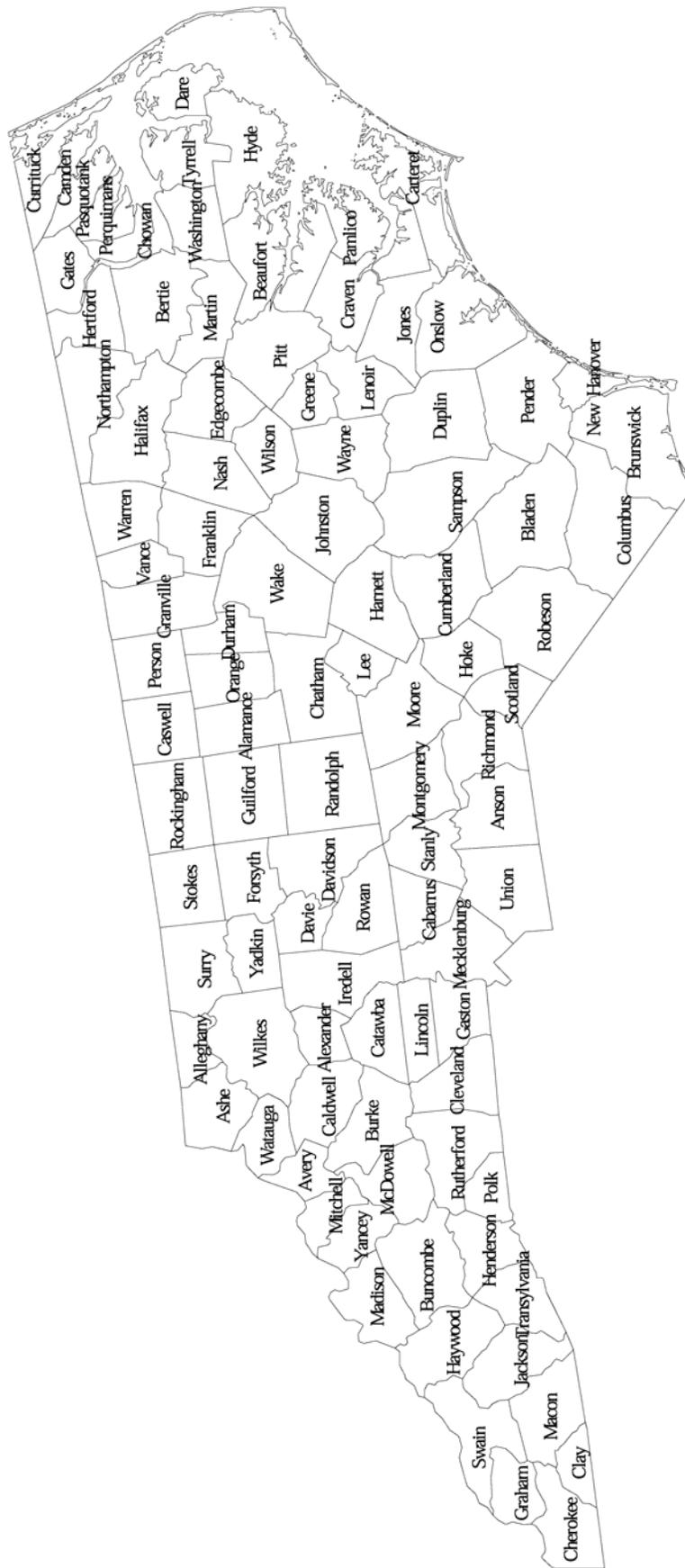
**MISSISSIPPI - 28**

Adams	001	Leflore	083
Alcorn	003	Lincoln	085
Amite	005	Lowndes	087
Attala	007	Madison	089
Benton	009	Marion	091
Bolivar	011	Marshall	093
Calhoun	013	Monroe	095
Carroll	015	Montgomery	097
Chickasaw	017	Neshoba	099
Choctaw	019	Newton	101
Claiborne	021	Noxubee	103
Clarke	023	Oktibbeha	105
Clay	025	Panola	107
Coahoma	027	Pearl River	109
Copiah	029	Perry	111
Covington	031	Pike	113
De Soto	033	Pontotoc	115
Forrest	035	Prentiss	117
Franklin	037	Quitman	119
George	039	Rankin	121
Greene	041	Scott	123
Grenada	043	Sharkey	125
Hancock	045	Simpson	127
Harrison	047	Smith	129
Hinds	049	Stone	131
Holmes	051	Sunflower	133
Humphreys	053	Tallahatchie	135
Issaquena	055	Tate	137
Itawamba	057	Tippah	139
Jackson	059	Tishomingo	141
Jasper	061	Tunica	143
Jefferson	063	Union	145
Jefferson Davis	065	Walthall	147
Jones	067	Warren	149
Kemper	069	Washington	151
Lafayette	071	Wayne	153
Lamar	073	Webster	155
Lauderdale	075	Wilkinson	157
Lawrence	077	Winston	159
Leake	079	Yalobusha	161
Lee	081	Yazoo	163



**NORTH CAROLINA - 37**

Alamance	001	Johnston	101
Alexander	003	Jones	103
Alleghany	005	Lee	105
Anson	007	Lenoir	107
Ashe	009	Lincoln	109
Avery	011	McDowell	111
Beaufort	013	Macon	113
Bertie	015	Madison	115
Bladen	017	Martin	117
Brunswick	019	Mecklenburg	119
Buncombe	021	Mitchell	121
Burke	023	Montgomery	123
Cabarrus	025	Moore	125
Caldwell	027	Nash	127
Camden	029	New Hanover	129
Carteret	031	Northhampton	131
Caswell	033	Onslow	133
Catawba	035	Orange	135
Chatham	037	Pamlico	137
Cherokee	039	Pasquotank	139
Chowan	041	Pender	141
Clay	043	Perquimans	143
Cleveland	045	Person	145
Columbus	047	Pitt	147
Craven	049	Polk	149
Cumberland	051	Randolph	151
Currituck	053	Richmond	153
Dare	055	Robeson	155
Davidson	057	Rockingham	157
Davie	059	Rowan	159
Duplin	061	Rutherford	161
Durham	063	Sampson	163
Edgecombe	065	Scotland	165
Forsyth	067	Stanly	167
Franklin	069	Stokes	169
Gaston	071	Surry	171
Gates	073	Swain	173
Graham	075	Transylvania	175
Granville	077	Tyrrell	177
Greene	079	Union	179
Guilford	081	Vance	181
Halifax	083	Wake	183
Harnett	085	Warren	185
Haywood	087	Washington	187
Henderson	089	Watauga	189
Hertford	091	Wayne	191
Hoke	093	Wilkes	193
Hyde	095	Wilson	195
Iredell	097	Yadkin	197
Jackson	099	Yancey	199



**OKLAHOMA - 40**

Atoka	005
Adair	001
Bryan	013
Cherokee	021
Choctaw	023
Coal	029
Delaware	041
Haskell	061
Latimer	077
Le Flore	079
McCurtain	089
McIntosh	091
Mayes	097
Muskogee	101
Ottawa	115
Pittsburg	121
Pushmataha	127
Sequoyah	135



**SOUTH CAROLINA – 45**

Abbeville	001	Greenwood	047
Aiken	003	Hampton	049
Allendale	005	Horry	051
Anderson	007	Jasper	053
Bamberg	009	Kershaw	055
Barnwell	011	Lancaster	057
Beaufort	013	Laurens	059
Berkeley	015	Lee	061
Calhoun	017	Lexington	063
Charleston	019	Mc Cormick	065
Cherokee	021	Marion	067
Chester	023	Marlboro	069
Chesterfield	025	Newberry	071
Clarendon	027	Oconee	073
Colleton	029	Orangeburg	075
Darlington	031	Pickens	077
Dillon	033	Richland	079
Dorchester	035	Saluda	081
Edgefield	037	Spartanburg	083
Fairfield	039	Sumter	085
Florence	041	Union	087
Georgetown	043	Williamsburg	089
Greenville	045	York	091



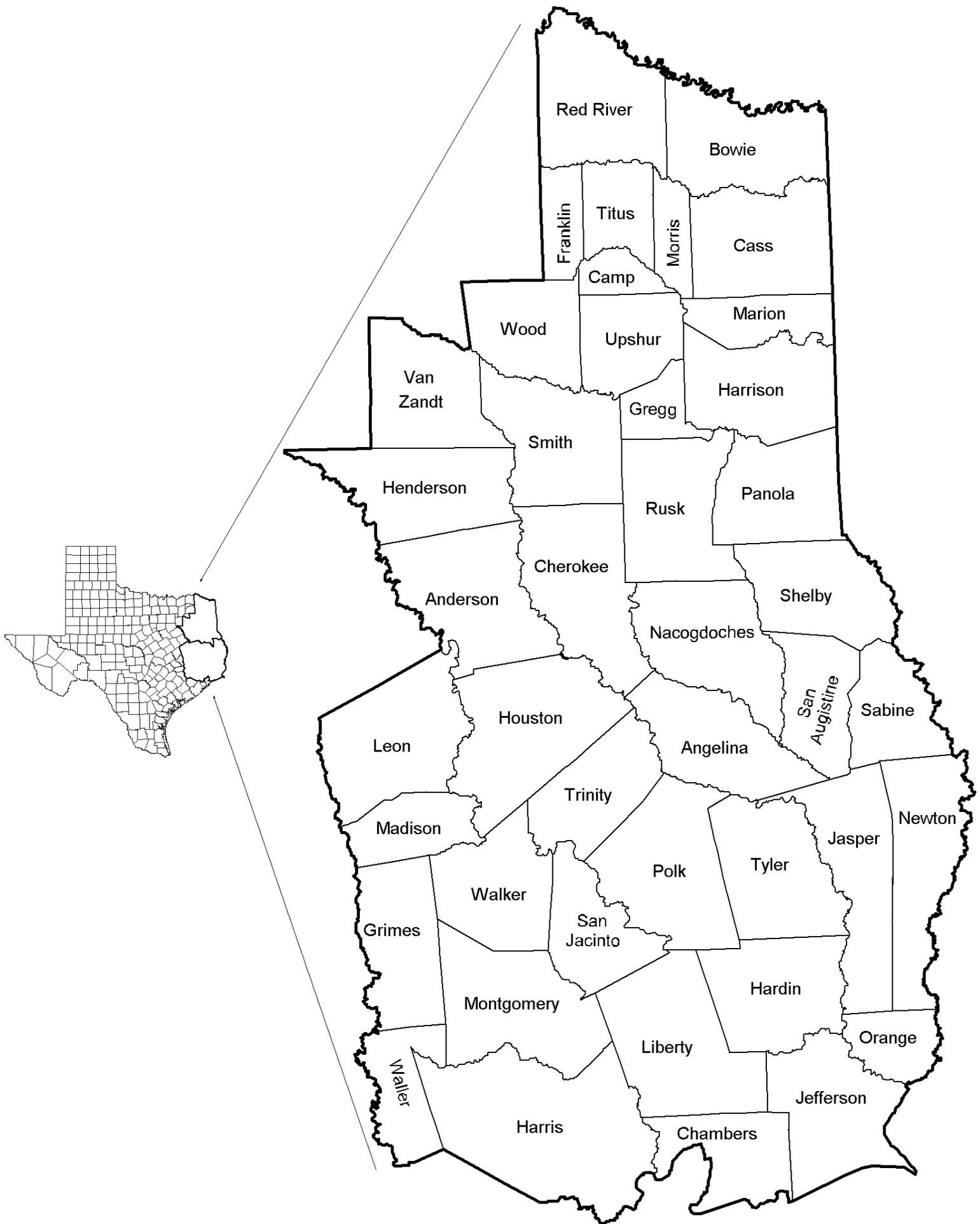
**TENNESSEE - 47**

Anderson	001	Lauderdale	097
Bedford	003	Lawrence	099
Benton	005	Lewis	101
Bledsoe	007	Lincoln	103
Blount	009	Loudon	105
Bradley	011	McMinn	107
Campbell	013	McNairy	109
Cannon	015	Macon	111
Carroll	017	Madison	113
Carter	019	Marion	115
Cheatham	021	Marshall	117
Chester	023	Maury	119
Claiborne	025	Meigs	121
Clay	027	Monroe	123
Cocke	029	Montgomery	125
Coffee	031	Moore	127
Crockett	033	Morgan	129
Cumberland	035	Obion	131
Davidson	037	Overton	133
Decatur	039	Perry	135
De Kalb	041	Pickett	137
Dickson	043	Polk	139
Dyer	045	Putnam	141
Fayette	047	Rhea	143
Fentress	049	Roane	145
Franklin	051	Robertson	147
Gibson	053	Rutherford	149
Giles	055	Scott	151
Grainger	057	Sequatchie	153
Greene	059	Sevier	155
Grundy	061	Shelby	157
Hamblen	063	Smith	159
Hamilton	065	Stewart	161
Hancock	067	Sullivan	163
Hardeman	069	Sumner	165
Hardin	071	Tipton	167
Hawkins	073	Trousdale	169
Haywood	075	Unicoi	171
Henderson	077	Union	173
Henry	079	Van Buren	175
Hickman	081	Warren	177
Houston	083	Washington	179
Humphreys	085	Wayne	181
Jackson	087	Weakley	183
Jefferson	089	White	185
Johnson	091	Williamson	187
Knox	093	Wilson	189
Lake	095		



**TEXAS – 48** (East)

Anderson	001
Angelina	005
Bowie	037
Camp	063
Cass	067
Chambers	071
Cherokee	073
Franklin	159
Gregg	183
Grimes	185
Hardin	199
Harris	201
Harrison	203
Henderson	213
Houston	225
Jasper	241
Jefferson	245
Leon	289
Liberty	291
Madison	313
Marion	315
Montgomery	339
Morris	343
Nacogdoches	347
Newton	351
Orange	361
Panola	365
Polk	373
Red River	387
Rusk	401
Sabine	403
San Augustine	405
San Jacinto	407
Shelby	419
Smith	423
Titus	449
Trinity	455
Tyler	457
Upshur	459
Van Zandt	467
Walker	471
Waller	473
Wood	499



**VIRGINIA – 51**

Accomack	001	Loudoun	107
Albemarle	003	Louisa	109
Alleghany	005	Lunenburg	111
Amelia	007	Madison	113
Amherst	009	Mathews	115
Appomattox	011	Mecklenburg	117
Arlington	013	Middlesex	119
Augusta	015	Montgomery	121
Bath	017	Nelson	125
Bedford	019	New Kent	127
Bland	021	Northampton	131
Botetourt	023	Northumberland	133
Brunswick	025	Nottoway	135
Buchanan	027	Orange	137
Buckingham	029	Page	139
Campbell	031	Patrick	141
Caroline	033	Pittsylvania	143
Carroll	035	Powhatan	145
Charles City	036	Prince Edward	147
Charlotte	037	Prince George	149
Chesterfield	041	Prince William	153
Clarke	043	Pulaski	155
Craig	045	Rappahannock	157
Culpeper	047	Richmond	159
Cumberland	049	Roanoke	161
Dickenson	051	Rockbridge	163
Dinwiddie	053	Rockingham	165
Essex	057	Russell	167
Fairfax	059	Scott	169
Fauquier	061	Shenandoah	171
Floyd	063	Smyth	173
Fluvanna	065	Southampton	175
Franklin	067	Spotsylvania	177
Frederick	069	Stafford	179
Giles	071	Surry	181
Gloucester	073	Sussex	183
Goochland	075	Tazewell	185
Grayson	077	Warren	187
Greene	079	Washington	191
Greensville	081	Westmoreland	193
Halifax	083	Wise	195
Hanover	085	Wythe	197
Henrico	087	York	199
Henry	089	Chesapeake City	550
Highland	091	Hampton City	650
Isle of Wight	093	Newport News City	700
James City	095	Suffolk City	800
King and Queen	097	Virginia Beach City	810
King George	099		
King William	101		
Lancaster	103		
Lee	105		

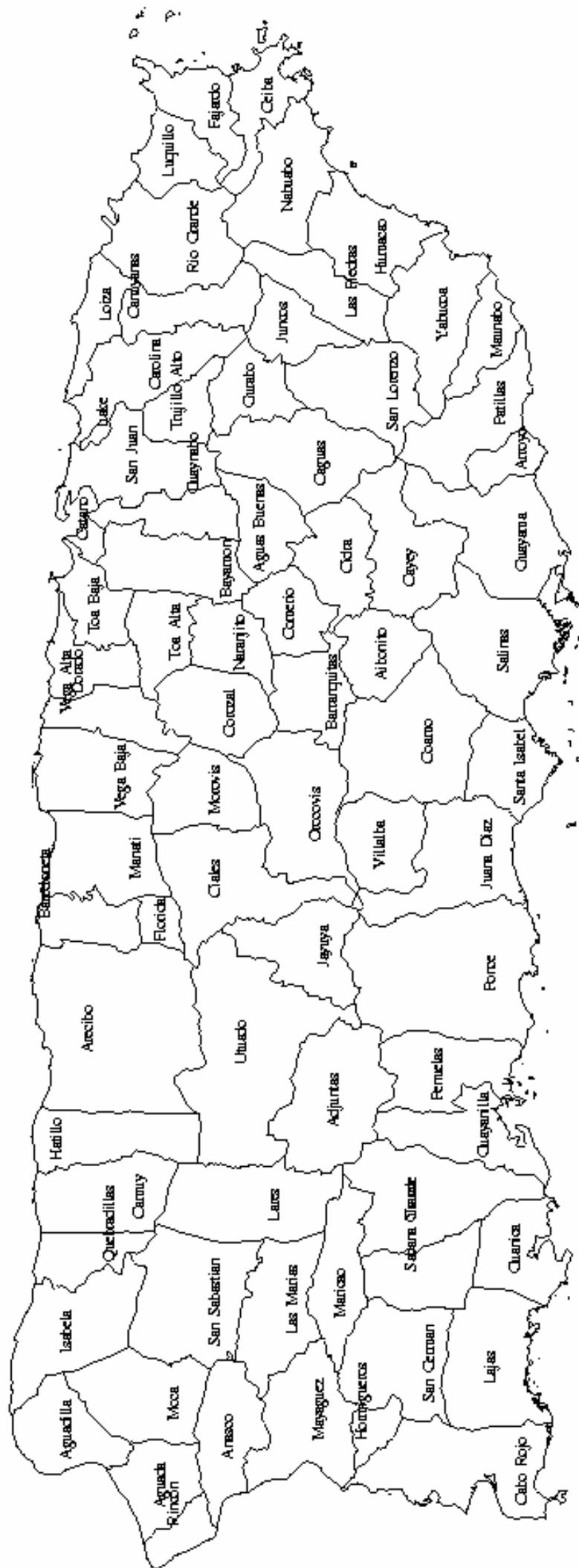


**PUERTO RICO - 72**

Adjuntas	001	Juncos	077
Aguada	003	Lajas	079
Aguadilla	005	Lares	081
Aguas Buenas	007	Las Marias	083
Aibonito	009	Las Piedras	085
Anasco	011	Loiza	087
Arecibo	013	Luquillo	089
Arroyo	015	Manati	091
Barceloneta	017	Maricao	093
Barranquitas	019	Maunabo	095
Bayamon	021	Mayaguez	097
Cabo Rojo	023	Moca	099
Caguas	025	Morovis	101
Camuy	027	Naguabo	103
Canovanas	029	Naranjito	105
Carolina	031	Orocovis	107
Catano	033	Patillas	109
Cayey	035	Penuelas	111
Ceiba	037	Ponce	113
Ciales	039	Quebradillas	115
Cidra	041	Rincon	117
Coamo	043	Rio Grande	119
Comerio	045	Sabana Grande	121
Corozal	047	Salinas	123
Culebra	049	San German	125
Dorado	051	San Juan	127
Fajardo	054	San Lorenzo	129
Florida	053	San Sebastian	131
Guanica	055	Santa Isabel	133
Guayama	057	Toa Alta	135
Guayanilla	059	Toa Baja	137
Guaynabo	061	Trujillo Alto	139
Gurabo	063	Utuado	141
Hatillo	065	Vega Alta	143
Hormigueros	067	Vega Baja	145
Humacao	069	Vieques	147
Isabela Municipio	071	Villalba	149
Jayuya	073	Yabucoa	151
Juana Diaz	075	Yuaco	153

**U.S. VIRGIN ISLANDS - 78**

St. Croix Island	010
St. John Island	020
St. Thomas Island	030







## **Appendix 2**

### **Southern Forest Type Descriptions**



## SOUTHERN FOREST TYPE DESCRIPTIONS

### WHITE/RED/JACK PINE GROUP

In pure pine forest types, the pine component stocking needs to be > 50%

103 Eastern white pine: Associates – pitch pine, gray birch, aspen, red maple, pin cherry, white oak, paper birch, sweet birch, yellow birch, black cherry, white ash, northern red oak, sugar maple, basswood, hemlock, northern white-cedar, yellow-poplar, white oak, chestnut oak, scarlet oak, and shortleaf pine. Sites--wide variety, but best development on well drained sands and sandy loams.

104 Eastern white pine/ Eastern hemlock: Associates – beech, sugar maple, basswood, red maple, yellow birch, black cherry, white ash, paper birch, sweet birch, northern red oak, white oak, chestnut oak, yellow-poplar, and cucumbertree. Sites--wide variety but favors cool locations, moist ravines, and north slopes.

105 Eastern hemlock: Associates – beech, sugar maple, yellow birch, basswood, red maple, black cherry, white ash, white pine, paper birch, sweet birch, northern red oak, and white oak. Sites--cool locations, moist ravines, and north slopes.

### SPRUCE/FIR GROUP

121 Balsam fir: Associates – black, white, or red spruce; paper or yellow birch; quaking or bigtooth aspen, beech; red maple; hemlock; tamarack; black ash; or northern white-cedar. Sites--upland sites on low lying moist flats and in swamps.

123 Red Spruce: Associates – vary widely and may include red maple, yellow birch, eastern hemlock, eastern white pine, white spruce, northern white-cedar, paper birch, pin cherry, gray birch, mountain ash, beech, striped maple, sugar maple, northern red oak, red pine, and aspen. Sites--include moderately well drained to poorly drained flats and thin-slopes and on varying acidic soils in abandoned fields and pastures. This code should be used where red spruce comprises a plurality or majority of the stand's stocking but where balsam fir is either nonexistent or has very little stocking. Otherwise the plot would be coded 124, red spruce/balsam fir.

124 Red spruce/balsam fir: Associates – red maple, paper birch, white pine, hemlock, white spruce, and northern white-cedar. Sites--moderately drained to poorly drained flats or on thin-soiled upper slopes.

## **LONGLEAF/SLASH PINE GROUP**

- 141 Longleaf pine: Longleaf pine occurs as a pure type or comprises a majority of the trees in the overstory. Associates--slash, loblolly and shortleaf pine, southern red oak, blackjack oak, water oak, persimmon, and sweetgum. Sites--those areas that can and do burn on a periodic basis--usually occurs on middle and upper slopes with a low severity of hardwood and brush competition. Regional distribution--coastal plain and piedmont units.
- 142 Slash pine: Slash pine is pure or provides a majority of the stocking. Associates--on moist sites; a wide variety of moist-site hardwoods, pond pine, and pondcypress. On dry sites; a wide variety of dry-site hardwoods, longleaf, loblolly, and sand pine. Sites--both moist and well-drained flatwoods, and bays. Regional distribution--coastal plain and piedmont units from North Carolina to Florida.

## **LOBLOLLY/SHORTLEAF PINE GROUP**

- 161 Loblolly pine: Associates – sweetgum, southern red oak, post oak, blackjack oak, blackgum, yellow-poplar, and pond pine. Sites--upland soils with abundant moisture but good drainage and on poorly drained depressions.
- 162 Shortleaf pine: Associates – white oak, southern red oak, scarlet oak, black oak, hickory, post oak, blackjack oak, blackgum, red maple, pitch pine, and Virginia pine. Sites--low, well drained ridges to rocky, dry, south slopes and the better drained spur ridges on north slopes and also on old fields.
- 163 Virginia pine: Associates – shortleaf pine, white oak, chestnut oak, southern red oak, black oak, sweetgum, red maple, blackgum, and pitch pine. Sites--dry sites, often abandoned fields.
- 164 Sand pine: Sand pine occurs in pure stands or provides a majority of the stocking. Associates--dwarf live oak, dwarf post oak, turkey oak, persimmon, and longleaf pine. Sites--dry, acidic, infertile sands. Regional distribution--found chiefly in the central peninsula and panhandle of Florida, although planted stands extend into the sandhills of Georgia and South Carolina.
- 165 Table-mountain pine: Associates – chestnut oak, scarlet oak, pitch pine, pine, and black oak. Sites--poor, dry, often rocky slopes.
- 166 Pond pine: Associates – loblolly pine, sweetgum, baldcypress, and Atlantic white-cedar. Sites--rare, but found in southern New Jersey, Delaware, and Maryland in low, poorly drained acres, swamps, and marshes.
- 167 Pitch pine: Associates – chestnut oak, scarlet oak, table-mountain pine, black oak, and blackgum. Sites--relatively infertile ridges, dry flats, and slopes.

168 Spruce pine: Spruce pine comprises a majority of the stocking. Associates--any of the moist site softwood or hardwood species. Sites--moist or poorly drained areas. Regional distribution--this type is rarely encountered and is found almost exclusively in the coastal plain.

### **PINYON / JUNIPER GROUP**

181 Eastern redcedar: Associates – gray birch, red maple, sweetbirch, Virginia Pine, shortleaf pine, oak. Sites--usually dry uplands and abandoned fields on limestone outcrops and other shallow soils but can grow well on good sites.

182 Rocky Mountain juniper

184 Juniper woodland

185 Pinyon juniper woodland

### **PONDEROSA PINE GROUP**

221 Ponderosa pine

### **OTHER WESTERN SOFTWOODS GROUP**

362 Southwestern white pine

366 Limber pine

368 Miscellaneous western softwoods

### **EXOTIC SOFTWOODS GROUP**

381 Scotch pine: plantation type, not naturally occurring.

382 Australian pine:

383 Other exotic softwoods

384 Norway spruce: plantation type, not naturally occurring

### **OAK/PINE GROUP**

In the oak/pine forest types, the pine component stocking needs to be 25 – 50%

401 Eastern white pine/northern red oak/white ash: Associates – red maple, basswood, yellow birch, bigtooth aspen, sugar maple, beech, paper birch, black cherry, hemlock, and sweet birch. Sites--deep, fertile, well-drained soil.

402 Eastern redcedar/hardwood: Associates – oak, hickory, walnut, ash, locust, dogwood, blackgum, hackberry, winged elm, shortleaf pine, and Virginia pine. Sites--usually dry uplands and abandoned fields.

- 403 Longleaf pine/oak: Longleaf pine and scrub oaks--primarily turkey, bluejack, blackjack, and dwarf post oak--comprise the type. Associates--southern scrub oaks in the understory. Sites--common on sandhills where soils are dry, infertile, and coarse textured. Regional distribution-- coastal plain and piedmont units.
- 404 Shortleaf pine/oak: Associates - (oaks generally include white, scarlet, blackjack, black, post, and southern red) hickory, blackgum, sweetgum, Virginia pine, and pitch pine. Sites--generally in dry, low ridges, flats, and south slopes.
- 405 Virginia pine/southern red oak: Associates – black oak, scarlet oak, white oak, post oak, blackjack oak, shortleaf pine, blackgum, hickory, pitch pine, table-mountain pine, chestnut oak. Sites--dry slopes and ridges.
- 406 Loblolly pine/hardwood: Associates – wide variety of moist and wet site hardwoods including blackgum, sweetgum, yellow-poplar, red maple, white and green ash, and American elm; on drier sites associates include southern and northern red oak, white oak, post oak, scarlet oak, persimmon, and hickory. Sites--usually moist to very moist though not wet all year but also on drier sites.
- 407 Slash pine/hardwood: Slash pine and a variable mixture of hardwoods comprise the type. Associates-- codominant with the slash pine component are sweetbay, blackgum, loblolly-bay, pondcypress, pond pine, Atlantic white-cedar, red maple, ash, and water oak. Sites--undrained or poorly drained depressions such as bays or pocosins and along pond margins. Regional distribution--primarily coastal plain units.
- 409 Other pine/hardwood:

## **OAK/HICKORY GROUP**

- 501 Post oak/blackjack oak: Associates – black oak, hickory, southern red oak, white oak, scarlet oak, shingle oak, live oak, shortleaf pine, Virginia pine, blackgum, sourwood, red maple, winged elm, hackberry, chinkapin oak, shumard oak, dogwood, and eastern redcedar. Sites--dry uplands and ridges.
- 502 Chestnut oak: Associates – scarlet oak, white oak, black oak, post oak, pitch pine, blackgum, sweetgum, red maple, red oak, shortleaf pine, Virginia pine. Sites--rocky outcrops with thin soil, ridge tops.
- 503 White oak/red oak/hickory: Associates – scarlet oak, bur oak, pinoak, white ash, sugar maple, red maple, walnut, basswood, locust, beech, sweetgum, blackgum, yellow-poplar, and dogwood. Sites--wide variety of well drained upland soils.
- 504 White oak: Associates – black oak, northern red oak, bur oak, hickory, white ash, yellow-poplar. Sites--scattered patches on upland, loamy soils but on drier sites than type 503.

- 505 Northern red oak: Associates – black oak, scarlet oak, chestnut oak, and yellow-poplar. Sites--spotty distribution on ridge crests and north slopes in mountains but also found on rolling land, slopes, and benches on loamy soil.
- 506 Yellow-poplar/white oak/northern red oak: Associates – blackoak, hemlock, blackgum, and hickory. Sites--northern slopes, coves, and moist flats.
- 507 Sassafras/persimmon: Associates – elm, eastern redcedar, hickory, ash, sugar maple, yellow-poplar, and oaks. Sites--abandoned farmlands and old fields.
- 508 Sweetgum/yellow-poplar: Associates – red maple, white ash, green ash, and other moist site hardwoods. Sites--generally occupies moist, lower slopes.
- 509 Bur oak: Associates—northern pin oak, black oak, chinkapin oak, and eastern redcedar in northern and dry upland sites; shagbark hickory, black walnut, eastern cottonwood, white ash, American elm, swamp white oak, honey locust, and American basswood in southern and lowland sites. Sites – drier uplands to moist bottomlands with the drier uplands more common in the northern part of the range and the moist bottomlands more common in the southern part of the range.
- 510 Scarlet oak: Associates – black oak, southern red oak, chestnut oak, white oak, post oak, hickory, pitch pine, blackgum, sweetgum, black locust, sourwood, dogwood, shortleaf pine, and Virginia pine. Sites--dry ridges, south- or west-facing slopes and flats but often moister situations probably as a result of logging or fire.
- 511 Yellow-poplar: Associates – black locust, red maple, sweet birch, cucumbertree, and other moist-site hardwoods (except sweetgum, see type 508) and white oak and northern red oak (see type 503). Sites--lower slopes, northerly slopes, moist coves, flats, and old fields.
- 512 Black Walnut: Associates – yellow-poplar, white ash, black cherry, basswood, beech, sugar maple, oaks, and hickory. Sites--coves and well-drained bottoms.
- 513 Black locust: Associates – many species of hardwoods and hardpines may occur with it in mixture, either having been planted or from natural seeding. Sites--may occur on any well-drained soil but best on dry sites, often in old fields.
- 514 Southern scrub oak: This forest cover type consists of a mixture of scrub oaks that may include several of the following species: turkey oak, bluejack oak, blackjack oak, dwarf post oak, and dwarf live oak. Sites--dry sandy ridges-the type frequently develops on areas formerly occupied by longleaf pine. Regional distribution--common throughout all coastal plain units and into the lower piedmont.

- 515 Chestnut oak / black oak / scarlet oak: Associates—northern and southern red oaks, post oak, white oak, sourwood, shagbark hickory, pignut hickory, yellow-poplar, blackgum, sweetgum, red maple, eastern white pine, pitch pine, Table Mountain pine, shortleaf pine, and Virginia pine. Sites—dry upland sites on thin-soiled rocky outcrops on dry ridges and slopes.
- 519 Red maple / oak: Associates – the type is dominated by red maple and some of the wide variety of central hardwood associates include upland oak, hickory, yellow-poplar, black locust, sassafras as well as some central softwoods like Virginia and shortleaf pines. Sites -- uplands.
- 520 Mixed upland hardwoods: Associates – Any mixture of hardwoods of species typical of the upland central hardwood region, should include at least some oak. Sites--wide variety of upland sites.

### **OAK/GUM/CYPRESS GROUP**

- 601 Swamp chestnut oak/cherrybark oak: Associates – white ash, hickory, white oak, shumard oak, blackgum, sweetgum, southern red oak, post oak, American elm, winged elm, yellow-poplar, and beech. Sites--within alluvial flood plains of major rivers on all ridges in the terraces and on the best fine sandy loam soils on the highest first bottom ridges.
- 602 Sweetgum/Nuttall oak/willow oak: Associates – green ash, American elm, pecan, cottonwood, red maple, honeylocust, and persimmon. Sites--very wet.
- 605 Overcup oak/water hickory: Associates – willow oak, American elm, green ash, hackberry, persimmon, and red maple. Sites--in South within alluvial flood plains in low, poorly drained flats with clay soils; also in sloughs and lowest backwater basins and low ridges with heavy soils that are subject to late spring inundation.
- 606 Atlantic white-cedar: Associates – North includes gray birch, pitch pine, hemlock, blackgum, and red maple. South includes pond pine, baldcypress, and red maple. Sites--usually confined to sandy-bottomed, peaty, interior, and river swamps, wet depressions, and stream banks.
- 607 Cypress/water tupelo: 25% -50% stocking of Cypress. (Bald and/or Pond cypress) Associates – Blackgum, willow, red maple, American elm, persimmon, overcup oak, and sweetgum. Sites--very low, poorly drained flats, deep sloughs, and swamps wet most all the year. Also, floodplains and stream margins.
- 608 Sweetbay/swamp tupelo/red maple: Associates – blackgum, loblolly and pond pines, American elm, and other moist-site hardwoods. Sites--very moist but seldom wet all year--shallow ponds, muck swamps, along smaller creeks in Coastal Plain (rare in Northeast).

609 Cypress : > 50 % stocking of Bald cypress and/or Pond cypress. Associates – Blackgum, willow, red maple, American elm, persimmon, overcup oak, and sweetgum. Sites--very low, poorly drained flats, deep sloughs, and swamps wet most all the year. Also, floodplains and stream margins.

### **ELM/ASH/COTTONWOOD GROUP**

- 701 Black ash/American elm/red maple: Associates – silver maple, swampwhite oak, sycamore, pin oak, blackgum, white ash, and cottonwood. Sites--moist to wet areas, swamps, gullies, and poorly drained flats.
- 702 River birch/sycamore: Associates – red maple, black willow, and other moist-site hardwoods. Sites--moist soils at edges of creeks and rivers.
- 703 Cottonwood: Associates – willow, white ash, green ash, and sycamore. Sites--streambanks where bare, moist soil is available.
- 704 Willow: Associates – cottonwood, green ash, sycamore, pecan, American elm, red maple, and boxelder. Sites--streambanks where bare, moist soil is available.
- 705 Sycamore/pecan/American elm: Associates – boxelder, green ash, hackberry, silver maple, cottonwood, willow, sweetgum, and river birch. Sites--bottomlands, alluvial flood plains of major rivers.
- 706 Sugarberry/hackberry/elm/green ash: Associates – pecan, blackgum, persimmon, honeylocust, red maple, hackberry, and boxelder. Sites--low ridges and flats in flood plains.
- 707 Silver maple/American elm: Silver maple and American elm are the majority species in this type. Associates – sweetgum, pin oak, swamp white oak, eastern cottonwood, sycamore, green ash, and other moist-site hardwoods, according to the region. Sites – primarily on well-drained moist sites along river bottoms and floodplains and beside lakes and larger streams.
- 708 Red maple/lowland: Red maple comprises a majority of the stocking. Because this type grows on a wide variety of sites over an extensive range, associates are diverse. Associates include yellow-poplar, blackgum, sweetgum, and loblolly pine. Site – generally restricted to very moist to wet sites with poorly drained soils, and on swamp borders.
- 709 Cottonwood/willow: Associates – white ash, green ash sycamore, American elm, red maple and boxelder. Sites – stream banks where bare, moist soil is available.

## MAPLE/BEECH/BIRCH GROUP

- 801 Sugar maple/beech/yellow birch: Associates – basswood, red maple, hemlock, northern red oak, white ash, white pine, black cherry, sweet birch, American elm, rock elm, and eastern hophornbeam. Sites--fertile, moist, well-drained sites.
- 802 Black cherry: Associates – sugar maple, northern red oak, red maple, white ash, basswood, sweet birch, butternut, American elm, and hemlock. Sites--fertile, moist, well-drained sites.
- 803 Cherry/ash/yellow-poplar: Associates – sugar maple, American beech, northern red oak, white oak, blackgum, hickory, cucumbertree, and yellow birch. Sites -- fertile, moist, well-drained sites.
- 805 Hard maple/basswood: Associates – white ash, northern red oak, eastern hophornbeam, American elm, red maple, eastern white pine, eastern hemlock. Sugar maple and basswood occur in different proportions but together comprise the majority of the stocking. Sites -- fertile, moist, well-drained sites.
- 807 Elm/ash/locust: Associates – Locust, silver maple, boxelder, elm, red maple, green ash predominate. Found in North Central region, unknown in Northeast. Sites--upland
- 809 Red maple/upland: Associates — the type is dominated by red maple and some of the wide variety of northern hardwood associates include sugar maple, beech, birch, aspen, as well as some northern softwoods like white pine, red pine, and hemlock; this type is often man-made and may be the result of repeated cuttings. Sites -- uplands. (See Type 519 under oak/hickory group)

## ASPEN BIRCH GROUP

- 902 Paper birch

## WESTERN OAK GROUP

- 925 Deciduous oak woodland: Primarily a shrub type, it often occurs in small colonies or mottes. This type is made up of Mohrs oak (also called shin oak) forms mixed stands with other oaks of this cover type. Much variation exists in the shin oak complex there may be as many as five phonological variants. Different leaf-out dates are often evident in the same stand, and acorn size is highly variable within the hybrids. Sites – Because of Mohrs oak's preference for calcareous soils, it is most common where caliche fragments are on or near the soil surface.

## **OTHER WESTERN HARDWOODS GROUP**

952 Mesquite woodland: Honey mesquite and screwbean mesquite comprise the majority of the stocking of this cover type. Honey mesquite associates, which are many, vary with climate and soils. Sites – occurs on a wide array of sites and soils, which largely regulate the rate and extent of growth and development.

955 Miscellaneous western hardwood woodlands

## **TROPICAL HARDWOODS GROUP**

981 Sabal palm: Through most of its range sabal palm (cabbage palmetto) comprises a plurality of the stocking. Associates – Sand live oak, slash pine, live oak, laurel oak, water oak, baldcypress, southern magnolia, red maple, redbay, swamp tupelo, sweetgum, southern redcedar, and loblolly pine. In south central Florida, sabal palm grows in pure stands in wet prairie areas; in extreme southern Florida, tropical hardwoods replace temperate hardwoods as associates. Sites – can tolerate a broad range of soil pH, salinity, and drainage.

982 Mangrove: Forests in which mangrove comprises a majority of the stocking. Associates--cabbage palm on some of the higher sites in the area. Sites--predominantly salt marshes; mangrove frequently develops its own island or shoreline made up of a dense mat of root structures. Regional distribution--restricted to South Florida and the Keys.

989 Other tropical: This type consists of dense forests of hardwood trees and palms. Associates – gumbo-limbo, wild-tamarind, poisonwood (Florida poisonwood), pigeon-plum, black ironwood (leadwood), torchwood, lancewood, lancewood, mastic, and willow bastic, as well as more temperate live oak and red bay. Sites - Occurs on land slightly higher than surrounding fresh and saltwater marshes or on pineland.

## **EXOTIC HARDWOODS GROUP**

991 Paulownia:

992 Melaleuca:

993 Eucalyptus:

995 Other exotic hardwoods:



## **Appendix 3**

### **Southern U.S. Tree Species Codes**

## SOUTHERN U.S. TREE SPECIES CODES

The following list includes tree species tallied in the southern FIA region.

(w) designates woodland species where DRC is measured instead of DBH.

<b>Code</b>	<b>Common Name</b>	<b>Genus</b>	<b>Specific epithet</b>
0010	fir spp.	Abies	spp.
0012	balsam fir	Abies	balsamea
0016	Fraser fir	Abies	fraseri
0043	Atlantic white-cedar	Chamaecyparis	thyoides
0051	Arizona cypress	Cupressus	arizonica
0057	redcedar / juniper	Juniperus	spp.
0059	redberry juniper (w)	Juniperus	coahuilensis
0061	Ashe juniper	Juniperus	ashei
0063	alligator juniper (w)	Juniperus	deppeana
0066	Rocky Mnt. juniper (w)	Juniperus	scopulorum
0067	southern redcedar	Juniperus	silicicola
0068	eastern redcedar	Juniperus	virginiana
0069	oneseed juniper (w)	Juniperus	monosperma
0090	spruce spp.	Picea	spp.
0091	Norway spruce	Picea	abies
0094	white spruce	Picea	glauca
0095	black spruce	Picea	mariana
0096	blue spruce	Picea	pungens
0097	red spruce	Picea	rubens
0100	pine spp.	Pinus	spp.
0106	common pinyon (w)	Pinus	edulis
0107	sand pine	Pinus	clausa
0110	shortleaf pine	Pinus	echinata
0111	slash pine	Pinus	elliottii
0113	limber pine	Pinus	flexilis
0114	southwestern white pine	Pinus	strobiformis
0115	spruce pine	Pinus	glabra
0121	longleaf pine	Pinus	palustris
0122	ponderosa pine	Pinus	ponderosa
0123	Table Mountain pine	Pinus	pungens
0125	red pine	Pinus	resinosa
0126	pitch pine	Pinus	rigida
0128	pond pine	Pinus	serotina
0129	eastern white pine	Pinus	strobus
0130	Scotch pine	Pinus	sylvestris
0131	loblolly pine	Pinus	taeda
0132	Virginia pine	Pinus	virginiana
0136	Austrian pine	Pinus	nigra
0140	Mexican pinyon pine	Pinus	cembroides
0144	Caribbean pine	Pinus	elliottii var. elliottii
0220	cypress spp.	Taxodium	spp.
0221	baldcypress	Taxodium	distichum
0222	pondcypress	Taxodium	distichum var. nutans
0230	yew spp.	Taxus	spp.
0232	Florida yew	Taxus	floridana
0241	northern white-cedar	Thuja	occidentalis
0252	Florida torreyia	Torreya	taxifolia
0260	hemlock spp.	Tsuga	spp.
0261	eastern hemlock	Tsuga	canadensis

<b>Code</b>	<b>Common Name</b>	<b>Genus</b>	<b>Specific epithet</b>
0262	Carolina hemlock	Tsuga	caroliniana
0299	unknown dead conifer	UNKNOWN	UNKNOWN
0300	acacia spp.	Acacia	spp.
<del>0303</del>	<del>sweet acacia</del>	<del>Acacia</del>	<del>farnesiana</del>
<del>0304</del>	<del>catclaw acacia</del>	<del>Acacia</del>	<del>greggii</del>
0310	maple spp.	Acer	spp.
0311	Florida maple	Acer	barbatum
0313	boxelder	Acer	negundo
0314	black maple	Acer	nigrum
0315	striped maple	Acer	pensylvanicum
0316	red maple	Acer	rubrum
0317	silver maple	Acer	saccharinum
0318	sugar maple	Acer	saccharum
0319	mountain maple	Acer	spicatum
0320	Norway maple	Acer	platanoides
0323	chalk maple	Acer	leucoderme
0330	buckeye, horsechestnut spp.	Aesculus	spp.
0331	Ohio buckeye	Aesculus	glabra
0332	yellow buckeye	Aesculus	flava
0334	Texas buckeye	Aesculus	glabra var. arguta
<del>0336</del>	<del>red buckeye</del>	<del>Aesculus</del>	<del>pavia</del>
0337	painted buckeye	Aesculus	sylvatica
0341	ailanthus	Ailanthus	altissima
0345	mimosa, silktree	Albizzia	julibrissin
0355	European Alder	Alnus	glutinosa
0356	serviceberry spp.	Amelanchier	spp.
<del>0357</del>	<del>common serviceberry</del>	<del>Amelanchier</del>	<del>arborea</del>
<del>0358</del>	<del>roundleaf serviceberry</del>	<del>Amelanchier</del>	<del>sanguinea</del>
0367	pawpaw	Asimina	triloba
0370	birch spp.	Betula	spp.
0371	yellow birch	Betula	alleghaniensis
0372	sweet birch	Betula	lenta
0373	river birch	Betula	nigra
0374	water birch	Betula	occidentalis
0375	paper birch	Betula	papyrifera
0377	Virginia roundleaf birch	Betula	uber
0379	gray birch	Betula	populifolia
0381	chittamwood, gum bumelia	Bumelia	Lanuginosum ssp. lanuginosum
0391	American hornbeam, musclewood	Carpinus	caroliniana
0400	hickory spp.	Carya	spp.
0401	water hickory	Carya	aquatica
0402	bitternut hickory	Carya	cordiformis
0403	pignut hickory	Carya	glabra
0404	pecan	Carya	illinoensis
0405	shellbark hickory	Carya	laciniosa
0406	nutmeg hickory	Carya	myristiciformis
0407	shagbark hickory	Carya	ovata
0408	black hickory	Carya	texana
0409	mockernut hickory	Carya	alba
0410	sand hickory	Carya	pallida

<b>Code</b>	<b>Common Name</b>	<b>Genus</b>	<b>Specific epithet</b>
0411	scrub hickory	Carya	floridana
0412	red hickory	Carya	ovalis
0413	southern shagbark hickory	Carya	carolinae-septentrionalis
0420	chestnut spp.	Castanea	spp.
0421	American chestnut	Castanea	dentata
0422	Allegheny chinkapin	Castanea	pumila
0423	Ozark chinkapin	Castanea	Pumila var. ozarkensis
0424	Chinese chestnut	Castanea	mollissima
0450	catalpa spp.	Catalpa	spp.
0451	southern catalpa	Catalpa	bignonioides
0452	northern catalpa	Catalpa	speciosa
0460	hackberry spp.	Celtis	spp.
0461	sugarberry	Celtis	laevigata
0462	hackberry	Celtis	occidentalis
0463	netleaf hackberry	Celtis	laevigata
0471	eastern redbud	Cercis	canadensis
0481	yellowwood	Cladrastis	kentukea
0491	flowering dogwood	Cornus	florida
0500	hawthorn	Crataegus	spp.
0501	cockspur hawthorn	Crataegus	crus-galli
0502	downy hawthorn	Crataegus	mollis
0503	<del>Brainerd hawthorn</del>	Crataegus	brainerdii
0504	<del>pear hawthorn</del>	Crataegus	calpodendron
0505	Fireberry hawthorn	Crataegus	chrysocarpa
0506	broadleaf hawthorn	Crataegus	dilatata
0507	fanleaf hawthorn	Crataegus	flabellata
0508	Oneseed hawthorn	Crataegus	monogyna
0509	scarlet hawthorn	Crataegus	pedicellata
5091	<del>Washington hawthorn</del>	Crataegus	phaenopyrum
5092	<del>fleshy hawthorn</del>	Crataegus	succulenta
5093	<del>dwarf hawthorn</del>	Crataegus	uniflora
0510	eucalyptus	Eucalyptus	spp.
0513	grand eucalyptus	Eucalyptus	grandis
0514	swamp mahogany	Eucalyptus	robusta
0520	persimmon spp.	Diospyros	spp.
0521	common persimmon	Diospyros	virginiana
0522	Texas persimmon	Diospyros	texana
0531	American beech	Fagus	grandifolia
0540	ash spp.	Fraxinus	spp.
0541	white ash	Fraxinus	americana
0543	black ash	Fraxinus	nigra
0544	green ash	Fraxinus	pennsylvanica
0545	pumpkin ash	Fraxinus	profunda
0546	blue ash	Fraxinus	quadrangulata
0547	velvet ash	Fraxinus	velutina
0548	Carolina ash	Fraxinus	caroliniana
0549	Texas ash	Fraxinus	texensis
0550	locust spp.	Gleditsia	spp.
0551	waterlocust	Gleditsia	aquatica
0552	honeylocust	Gleditsia	triacanthos
0555	loblolly-bay	Gordonia	lasianthus
0561	Ginkgo, maidenhair tree	Ginkgo	biloba
0571	Kentucky coffeetree	Gymnocladus	dioicus

<b>Code</b>	<b>Common Name</b>	<b>Genus</b>	<b>Specific epithet</b>
0580	silverbell	Halesia	spp.
0581	Carolina silverbell	Halesia	carolina
0582	two-wing silverbell	Halesia	diptera
0591	American holly	Ilex	opaca
0600	walnut spp.	Juglans	spp.
0601	butternut	Juglans	cinerea
0602	black walnut	Juglans	nigra
0605	Texas walnut	Juglans	microcarpa
0611	sweetgum	Liquidambar	styraciflua
0621	yellow-poplar	Liriodendron	tulipifera
0641	Osage-orange	Maclura	pomifera
0650	magnolia spp.	Magnolia	spp.
0651	cucumbertree	Magnolia	acuminata
0652	southern magnolia	Magnolia	grandiflora
0653	sweetbay	Magnolia	virginiana
0654	bigleaf magnolia	Magnolia	macrophylla
0655	mountain magnolia	Magnolia	fraseri
0657	pyramid magnolia	Magnolia	pyramidata
0658	umbrella magnolia	Magnolia	tripetala
0660	apple spp.	Malus	spp.
0662	southern crabapple	Malus	angustifolia
0663	sweet crabapple	Malus	coronaria
0664	prairie crabapple	Malus	ioensis
0680	mulberry spp.	Morus	spp.
0681	white mulberry	Morus	alba
0682	red mulberry	Morus	rubra
0683	Texas mulberry	Morus	microphylla
0684	black mulberry	Morus	nigra
0690	gum, tupelo	Nyssa	spp.
0691	water tupelo	Nyssa	aquatica
0692	Ogeechee tupelo	Nyssa	ogeche
0693	blackgum	Nyssa	sylvatica
0694	swamp tupelo	Nyssa	buflora
0701	eastern hophornbeam	Ostrya	virginiana
0711	sourwood	Oxydendrum	arboreum
0712	paulownia, empress-tree	Paulownia	tomentosa
0720	bay spp.	Persea	spp.
0721	redbay	Persea	borbonia
0722	water-elm, planertree	Planera	aquatica
0729	sycamore spp.	Platanus	spp.
0731	American sycamore	Platanus	occidentallis
0740	cottonwood, poplar spp.	Populus	spp.
0741	balsam poplar	Populus	balsamifera
0742	eastern cottonwood	Populus	deltoides
0743	bigtooth aspen	Populus	grandidentata
0744	swamp cottonwood	Populus	heterophylla
0745	plains cottonwood	Populus	deltoides ssp. monilifera
0746	quaking aspen	Populus	tremuloides
0748	Rio Grande cottonwood, Fremont poplar	Populus	deltoides ssp. wislizeni
0749	narrowleaf poplar	Populus	angustifolia
0752	silver poplar	Populus	alba
0753	Lombardy poplar	Populus	nigra

<b>Code</b>	<b>Common Name</b>	<b>Genus</b>	<b>Specific epithet</b>
0755	mesquite spp.	Prosopis	spp.
0757	velvet mesquite	Prosopis	velutina
0758	screwbean mesquite	Prosopis	pubescens
0760	cherry and plum spp.	Prunus	spp.
0761	pin cherry (fire cherry)	Prunus	pensylvanica
0762	black cherry	Prunus	serotina
0763	chokecherry	Prunus	virginiana
0764	peach	Prunus	persica
0765	Canada plum	Prunus	nigra
0766	wild plum	Prunus	americana
0769	Allegheny plum	Prunus	alleghaniensis
0770	Chickasaw plum	Prunus	angustifolia
0771	sweet cherry, domesticated	Prunus	avium
0772	sour cherry, domesticated	Prunus	cerasus
0773	European plum, domesticated	Prunus	domestica
0774	Mahaleb plum, domesticated	Prunus	mahaleb
0800	oak -- deciduous	Quercus	spp.
0802	white oak	Quercus	alba
0803	Arizona white oak (w) and gray oak (w)	Quercus	arizonica
0804	swamp white oak	Quercus	grisea
0806	scarlet oak	Quercus	bicolor
0808	scarlet oak	Quercus	coccinea
0808	Durand oak	Quercus	sinuata var. sinuata
0809	northern pin oak	Quercus	ellipsoidalis
0812	southern red oak	Quercus	falcata var. falcata
0813	cherrybark oak	Quercus	pagoda
0814	Gambel oak (w)	Quercus	gambelii
0816	bear oak, scrub oak	Quercus	ilicifolia
0817	shingle oak	Quercus	imbricaria
0819	turkey oak	Quercus	laevis
0820	laurel oak	Quercus	laurifolia
0822	overcup oak	Quercus	lyrata
0823	bur oak	Quercus	macrocarpa
0824	blackjack oak	Quercus	marilandica
0825	swamp chestnut oak	Quercus	michauxii
0826	chinkapin oak	Quercus	muehlenbergii
0827	water oak	Quercus	nigra
0828	Nuttall oak	Quercus	buckley
0830	pin oak	Quercus	palustris
0831	willow oak	Quercus	phellos
0832	chestnut oak	Quercus	prinus
0833	northern red oak	Quercus	rubra
0834	Shumard oak	Quercus	shumardii
0835	post oak	Quercus	stellata
0836	Delta post oak	Quercus	margarettae
0837	black oak	Quercus	velutina
0838	live oak	Quercus	virginiana
0840	dwarf post oak	Quercus	stellata var. margaretta
0841	dwarf live oak	Quercus	minima
0842	bluejack oak	Quercus	incana
0843	silverleaf oak (w)	Quercus	hypoleucoides

<b>Code</b>	<b>Common Name</b>	<b>Genus</b>	<b>Specific epithet</b>
0844	Oglethorpe oak	Quercus	oglethorpensis
0845	Dwarf chinkapin oak	Quercus	prinoides
0850	oak – evergreen (w)	Quercus	spp.
0852	torchwood	Amyris	elemifera
0853	pond apple	Annona	glabra
0854	gumbo limbo	Bursera	simaruba
0855	sheoak spp.	Casuarina	spp.
0856	gray sheoak	Casuarina	glauca
0857	Australian pine	Casuarina	lepidophloia
0858	camphor tree	Cinnamomum	camphora
0859	fiddlewood	Citharexylum	fruticosum
0860	citrus spp.	Citrus	spp.
0863	pigeon plum (tietongue)	Coccoloba	diversifolia
0864	soldierwood	Colubrina	elliptica
0865	geiger tree	Cordia	sebestena
0866	carrotwood	Cupaniopsis	anacardioides
0873	red stopper	Eugenia	rhombea
0874	inkwood (butterbough)	Exothea	paniculata
0876	strangler fig	Ficus	aurea
0877	shortleaf fig (wild banyantree)	Ficus	citrifolia
0882	blolly (beef tree)	Guapira	discolor
0883	manchineel	Hippomane	mancinella
0884	false tamarind	Lysiloma	latisiliquum
0885	mango	Mangifera	indica
0886	poisonwood	Metopium	toxiferum
0887	fishpoison tree	Piscidia	piscipula
0888	schefflera (octopus tree)	Schefflera	actinophylla
0890	false mastic	Sideroxylon	foetidissimum
0891	white bully (willow bustic)	Sideroxylon	salicifolium
0895	paradise tree	Simarouba	glauca
0896	java plum	Syzygium	cumini
0897	tamarind	Tamarindus	indica
0901	black locust	Robinia	pseudoacacia
0902	<del>New Mexico locust</del>	<del>Robinia</del>	<del>neomexicana</del>
0906	paurotis palm	Acoelorrhaphe	wrightii
0907	silver palm	Coccothrinax	argentata
0908	coconut palm	Cocos	nucifera
0909	royal palm	Roystonea	spp.
0912	sabal palmetto	Sabal	palmetto
0913	key thatch palm	Thrinax	morrisii
0914	Florida thatch palm	Thrinax	radiata
0915	other palms	Family Arecaceae	when not listed above
0919	western soapberry	Sapindus	Saponaria var. drummondii
0920	willow	Salix	spp.
0921	peachleaf willow	Salix	amygdaloides
0922	black willow	Salix	nigra
0923	Bebb willow	Salix	bebbiana
0924	red willow	Salix	bonplandiana
0925	coastal plain willow	Salix	caroliniana
0926	balsam willow	Salix	pyrifolia
0927	white willow	Salix	alba
0929	weeping willow	Salix	sepulcralis

<b>Code</b>	<b>Common Name</b>	<b>Genus</b>	<b>Specific epithet</b>
0931	sassafras	Sassafras	albidum
0934	mountain ash spp.	Sorbus	spp.
0935	American mountain-ash	Sorbus	americana
0936	European mountain-ash	Sorbus	aucuparia
0940	Mahogany	Swietenia	mahagoni
0950	basswood spp.	Tilia	spp.
0951	American basswood	Tilia	americana
0952	white basswood	Tilia	Americana var. heterophylla
0953	Carolina basswood	Tilia	americana var. caroliniana
0970	elm spp.	Ulmus	spp.
0971	winged elm	Ulmus	alata
0972	American elm	Ulmus	americana
0973	cedar elm	Ulmus	crassifolia
0974	Siberian elm	Ulmus	pumila
0975	slippery elm	Ulmus	rubra
0976	September elm	Ulmus	serotina
0977	rock elm	Ulmus	thomasii
0986	black mangrove	Avicennia	germinans
0987	buttonwood mangrove	Conocarpus	erectus
0988	white mangrove	Laguncularia	racemosa
0989	red mangrove, American mangrove	Rhizophora	mangle
0992	melaleuca	Melaleuca	quinquenervia
0993	chinaberry	Melia	azedarach
0994	Chinese tallowtree	Sapium	sebifera
0995	tung-oil-tree	Vernicia	fordii
0996	smoketree	Cotinus	obovatus
0997	Russian olive	Elaeagnus	angustifolia
0998	unknown dead hardwood	take a sample and consult supervisor	
0999	Other/unknown	UNKNOWN	UNKNOWN

## **Appendix 4**

### **Southern U.S. Site Tree Selection Criteria**

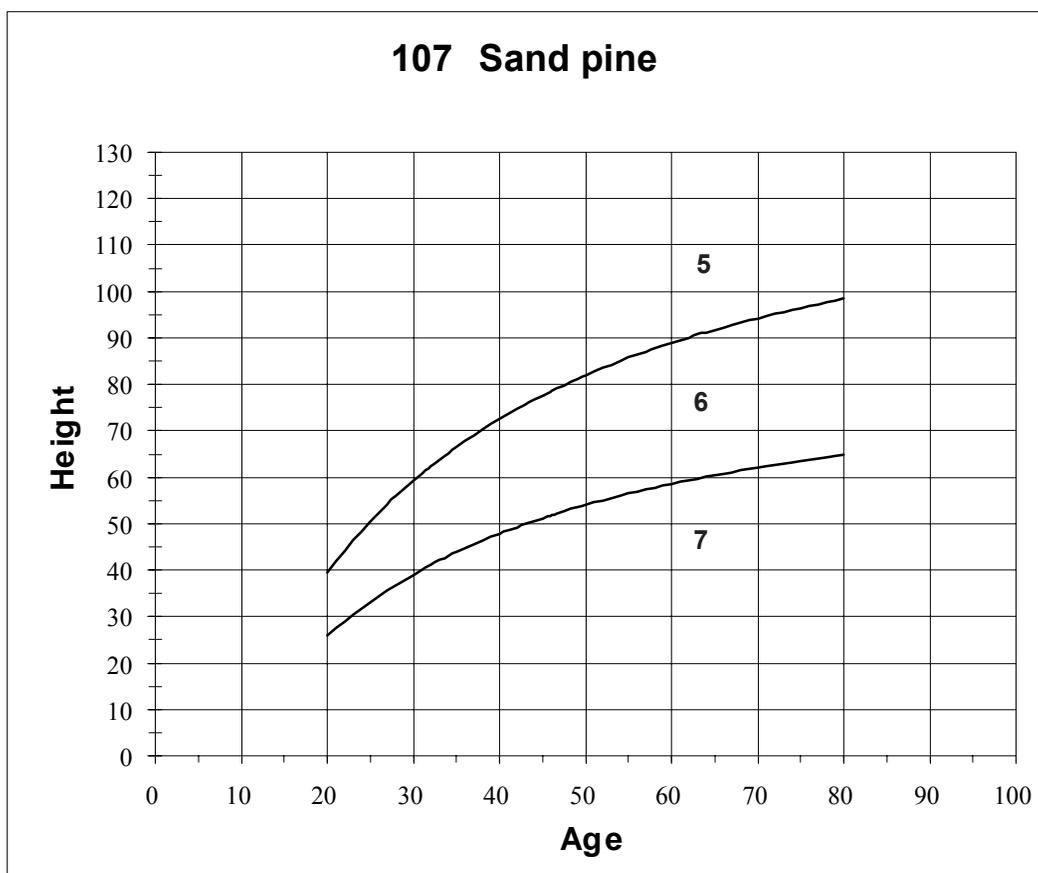
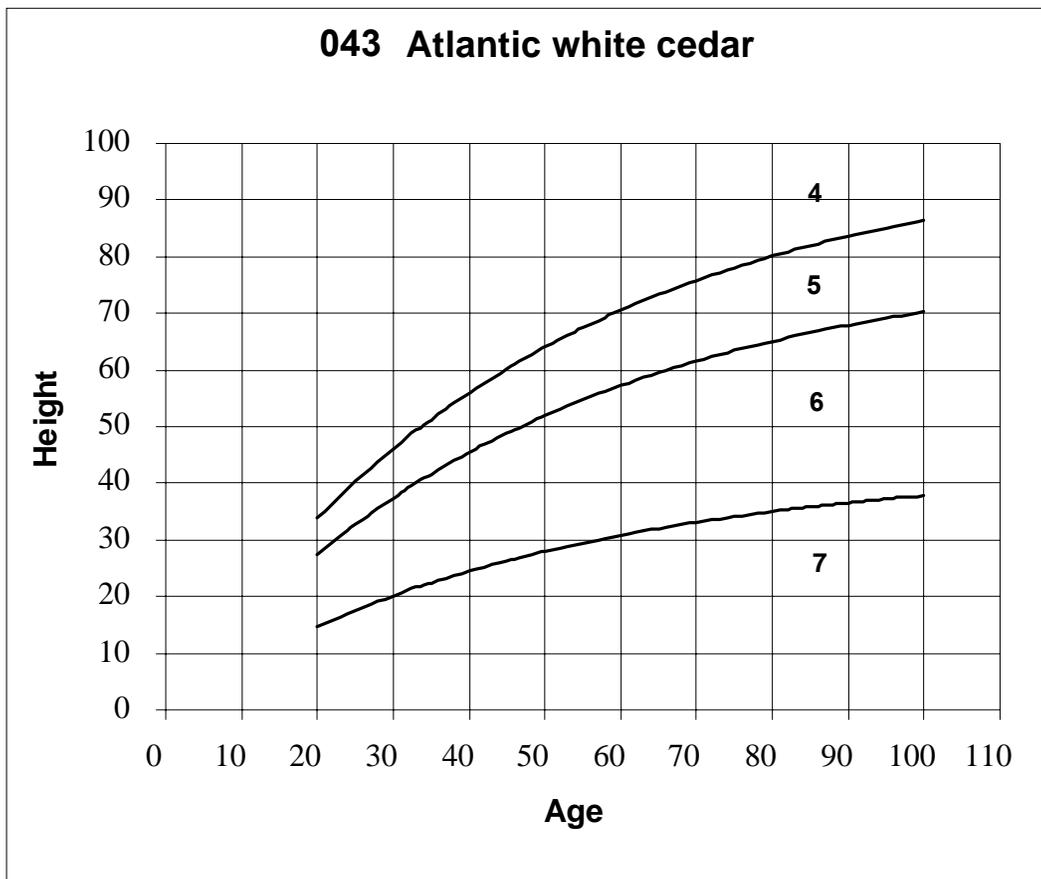


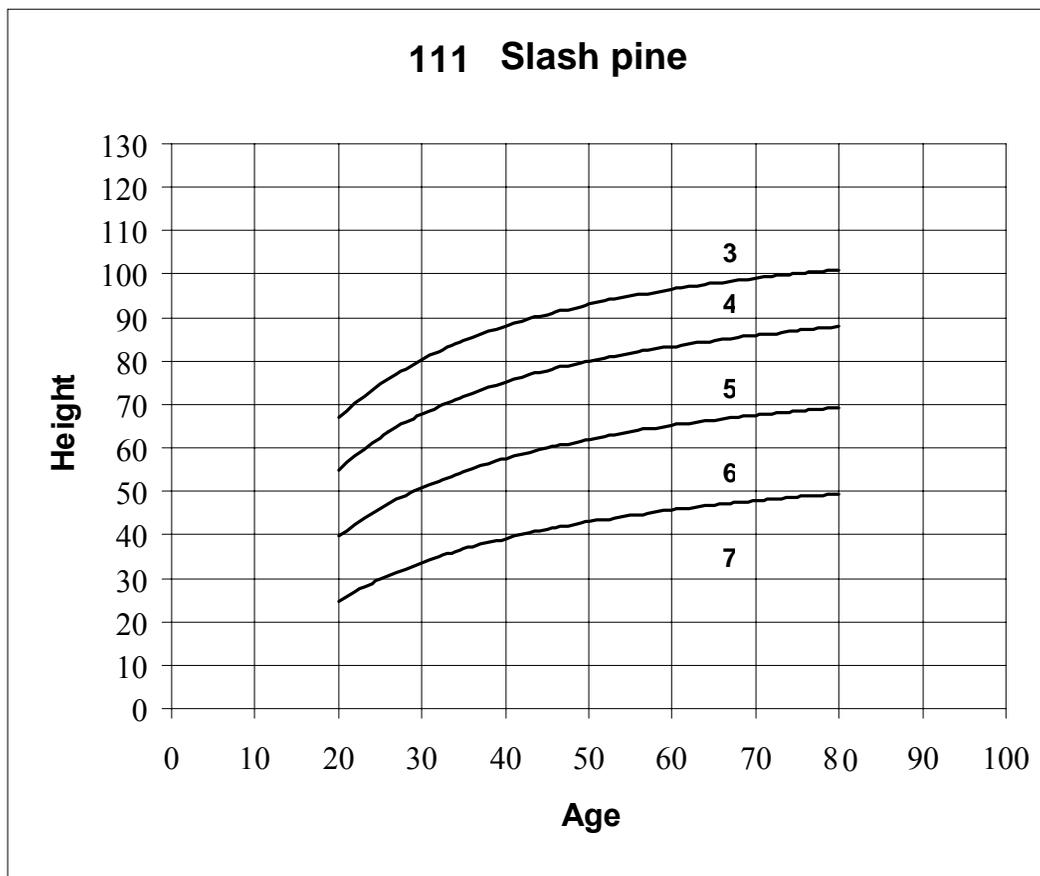
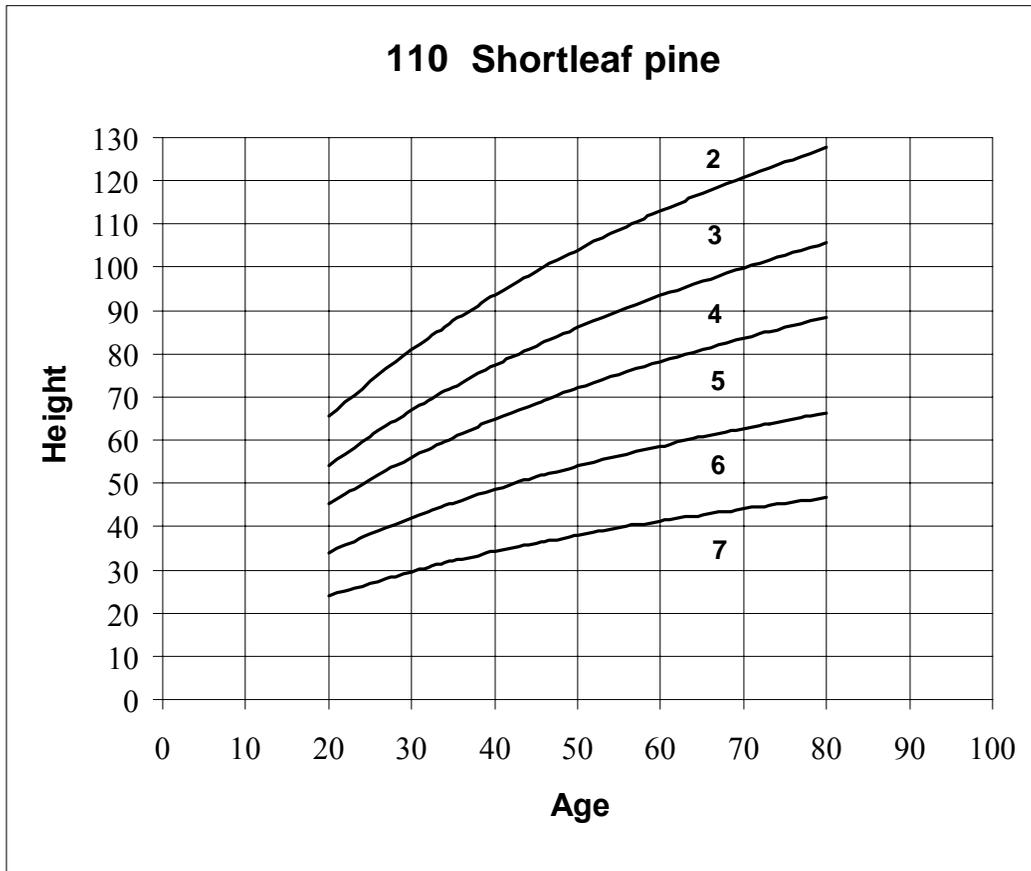
## SOUTHERN U.S. SITE TREE SELECTION CRITERIA

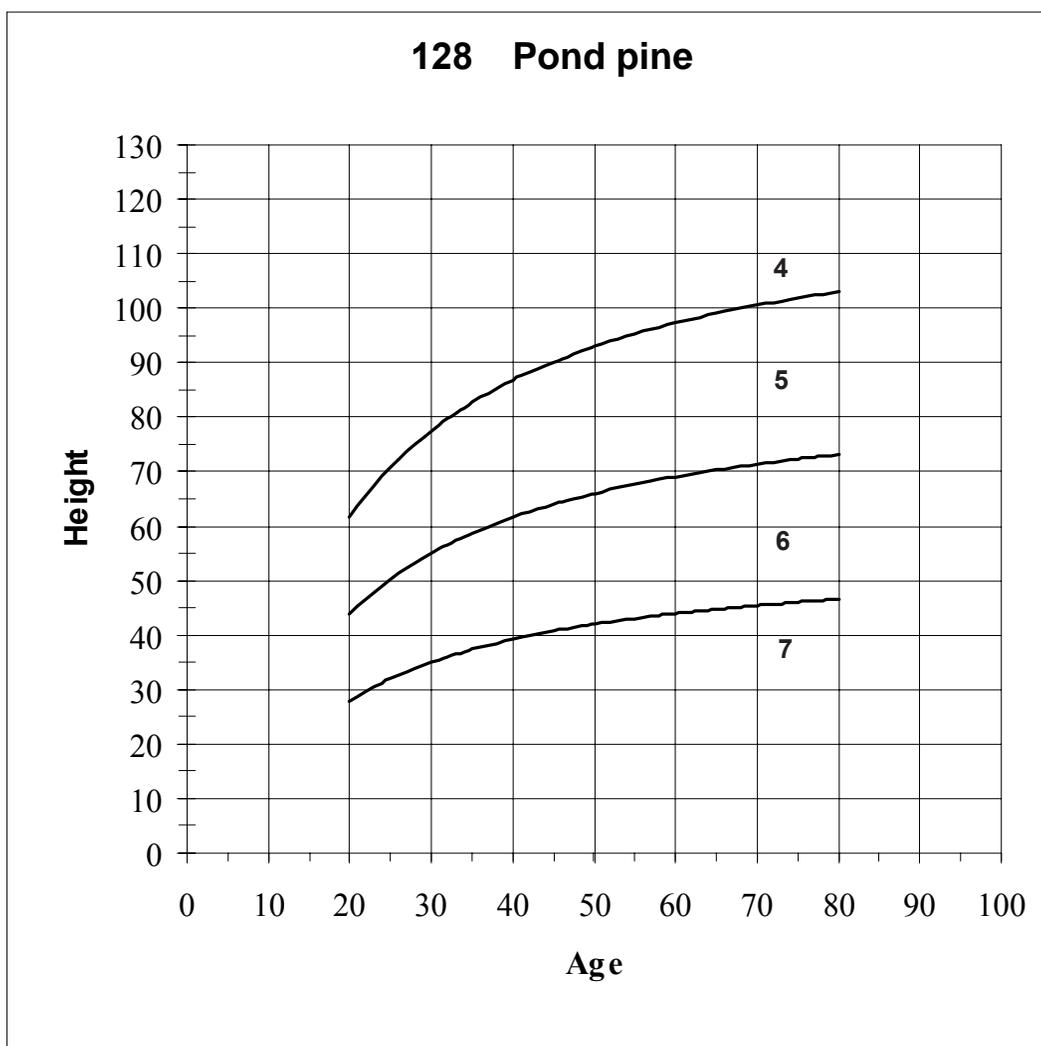
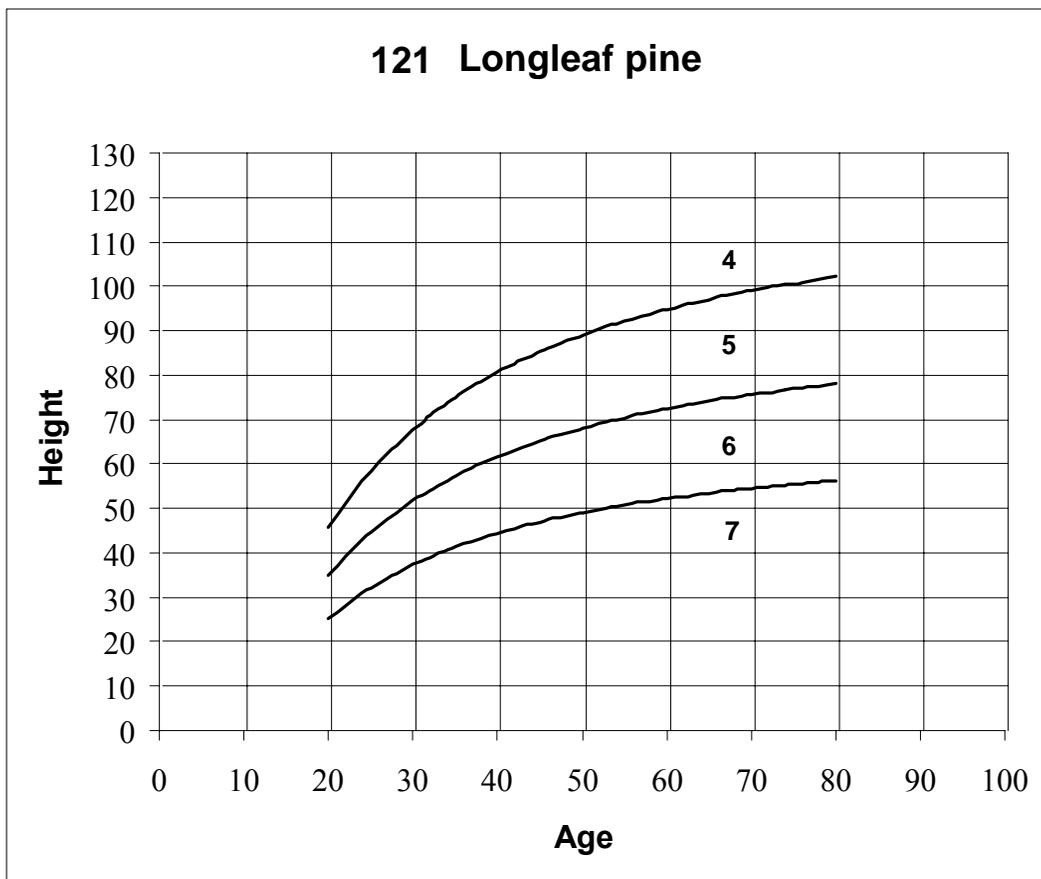
Ideally, site trees in the southern U.S. should be between 20-70 years old. If preferred trees cannot be found in this age range, expand the age range to 15-120 years. Reject trees outside the 15-120 year age range, trees that exhibit signs of damage, trees with ring patterns that show signs of suppression, trees less than 5.0 inches DBH, trees with abnormalities at DBH, and trees with rotten cores. A list of acceptable site tree species is provided below.

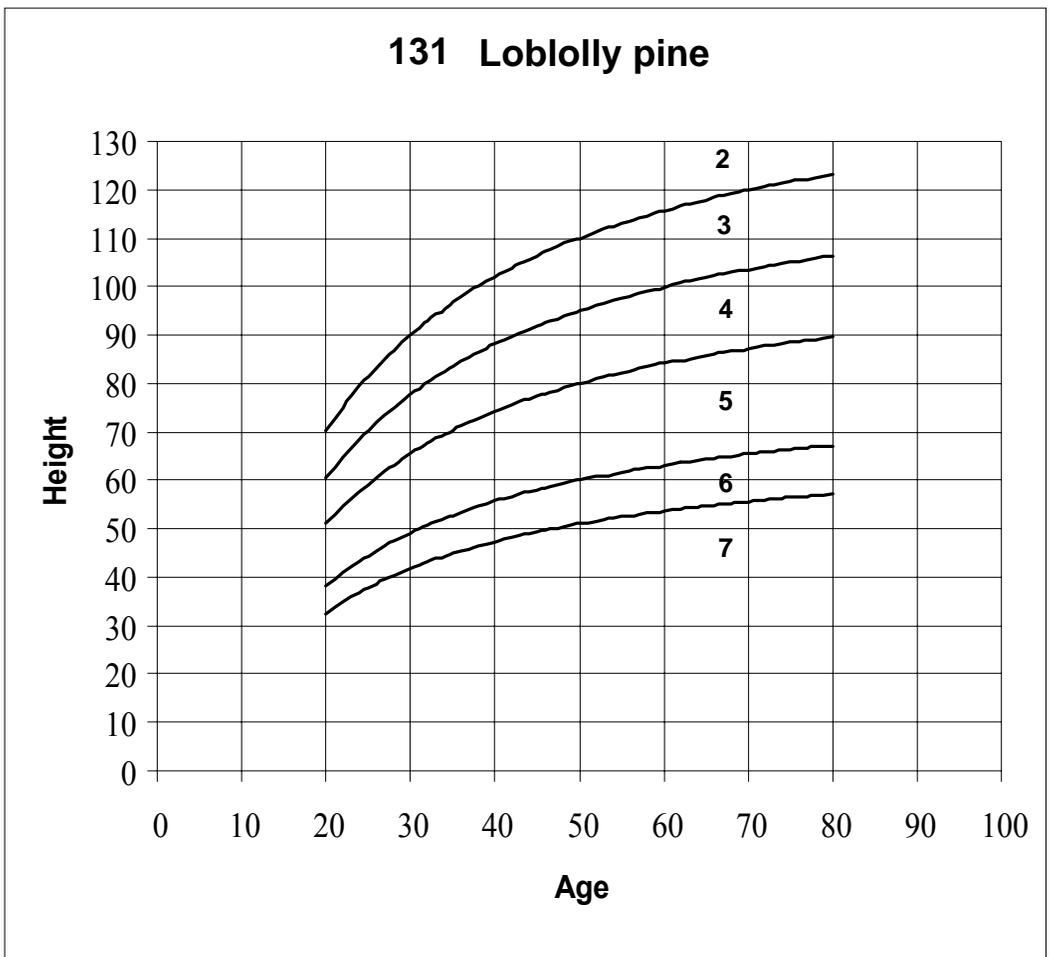
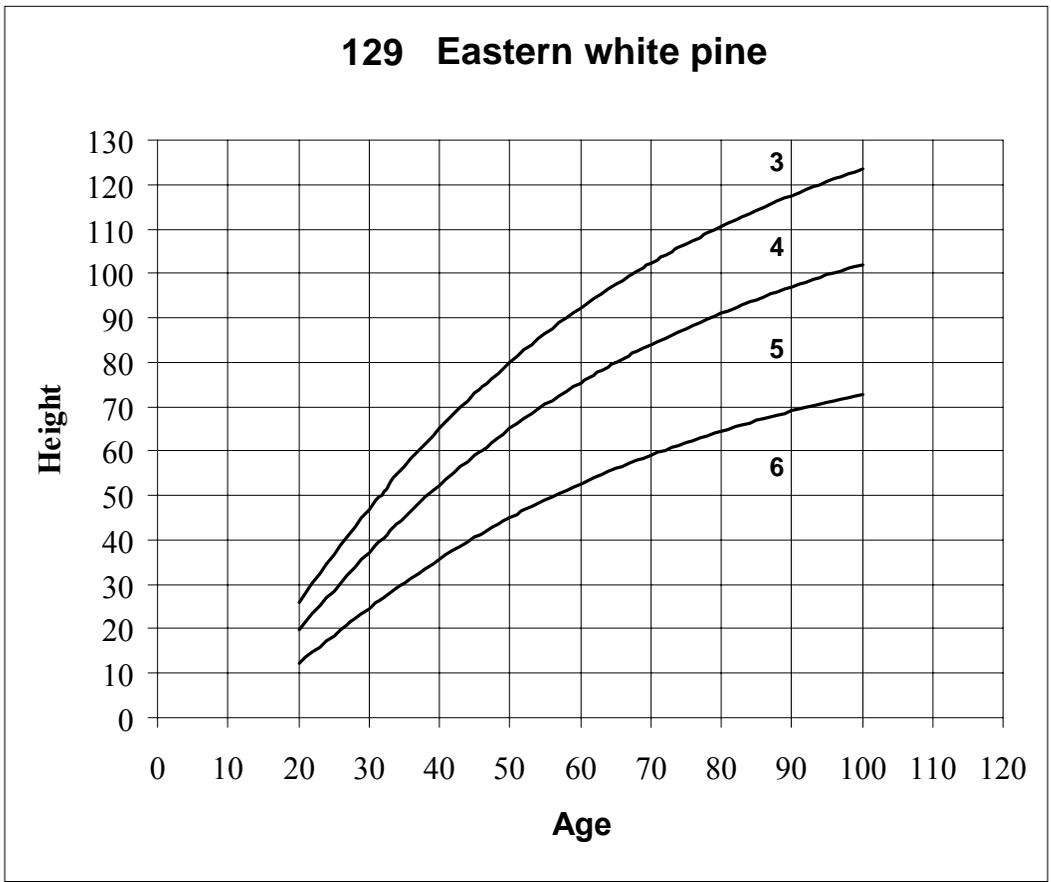
<b>Southern Region Species</b>	
<b>Code</b>	<b>Common Name</b>
<b>-----Softwood Species-----</b>	
043	Atlantic white-cedar
107	sand pine
110	shortleaf pine
111	slash pine
121	longleaf pine
128	pond pine
129	eastern white pine
131	loblolly pine
132	Virginia pine
<b>Code</b>	<b>Common Name</b>
<b>-----Hardwood Species-----</b>	
611	sweetgum
621	yellow-poplar
742	eastern cottonwood
802	white oak
806	scarlet oak
812	southern red oak
813	cherrybark oak
817	shingle oak
827	water oak
830	pin oak
832	chestnut oak
833	northern red oak
835	post oak
837	black oak

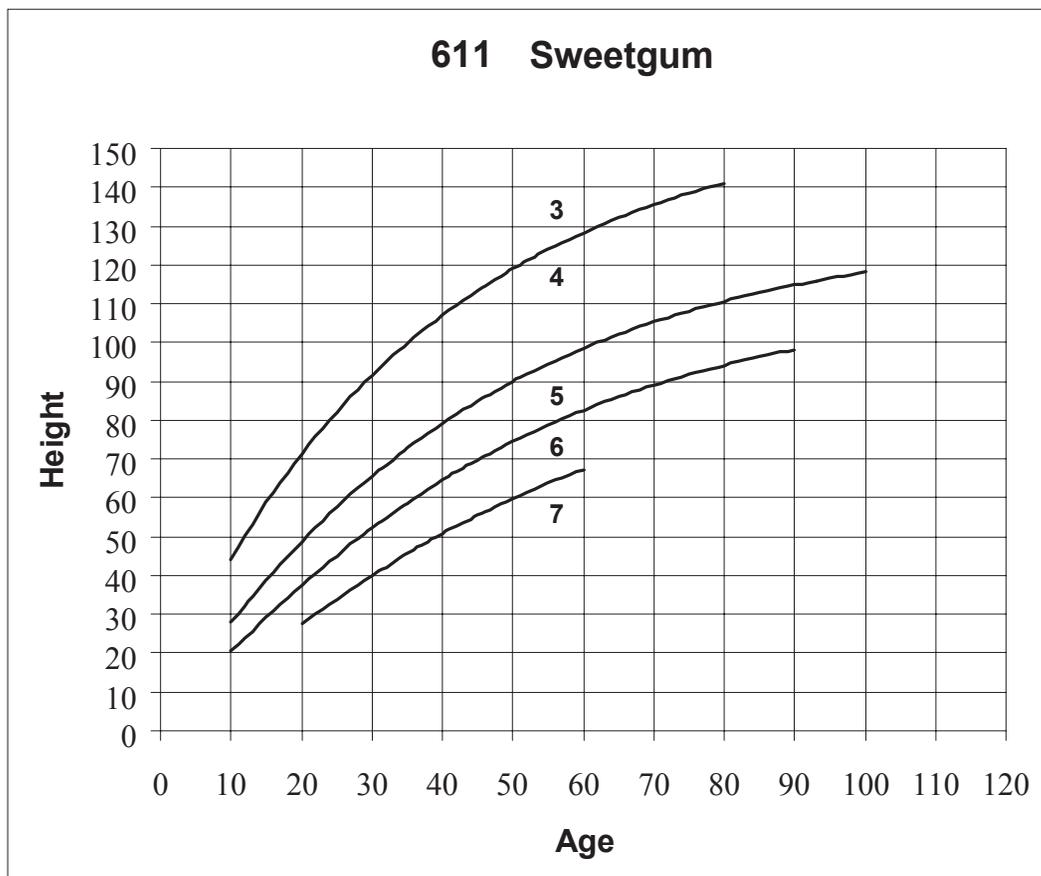
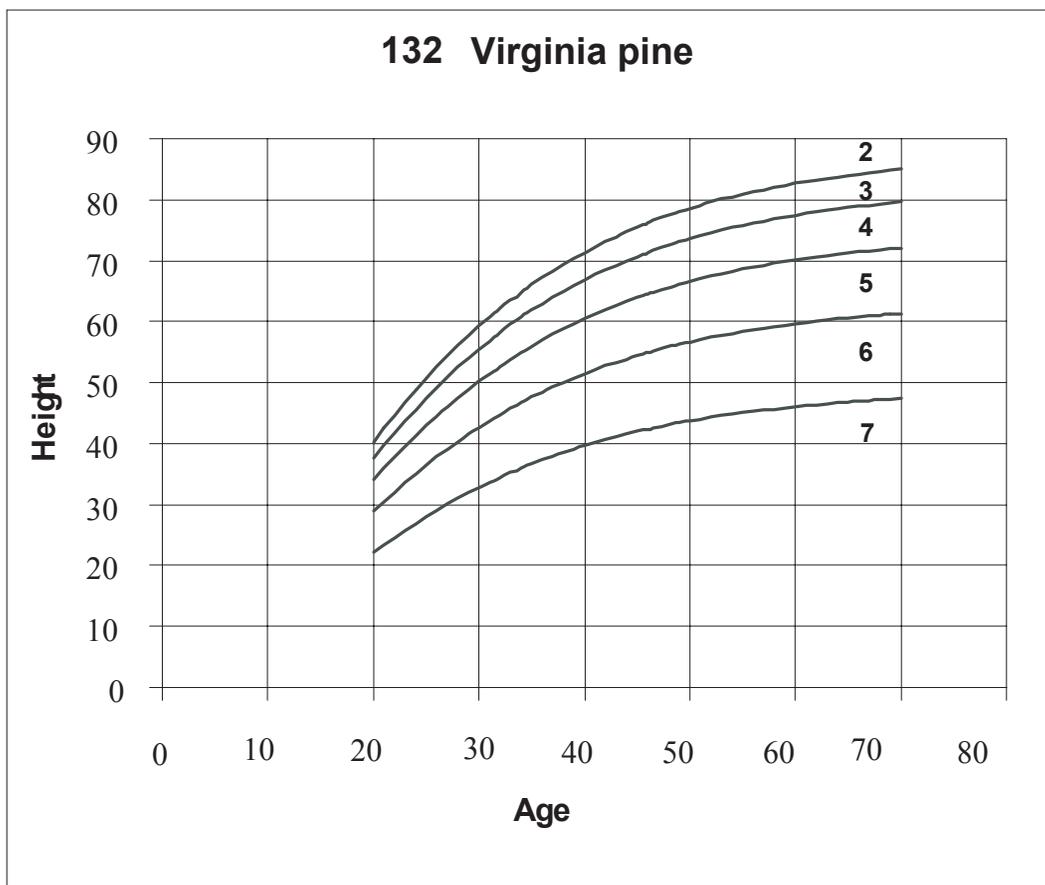
### SITE CLASS CURVES

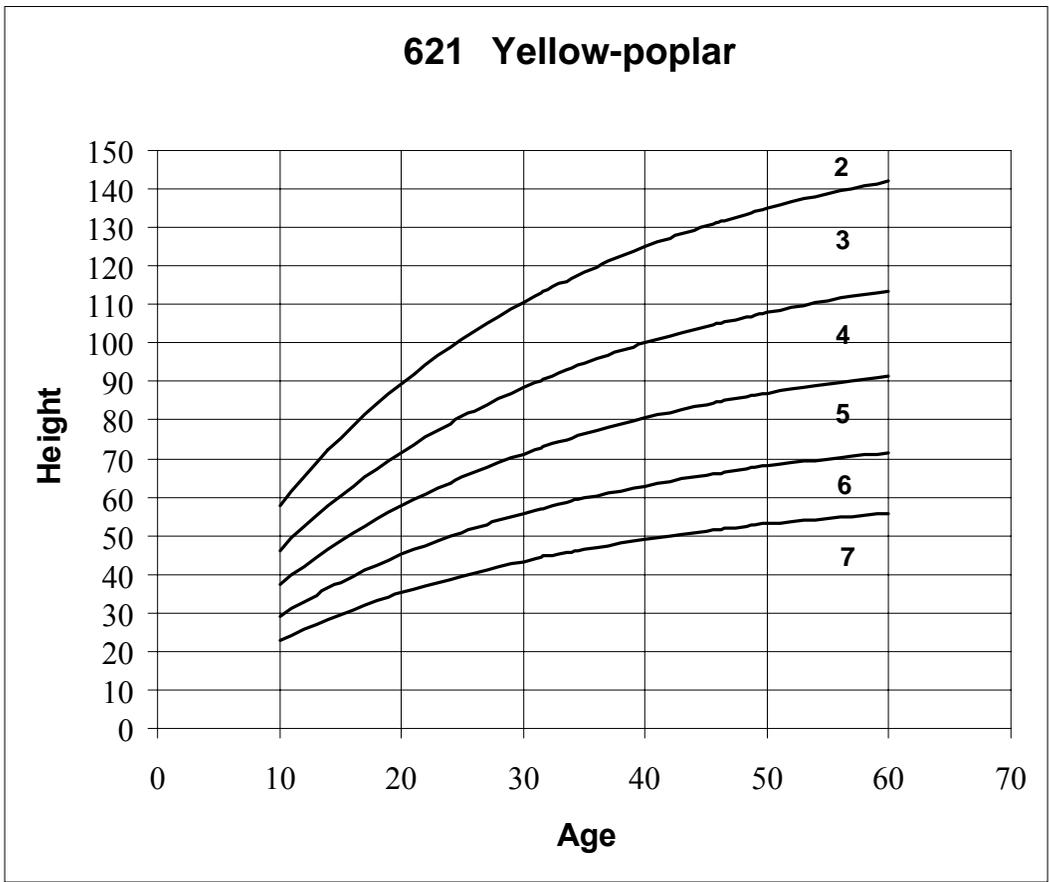


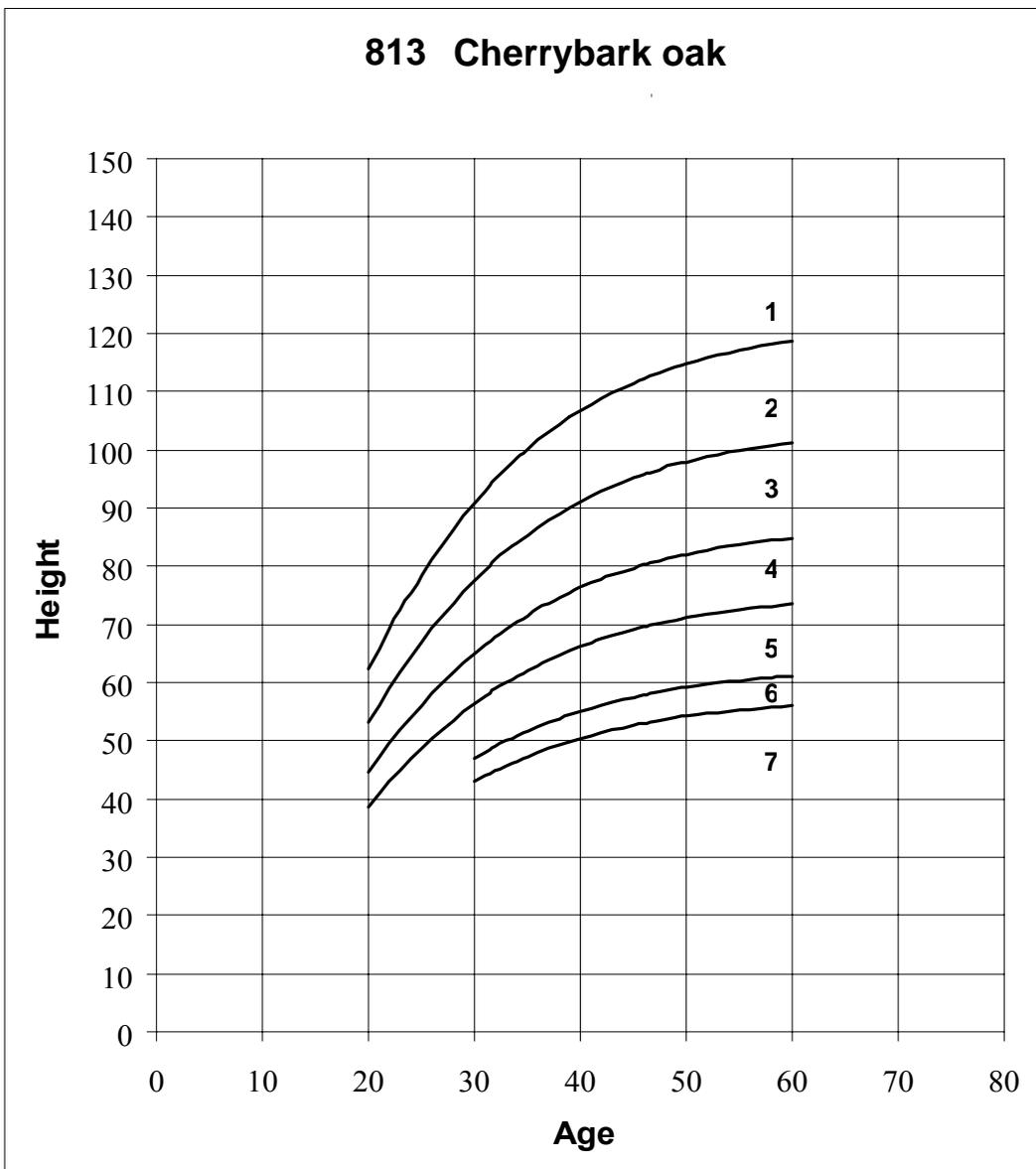
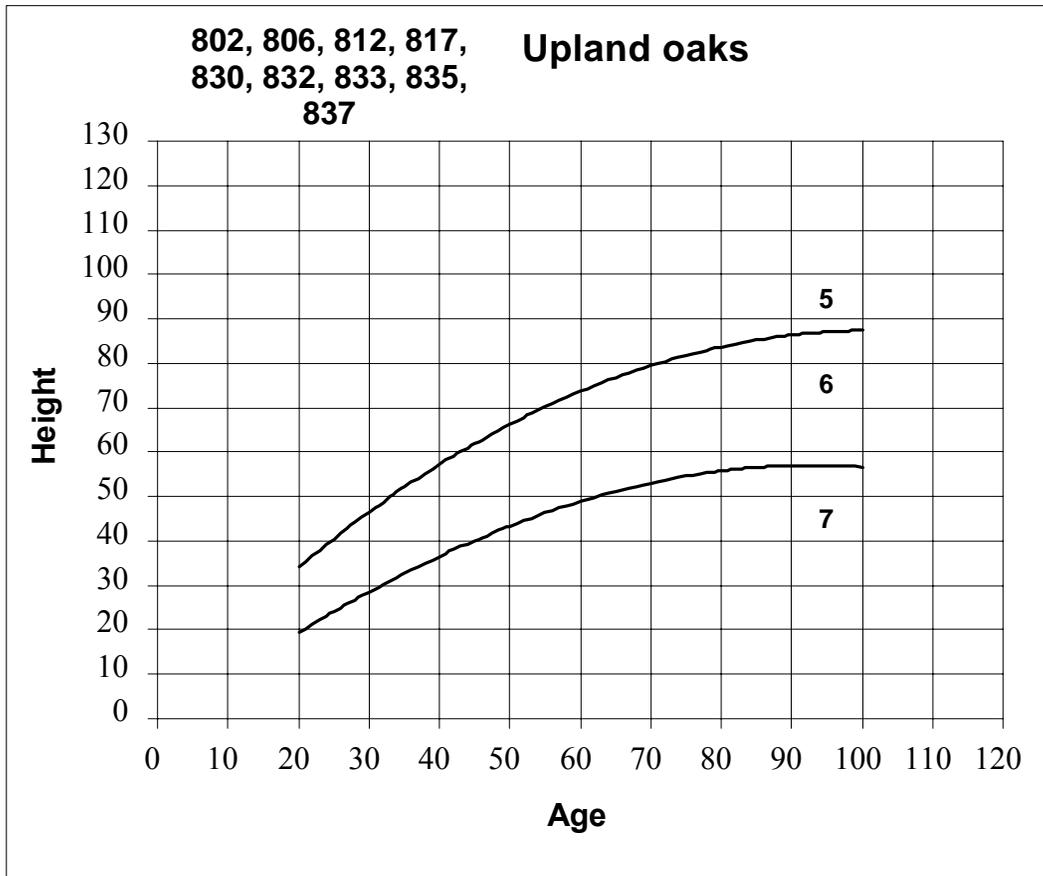


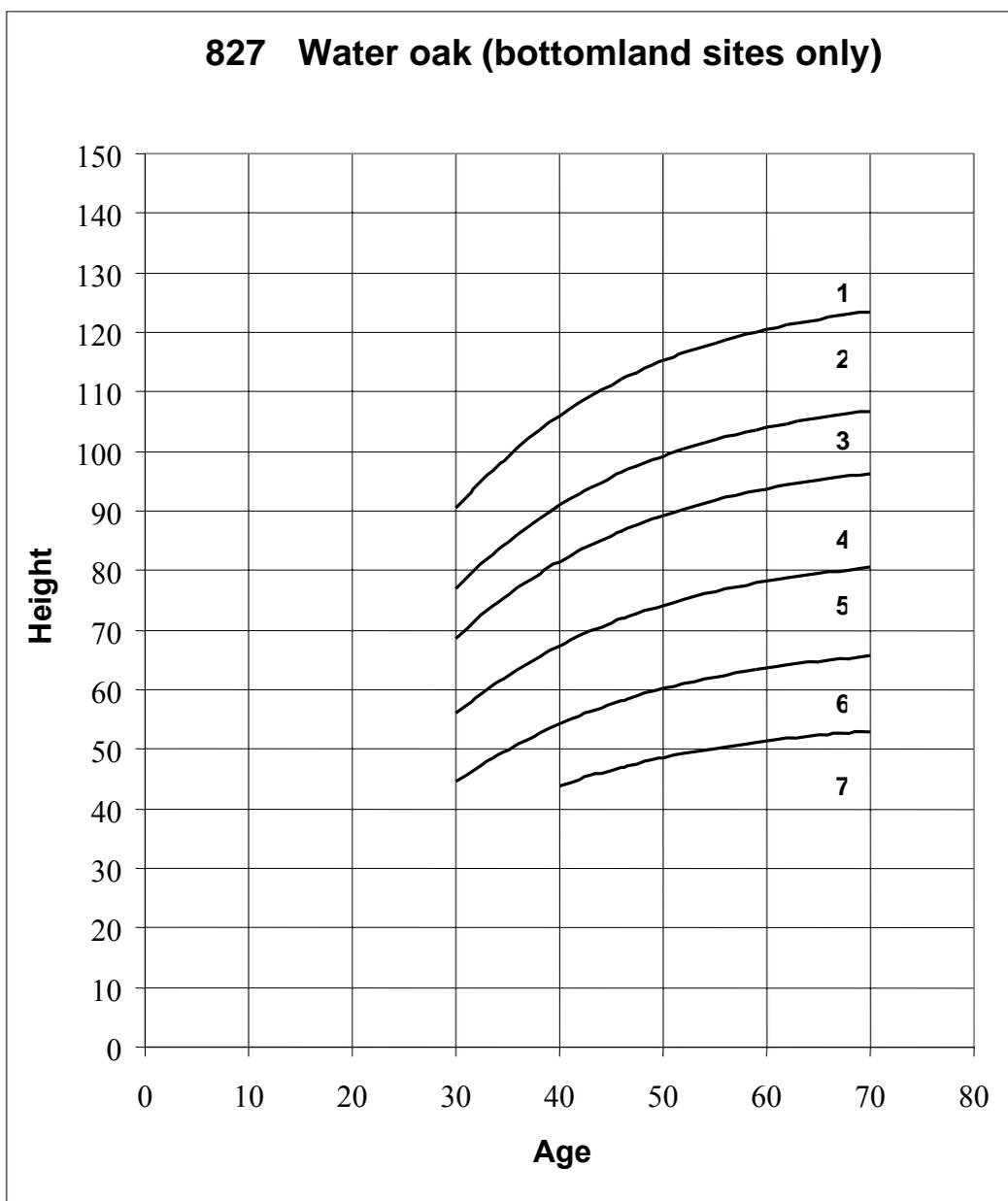














**Appendix 5**  
**Cubic Foot Cull, Board Foot Cull, Tree Grades**



## CUBIC FOOT CULL PROCEDURES

### PERCENT ROTTEN/MISSING CULL (CORE 5.11)

Record the percent rotten or missing cubic-foot cull for all live tally trees  $\geq$  5.0 in DBH.

When Collected: All live tally trees  $\geq$  5.0 in DBH

Field width: 2 digits

Values: 00 to 99

Record the percentage of rotten and missing cubic-foot volume, to the nearest 1 percent. When estimating volume loss (tree cull), only consider the cull on the merchantable bole/portion of the tree, from a 1-ft stump to a 4-inch top. Do not include any cull estimate above actual length.

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.
- 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 in tree (ex. signs, deerstands, fences, etc.)

Cull portions of the tree that contain embedded metal objects (e.g., fencing, nails) and sections between metal objects that are less than 4 feet in length from the stump to the 4in top, (aluminum is okay).

<b>Cubic-Foot Volume of Short Logs</b>										
D.I.B. midpoint	Length of log or section (feet)									
	1	2	3	4	6	8	10	12	14	16
4	0.1	0.2	0.3	0.3	0.5	--	--	--	--	--
5	0.1	0.3	0.4	0.5	0.8	1.1	1.4	1.6	1.9	2.2
6	0.2	0.4	0.6	0.8	1.2	1.6	2.0	2.4	2.7	3.1
7	0.3	0.5	0.8	1.1	1.6	2.1	2.7	3.2	3.7	4.3
8	0.3	0.7	1.0	1.4	2.1	2.8	3.5	4.2	4.9	5.6
9	0.4	0.9	1.3	1.8	2.7	3.5	4.4	5.3	6.2	7.1
10	0.5	1.1	1.6	2.2	3.3	4.4	5.5	6.5	7.6	8.7
12	0.8	1.6	2.4	3.1	4.7	6.3	7.9	9.4	11.0	13.0
14	1.1	2.1	3.2	4.3	6.4	8.6	11.0	13.0	15.0	17.0
16	1.4	2.8	4.2	5.6	8.4	11.0	14.0	17.0	20.0	22.0
18	1.8	3.5	5.3	7.1	11.0	14.0	18.0	21.0	25.0	28.0
20	2.2	4.4	6.5	8.7	13.0	18.0	22.0	26.0	30.0	35.0
22	2.6	5.3	7.9	11.0	16.0	21.0	26.0	32.0	37.0	42.0
24	3.1	6.3	9.4	13.0	19.0	25.0	31.0	38.0	44.0	50.0
26	3.7	7.4	11.0	15.0	22.0	30.0	37.0	44.0	52.0	59.0
28	4.3	8.6	13.0	17.0	26.0	34.0	43.0	51.0	60.0	68.0
30	4.9	9.8	15.0	20.0	30.0	39.0	49.0	59.0	69.0	78.0
32	5.6	11.0	17.0	22.0	34.0	45.0	56.0	67.0	78.0	89.0
34	6.3	13.0	19.0	25.0	38.0	50.0	63.0	76.0	88.0	101.0
36	7.1	14.0	21.0	28.0	42.0	56.0	71.0	85.0	99.0	113.0
38	7.9	16.0	24.0	32.0	47.0	63.0	79.0	94.0	110.0	126.0
40	8.7	18.0	26.0	35.0	52.0	70.0	87.0	105.0	122.0	140.0

## BOARD FOOT CULL PROCEDURES

### PERCENT BOARD FOOT CULL

Record the percentage of rotten and missing board-foot volume, to the nearest 1 percent. When estimating board-foot cull, only consider the cull in the sawlog portion of the tree, from a 1-ft stump to a 7-inch top for pines, from a 1-ft stump to 9-inch top on hardwoods. Do not include any cull estimate above actual length. Board foot cull cannot be coded greater than 67 percent. If the actual amount of board foot cull is greater than 67 percent, then TREE CLASS = 2, and board foot cull is not required.

When collected: live trees with DBH = 9.0 in, SPECIES < 300, and TREE CLASS = 2; live trees with DBH = 11.0 in and TREE CLASS = 2

Field width: 2 digits

Values: 00-67

Board-foot cull is the volume within the entire sawlog portion of all live trees that cannot be recovered for use as lumber because of rot, sweep or crook, or other defect. Cull volume includes the entire volume of sections that do not meet minimum log grade requirements. This includes all sections less than 8 feet in length and the cull volume within sawlogs. Board foot cull is assigned for those trees receiving a tree grade, according to the section length (in feet), from a 1-foot stump to a 7-inch top in softwood or 9 inch top in hardwood.

#### Sweep and Crook

Estimate the length, small-end DIB, and sweep or crook departure of the affected section. If the length is 6 feet or less, treat as crook. To determine board-foot deduction, see the tables for sweep and crook in the appendix. If sweep or crook is so excessive that the section is cull, record the entire volume of the section as cull. This is the area within the heavy black lines of the sweep/crook tables.

#### Other Board-Foot Cull

Determine the length and the small-end DIB of the section containing decay, missing wood, fork, etc. Estimate the percentage of the section that is unusable for lumber, ties, or timber, ignoring cull defect that could normally be removed in slabbing. Apply this percentage to the total volume contained in the section, as shown in the board foot cull table.

#### Sawlog Stoppers

Measure the main stem to the point above which no sawlog can be produced to meet log grade standards (size and soundness) and to a minimum top of 7.0 inches DOB for softwoods and 9.0 inches DOB for hardwoods.

The sawlog cannot extend above a point where taper becomes excessive as evidenced by:

- (1) A fork with less than 8 foot sawlog above it (12 feet if this is the only log in the tree)
- (2) A limb with a base diameter equal to one half or more of the stem diameter below the limb, or a group of smaller limbs 2.0 inches or larger within a 1 foot section with equivalent diameter which collectively influence taper to the same degree.

Sawlog length should not extend above a sawlog section that does not meet minimum grade specifications and which has less than 8 feet of sawlog length above it (12 feet if this is the only log in the tree).

<b>Board-Foot Volume of Short Logs</b>										
DIB small end	Length of log or section (feet)									
	1	2	3	4	6	8	10	12	14	16
6	1	2	2	3	5	8	10	13	16	19
7	1	3	4	5	8	12	15	19	24	28
8	2	4	6	8	12	17	22	27	33	39
9	3	5	8	10	16	22	29	36	43	51
10	3	7	10	13	21	29	37	46	55	65
11	4	9	13	17	26	36	46	57	68	80
12	5	10	16	21	32	44	57	69	83	97
13	6	13	19	25	39	53	68	83	99	115
14	8	15	23	30	46	63	80	98	117	136
16	10	20	31	41	62	84	108	131	158	181
18	13	26	40	53	81	109	139	169	200	232
20	17	33	50	67	102	137	174	212	251	290
22	21	41	62	82	125	169	214	259	306	354
24	25	50	74	99	151	203	257	311	368	424
26	29	59	88	118	179	241	304	368	435	501
28	35	69	104	138	210	281	356	430	507	584
30	40	80	120	160	243	325	411	497	585	674
32	46	92	137	183	278	373	470	568	669	770
34	52	104	156	208	316	423	534	644	758	872
36	59	117	176	235	356	477	601	725	853	981
38	66	132	197	263	398	533	672	811	954	1096
40	73	146	220	293	443	593	747	902	1060	1218

Crook Deduction in Board Feet															
Crook departure (inches)	Crook length (feet)	Scaling diameter of section with crook (inches)													
		6	7	8	9	10	12	14	16	18	20	22	24	26	28
1	1	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	2	0	0	0	1	1	1	1	1	1	2	2	2	2	2
	3	1	1	1	1	1	1	2	2	2	2	3	3	3	4
	4	1	1	1	1	1	2	2	3	3	4	4	4	5	6
	6	1	1	2	2	2	3	3	4	5	5	6	6	7	8
2	1	0	0	0	1	1	1	1	1	1	2	2	2	2	3
	2	1	1	1	1	1	2	2	2	3	3	4	4	4	5
	3	1	1	2	2	2	3	3	4	4	4	6	6	7	7
	4	1	1	2	2	3	3	4	5	6	7	8	8	9	10
	6	2	2	3	4	4	5	7	8	9	10	13	13	14	15
3	1	0	0	1	1	1	1	2	2	2	3	3	3	3	4
	2	1	1	2	2	2	2	3	4	4	5	5	6	7	7
	3	1	2	2	3	3	4	5	6	7	8	8	9	10	11
	4	2	2	3	3	4	5	6	8	9	10	10	12	13	15
	6	2	3	4	4	5	6	8	10	11	13	13	16	17	19
4	1	1	1	1	1	1	2	2	3	3	4	4	4	4	5
	2	1	2	2	2	3	3	4	5	6	7	7	8	9	10
	3	1	2	3	3	4	5	7	8	9	10	10	12	13	15
	4	2	3	4	3	5	7	9	10	12	13	13	17	18	20
	6	3	5	6	7	8	11	13	15	18	20	20	25	27	30
5	1	-	-	1	2	2	2	3	3	4	4	4	5	6	6
	2	-	-	2	3	4	4	5	6	7	8	8	10	11	12
	3	-	-	4	4	5	7	8	10	11	12	12	16	17	19
	4	-	-	5	6	6	9	11	13	15	17	17	21	22	25
	6	-	-	8	9	10	13	16	19	23	26	26	32	34	36
6	1	-	-	-	2	2	2	3	4	4	5	5	6	7	8
	2	-	-	-	3	4	5	6	7	9	10	10	13	13	15
	3	-	-	-	4	6	8	10	12	13	15	15	19	20	22
	4	-	-	-	7	8	10	13	15	18	20	20	25	27	30
	6	-	-	-	9	10	13	16	19	23	25	25	32	34	38
8	1	-	-	-	-	-	3	5	5	6	7	7	8	9	10
	2	-	-	-	-	-	7	9	10	12	13	13	17	18	20
	3	-	-	-	-	-	10	13	16	18	20	20	25	27	30
	4	-	-	-	-	-	14	17	20	24	27	27	33	36	40
	6	-	-	-	-	-	17	22	26	30	34	34	42	45	50
10	1	-	-	-	-	-	-	-	6	7	8	8	10	11	12
	2	-	-	-	-	-	-	-	12	14	16	16	21	23	25
	3	-	-	-	-	-	-	-	19	22	25	25	31	34	37
	4	-	-	-	-	-	-	-	26	29	34	34	41	45	49
	6	-	-	-	-	-	-	-	32	37	42	42	52	57	62
	6	-	-	-	-	-	-	-	39	45	51	51	63	69	75

Sweep Deduction in Board Feet															
Sweep departure (inches)	Sweep length (feet)	Scaling diameter of section with sweep (inches)													
		6	7	8	9	10	12	14	16	18	20	22	24	26	28
2	6	1	1	2	2	3	3	4	5	6	6	7	8	9	9
	8	1	1	2	2	3	4	5	5	6	7	8	8	9	10
	10	1	1	2	2	3	4	4	5	6	7	7	8	9	10
	12	1	1	2	2	2	3	4	4	5	6	6	6	7	8
	14	1	1	1	1	1	2	2	2	3	3	3	4	4	5
	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	6	2	3	3	5	5	6	7	9	10	11	13	14	15	17
	8	2	3	4	6	6	7	9	10	12	14	15	17	19	20
	10	2	4	5	6	6	8	10	12	13	15	17	19	20	22
	12	3	4	5	7	7	9	11	12	14	16	18	19	21	23
	14	3	4	5	7	7	9	10	12	14	16	17	19	21	23
	16	3	4	5	6	6	8	10	11	13	14	16	18	19	21
4	6	3	4	5	6	7	8	11	13	15	17	18	20	22	24
	8	4	5	6	7	9	11	14	16	18	21	23	25	28	30
	10	5	6	8	9	10	13	16	19	21	24	27	29	32	35
	12	5	7	8	10	12	14	18	20	23	26	29	32	35	38
	14	6	8	9	11	12	16	19	22	25	28	31	35	38	41
	16	6	8	10	11	13	16	19	23	26	29	32	35	39	42
5	6	-	5	6	8	9	11	14	16	19	22	24	27	29	32
	8	5	7	8	10	12	15	18	21	24	27	31	34	37	40
	10	6	8	10	12	14	18	21	25	29	33	36	40	44	48
	12	8	10	12	12	16	20	25	29	33	37	41	45	50	54
	14	9	11	13	16	18	22	27	32	36	41	45	50	54	59
	16	10	12	15	17	20	24	29	34	39	44	48	53	58	63
6	6	-	-	8	9	11	14	17	20	24	27	30	33	36	39
	8	-	-	11	12	14	18	22	26	30	34	38	42	46	50
	10	-	10	13	15	18	23	27	32	36	41	46	51	56	60
	12	-	12	15	18	21	26	32	37	42	48	53	58	64	69
	14	11	15	18	20	23	29	36	41	47	53	59	65	71	77
	16	13	16	20	23	26	32	39	45	52	58	64	71	77	83
7	6	-	-	-	11	13	16	21	24	28	32	36	39	43	47
	8	-	-	-	15	17	22	27	31	36	41	46	51	56	60
	10	-	-	-	19	21	27	33	39	44	50	56	62	67	73
	12	-	-	-	22	25	32	39	45	52	58	65	71	78	84
	14	-	-	-	25	29	36	44	51	58	66	73	81	88	95
	16	-	-	24	28	33	40	49	57	64	72	80	88	96	104
8	6	-	-	-	-	-	19	24	28	33	37	41	46	50	54
	8	-	-	-	-	-	25	31	37	42	48	54	59	65	70
	10	-	-	-	-	25	32	39	46	52	59	66	72	79	86
	12	-	-	-	-	30	37	46	53	61	69	76	84	92	100
	14	-	-	-	-	34	43	52	61	69	78	87	96	105	113
	16	-	-	-	34	39	48	58	68	77	87	97	106	116	125
9	6	-	-	-	-	-	-	27	32	37	42	47	52	57	62
	8	-	-	-	-	-	29	36	42	48	55	61	68	74	80
	10	-	-	-	-	-	37	44	52	60	67	75	83	91	99
	12	-	-	-	-	-	43	52	61	70	80	88	97	106	115
	14	-	-	-	-	-	50	61	71	81	91	101	111	121	131
	16	-	-	-	-	-	57	68	79	90	102	113	124	135	146

## TREE GRADE PROCEDURES

### HARDWOOD TREE GRADES

<b>HARDWOOD TREE GRADES</b>			
<b>GRADING FACTORS</b>	<b>GRADE 1</b>	<b>GRADE 2</b>	<b>GRADE 3</b>
Length of grading zone (ft)	Butt 16	Butt 16	Butt 16
Length of grading section <sup>a</sup> (ft)	Best 12	Best 12	Best 12
Minimum DBH (in)	16 <sup>b</sup>	13	11
Minimum DIB at the top of the grading section (in)	13 <sup>b</sup> 16 20	11 <sup>c</sup> 12	8
Clear cuttings on 3rd best face <sup>d</sup> minimum length (ft)	7 5 3	3 3	2
number on face (max)	2	2 3	unlimited
yield in face length (min)*	5/6	4/6	3/6
Cull deduction, including crook and sweep but excluding shake, maximum w/in grading section (%)	9	9 <sup>e</sup>	50

<sup>a</sup> Whenever a 14- or 16-ft section of the butt log is better than the best 12-ft section, the grade of the longer section will become the grade of the tree. This longer section, when used, is the basis for determining the grading factors, such as diameter and cull deduction.

<sup>b</sup> In basswood and ash, DIB at the top of the grading section may be 12-in and DBH may be 15-in.

<sup>c</sup> Grade 2 trees can be 10-in DIB at the top of the grading section if otherwise meeting surface requirements for small grade 1's.

<sup>d</sup> A clear cutting is a portion of a face free of defects, extending the width of the face. A face is one-fourth of the surface of the grading section as divided lengthwise.

<sup>e</sup> 15% crook and sweep, or 40% total cull deduction are permitted in grade 2 if size and surface of grading section qualify as grade 1. If rot shortens the required clear cuttings to the extent of dropping the butt log to grade 2, do not drop the tree's grade to 3 unless the cull deduction for rot is greater than 40%.

<b>*Minimum Yield in Face Length</b>			
Face Length	Grade 1 Min. Yield	Grade 2 Min. Yield	Grade 3 Min. Yield
12-ft	10-ft	8-ft	6-ft
14-ft	11.7-ft	9.3-ft	7-ft
16-ft	13.3-ft	10.7-ft	8-ft

<b>HARDWOOD TIE AND TIMBER GRADE 4</b>	
<b>GRADING FACTORS</b>	<b>SPECIFICATIONS</b>
Length of grading zone (ft)	Butt 16
Scaling diameter (in)	8-in DIB and larger
Length, w/o trim (ft)	12-ft and longer
Clear cuttings	No requirements (not graded on cutting basis)
Maximum sweep allowance	One-fourth DIB of small end for half logs, and one-half DIB for logs 16-ft long
Sound surface defects -	
Single knots	Any number, if none has an average collar <sup>a</sup> diameter that is more than one-third of the log diameter at the point of occurrence.
Whorled knots	Any number, provided the sum of the collar diameters does not exceed one-third the log diameter at the point of occurrence.
Knots	Any number not exceeding knot specifications, if they do not extend more than 3-in into the contained tie or timber.
Unsound surface defects <sup>b</sup>	Any number and size, if they do not extend into contained tie or timber. If they extend into contained tie or timber, they shall not exceed size, number, and depth of limits for sound defects.

<sup>a</sup> Knot collar is the average of the vertical and horizontal diameters of the limb, or knot swelling, as measured flush with the surface of the log.

<sup>b</sup> Interior defects are not visible in standing trees. They are considered in grading cut logs. No interior defects are permitted except one shake not more than one-third the width of the contained tie or timber, and one split not more than 5-in long.

### **HARDWOOD TREE GRADE 5**

Record TREE GRADE 5 for hardwood species that do not meet the length of grading zone requirement for TREE GRADE 1-4, but do have either an upper 12-foot log or 2 non-contiguous 8-foot logs, and the total board foot cull deduction is less than 67%.

These logs must still meet the size, soundness and surface yield requirements for a grade 1-4 log. The only difference is that the length of the grading zone extends beyond the butt 16-foot log.

Since these logs are in the upper portion of the tree, determining the surface yield is impractical. When determining if TREE GRADE = 5, simply make sure the log appears to meet the size and soundness requirements of a TREE GRADE 4 (no internal rot). If it is clear the upper log does have internal rot, then it must be examined further to determine if it can at least meet the size, soundness and surface yield requirements of a TREE GRADE 3 (the log must be at least 8 inches DIB, with no more than 50% board foot cull in the section, at least 3/6 of the section length clear of defects, and at least 2 feet between defects.)

Log abnormalities that are defects in factory logs include the following:

Adventitious bud clusters	Limb
Bulge, butt or stem	Knots
High bumps	Knot overgrowths
Burl	Low bumps
Butt scar	Overgrowths following insect damage or bird peck*
Canker	Seams, if not superficial
Conk	Wounds extending into the bole
Flutes, if not superficial	
Holes extending into the bole	
Embedded metal (fence)	

Bird pecks: There must be four bird pecks within a square foot to affect the tree grade. First, determine the tree grade without the bird pecks. If the tree grade is determined to be 1 or 2, then down grade the tree by one grade. If the tree graded out to be a 3 or 4 without the bird pecks, then ignore them as defects and record the initial tree grade.

Abnormalities not ordinarily limiting cuttings are butt swell, flanges and surface rise.

## SOUTHERN PINE TREE GRADES

SOUTHERN PINE TREE GRADES			
All pines except eastern white pine. Includes eastern red cedar.			
FACE LENGTH	GRADE 1	GRADE 2	GRADE 3
Butt 16-ft*	3 or 4 clear faces	1 or 2 clear faces	No clear faces

After the tentative grade is established, the tree will be **reduced one grade** for each of the following:

**Sweep** - Degrade any tentative Grade 1 or 2 tree one grade if sweep in the lower 12-ft of the grading section amounts to 3 or more inches and equals or exceeds one-fourth the DBH.

**Heart rot** - Degrade any tentative Grade 1 or 2 tree one grade if conks, punk knots, or other evidence of advanced heart rot is found anywhere on the tree stem.

**Note** - No tree can be degraded below Grade 3, provided the total scaling deductions for sweep and/or rot do not exceed two-thirds the gross scale of the tree. Trees with total scaling deductions in excess of two-thirds are classified as cull (Tree Class 3 or 4).

A face is one-fourth the circumference of the 16-ft grading section and extends the full length of the grading section. Clear faces are those free from knots measuring more than 1/2-in in diameter, overgrown knots of any size, and holes more than 1/4-in in diameter. Faces may be rotated, if necessary, to obtain the maximum number of clear faces on the grading section.

\*Note: Only grade the length of the log up to a 7-inch top DOB. The 7-inch top DOB must be between 12 and 16 feet off of the 1-ft stump to be TREE CLASS 2.

### SOUTHERN PINE Tree Grade 5

Record TREE GRADE 5 for southern pine species that do not have a 12-foot log in the butt 16-foot grading section due primarily to poor form, but do have either an upper 12-foot log or 2 non-contiguous 8-foot logs, and the total board foot cull deduction is less than 67%.

## EASTERN WHITE PINE TREE GRADES

EASTERN WHITE PINE TREE GRADES				
GRADING FACTORS	GRADE 1	GRADE 2	GRADE 3	GRADE 4
Minimum DBH (in)	9	9	9	9
Maximum weevil injury in butt 16-ft section (number)	None	None	2 Injuries	No limit
Minimum face requirements on butt 16-ft section	Two full length or four 50% length good faces <sup>1</sup> . (In addition, knots on balance of faces shall not exceed size limitations for Grade 2 sections.)	NO GOOD FACES REQUIRED. Maximum diameter of knots on 3 best faces: <b>SOUND RED KNOTS</b> not to exceed 1/6 of scaling diameter or 3-in maximum <sup>2</sup> . <b>DEAD OR BLACK KNOTS</b> , including overgrown knots, not to exceed 1/12 scaling diameter and 1-1/2-in maximum.	NO GOOD FACES REQUIRED. Maximum diameter of knots on 3 best faces: <b>SOUND RED KNOTS</b> not to exceed 1/3 of scaling diameter of 5-in maximum <sup>2</sup> . <b>DEAD OR BLACK KNOTS</b> , including overgrown knots, not to exceed 1/6 scaling diameter and 2-1/2 in maximum.	Includes all trees not qualifying for Grade 3 or better and judged to have at least 1/3 of their gross volume in sound wood suitable for manufacture into standard lumber.
Maximum sweep or crook in butt 16-ft section (%)	20	30	40	No limit
Maximum total scaling deduction in 16-ft section (%)	50	50	50	No limit

After the tentative grade of the section is established from face examination, the section will be **reduced one grade** whenever the following defects are evident<sup>3</sup>:

**CONKS, PUNK KNOTS AND PINE BORER DAMAGE ON THE SURFACE OF THE SECTION**  
 Degrade one grade if present on one face.  
 Degrade two grades if present on two faces.  
 Degrade three grades if present on three to four faces.

If the final grade of the grading section is 1, 2 or 3, examine the tree for weevil injuries in the merchantable stem **above** 16-ft. If the total apparent weevil damage exceeds 3, degrade the tree grade one below the section grade<sup>3</sup>. Otherwise the tree grade is the same as the final section grade.

<sup>1</sup> Trees under 16-in DBH require four full length good faces.

<sup>2</sup> Scaling diameter is estimated at the top of the 16-ft grading section.

<sup>3</sup> No tree will be designated below Grade 4 unless net tree scale is less than one-third of gross tree scale.

<b>White Pine Collar Diameter Limits for Red &amp; Black Knots</b>			
<b>Scaling Diameter (DIB in)</b>	<b>Black Knots 1/12</b>	<b>Black &amp; Red Knots 1/6</b>	<b>Red Knots 1/3</b>
7	7/12"	1-1/6"	2-1/3"
8	2/3"	1-1/3"	2-2/3"
9	3/4"	1-1/2"	3"
10	5/6"	1-2/3"	3-1/3"
11	11/12"	1-5/6"	3-2/3"
12	1"	2"	4"
13	1-1/12"	2-1/6"	4-1/3"
14	1-1/6"	2-1/3"	4-2/3"
15	1-1/4"	<b>2-1/2" Black Max</b>	<b>5" Max</b>
16	1-1/3"	2-2/3"	<b>5" Max</b>
17	1-5/12"	2-5/6"	<b>5" Max</b>
18	<b>1-1/2" Max</b>	<b>3" Red Max</b>	<b>5" Max</b>

### **EASTERN WHITE PINE TREE GRADE 5**

Record TREE GRADE 5 for eastern white pine trees that do not have a 12-foot log in the butt 16-foot grading section due primarily to poor form, but do have either an upper 12-foot log or 2 non-contiguous 8-foot logs, and the total board foot cull deduction is less than 67%.

*SPRUCE, FIR, CEDAR (not eastern red) TAMARACK AND HEMLOCK*

<b>SPRUCE, FIR, CEDAR, TAMARACK AND HEMLOCK</b>				
<b>Minimum Merchantability Specifications for Grade 1</b>				
<b>DIB (small end of log)</b>	<b>Length (2-ft multiples w/o trim)</b>	<b>Total Deduction</b>	<b>Sweep Permitted</b>	<b>Other Requirements*</b>
6" - 12"	12' - 16'	50%	25%	Not more than one sound knot or branch greater than 2" in diameter.
13" +	12' - 16'	50%	25%	Not more than one sound knot or branch greater than 3" in diameter.

If the tree does not meet the specifications for a grade 1, but does have a 12-foot log in the butt 16-foot section, then record TREE GRADE = 4.

**SPRUCE, FIR, CEDAR (not eastern red) TAMARACK AND HEMLOCK  
TREE GRADE 5**

Record TREE GRADE 5 for trees that do not have a 12-foot log in the butt 16-foot grading section due primarily to poor form, but do have either an upper 12-foot log or 2 non-contiguous 8-foot logs, and the total board foot cull deduction is less than 67%.

**APPENDIX 6**  
**STOCKING TABLES**



## **APPENDIX 7**

### **GLOSSARY**

## Appendix 7. Glossary

**Accessible Forest Land** – Land that is within sampled area (the population of interest), is accessible and can safely be visited and meets the following criteria:

the condition is at least 10-percent stocked by trees (appendix 3) of any size or has been at least 10-percent stocked in the past. Additionally, the condition is not subject to nonforest use(s) that prevent normal tree regeneration and succession such as regular mowing, grazing, or recreation activities

**Accessible Other Forest Land** – Land that meets the definition of accessible forest land, but is incapable of producing 20 cubic feet per acre per year of industrial wood under natural condition, because of adverse site conditions (SITE CLASS = 7). Note: Adverse conditions include sterile soils, dry climate, poor drainage, high elevation, steepness, and rockiness.

**ACTUAL LENGTH** – For trees with broken or missing tops. The actual length of the tree is recorded to the nearest 1.0 foot from ground level to the highest remaining portion of the tree still present and attached to the bole. If the top is intact, this item may be omitted. Forked trees should be treated the same as unforked trees.

**Agricultural Land** – Land managed for crops, pasture, or other agricultural use. Evidence includes geometric field and road patterns, fencing, and the traces produced by livestock or mechanized equipment. The area must be at least 1.0 acre in size and 120.0 feet wide at the point of occurrence.

**Annular Plot** – A circular, fixed area plot with a radius of 58.9 feet. Annular plots may be used for sample intensification or for sampling relatively rare events.

**ARTIFICIAL REGENERATION SPECIES** – Indicates the predominant species that is planted or seeded in an artificially regenerated condition.

**Black Knot** – Visible branches, stubs or sockets that do not conform to the definition of sound red knots.

**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.

**Bole** – The main stem of a tree, extending from one foot above the ground to the point on the tree where DOB reaches 4 inches

**BOARD-FOOT CULL** – Solid wood cull due to sweep, crook, and excessive knot collars, as well as unsound cull due to rotten or missing wood. Board-foot cull is expressed as a percentage of the sawlog portion of the tree.

**Boundary** – The intersection of two or more conditions on a subplot or microplot. Each boundary is described by recording the azimuth and horizontal distance from the subplot or microplot center to the left and right points of where the boundary intersects the perimeter of the subplot or microplot. An azimuth and distance to a corner point may also be described, if one exists. If multiple boundaries exist at a subplot, they are recorded in the order of their occurrence on the subplot, starting from north and proceeding around the compass.

**Census Water** – Rivers and streams that are more than 200 feet wide and bodies of water that are greater than 4.5 acres in size.

**Certification plot** – a plot installed by a certification candidate. It may be a training plot or a production plot. The candidate working alone installs the plot.

**Cold check** – an inspection done either as part of the training 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. Discrepancies between the two sets of data may be reconciled. Cold checks are done on production plots only.

**CONDITION CLASS** – The combination of discrete landscape and forest attributes that identify and define different strata on the plot. Examples of such attributes include condition status, forest type, stand origin, stand size, owner group, reserve status and stand density.

**Cropland** – Land under cultivation within the past 24 months, including orchards and land in soil improving crops, but excluding land cultivated in developing improved pasture.

**CROWN CLASS** – A classification of trees based on dominance in relation to adjacent trees within the stand as indicated by crown development and the amount of sunlight received from above and sides.

**Cull** – Portions of a tree that are unusable for industrial wood products because of rot, form, or other defect.

**Diameter at Breast Height (DBH)** – The diameter of the bole of a tree at breast height (4.5 feet above the ground), measured outside of the bark.

**Diameter Outside Bark (DOB)** – A diameter that may be taken at various points on a tree, or log, **outside** of the bark. Diameter Outside Bark is often estimated.

**Federal Information Processing Standard (FIPS)** – A unique code identifying U.S. States and counties (or units in Alaska).

**Forest Industry Land** – Land owned by companies or individuals that operate wood-using plants.

**Forest Trees** – Plants having a well-developed, woody stem and usually more than 12 feet in height at maturity.

**FOREST TYPE** – A classification of forest land based upon the trees or tree communities that constitute the majority of stocking on the site.

**GPS** – Global Positioning System. Information from this system is collected and used to determine the latitude and longitude of each plot.

**Hardwoods** – Dicotyledonous trees, usually broad-leaved and deciduous.

**Hot check** – an inspection normally done as part of the training process. The inspector is present on the plot with the trainee and provides immediate feedback regarding data quality. Data errors are corrected. Hot checks can be done on training plots or production plots.

**Idle Farmland** -- Former cropland or pasture that has not been tended within the last 2 years and that has less than 10 percent stocking with live trees.

**Improved Pasture** -- Land that is currently maintained and used for grazing. Evidence of maintenance, besides the degree of grazing, includes condition of fencing, presence of stock ponds, periodic brush removal, seeding, irrigation, or mowing.

**Inclusion** – An area that would generally would be recognized as a separate condition, except that it is not large enough to qualify. For example, a ½ acre pond within a forested stand.

**Industrial Wood** – All roundwood products, except firewood.

**Inspection crew** – a crew of qualified QA/QC individuals whose primary responsibility is the training, certification and inspection of production crews.

**Land Area** – As defined by the Bureau of the Census: The area of dry land and land temporarily or partially covered by water such as marshes, swamps, and river flood plains (omitting tidal flats below mean tide); streams, sloughs, estuaries and canals less than 200 feet in width, and ponds less than 4.5 acres in area.

**Maintained Road** – Any road, hard topped or other surfaces, that is plowed or graded periodically and capable of use by a large vehicle. Rights-of-way that are cut or treated to limit herbaceous growth are included in this area.

**Marsh** – Low, wet areas characterized by heavy growth of weeds and grasses and an absence of trees.

**Measurement Quality Objective (MQO)** – Describes the acceptable tolerance for each data element. MQOs consist of two parts: a statement of the tolerance and a percentage of time when the collected data are required to be within tolerance.

**Merchantable Top** – The point on the bole of trees above which merchantable material cannot be produced.

**Microplot** – A circular, fixed-radius plot with a radius of 6.8 feet that is used to sample trees less than 5.0 inches at DBH, as well as other vegetation.

**MORTALITY** – Remeasure trees and saplings that were alive at the time of the last visit, but are now dead. Does not include trees or saplings that have been Utilized.

**National Forest Land** – Federal lands which have been legally designated as National Forests or purchase units, and other lands under the administration of the Forest Service, including experimental areas and Bankhead-Jones Title III lands.

**Native American (Indian) Land** – Tribal lands held in fee, or trust, by the Federal government but administered for Indian tribal groups and Indian trust allotments. This land is considered “Private Lands”, Owner Group 40.

**Non-census Water** – Bodies of water from 1 to 4.5 acres in size and water courses from 30 feet to 200 feet in width.

**Nonforest Land** -- Land that does not support, or has never supported, forests, and lands formerly forested where use for timber management is precluded by development for other uses. Includes areas used for crops, improved pasture, residential areas, city parks, improved roads of any width and adjoining rights-of-way, power line clearings of any width, and noncensus water. If intermingled in forest areas, unimproved roads and nonforest strips must be more than 120.0 feet wide, and clearings, etc., more than one acre in size, to qualify as nonforest land.

**Nonstockable** – Areas of forest land that are not capable of supporting trees because of the presence of rock, water, etc.

**Other Federal Lands** – Federal land other than National Forests. These include lands administered by the USDI Bureau of Land Management, USDI National Park Service, USDI Fish and Wildlife Service, Department of Defense, Department of Energy, Army Corps of Engineers, and military bases.

**OWNER CLASS** – A variable that classifies land into fine categories of ownership.

**OWNER GROUP** – A variable that classifies land into broad categories of ownership; Forest Service, Other Federal Agency, State and Local Government, and Private. Differing categories of Owner Group on a plot require different conditions.

**Phase 1 (P1)** – FIA activities done as part of remote-sensing and/or aerial photography.

**Phase 2 (P2)** – FIA activities done on the network of ground plots formerly known as FIA plots.

**Phase 3 (P3)** – FIA activities done on a subset of Phase 2 plots formerly known as Forest Health Monitoring plots. Additional ecological indicator information is collected from Phase 3 plots.

**Plot** – A cluster of four subplots that samples approximately 1/6 acre. The subplots are established so that subplot 1 is centered within the sample and the centers of subplots 2, 3, and 4 are located 120.0 feet from the center of subplot 1 at azimuths of 360, 120, and 240 degrees, respectively. Each subplot has an associated microplot and annular plot

**PRIVATE OWNER INDUSTRIAL STATUS** – Indicates whether Private land owners own and operate a wood processing plant.

**Production crew** – a crew containing at least one certified individual. The crew is involved in routine installation of plots.

**Production plot** – a plot that belongs to the 6000-acre grid database. It may also be used for training purposes.

**Red Knot** – Visible branches, stubs or sockets that are from living branches or branches that have recently died. They are inter-grown with the surrounding wood and contain no rot.

**REGENERATION STATUS** – A stand descriptor that indicates whether a stand has been naturally or artificially regenerated.

**Reserved Land** – Land that is withdrawn from timber utilization by a public agency or by law.

**RESERVE STATUS** – An indication of whether the land in a condition has been reserved.

**ROTTEN/MISSING CULL** – An assessment of the rotten, missing, or otherwise defective portions of a tree bole that are unsuitable for industrial wood products. Cubic-foot cull is expressed as a percentage of the entire bole.

**Saplings** – Live trees 1.0 to 4.9 inches DBH.

**Seedlings** – Conifer seedlings must be at least 6.0 inches in length and less than 1.0 inch at DBH in order to qualify for tallying, except Longleaf pine must be at least 0.5 in at the root collar. Hardwood seedlings must be at least 12.0 inches in length and less than 1.0 inch at DBH in order to qualify for tallying. .

**Softwoods** – Coniferous trees, usually evergreen having needles or scale-like leaves.

**STAND AGE** – A stand descriptor that indicates the average age of the live trees not overtopped in the predominant stand size-class of a condition.

**STAND DENSITY** – A stand descriptor that indicates the relative tree density of a condition class. The classification is based on the number of

stems/unit area, basal area, tree cover, or stocking of all live trees in the condition which are not overtopped, compared to any previously defined condition class tree density.

**STAND SIZE** – A stand descriptor that indicates which size-class of trees that are not overtopped constitutes the majority of stocking in the stand.

**State, County and Municipal Lands** – Lands owned by states, counties, and local public agencies or municipalities, or lands leased to these government units for 50 years or more.

**Stocking** – The relative degree of occupancy land by trees, measured as basal area or the number of trees in a stand by size or age and spacing, compared to the basal area or number of trees required to fully utilize the growth potential of the land; that is, the stocking standard.

**Subplot** – A circular, fixed-area plot with a radius of 24.0 feet. Each subplot represents  $\frac{1}{4}$  of the fixed plot sample unit.

**TOTAL LENGTH** – The total length of the tree, recorded to the nearest 1.0 foot from ground level to the tip of the apical meristem. For trees growing on a slope, measure on the uphill side of the tree. If the tree has a broken or missing top, the total length is estimated to what the length would be if there were no missing or broken top. Forked trees should be treated the same as unforked trees

**Training plot** – a plot established for training or certification purposes only. It does NOT belong to the 6000-acre grid database.

**Transition Zone** – An area where a distinct boundary between two or more different conditions cannot be determined.



## Appendix 8. Tolerance / MQO / Value / Units Table

Core optional variables are in italics. n/a is not applicable.

Item#	Variable Name	Tolerance	MQO	Values	Units	Factor
<b>General Description</b>						
	New Subplot Location	+/- 7 feet	at least 95% of the time	n/a	feet	10
	New Microplot Location	+/- 1 foot	at least 95% of the time	n/a	feet	10
<b>Plot Level Data</b>						
101	STATE	No errors	at least 99% of the time	Appendix 1	n/a	5
102R	CYCLE	No errors	At least 99% of the time	01 to 99	n/a	1
103R	PANEL	No errors	At least 99% of the time	1 to 5	n/a	1
104	COUNTY	No errors	at least 99% of the time	Appendix 1	n/a	5
105	PLOT NUMBER	No errors	at least 99% of the time	0001 to 9999	n/a	5
106R	PHASE	No errors	At least 99% of the time	2, 3	n/a	1
107	PLOT STATUS	No errors	at least 99% of the time	1	n/a	5
108	SAMPLE KIND	No errors	at least 99% of the time	1 to 3	n/a	5
109	FIELD GUIDE VERSION	No errors	at least 99% of the time	2.0	n/a	1
110	P3 HEXAGON NUMBER	No errors	at least 99% of the time	n/a	n/a	5
111	P3 PLOT NUMBER	No errors	at least 99% of the time	1 to 9	n/a	1
112R	PLOT IN CORRECT COUNTY?	No errors	At least 99% of the time	0 or 1	n/a	1
113	CURRENT YEAR	No errors	at least 99% of the time	≥ 2003	year	1
114	CURRENT MONTH	No errors	at least 99% of the time	Jan – Dec (01 – 12)	month	1
115	CURRENT DAY	No errors	at least 99% of the time	01 to 31	day	1
116R	PAST YEAR	No errors	At least 99% of the time	≤ 2003	n/a	1
117R	PAST MONTH	No errors	At least 99% of the time	01 - 12	n/a	1
118R	PAST DAY	No errors	At least 99% of the time	01- 31	n/a	1
119	QA STATUS	No errors	at least 99% of the time	1 to 7	n/a	1
120	CREW TYPE	No errors	at least 99% of the time	1, 2	n/a	1
121R	CRUISER NUMBER	No errors	at least 99% of the time	numeric	n/a	1
122R	NUMBER OF ACCESSIBLE FORESTLAND CONDITIONS	No errors	at least 99% of the time	0 to 9	n/a	1
123R	NUMBER OF TREE ENTRIES	No errors	at least 99% of the time	000 - 999	n/a	1
124R	NUMBER OF PRISM POINTS REMEASURED	No errors	At least 99% of the time	1- 5	n/a	1
125R	NUMBER OF SUBPLOT CENTERS REVERTED	No errors	At least 99% of the time	0 - 4	n/a	1
126R	HUMAN DEBRIS	No errors	At least 80% of the time	0, 1, 2, 3	n/a	1
127	WATER ON PLOT	No errors	at least 90% of the time	0 to 5, 9	n/a	1
128	HORIZONTAL DISTANCE TO IMPROVED ROAD	No errors	at least 90% of the time	1 to 9	n/a	1
129R	HORIZONTAL DISTANCE TO URBAN OR BUILT- UP LAND	No errors	At least 90% of the time	1- 9	n/a	1
130R	HORIZONTAL DISTANCE TO AGRICULTURAL LAND	No errors	At least 90% of the time	1- 9	n/a	1
131R	SIZE OF CONTIGUOUS FORESTLAND	No errors	At least 90% of the time	1-7	n/a	1
132	GPS UNIT	No errors	at least 99% of the time	0 to 4	n/a	1
133	GPS SERIAL NUMBER	No errors	at least 99% of the time	000001 to 999999	n/a	1

Item#	Variable Name	Tolerance	MQO	Values	Units	Factor
<b>General Description</b>						
134	LATITUDE	+/- 140 ft	at least 99% of the time	Dependent of location	D/M/S	3
135	LONGITUDE	+/- 140 ft	at least 99% of the time	Dependent of location	D/M/S	3
136	GPS ELEVATION		at least 99% of the time	-00100 to 20000	feet	1
137	GPS ERROR	No errors	at least 99% of the time	000 to 070 if possible 071 to 999 if an error < 70 cannot be obtained	feet	1
138	NUMBER OF READINGS	No errors	at least 99% of the time	001 to 999	n/a	1
	<i>GPS FILENAME</i>	<i>No errors</i>	<i>at least 99% of the time</i>	<i>English, alpha-numeric</i>	<i>n/a</i>	<i>-----</i>
139	AZIMUTH TO PLOT CENTER	+/- 3 degrees	at least 99% of the time	000 at plot center 001 to 360 not at plot center	degrees	1
140	DISTANCE TO PLOT CENTER	+/- 6 ft	at least 99% of the time	000 at plot center 001 to 200 if a Laser range finder not used 001 to 999 if a Laser range finder is used	feet	1
141	PLOT-LEVEL NOTES	n/a	n/a	English, alpha-numeric	n/a	1 to 5

<b>Condition Class Information</b>						
201	CONDITION CLASS NUMBER	No errors	at least 99% of the time	1 to 9	n/a	1
202R	PRESENT LAND USE	No errors	At least 99% of the time	01- 03, 10- 11 20, 30-34,40-42, 50- 53, 91,92	n/a	5
203	CONDITION CLASS STATUS	No errors	at least 99% of the time	1 to 5	n/a	5
204	CONDITION NONSAMPLED REASON	No errors	at least 99% of the time	01, 02, 03, 10	n/a	1
205R	NEW PAST LAND USE	No errors	at least 99% of the time	01- 03, 10- 11 20, 30-34,40-42, 50- 53, 91,92	n/a	5
206	RESERVED STATUS	No errors	at least 99% of the time	0, 1	n/a	3
207	OWNER CLASS	No errors	at least 99% of the time	11-13; 21-25; 31-33; 41-45	class	2
208	OWNER GROUP	No errors	at least 99% of the time	10, 20, 30, 40	n/a	3
209	PRIVATE OWNER INDUSTRIAL STATUS	No errors	at least 99% of the time	0, 1	n/a	1
210R	TRACT SIZE (TOTAL ACRES)	No errors	At least 99% of the time	00001- 99999	n/a	1
211R	TRACT SIZE (PERCENT FOREST)	No errors	At least 99% of the time	001- 100	n/a	1
212	FOREST TYPE	No errors	at least 99% of the time in group at least 95% of the time in type no MQO when STAND SIZE CLASS = 0	Appendix 2	n/a	5
213	STAND SIZE CLASS	No errors	at least 99% of the time	0 to 6	class	5
214	REGENERATION STATUS	No errors	at least 99% of the time	0, 1	n/a	5
215	ARTIFICIAL REGENERATION SPECIES	No errors	at least 99% of the time	Appendix 3	n/a	1
216	TREE DENSITY	No errors	at least 99% of the time	1 to 3	n/a	1
217	STAND AGE	+/- 10%	at least 95% of the time	000 to 997, 998, 999	year	5
218R	STAND STRUCTURE	No errors	At least 99% of the time	1 - 4	n/a	1
219	DISTURBANCE 1	No errors	at least 99% of the time	00; 10-12; 20-22; 30-32;40-46; 50-55; 60; 70; 80	n/a	5
220	DISTURBANCE YEAR 1	+/- 1 year for 5-year measure. cycles +/ 2 years for > 5-year measure. cycles	at least 99% of the time	Since the previous plot visit, or the past 5 years for plots visited for the first time; 9999 if disturbance occurs continuously over time	year	1
221	DISTURBANCE 2	No errors	at least 99% of the time	00; 10-12; 20-22; 30-32;40-46; 50-55; 60; 70; 80	n/a	5

Item#	Variable Name	Tolerance	MQO	Values	Units	Factor
<b>General Description</b>						
222	DISTURBANCE YEAR 2	+/- 1 year for 5-year measure. cycles +/ 2years for > 5-year measure. cycles	at least 99% of the time	Since the previous plot visit, or the past 5 years for plots visited for the first time; 9999 if disturbance occurs continuously over time	year	1
223	DISTURBANCE 3	No errors	at least 99% of the time	00; 10-12; 20-22; 30-32;40-46; 50-55; 60; 70; 80	n/a	5
224	DISTURBANCE YEAR 3	+/- 1 year for 5-year measure. cycles +/ 2years for > 5-year measure. cycles	at least 99% of the time	Since the previous plot visit, or the past 5 years for plots visited for the first time; 9999 if disturbance occurs continuously over time	year	1
225	TREATMENT 1	No errors	at least 99% of the time	00, 10, 20, 30, 40, 50	n/a	5
226	TREATMENT YEAR 1	+/- 1 year for 5-year measure. cycles +/ 2 years for >5-year measure. cycles	at least 99% of the time	Since the previous plot visit, or the past 5 years for plots visited for the first time	year	1
227	TREATMENT 2	No errors	at least 99% of the time	00, 10, 20, 30, 40, 50	n/a	5
228	TREATMENT YEAR 2	+/- 1 year for 5-year measure. cycles +/ 2 years for >5-year measure. cycles	at least 99% of the time	Since the previous plot visit, or the past 5 years for plots visited for the first time	year	1
229	TREATMENT 3	No errors	at least 99% of the time	00, 10, 20, 30, 40, 50	n/a	5
230	TREATMENT YEAR 3	+/- 1 year for 5-year measure. cycles +/ 2 years for >5-year measure. cycles	at least 99% of the time	Since the previous plot visit, or the past 5 years for plots visited for the first time	year	1
231	PHYSIOGRAPHIC CLASS	No errors	at least 80% of the time	xeric: 11, 12, 13, 19 mesic: 21, 22, 23, 24, 25, 29 hydric: 31, 32, 33, 34, 35, 39	n/a	3
232R	OPERABILITY	No errors	At least 99% of the time	0 - 5	n/a	1
233R	WATER SOURCE	No errors	At least 90% of the time	0 - 9	n/a	1
234R	DISTANCE TO WATER SOURCE	<100' +/- 10' >100' +/- 100'	At least 90% of the time	0 – 100, 150,250, etc.	n/a	1
235R	SITE CLASS	+/- 1 class	At least 99% of the time	0 - 7	n/a	5
236R	FIRE	No errors	At least 99% of the time	0,1	n/a	1
237R	GRAZING	No errors	At least 99% of the time	0,1	n/a	1
<b>Subplot Information</b>						
301	SUBPLOT NUMBER	No errors	at least 99% of the time	1 to 4	n/a	1
302	SUBPLOT STATUS	No errors	at least 99% of the time	1 to 3	n/a	5
303	SUBPLOT NONSAMPLED REASON	No errors	at least 99% of the time	01 to 05, 10	n/a	1
304	SUBPLOT CENTER CONDITION	No errors	at least 99% of the time	1 to 9	n/a	5
305	MICROPLOT CENTER CONDITION	No errors	at least 99% of the time	1 to 9	n/a	5
306	SUBPLOT CONDITION LIST	No errors	at least 99% of the time	1000 to 9876	n/a	1
307	SUBPLOT SLOPE	+/- 10 %	at least 90% of the time	000 to 155	percent	1
308	SUBPLOT ASPECT	+/- 10 degrees	at least 90% of the time	000 to 360	degrees	1
309	SNOW/WATER DEPTH	+/- 0.5 ft	at the time of measurement	0.0 to 9.9	feet	1
310R, 312R, 314R, 316R	NONNATIVE INVASIVE PEST PLANTS	No errors	At least 90% of the time	0000, see section 3.10	n/a	1

Item#	Variable Name	Tolerance	MQO	Values	Units	Factor
<b>General Description</b>						
311R, 313R, 315R, 317R	NONNATIVE INVASIVE PEST PLANT % COVER	No errors	At least 90% of the time	1 - 6	n/a	1
<b>Boundary Data</b>						
401	SUBPLOT NUMBER	No errors	at least 99% of the time	1 to 4	n/a	1
402	PLOT TYPE	No errors	at least 99% of the time	1 to 3	n/a	1
403R	BOUNDARY STATUS	No errors	At least 99% of the time	0 or 1	n/a	1
404	BOUNDARY CHANGE	No errors	at least 99% of the time	0 to 3	n/a	1
405	CONTRASTING CONDITION	No errors	at least 99% of the time	1 to 9	n/a	1
406	LEFT AZIMUTH	+/- 10 degrees	at least 90% of the time	001 to 360	degrees	3
407	CORNER AZIMUTH	+/- 10 degrees	at least 90% of the time	000 to 360	degrees	3
408	CORNER DISTANCE	+/- 1 ft	at least 90% of the time	microplot: 01 to 07 (6.8 ft actual limiting distance) subplot: 01 to 24 annular plot: 01 to 59 (58.9 ft actual limiting distance)	feet	3
409	RIGHT AZIMUTH	+/- 10 degrees	at least 90% of the time	001 to 360	degrees	3
<b>Tree and Sapling Data</b>						
501R	ENTRY NUMBER	No errors	At least 99% of the time	001 to 999	n/a	1
502	SUBPLOT NUMBER	No errors	at least 99% of the time	1 to 4	n/a	1
503	TREE RECORD NUMBER	No errors	at least 99% of the time	000, 001 to 999	n/a	1
504	PRISM TREE#/TREE#	No errors	at least 99% of the time	000, 001 to 999	n/a	1
505	CONDITION CLASS NUMBER	No errors	at least 99% of the time	1 to 9	n/a	1
506	AZIMUTH	+/- 10 degrees	at least 90% of the time	001 to 360	degrees	1
507	HORIZONTAL DISTANCE	microplot: +/- 0.2 ft subplot: +/- 1.0 ft annular plot: +/- 3.0 ft	at least 90% of the time	microplot: 00.1 to 06.8 subplot: 00.1 to 24.0 annular plot: 00.1 to 58.9	feet	1
508	PRESENT TREE STATUS	No errors	at least 95% of the time	0 to 3	n/a	5
509R	OLD MICROPLOT SAPLING STATUS	No errors	At least 99% of the time	0 to 3	n/a	5
510R	PRISM TREE STATUS	No errors	At least 99% of the time	0 to 3	n/a	5
511	PREVIOUS TREE STATUS	No errors	at least 95% of the time	1, 2	n/a	5
512	RECONCILE	No errors	at least 95% of the time	1 to 4: valid for new trees on the plot 5 to 8: valid for remeasured trees that no longer qualify as tally	n/a	5
513	STANDING DEAD	No errors	At least 99% of the time	0, 1	n/a	1
514	SPECIES	No errors	at least 99% of the time for genus at least 95% of the time for species	Appendix 3	n/a	2
515	DIAMETER	+/- 0.1 inch per 20.0 inch increment of measured diameter on all live trees and dead trees with DECAY CLASS = 1, 2 +/-1.0 inch per 20.0 inch increment of measured diameter on dead trees with DECAY CLASS = 3, 4, 5	at least 95% of the time	0001 to 9999	inches	Saps & Snags = 1, Pole & Saw =5

Item#	Variable Name	Tolerance	MQO	Values	Units	Factor
<b>General Description</b>						
516	PREVIOUS DIAMETER	No errors	At least 99% of the time	0001 to 9999	n/a	Saps & Snags = 1, Pole & Saw =5
517	DIAMETER CHECK	No errors	at least 99% of the time	0 to 2	n/a	1
518	LENGTH TO DIAMETER MEASUREMENT POINT	+/- 0.2 ft	at least 90% of the time	00.1 to 15.0	inches	1
519R	TREE CLASS	No errors	At least 90% of the time	2, 3, 4	n/a	5
520	CROWN CLASS	No errors	at least 85% of the time	1 to 5	n/a	2
521	UNCOMPACTED CROWN RATIO	+/- 10%	at least 80% of the time	00 to 99	Percent	1
522	COMPACTED CROWN RATIO	+/- 10%	at least 80% of the time	00 to 99	percent	1
523R	TREE GRADE	No errors	At least 90% of the time	1 to 5	n/a	2
524R	PERCENT BOARD FOOT CULL	+/- 10%	At least 90% of the time	00- 67	percent	2
525	ROTTEN / MISSING CULL	+/- 10%	at least 90% of the time	00 to 99	percent	2
526	TOTAL LENGTH	+/- 10% of true length	at least 90% of the time	005 to 400	feet	Saps & Snags = 1, Pole & Saw =5
527	ACTUAL LENGTH	+/- 10% of true length	at least 90% of the time	005 to 400	feet	Saps & Snags = 1, Pole & Saw =5
528	LENGTH METHOD	No errors	at least 99% of the time	1 to 3	n/a	1
529R	FUSIFORM/ COMANDRA RUST/ HARDWOOD DIEBACK	No errors	At least 80% of the time	0, 1, 2	n/a	1
530R	DIEBACK SEVERITY	+/- 1 class	At least 80% of the time	1 to 9	Class	1
531	CAUSE OF DEATH	No errors	at least 80% of the time	10 to 80	n/a	1
532	MORTALITY YEAR	+/- 1year for 5-year measure. cycles +/- 2years for > 5-year measure. cycles	at least 70% of the time	1995 or higher	year	1
533	DECAY CLASS	+/- 1 class	at least 90% of the time	1 to 5	class	1
534R	UTILIZATION CLASS	No errors	At least 99% of the time	1, 2	n/a	1
535	TREE NOTES	n/a	n/a	English, alpha-numeric	n/a	n/a
<b>Seedling Data</b>						
601	MICROPLOT NUMBER	No errors	at least 99% of the time	1 to 4	n/a	1
602	CONDITION CLASS NUMBER	No errors	at least 99% of the time	1-9	n/a	1
603	SPECIES	No errors	at least 90% of the time for genus at least 85% of the time for species	Appendix 3	n/a	1
604	SEEDLING COUNT	No errors for 5 or less per species +/- 20% over a count of 5	at least 90% of the time	001-999	number	1
<b>Site Tree Information</b>						
701R	SITE TREE NUMBER	No errors	At least 99% of the time	1to 9	n/a	1
702	CONDITION CLASS LIST	No errors	at least 99% of the time	1 to 9 or 10000 to 98765	n/a	1

Item#	Variable Name	Tolerance	MQO	Values	Units	Factor
<b>General Description</b>						
703	SPECIES	No errors	at least 99% of the time for genus at least 95% of the time for species	Appendix 3	n/a	1
704	DIAMETER	+/- 0.1 inch per 20 inches of diameter on trees with a measured diameter	at least 95% of the time	0001 to 9999	inches	1
705	SITE TREE LENGTH	+/- 10% of true length	at least 90% of the time	001 to 999	Feet	1
706	TREE AGE AT DIAMETER	+/- 5 years	at least 95% of the time	001 to 999	year	1
707R	SITE CLASS	+/- 1 class	At least 99% of the time	0 - 7	n/a	1
708	SITE TREE NOTES	n/a	n/a	English, alpha-numeric	n/a	1 to 5
709	SUBPLOT NUMBER	No errors	at least 99% of the time	1 to 4	n/a	1
710	AZIMUTH	+/- 10 degrees	at least 90% of the time	001 to 360	degrees	1
711	HORIZONTAL DISTANCE	+/-5 ft	at least 90% of the time	000.1 to 200.0	feet	1
<b>NONFOREST / NONSAMPLED/ INTENSIFICATION PLOTS</b>						
801	STATE	No errors	at least 99% of the time	Appendix 1	n/a	5
802R	CYCLE	No errors	At least 99% of the time	01 to 99	n/a	1
803R	PANEL	No errors	At least 99% of the time	1 to 5	n/a	1
804	COUNTY	No errors	at least 99% of the time	Appendix 1	n/a	5
805	PLOT NUMBER	No errors	at least 99% of the time	0001 to 9999	n/a	5
806R	PHASE	No errors	At least 99% of the time	2, 3	n/a	1
807	PLOT STATUS	No errors	at least 99% of the time	2, 3, 4	n/a	5
808	PLOT NONSAMPLED REASON	No errors	at least 99% of the time	01 to 10	n/a	1
809	SAMPLE KIND	No errors	at least 99% of the time	1 to 3	n/a	5
810	FIELD GUIDE VERSION	No errors	at least 99% of the time	2.0	n/a	1
811	P3 HEXAGON NUMBER	No errors	at least 99% of the time	n/a	n/a	5
812	P3 PLOT NUMBER	No errors	at least 99% of the time	1 to 9	n/a	1
813R	PLOT IN CORRECT COUNTY?	No errors	At least 99% of the time	0 or 1	n/a	1
814	YEAR	No errors	at least 99% of the time	≥ 2003	year	1
815	MONTH	No errors	at least 99% of the time	Jan – Dec (01 – 12)	month	1
816	DAY	No errors	at least 99% of the time	01 to 31	Day	1
817R	PAST YEAR	No errors	At least 99% of the time	≤ 2003	year	1
818R	PAST MONTH	No errors	At least 99% of the time	Jan – Dec (01 – 12)	month	1
819R	PAST DAY	No errors	At least 99% of the time	01 to 31	day	1
820	QA STATUS	No errors	at least 99% of the time	1 to 7	n/a	1
821	CREW TYPE	No errors	at least 99% of the time	1, 2	n/a	1
822R	CRUISER NUMBER	No errors	at least 99% of the time	numeric	n/a	1
823R	PRESENT LAND USE	No errors	At least 99% of the time	01- 03, 10- 11 20, 30-34,40-42, 50- 53, 91,92	n/a	5
824	CONDITION CLASS STATUS 1	No errors	at least 99% of the time	2 to 5	n/a	5
825R	NEW PAST LAND USE	No errors	at least 99% of the time	01- 03, 10- 11 20, 30-34,40-42, 50- 53, 91,92	n/a	5
826	GPS UNIT	No errors	at least 99% of the time	0 to 4	n/a	1
827	GPS SERIAL NUMBER	No errors	at least 99% of the time	000001 to 999999	n/a	1

Item#	Variable Name	Tolerance	MQO	Values	Units	Factor
<b>General Description</b>						
828	LATITUDE	+/- 140 ft	at least 99% of the time	Dependent on location	degrees, seconds	3
829	LONGITUDE	+/- 140 ft	at least 99% of the time	Dependent on location	degrees, seconds	3
830	GPS ELEVATION		at least 99% of the time	-00100 to 20000	feet	1
831	GPS ERROR	No errors	at least 99% of the time	000 to 070 if possible 071 to 999 if an error < 70 cannot be obtained	feet	1
832	NUMBER OF READINGS	No errors	at least 99% of the time	001 to 999	n/a	1
833	AZIMUTH TO PLOT CENTER	+/- 3 degrees	at least 99% of the time	000 at plot center 001 to 360 not at plot center	degrees	1
834	DISTANCE TO PLOT CENTER	+/- 6 ft	at least 99% of the time	000 at plot center 001 to 200 if a Laser range finder not used 001 to 999 if a Laser range finder is used	feet	1
835	PLOT-LEVEL NOTES	n/a	n/a	English, alpha-numeric	n/a	1 to 5



**SUPPLEMENT A**  
**ILLUSTRATIONS**



**SUPPLEMENT B**  
**GPS INSTRUCTIONS**



## INTRODUCTION

It has become necessary for the Forest Inventory and Analysis (FIA) crews to collect precise position coordinates of inventory sample plot centers. The purposes are 1) to allow FIA data to be accurately incorporated into GIS applications and other data bases and 2) to enhance plot recovery.

The purpose of this manual is to provide the operator with a brief history of the technology and with the procedures used by FIA crews to obtain position coordinates, calculate a coordinate, navigate to a coordinate, and other field applications.

## THE GLOBAL POSITIONING SYSTEM

The concept for a Global Positioning System (GPS) dates back to the early days of space exploration. U.S. scientists tracking the Soviet Union's Sputnik satellite in the 1950s used the doppler effect of the satellite's radio beacon to determine its orbit. They realized that they could use the same process to determine a position on the earth. Development of the system began in 1973. The first satellites were launched in 1978. Today's system utilizes accurate clocks and measures the time required for a radio signal to travel between the satellite and receiver.

Previously, collecting accurate positions was limited because of the bulk and inconvenience of GPS receivers. These early versions had low accuracy and could not obtain a position fix in real time. Recent developments have provided a methodology capable of accurate position estimates ( $\pm 12$  meters) in a small, handheld, lightweight receiver. With the aid of a base station, accuracies of less than 0.5 centimeter are obtainable.

The Global Positioning System is a space-based radio positioning system designed to provide suitably equipped users with highly accurate positioning, velocity, and time data. It is comprised of three segments:

The space segment consists of a constellation of GPS satellites in orbit around the earth. There are 21 operational satellites. There are three or four operational satellites in each of the six orbital planes.

Additionally, there are up to three spare satellites. The satellites orbit the earth twice each day at an altitude of 10,900 miles.

The control segment is comprised of a Master Control Station (MCS) and a number of monitoring stations located around the world. The MCS tracks, monitors, and manages the satellite constellation. It also updates the navigation data messages transmitted by the satellites.

The user segment consists of a variety of radio navigation receivers designed to receive, decode, and process the GPS satellite signals.

The system is managed by the Department of Defense (DOD). To prevent enemy forces from utilizing our GPS system, an intentional error is introduced, Selective Availability (SA). SA is the largest source of error within the system. SA induces up to a 100-meter error into any position estimate. To overcome SA, military GPS units have a special chip with a decoding "key" installed that removes the SA. Recently, the U.S.

Department of Agriculture (USDA) and the U.S. Department of the Interior (USDI) have been granted authority to purchase GPS receivers with this chip. There are two models available to these agencies: the Trimble Centurion and the Rockwell Precise Lightweight GPS Receiver (PLGR). Receivers equipped with the decoding chip are referred to as Precise Positioning Service (PPS).

In May 2000, SA was deactivated by the DOD. All GPS units have the same  $\pm 12$  meter accuracy. The DOD has, however, reserved the right to activate SA whenever national security dictates.

## SECURITY

PPS receivers because of the security module installed within them are very sensitive security items. As an operator of these receivers, you are assuming a great responsibility, one far and above that of just having signed for another piece of expensive equipment. The security and accountability of your receiver must be your first priority. **Any incident or violation of the restrictions will immediately involve the National Security Agency (NSA) and the FBI.** If they determine that the incident may have compromised key security, the Department of Defense can press for criminal prosecution. They are serious about this. A compromise of the “key” code within your receiver could cause the changing of all keys world-wide, a very expensive and disruptive procedure.

The use of this receiver is authorized by Memorandum of Understanding (MOU) between the Department of Defense and the Department of Agriculture. The continued use of this receiver and the Precise Positioning Service is at the sole discretion of the Assistant Secretary of Defense for Command, Control, Communications, and Intelligence.

Pursuant to the MOU, the Federal Radionavigation Plan, and current guidance from the National Security Agency and the Department of Defense Space Command, **the use of PPS receivers is limited to permanent or temporary Federal employees, who are U.S. citizens, or state government employees who are U.S. citizens and are under the supervision of Federal employees.** The use of PPS receivers by others than those mentioned above is currently considered detrimental to security.

The internal security module and cryptographic keys remain the property of the National Security Agency. As such, PPS receivers must be returned to the Agency GPS-PPS Coordinator in a timely manner, upon demand. Requests for return of equipment may also come from the Federal GPS-PPS Coordinator or the controlling authority at Space Command. However, you should never surrender any PPS receiver without first checking with the Agency GPS-PPS Coordinator.

The PPS receiver is considered unclassified by the DOD. However, the receiver contains cryptographic logic which makes the receiver a DOD “High Value Item”. **As such, any loss, theft, tampering, or destruction of a receiver must be reported by the custodian to the Agency GPS-PPS Coordinator immediately.** Serious infractions which may constitute

sabotage, loss through negligence, theft, or espionage are punishable under various sections of the United States Code.

The custodian is responsible for all property accounting, including prompt response to the annual inventory by the Federal GPS-PPS Coordinator. The receiver cannot be processed as excess property. The receiver must be returned to the Agency GPS-PPS Coordinator for proper disposal.

**When not in use, PPS receivers should be kept in a secure location such as a locked drawer, cabinet, or storage space. Receivers should never be stored in vehicles.**

Shipping of PPS receivers must be via traceable mail such as FedEx, UPS, etc.

PPS equipment cannot be shipped or hand-carried outside of the United States (encrypted or not encrypted), without prior approval from the controlling authority at DOD. Outside of the United States is considered to be any other place besides the conterminous United States, Alaska, and Hawaii. The Agency GPS-PPS Coordinator must be contacted prior to any shipping or carrying of PPS receivers outside of the United States, as defined.

When traveling, receivers should be carried in carry-on luggage rather than checked luggage on commercial transport. That carry-on luggage should be in your possession at all times. The receiver cannot be inspected or handled by anyone out of your sight. Do not leave a receiver in plain sight in a locked vehicle. Do not leave a receiver in an unlocked vehicle.

All Forest Service receivers must have a property tag attached. Compliance will be checked each time the unit is sent in to be rekeyed.

## **THE ROCKWELL PLGR**

FIA has chosen to purchase the Rockwell PLGR (pronounced "plugger"). One of the reasons for its selection was its ability to obtain a position fix under a forest canopy. The PLGR is capable of far more than simply calculating the desired position and elevation. Cruisers quickly learned it can be used to navigate to the plot, determine the course to plot, obtain a photo reference azimuth, and determine areas.

## **REPORTABLE INCIDENTS**

If any of the following incidents happens to the PLGR, **report it immediately to the SRS GPS Coordinator or to the Missoula Technology and Development Center (MTDC):**

1. **Lost receiver:** Know where your receiver is at all times. If you lend it to someone, keep that information in a notebook.
2. **Stolen receiver:** Keep your receiver locked-up, even in the office.
3. **Appears to have been tampered with:** Do not attempt to repair or for any other reason attempt to get into the receiver case. NSA will consider that a possible compromise of the code module.

4. **Damaged.** Regardless of the extent, a damaged unit must be returned to MTDC.

If loss or damage to the unit is determined to be the result of negligence, you will be held financially responsible in addition to facing possible criminal charges.

Do not place the PLGR or other equipment on the top of your vehicle after completing a plot. Too many PLGRs and data recorders have been lost or damaged when the driver pulls away.

For future reference:

SRS GPS Coordinator:

Horace Brooks  
Southern Research Station  
4700 Old Kingston Pike  
Knoxville, TN 37919  
Phone: 865-862-2100  
Fax: 828-230-0076  
E-Mail: [hbrooks@fs.fed.us](mailto:hbrooks@fs.fed.us)

National GPS Coordinator:

Bill Kilroy  
USDA Forest Service -- MTDC  
5785 Highway 10 West  
Missoula, MT 59808  
Phone: 406-329-3925  
E-Mail: [bkilroy@fs.fed.us](mailto:bkilroy@fs.fed.us)

In addition to the property tag mentioned earlier, all SRS FIA PLGRs must have a tag instructing the finder to call 865-862-2000.

When transferring a PLGR to another person, an Acknowledgement of Receipt of PLGR GPS Unit must be completed by the receiving party and sent to the SRS GPS Coordinator. An example of this form appears at the end of this manual.

## **COSTS**

This technology does not come cheap:

Item	Cost (\$)
PLGR	2000
NiCad Battery	56
NiCad Charging Station	281
12v. Cell Phone Battery	35
3.6v. Memory Battery	5
External Antenna	188
External Antenna Cable	75
External Power Cable	26
AC/DC Power Adapter	30

## CRYPTOGRAPHIC KEY

The PLGR will need to be keyed annually by the MTDC. This usually occurs during the last quarter of the calendar year. With overnight shipping, this procedure will require three business days. Therefore, cruisers need to schedule their work so as to have the use of another PLGR while theirs is being rekeyed, or be prepared to return to plots to obtain coordinates when the PLGR has been returned.

## SHIPPING

The PLGR must be shipped via traceable mail. Because of the excellent service and corporate account, SRS prefers to use FedEx. The account number will be provided when required.

When shipping the PLGR to MTDC for rekeying, include a paid, return shipping label.

## POWER MANAGEMENT

The PLGR requires 12 volts to operate. External power sources must be between 12 and 32 volts DC. For field operations, there are three power source options:

**AA battery pack:** Utilizes eight AA batteries. Cruisers report the AA batteries will power the unit for about four hours, sometimes more, usually less. The short life expectancy and cost of AA batteries makes this an expensive option.

**Rechargeable NiCad battery:** A good NiCad battery is rated for about four of use. Cruisers report the NiCad battery lasts up to six hours. However, the useful life decreases as the battery develops a memory with age. An external charger is provided with the battery for overnight charging. Connecting an external power source to the PLGR recharges the NiCad battery within 36 hours. The initial cost of the battery and charger make this is a relatively expensive option.

**Cell phone battery:** This is a 12-volt, lead-acid battery that is used as an external power source. This battery can power the unit for 16 hours easily. The battery requires nine hours to charge. This option is relatively inexpensive and is recommended if the PLGR is used for several hours each day.

Two sources of power should be taken into the field at all times. Most cruisers use either the cell phone battery or the NiCad battery as their primary power source and the AA battery pack as a reserve.

When installing the AA battery pack or the NiCad battery, **do not drop the pack into the battery compartment.** The contacts at the bottom of the compartment can be broken. Gently slide the battery into the compartment.

The PLGR also uses a 3.6-volt lithium battery to maintain the data, setup information and cryptographic key. This battery is similar in size to a AA battery. Don't get them confused. The memory battery is replaced annually. The GPS Coordinator will provide one as needed. Instructions are provided with the replacement battery.

While operating the PLGR, you may receive one or more power warning messages:

*Low Primary Power:* Your AA/NiCad battery is low. Replace the battery.

*Lost External Power:* You have lost external power. This is most likely the result of a loose connection or low external battery power. However, a frayed power cord or a blown fuse in the external power cord is also a possibility.

*Low Memory Battery:* The memory battery is low. Replace the memory battery.

It is recommended that you maintain a fresh primary battery, whether for overnight or extended storage. The PLGR will attempt to operate using the memory battery if there is no other power source. The unit will begin the startup cycle when turned ON. But after a few seconds the screen goes blank. **Do not continue pressing the "ON" button when this occurs.** Continued attempts to turn the unit ON will drain the memory battery. You risk losing the key and any stored data.

You may monitor your battery's performance on the Battery Status Page.

1. Press MENU, STATUS will be blinking
2. Press the Down-arrow. The bottom line of the first STATUS page displays the source of power: Battery or Vehicle
3. Press the Down-arrow. The Battery Status page is now displayed.
4. The first line displays the type of battery installed. You will need to change this if the type battery installed is not correctly displayed. If a NiCad battery is installed, the PLGR will automatically sense it and display: "NiCad". If you are using a AA-pack, you will need to tell the PLGR the type of battery being used. Press the right-arrow. Use the up-/down-arrow to scroll between the battery options: AA-Alk, BA-5800, and AA-Lith.
5. The third line displays the elapsed time the battery has been used.
6. If you have just installed a fresh battery, you will want to reset (RST) the time used. Press the left-/right-arrow until RST is blinking. Pressing the up-/down-arrow will reset the time used to zero.
7. The fourth line displays the calculated time left on the battery. This figure is notoriously overly optimistic.

## MAINTENANCE AND TESTING

With the exception of replacing batteries, the PLGR requires little maintenance. Inspect the gasket inside the battery cover for damage and dirt. Clean if necessary.

The PLGR has two tests:

The self-test is run every time the unit is turned ON. The self-test results can be seen by pressing the MENU key and selecting STATUS. If the self-test failed, press the up-arrow key to see the self-test failure page. See paragraph 2.7.1 of the Operations and Maintenance Manual for self-test messages.

A second, more comprehensive test is run at the command of the operator. Press the MENU key and select TEST. This test requires several minutes to complete. During this time, the PLGR cannot perform any navigation functions or provide any position coordinates.

Do not attempt to repair a malfunctioning PLGR. Return it to your GPS Coordinator.

## OPERATION

There are two iron-clad rules for operating the PLGR. If these rules are not complied with, the receiver will be disabled.

**Do not press the “CLR/MARK” and the “NUM LOCK” keys simultaneously!** This will erase (zeroize) all stored data and destroy the key. This feature was incorporated for use by the military. In the event of imminent capture, soldiers can prevent the enemy from using the technology against us.

**Do not remove the memory battery plug on the bottom of the unit!** Removing the battery plug will disconnect the memory battery. It will zeroize the unit if there is no other power source. When replacing this battery, the unit must be connected to an outside power source.

You can easily determine if the PLGR is keyed. On the second page of MENU options, “CRYPTO” should be displayed in the lower left-hand corner. If it is not displayed, then the unit is no longer keyed and must be returned to MTDC for rekeying.

## KEYPAD

### Left/Right-Arrow Keys

The Left-arrow (←) and Right-arrow (→) keys move the cursor from field to field in the display. Press the right-arrow key, and the cursor moves right across the display. It then moves down to the next line as if the display were a single line. As the last field on the bottom is reached, the cursor wraps to the first selectable field on the top of the display. Pressing the left-arrow key causes the cursor to move to the left, then up to the previous display line.

## Up-/Down-Arrow Keys

The Up-arrow ( ) and Down-arrow ( ) keys are used to change display pages, change number/alpha field values, and activate functions. The operation performed depends on what field is selected when the keys are depressed

When the cursor is on an option field, pressing the up-/down-arrow key scrolls through the options.

When the cursor is on a changeable value field, pressing the up-/down-arrow keys increases or decreases the field to the next higher/lower available value. When held, the key causes scrolling to speed up.

When the cursor is on the paging (P) field in the lower right-hand corner of the display, pressing the up-/down-arrow keys scrolls to additional pages.

## MENU Key

The MENU key displays the system menu pages. The menu consists of display pages that allow you to monitor PLGR operation and control operating functions and interfaces with other equipment

## WP Key

Pressing the WP key brings up the waypoint menu display. The waypoint functions allow you to manage waypoint data, calculate coordinates of a waypoint, and determine routes and distance data from one waypoint to another.

## POS Key

Pressing the POS key brings up the position display. The position display pages display current position, time, speed, satellite tracking status, current datum, magnetic variation, operator identification, and bullseye position. Pressing the POS key while in another display displays the last-used position page.

Pressing and holding the POS key for approximately five seconds causes the operating mode to toggle between averaging and continuous tracking modes.

## NAV Key

Pressing the NAV key brings up the navigation information displays. The first page selects the display mode, navigation method, and destination waypoint. More pages are available to display the various waypoint navigation information. Pressing the NAV key while in another display displays the last-used navigation page.

## MARK Key

The MARK key is used to activate the MARK (marking present position) and Man Overboard (MOB) waypoint selection page. On this page, the first unused waypoint is automatically selected for storage. The waypoint may be changed to any waypoint number and can be used with either MARK or MOB selection.

## NUM LOCK Key

Pressing the NUM LOCK key toggles the keypad between control mode and numeric mode. An N is displayed at the lower right of the display in the numeric mode.

### 0 thru 9 Keys

In the numeric mode, pressing a 0 thru 9 enters its numeric value into the selected field. If a nonnumeric field is selected, keypad operation is the same as described for the control mode.

## CLR Key

The CLR key moves the cursor to the left. This allows wrong entries to be reentered.

## PLGR SETUP

The first time you use the PLGR and after rekeying, you'll need to set several parameters. These parameters make the information specific to your location and needs. Once these values are set, they become the default values.

1. Turn the unit on. The PLGR goes through a self-test routine for a few seconds, briefly displays the battery status, and then displays the Position screen.
2. Press the MENU key. STATUS will be blinking.
3. Press the RIGHT-ARROW key. SETUP will be blinking.
4. Press the DOWN-ARROW key. The first page of the setup menu is now displayed.
5. Press the LEFT-ARROW key so the field value for SV-TYPE is blinking. Press the DOWN-ARROW so "mixed" is displayed. Press the RIGHT-ARROW. Note the double-arrow beside the "P" in the lower right corner.
6. Press the DOWN-ARROW to move to the next page.
7. Press the RIGHT-ARROW so the field value for SETUP UNITS is blinking. Use the DOWN-ARROW to scroll between the options. Stop when "L/L-dms" is displayed. "L/L-dms" signifies latitude/longitude-degrees, minutes, seconds.
8. Press the RIGHT-ARROW to set the units for Distance and Elevation. Use the DOWN-ARROW to scroll between the options. Stop when "ENGLISH" is displayed.
9. Press the RIGHT-ARROW so the value for Elev is blinking. Use the DOWN-ARROW to toggle to "feet".

10. Press the RIGHT-ARROW. Use the DOWN-ARROW to toggle to "MSL".
11. Press the RIGHT-ARROW so the value for ANG is blinking. Scroll through the options until "DEG" is displayed.
12. Press the RIGHT-ARROW. Scroll through the options until "Mag" is displayed. This parameter is used when calculating coordinates. Since our compasses are not set for declination, we want to use magnetic North rather than true or grid North.
13. Press the RIGHT-ARROW and DOWN-ARROW to go to the next page. This is the Magnetic Variation page.
14. Press the RIGHT-ARROW. The value for TYPE should be blinking. Scroll through the options until "Calc" is displayed.
15. Press the RIGHT-ARROW. Scroll through the options until "deg" is displayed.
16. Press the RIGHT-ARROW and DOWN-ARROW to proceed to the next page.
17. Press the RIGHT-ARROW to move to the "WAGE" field. WAGE should be "on". "WAGE" signifies Wide Area GPS Enhancements. When ON, the PLGR process enhanced clock correction signals from the satellites.
18. Press the RIGHT-ARROW to move to the "ELHold" field. ELHold should be "automatic".
19. Press the RIGHT-ARROW to move to the "TIME" field. Use the DOWN-ARROW to scroll to the correct time zone correction for your locality:  

EST LOC=Z-0500	EDT LOC=Z-0400
CST LOC=Z-0600	CDT LOC=Z-0500

This parameter is not critical to PLGR operations. When set correctly, the time displayed on the second Position page will be the correct local time.
20. Move the cursor to the "ERR:" field. Use the DOWN-ARROW to scroll to "EHE" for the two-dimensional error.
21. Press the RIGHT-ARROW and DOWN-ARROW to move to the next page.
22. Press the RIGHT-ARROW and scroll through the options for "DTM:" Stop when "NAR" for North American Datum 1983 is displayed.
23. Press the RIGHT-ARROW to move to the "AUTOMATIC OFF TIMER:". Scroll to select "20 min". This function is used to save battery power. It is enabled only when battery power is being used. This function starts when a good solution is obtained and resets every time a keystroke is entered.
24. Press the RIGHT-ARROW.

Your PLGR is now set up and ready to calculate your position. Press the "POS" key.

After the PLGR has run its self-tests and displays the Position screen, the PLGR downloads the daily almanac and verifies the cryptographic key. These processes are automatic and require 12 to 25 minutes. You will get the quickest position lock and most precise solutions with the current almanac. You may get a solution before the almanac has been updated; but it will likely have a higher error estimate. Therefore, it is recommended that you turn the unit on while you are driving to your work area. You can

connect the PLGR to the vehicle's electrical system using the external power cord. This will preserve your battery power. Use the external antennae or place the unit on the dashboard (safety permitting) while driving to the work area.

## OBTAINING A POSITION FIX

When the PLGR is turned on, the default screen is the Position screen. You need do nothing to get a position fix. You must track four satellites to obtain a position fix. However, if after 20 to 25 minutes you have not obtained a fix, turn the unit OFF and back ON. Sometimes the unit gets hung-up trying to track a satellite. Cycling it OFF and ON forces it to look at other satellites.

Several factors influence satellite reception. Satellite signals can be blocked by terrain, vegetation, and the human body. Although weather is not supposed to effect PLGR operations, cruisers have reported difficulty obtaining a position fix on overcast days. Orienting the PLGR's antennae vertically aids in signal reception.

The tracking mode is displayed in the upper left corner of the screen. The error estimate is displayed in the upper right corner. The Latitude and Longitude are displayed on the second and third lines. Finally, the elevation is displayed in the lower left corner.

The default operating mode for the PLGR is continuous (CONT). "CONT" is displayed in the upper left corner of the first Position screen. In this mode the PLGR continually calculates and displays the current position estimate. Once the PLGR has a fix on the position, you will note that the seconds of latitude and longitude constantly change. If you were to plot these coordinates, you would find that they are clustered around a central location. It is that central location we want to record. To determine that central location, the PLGR can calculate the running average of these coordinates.

There are two methods used to switch from continuous mode to averaging mode.

1. While the first Position screen is displayed, press and hold the POS key for five seconds. This toggles between the two modes. "AVG 00000" will replace "CONT" in the upper left corner of the screen.
2. This second method can be used to improve performance in very low signal environments, such as under dense foliage.
  - a) Go to the SETUP menu.
  - b) Change the SETUP MODE to "STBY",
  - c) Press MENU and return to the Setup menu.
  - d) Now change the SETUP MODE to "AVG".
  - e) Press the POS key.

For a brief instant, you will see "STBY" in the upper left corner before it changes to "AVG 00000".

While in averaging mode, **do not move the PLGR**. The PLGR must obtain a valid position fix for 13 seconds before averaging will begin. This may require some time. Solutions will be averaged once per second. The first

position screen displays the averaged value and the sample counter. Although there is no established rule for determining the sample number required to ensure an accurate estimate, FIA has selected 180 samples as the minimum required.

The maximum allowable error estimate is  $\pm 70$  feet. The PLGR routinely has error estimates in the low-20s. The error estimate is a function of the satellites relationship to the receiver. As the satellites orbit the Earth, this relationship, or geometry, changes. Consequently, the error estimate is constantly changing.

Occasionally, you may want to reset the sample counter. For example, the satellite geometry has changed, and you are now receiving a lower error estimate.

1. Press the left-/right-arrow, and the sample counter will begin to blink.
2. Press the up-/down-arrow key to reset the counter.
3. Pressing the left-/right-arrow key a second time returns the cursor to the paging (P) field in the lower right corner.

On the rare occasion that you cannot obtain a position fix, there are two options. You can try again at a different time of day when the satellite geometry has changed. Or, you can obtain a position fix off the plot center, determine the bearing and distance to the plot center, and use the PLGR's range-calc feature (discussed later).

Once you have the required number of samples, record the error estimate and the number of samples on your form(s) or data recorder. The error estimate and number of samples are not stored electronically in the PLGR. You have the option to record the coordinate on paper or data recorder, or you can save the coordinate in the PLGR's memory for entry onto the data recorder and form(s) at a later time.

## **SAVING A POSITION FIX**

The PLGR can store up to 999 waypoints, 1 – 999.

MARK saves the current position's coordinates. To save a position fix or waypoint (WP), press MARK. The PLGR will automatically assign the first available WP to that position. At this time you may change the WP number, by pressing the NUM LOCK key and entering the desired WP number, or using the up-/down-arrow key to scroll to the desired WP number. Once the desired WP number is displayed, pressing MARK a second time saves the entry. If you used the NUM LOCK feature, remember to press NUM LOCK again to return to the control mode before pressing MARK a second time. If the waypoint you have selected is already assigned, pressing MARK a second time overwrites the previously stored coordinate.

There is no rule for assigning waypoints. However, most cruisers assign the waypoint the same number as the plot number. Other waypoints used in association with that plot receive waypoint number(s) beginning or ending with the plot number. For example, plot 36 would be assigned WP

36. Associated waypoints, such as the SP, would be assigned WP 361, 362, 363, or 136, 236, 336....

## MANUALLY ENTERING A WAYPOINT

It will be necessary to manually enter a coordinate occasionally. SRS recently adopted a hexagon design for plot locations. If there is an existing plot located in the hexagon, that plot is used to represent the hex. In the event there is no plot in the hex, an empty hex, coordinates will be provided for the new plot's location. These coordinates must be manually entered into the PLGR.

1. Press WP, select ENTER, and press NUM LOCK.
2. Press the right-arrow and enter the desired waypoint number.
3. Pressing the right-arrow once allows you to name the waypoint if you want. Otherwise, press the right-arrow a second time.
4. Press the right-arrow a third time. The PLGR defaults to North latitude. All of our coordinates are North latitude.
5. Enter the degrees, minutes, and seconds north latitude.
6. Press the up-/down-arrow to toggle the longitude to "W". All of our longitudes are West longitude.
7. Press the right-arrow and enter the degrees, minutes, and seconds west longitude.
8. There is no elevation to enter. Press the right-arrow twice.
9. Press the up-/down arrow. You will see "WAYPOINT STORED"
10. Press any control mode key: POS to go to the position screen, NAV to navigate to a waypoint, WP to work with waypoints, etc. To enter additional waypoints, press the down arrow to return to the entry screen (step 2).

## CALCULATING A WAYPOINT

On occasion it will be necessary to calculate a waypoint. Rather than occupy a nonforest plot, we will calculate its coordinates. Having found the plot starting point (SP), you may want to calculate the plot center (PC) coordinate and use the PLGR to facilitate finding the plot.

Before you can calculate a waypoint, you must first have a waypoint stored in the PLGR. This waypoint may be a saved (marked) WP or a manually entered waypoint. This will usually be a marked WP that represents the SP. You must also have an azimuth and distance from the stored WP to the PC. This you will obtain from having drawn-up the photo or be provided by the previous crew.

1. Press WP and select RNG-CALC.
2. Use the right-arrow to move the cursor to the first numeric field.
3. Enter the waypoint number for the beginning point.
4. Move the cursor to the RNG field, and enter the distance and units to the desired location.
5. Move the cursor to the AZ field, and enter the azimuth to the desired location.
6. Move the cursor to the paging (P) field in the lower right corner. For our purposes, we do not need to enter an elevation.

7. Press the down-arrow to go to the next page. The calculated coordinate is now displayed. You can record the calculated coordinate on your data recorder or form(s).
8. To save the calculated coordinate as a waypoint:
  - a) Press the down arrow to go to the next page. This page is similar to the MARK page. Change the waypoint assignment if you desire.
  - b) Press the left-/right arrow key to move the cursor so STORE is blinking.
  - c) Pressing the up-/down-arrow while STORE is blinking will save the calculated coordinate as the assigned waypoint.

## NAVIGATING TO A WAYPOINT

You will want to use the PLGR to locate a point. This may be the PC of an established plot or a new plot, in the case of an empty hex.

The PLGR has several navigation scenarios pre-programmed. These navigation programs contain a number of parameters that are not needed for our application. Many of these functions require a minimum ground speed (approximately 1.5 kph) before they can be used. Also, the parameters of interest do not appear on one screen. The user must select one page to get the distance and another page to get the azimuth to plot. It is recommended that you enter a custom navigation program.

To enter a custom navigation screen, go to the CUSTOM NAV option in the MENU. You may select any parameter(s) that you feel will be useful. However, there are three parameters that are considered minimal: Waypoint and Error Estimate (WP/EHE), Azimuth to Waypoint (AZ), and Distance to Waypoint (RNG). A fourth parameter 2-Dimensional Steering (STR2d) is useful. After displaying the desired parameter, going to the next line selects that parameter. When you have selected all of the desired parameters, press any function key (MENU, POS, NAV, etc.) to exit and save your custom navigation screen.

1. Press MENU three times.
2. Select CUSTOM NAV.
3. Press the right-arrow and use the up-/down-arrow to scroll through the options until WP/EHE is displayed.
4. Press the right-arrow to go to the next line
5. Select AZ.
6. Press the right-arrow.
7. Select RNG.
8. Go to the next line.
9. Select STR2d.

These four items will be displayed on a single screen. Any other parameters you may choose would be displayed on the second and subsequent screens. Other parameters might include Ground Speed (GS), Slope Range (SR), Tracking (TRK), and Tracking and Ground Speed (TRK/GS),

To navigate to a waypoint, you first must configure the display mode and navigation method.

1. Press NAV.
2. Use the arrow keys to select CUSTOM (if you have defined a custom navigation screen) or SLOW as the display mode. SLOW navigation mode is used when traveling on foot over rough or difficult terrain.
3. Use the arrow keys to select DIRECT as the navigation method. DIRECT is used to navigate from the present position directly to the destination. Other methods require a predefined course or route.
4. Use the arrow keys to move to the second line and select the destination waypoint.
5. Move the cursor to the paging field, and go to the next page.
6. The navigation parameters are displayed on the second and subsequent screens.

You may use the PLGR to establish a plot. In the case of an empty hex, you will be provided with coordinates. Plot the location on your county map to determine the location and the appropriate photo. Use the map and photo to approach the area. Use the PLGR to direct you when you are close. When navigating to the plot, the position mode must be continuous. When you are prepared to set the plot, switch to the averaging mode. Before setting the PC, you must have the minimum 180 samples. Use a compass and tape to close the remaining bearing and distance to the plot.

## **DETERMINE THE COURSE TO PLOT**

This feature is used to determine the bearing and distance from the SP to the PC. For distances less than 500 feet, it is recommended that you use the PDRS traverse program. The PLGR's solution may not be within the quality assurance tolerance level for these shorter distances.

1. Obtain and MARK the coordinates for the SP and PC.
2. Press WP and select DIST.
3. Enter the waypoint that represents the SP.
4. Enter the waypoint that represents the PC.
5. The distance (RNG) and azimuth (AZ) are calculated and displayed.

You may also use the NAV function. This requires either the SP or PC coordinate be marked.

1. Obtain and mark the coordinate for the SP/PC.
2. Obtain the coordinate of the SP/PC.
3. Press the NAV key and enter the waypoint representing the marked SP/PC.
4. Go to the second NAV screen and obtain the distance and azimuth to the destination waypoint. If the marked coordinate is the SP, record the reverse azimuth of the solution.

## DETERMINE AREAS

One acre is the minimum size requirement for forest, nonforest, and within forest conditions. Therefore, accurately determining areas is essential. The PLGR calculates areas to the nearest 0.1 acre. If the calculated area is 1.0 acre, you may want to use the DIST function to obtain the azimuth and distances between waypoints and use the PDRS area feature to ensure the area is not 0.95 to 1.0 acres.

1. Obtain and mark coordinates around the perimeter of the area in question. Up to 26 waypoints can be used to define a single route. If you require more than 26 waypoints to define the perimeter, divide the area into two or more parcels.
2. Press WP and select ROUTE
3. Select ENTER
4. The PLGR defaults to the first unassigned route number. Assign a route number and name if desired.
5. Enter the waypoints corresponding to the perimeter.
6. To save the route, either scroll through to the end of the route list and select the SAVE option, or press one of the major function keys (MENU, POS, WP, etc.).
7. After the route has been saved, select the POLY option of the ROUTE menu. This displays the circumference and the area of the defined polygon.

## DETERMINE PHOTO REFERENCE AZIMUTH

In hilly/mountainous and undeveloped areas, finding a linear feature that can be used as a reference azimuth is difficult. The PLGR can be used to obtain an azimuth between two identifiable points. However, using the PLGR to obtain a Reference Azimuth should not become an everyday practice.

1. Identify two points on the photo that you will be able to locate on the ground. These points should be widely spaced, further is better.
2. Obtain and mark coordinates of the first point. Because of the scale of the photos, it is not necessary to use averaging mode for this application.
3. Obtain coordinates for the second point.
4. Use the procedures described above to determine the azimuth between the two points.

## CLEAR WAYPOINTS

Periodically, you will want to clear stored waypoints.

1. Press WP and select CLEAR.
2. Using the arrow keys, select the range of waypoints you want to delete.
3. Pressing the up-/down-arrow while "ACTIVATE" is blinking will begin the process.
4. The PLGR now needs confirmation that you want to delete the waypoints. If the range is correct, use the arrow buttons to select CONFIRM. If the range is incorrect, select CANCEL to stop the operation.

## OTHER USEFULL SCREENS

Information contained on a number of screens will help you monitor the PLGR's performance.

### STATUS

Page 1 displays the GPS Status, Self-Test Results, Antenna Source, and Power Source.

Page 2 displays the Battery Type, Recharge Status, Time Battery Used, and Time Battery Left.

Page 4 is the Satellite Tracking Status and shows the signal status of the satellites being tracked. Pressing the left-/right-arrow toggles the first column to display a fifth satellite.

Line 1 displays the number of the satellite (SV) being tracked/searched

Line 2 displays the signal strength (CN). 34 dB is considered nominal.

Line 3 displays the code type (CD) being transmitted by the satellite.

Line 4 displays the satellite status (ST): I=interference, R=recovery, S=search, and T=Track

Page 5 shows the satellite status information:

Line 1 displays the number of the visible satellite (SV).

Line 2 displays the satellite's health: OK or BAD.

Line 3 displays the azimuth to each satellite (AZ).

Line 4 displays the elevation angle of each satellite and whether the satellite is ascending or descending.

### POSITION

Page 1 displays the current position information

Page 2 displays the Time, Date, Track, and Ground Speed.

Page 3 displays the satellite usage summary that includes the almanac age.

Page 4 displays the current datum, the magnetic variation, and the operator ID.



**SUPPLEMENT C**  
**DATA RECORDER INSTRUCTIONS**

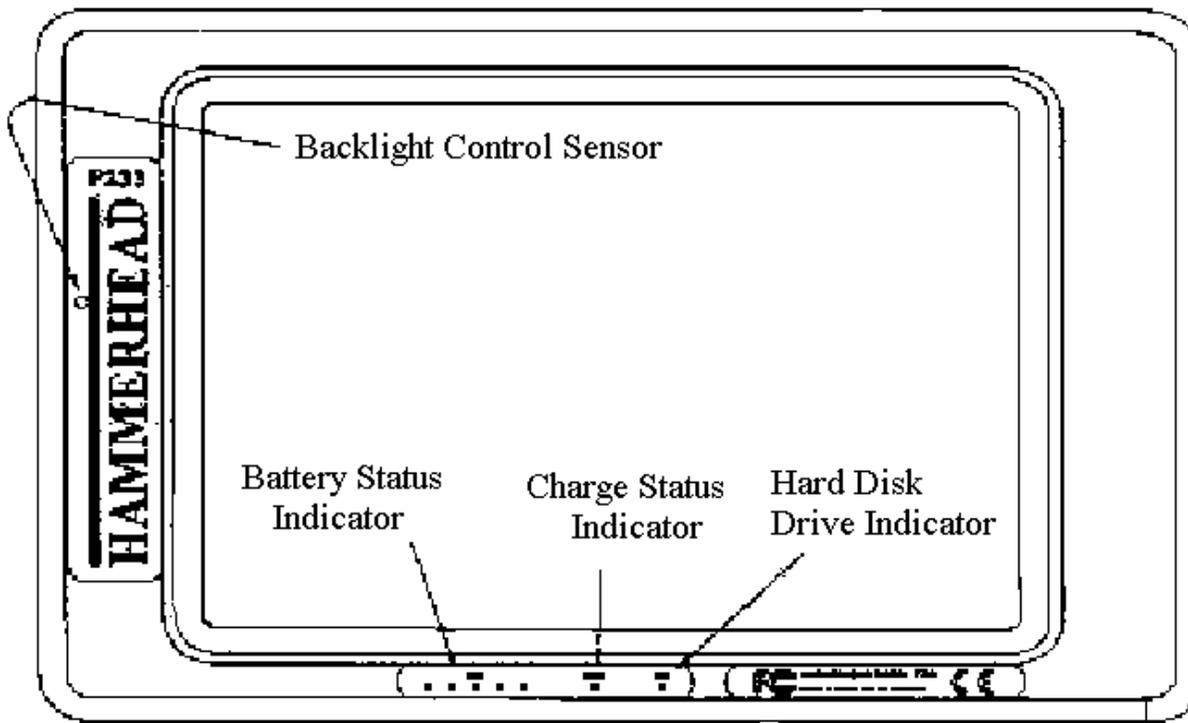


## Basic Hammer Head User's Guide

The current Data Recorder in use in the field is the Hammer Head P-233. It is a Windows 95, ruggedized lap top computer with a Pen Based interface. We run several specialized programs that allow the field personnel to collect and transmit data. The units are built around a 233 MHz Intel Pentium processor.

### Hammer Head specifications:

- minimum of 32 MB of main memory
- minimum of 3 GB of hard drive space
- two PCMCIA slots – one of which we use for a modem
- one infrared port
- pen services software
- 9.5" 640x480 backlit transfective monochrome LCD display
- one extra battery



*FRONT VIEW*

### The front panel features include:

A battery status indicator which uses five LED's and operates like a fuel gauge showing the status of the battery charge.

A charge status indicator which is lit whenever external power is supplied. It blinks slowly when the battery is charging and remains on steady when the battery is fully charged.

A hard drive indicator which flashes as the hard drive is accessed.

A backlight control sensor which automatically turns the backlight off in bright light to save battery power.

### On the right side:

The on/off switch. It is a rubber covered push switch, when pressed once turns the machine on.

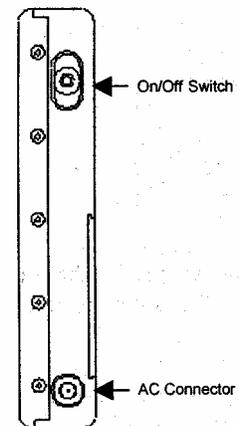
When pressed again it will power the machine down automatically following proper Windows shutdown procedures.

This switch can also be used to bring the system out of sleep mode by pressing it one time.

If the machine locks up, the on/off switch can be held in for 10-15 seconds and the machine will do hard shutdown of the machine. This should only be done when normal shutdown procedures will not work.

The newer machines come with an external power port for charging and operating the machine from another power source.

#### On/Off switch:



RIGHT SIDE  
VIEW

**On the left side:**

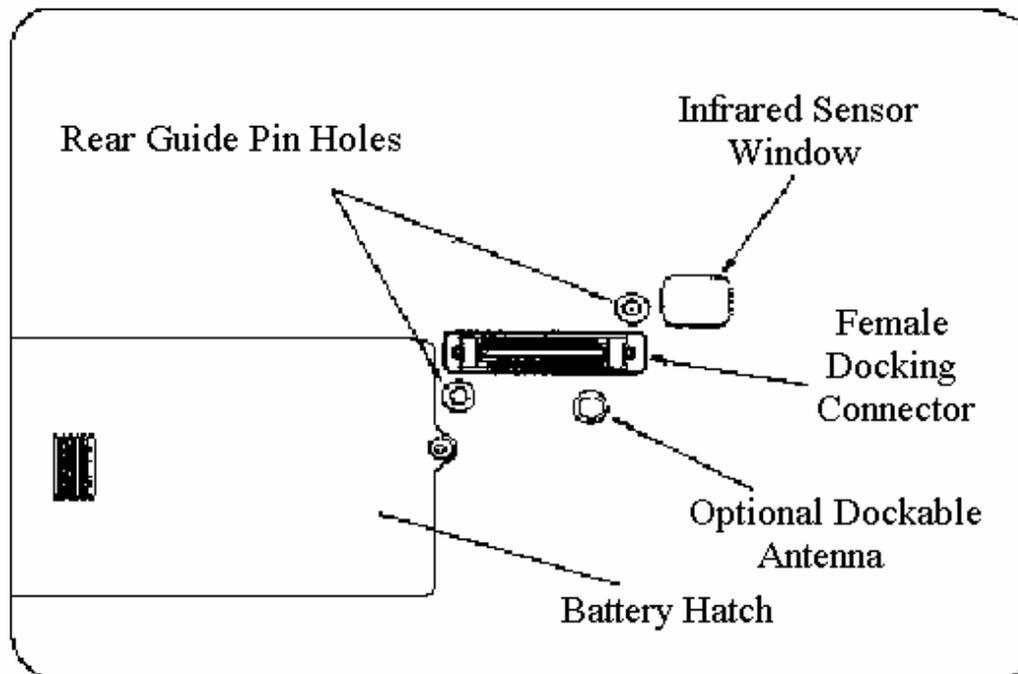
A cover for the PCMCIA slots encases a waterproof RJ11 connector for a standard phone line. This is the connection used to dial into the Starkville system to download county data and transmit field data.

**On the back side:**

The machine has a female docking connector. It is used to attach a port replicator. This is where all external devices are connected.

There is a small transparent port that is the infrared sensor window.

The battery hatch is also located on the rear and has a sliding cover. The battery compartment is sealed to prevent water from entering the machine even if the hatch is off.

**REAR VIEW**

## Batteries and Charging Procedures:

The red LED's on the front panel indicate the power status of the battery. At full charge all five indicators will be lit. As battery power decreases the lights will turn off from right to left.

The last indicator will begin to flash when approximately three to five minutes of battery power remain. There is also a warning screen that will appear prompting you to change the battery.

If the battery is allowed to completely fail there could be loss of data and the machine may require scan disk to be run before it will reboot. This is a problem in the field as it requires a keyboard to initiate scandisk.

Under normal operation the batteries will last approximately four hours if power management features are turned on. Battery life is also dependent on temperature. The batteries are NOT hot swappable! You MUST shut the machine down before removing the battery!

For the P-233 models the battery indicator light will not reinitialize when a new battery is installed. You must run the reset gas gauge tool once the machine is brought back up. The HH3 models will recognize the fresh battery and reinitialize on its own.

The battery status indicators are based on time of usage and depend on the new battery being fully charged to give an accurate reading. Each unit comes with a power supply that will power the unit and also charge the battery. It is marked with Walkabout Computer's logo.

Each unit also comes with an external charger that will charge two batteries. It charges one at a time and has a light for each battery that turns green when the batteries have a full charge. This unit is made by SPAN and the power supply is also marked with their name. **DO NOT** plug the SPAN power supply into the Hammer Head – it will fit, but **IT WILL DAMAGE THE MACHINE!!! PLEASE BE CAREFUL.** Only use the SPAN power supply with the SPAN external battery charger!!!!

**Port replicator:**

All external devices supplied with the unit (Zip drive, printer, charger, keyboard...) are connected by means of the port replicator. The port replicator also serves as a stand for the machine when used on a desk. It uses two thumb screws to attach it to the machine. It attaches directly to the female docking connector on the back of the unit.

**Pen:**

The pen is attached to the case with a tether and is the primary input device for the machine. The pen functions like a two-button mouse. There are two switches, one in the tip and a pink button on the side. Regular left mouse operations are done by simply tapping or double tapping the pen to the screen as you would click a mouse. Right mouse functions are accomplished by holding down the pink button on the side of the pen and tapping the screen. The pen requires some getting used to, but once familiar it works quite well.

The small plastic tip in the pen is replaceable and several tips are included with the unit as well as a circular metal band that is used to remove the tip. Simply pull the old tip out and gently push the new one in. The pen is not totally waterproof. It will tolerate rain, but not immersion. If the pen gets too wet it will start to act erratically. If this happens you can remove the plastic tip and sling the pen to get most of the water out. This will usually get you through the day and with the tip out it will dry out overnight. There are no batteries in the pen and, other than the tip, it is not made to come apart.

**Temperatures:**

The units will operate in temperatures from slightly below freezing to quite high temperatures. Do **NOT** leave the units in the vehicle overnight when the temps are low and expect it to boot in the morning. The machine will have to warm up before the hard drive will spin up and the display can work! Battery life is also shorter in colder weather.

If left face up in direct sunlight in high temps the display may turn dark and be difficult to read. This condition will go away when the unit cools down. This is especially bad if left on the dash of a hot vehicle in the summer.

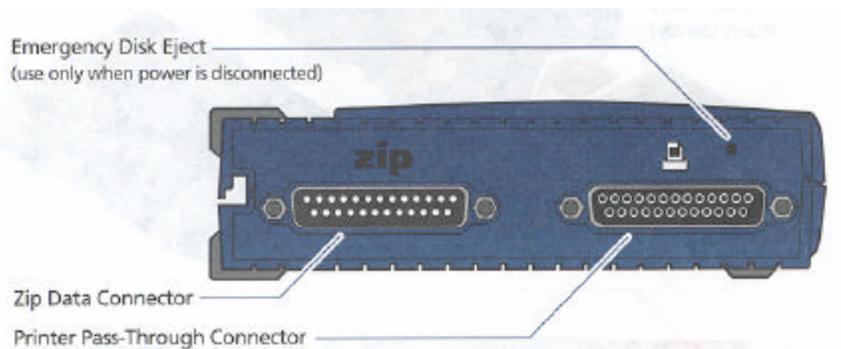
## Zip Drive:

Each unit comes with a Zip drive for storing backup data. The zip drive attaches to the port replicator with a parallel or USB cable depending on the PDR and zip drive. The cable and drive are marked as to how they attach. The zip drive comes with a power supply that is marked ZIP also. Use it only with the Zip drive.

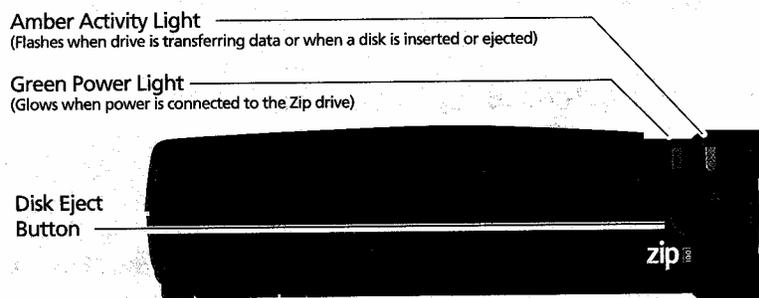
If using a parallel cable attach the Zip drive before starting the machine. If the machine is already on before the Zip drive is attached you will have to reboot the machine for it to recognize the drive.

There are two disks sent out with each unit and a tools disk. It is recommended that you alternate your backups between the two disks. The Tools disk cannot be used to write backups to.

If a disk ever becomes stuck in the drive there is a small hole in the back of the drive that you can insert a straightened out paper clip and eject the disk. Do NOT try to pry it out or physically pull it out, this will damage the drive!



**NEVER** insert a 3 1/2 " floppy disk into the Zip drive! It will damage the drive.



**Printer:**

Each unit comes with a HP deskjet 340 or deskjet 350 portable printer. These come with a battery, charger and infrared adaptor. As before, the charger is marked with HP's logo and is to be used only with the printer.

The printer can be attached to the port replicator with a parallel cable or be run through zip drive as long as the Zip drive is powered. This way both can be used.

You can also print via the infrared port on the back of the Hammer Head. The printer comes with an infrared adaptor that plugs into the same port as a cable. The infrared adaptor has a range of about three feet and must have a clear path between the port on the machine and the port on the adaptor. On the task bar at the bottom right hand corner of the screen on the Hammer Head there is a small dish shaped symbol that indicates the infrared port on the hammerhead. When the unit and the printer are aligned there will be two of these symbols shown connected. The port on the adaptor swivels to make it easier to get them to align. You may choose which printer you want to use (either the hpdeskjet340 (infrared) or cable printer) by using the dropdown menu on the print screen.

The paper feeder on the back of the printer will hold around thirty sheets. The printers have instructions printed on the inside of the front door and on the back for operation and assembly. The part number for the print cartridge is also listed there. The print cartridges are normally available at Wal-Mart and most office supply stores.

**Handwriting Recognition:**

The handwriting recognition system can be used in almost all programs. It can be tailored to personal preferences by clicking on the Handwriter Settings icon in the control panel. You can set the machine for right or left hand writing and for the way you make most characters. However, most people use the drop down keypad function for data entry instead of writing by hand.

For additional information you can also refer to Walkabout's users guide.

For more specific questions or problems you can contact:

Mark Ferguson	865/862/2096
Joe Johnson	865/862/2036
Haimes Critz	662/338/3118

