FIELD INSTRUCTIONS
FOR THE

INVENTORY
OF

PACIFIC ISLANDS
2005

Forest Inventory and Analysis Program

Pacific Northwest Research Station

USDA Forest Service

FIELD INSTRUCTIONS

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1. INTRODUCTION

1. INTRODUCTION

This manual documents the field procedures by the Forest Inventory and Analysis Program (FIA) in the inventory of the Pacific Islands.

FIA, a program within the Pacific Northwest Research Station (PNW), USDA Forest Service, is one of five Forest Inventory and Analysis work units across the United States. PNW-FIA is responsible for inventorying the forest resources of Alaska, California, Oregon, Washington, Hawaii, Guam, American Samoa, Republic of Palau, Federated States of Micronesia, Commonwealth of Northern Mariana Islands, and Marshall Islands.

A. Purposes of this manual

This manual serves two purposes, to:

- instruct field personnel in how to locate and measure field plots.
- document the field procedures, methods, and codes used in the inventory.

B. Organization of this manual

This manual is structured primarily for use by field personnel. Each chapter corresponds either to a separate function that must be performed in locating and measuring a field plot, or to a particular aspect of data recording that must be completed.

The procedures in this manual are ordered to coincide as much as possible with the order in which field data items are collected and entered onto data sheets in the field, and the laptop data entry program. Some procedures and codes are repeated in multiple chapters of the manual to minimize the need to refer to additional chapters while collecting data in the standard order.

This manual incorporates the field data collection procedures of the Forest Inventory and Analysis National Core Field Guide with regionally specific procedures.

Information that is infrequently used or that is included only for documentation is in the appendices at the end of this manual. A glossary and an index are provided for quick reference.

Each section of the field guide 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.

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

1.1 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 of 1.0 inch through 4.9 inches) and seedlings [DBH less than 1.0 inch in diameter and greater than 0.5 foot in length (conifers) or greater than 1.0 foot in length (hardwoods)].

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).

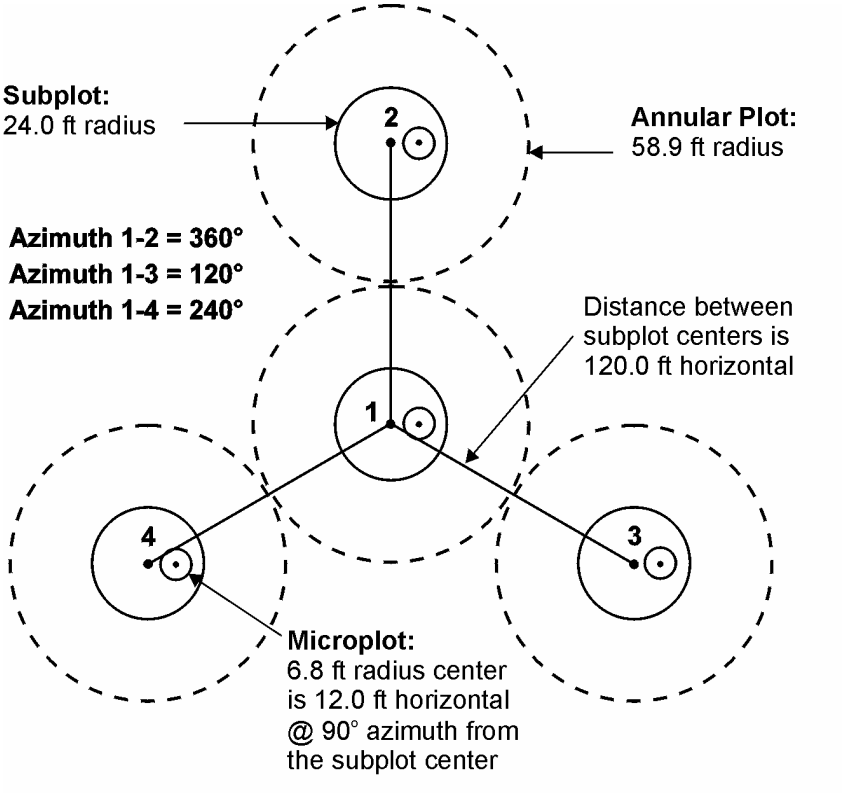

Figure 1. FIA Phase 2 plot diagram

1.2 PLOT SETUP

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.

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

Subplot Numbers		Azimuth	Backsigh	Distance
From	To	*degrees*		*feet*
2	3	150	330	207.8
2	4	210	030	207.8
3	4	270	090	207.8

Assign the appropriate present CONDITION CLASS STATUS Code(s) to the new subplot (usually CONDITION CLASS STATUS = 1 or 2)
Assign the next TREE RECORD NUMBER.

1.3 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.

Products
PNW-FIA provides information needed by resource planners, policy analysts, and others involved in forest resource decision-making. Data collected in PNW-FIA inventories is summarized, interpreted, analyzed, and published in statistical and analytical reports of national, state, and subregional scope. PNW-FIA publishes information on area by forest land and owner classes, land use change; timber volume, growth, mortality, and removals; potential forest productivity; opportunities for silvicultural treatment; and kind and area of wildlife habitats. PNW-FIA also provides data to answer questions about forest resources.

Research topics
The data collected in these inventories represent a wealth of information for both applied and basic questions concerning forest ecosystems. Topics include: the distribution of plant species and their relationship to environment, the incidence of insects and disease in relation to forest type and condition, changes in forest due to disturbance, and improved prediction of forest growth and development on different sites and in response to management.

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2. TRAVEL PLANNING AND LOCATING THE PLOT

A. Landowner contact

Permission
Written or verbal landowner permission must be obtained before a plot is visited. This responsibility lies with the field coordinator who may delegate contacting the landowner to the field crew.

Recording conversations with landowners
Include a record of each conversation with a plot landowner on the Ownership Contact form. While not a part of the official plot record, this information will document that permission was obtained, assist in accessing the area for variance-plots, and possibly aid the field crew during a future inventory.

Ask landowners if they can confirm the dates of any disturbance (usually harvesting) on the plot since the previous visit; record this date on the Plot Attribute Record. Record any special circumstances about plot accessibility--such as locked gates or washed-out roads on the Plot Record.

Data requests
Plot specific data is released only to the legal owner of the plot area. Requests for photocopies of the field data sheets and plotcard, summarized plot data, and for copies of future publications based on information collected in this inventory should be noted on the plot card. Current plot data will generally be sent to the owner after the field season is completed and plots are returned to the office. If the landowner desires, the crew may provide photocopies of plot data immediately after collection.

Any additional data requests should be referred to the client request person in the Portland office:

Otha Terry
Portland Forestry Sciences Lab
P.O. Box 3890
Portland, OR 97208

phone: (503) 808-2044
email: oterry@fs.fed.us

B. Before leaving base camp

1. Make sure the landowner has been contacted (see above).
2. Plan the route to the plot. Always bring two or more extra plots.
3. Leave word of plot locations and expected destinations with the crew coordinator using the arranged system (cell phone, voice mail, ...).
4. Make sure your vehicle has all of the necessary field gear and a plot map.
5. Be in agreement with your crew partner(s) on a work procedure.
6. Inspect vehicle for fuel, oil, lights, safety features, and plot supplies (stakes, tags, pins, and nails) prior to departure.

C. Checklist of items needed on plot

Data recording items
Previous plot records and photos
Plot jacket (previous and current plot records with subplot diagrams, and field photos)
Hand-held data recorder downloaded with plot records; extra AA batteries
GPS unit with fully-charged batteries
Mechanical pencils, red photo pen, black pen, eraser
Note pad(s) made of "write-in-the-rain" paper
Blank forms for plot, subplot, condition class attributes; tree tally; CWD; veg profile; and subplot diagram
Calculator(s)
Tatum and tatum aids
Field procedures manual
Plant ID guide(s), plant association guides, plant disease guide

Photo interpretation items
Plot (road) map
Stereoscope(s) (2x and/or 4x) with case and sharp straight pins
Photo scale (Timber Survey Aid #16)
6 inch ruler calibrated in 1/20th inches
Hand lens

Plot measuring items
Compass(es)
Clinometer(s)
Diameter tape(s)-20 foot
Increment borer(s) with sheath
100 foot tape(s) with carabiner(s)
Hand axe(s) with sheath
Laser height/rangefinder
Plant press for plant specimens and paper bags for root disease samples

Plot referencing items
Cedar stakes
Steel plot pins
Aluminum nails
Tree number tags
Square aluminum tags
Round aluminum tags
Flagging tape

First aid items
First aid kits
Bee sting and/or snake bite kits

Personal and safety gear
Canteens with water
Lunches

Utility pouch
Vest and hardhat
Rain gear
Gloves
Flashlight and batteries
Extra clothing
Extra food

Camping gear
When applicable:
Tent
Sleeping bag
Sleeping pad
Extra water or water purifier
Stove with fuel and matches
Food
Cooking/eating dishes and utensils
Flashlight

D. Safety

Personnel working in the field are subject to many safety hazards. Each person must always be conscious of these hazards to avoid accidents:

1. **Don't take chances!**
2. **Eliminate horseplay and carelessness!**
3. **Think safety!**
4. **No task is more important than personal safety!**
5. **Always make sure that someone else knows where you plan to work each day!**

Safety in the woods

Wear protective clothing: Long-sleeved shirts, long pants, and gloves may protect you from contact with brush and rocks, poison oak, and stinging insects. Trouser legs should be loose enough to avoid binding or cramping, and should not have cuffs. Wear a hardhat at all times in the woods. During hunting seasons, wear bright red or orange clothing.

Wear good quality boots that provide good support and traction. For example: 8-inch high leather work boots with lug-soles (Vibram-type soles).

Walk, don't run in the woods. Take your time and plan your route. Avoid plunging through the brush. The best route of travel may not be the shortest. Routes across brushy, irregular terrain with rocks and down logs can be hazardous.

Be watchful of twigs and branches, which may cause eye injury. Be especially alert when stepping up to trees which retain their small dead twigs. Keep a sufficient distance behind the person ahead of you to avoid being slapped by branches.

Lift knees high to clear obstacles in heavy undergrowth or slash. Slow down and watch your step.

When contouring a steep slope, do not lean into the hill. This tends to loosen footing. Erect posture or slightly leaning out gives more secure footing.

Know how to fall to avoid hard impacts. Keep flexible with knees slightly bent. If you feel yourself slipping, pick a landing spot. Do not stick your arms out to break a fall. Roll with the fall. Try to take the impact on the side of your body rather than your back.

Don't take chances by walking across ravines on small logs.

Bee aware. Keep an eye out for yellow jacket and hornet activity. Yellow jackets nest in the ground, often in well-decayed logs or in thick moss on trees or in snag cavities. Yellow jackets are particularly active (nasty) during late summer and early fall when forest conditions are very dry. Hornets nest above ground in "paper" nests that are suspended from branches; woe befalls those who unwittingly bump their head against a nest, or shake the sapling from which a nest is suspended. If allergic to insect stings, carry medication to counteract the effects of stings.

Be alert to rattling or buzzing noises. Look before putting hands or feet on or under rocks and logs. Be alert when walking in snake-infested areas.

Avoid poison oakand other poisonous plants, if possible. Place oil on exposed skin before going to field. After contact with poison oak, remove clothes carefully, wash exposed areas with cool, soapy water, and wash clothes before wearing them again.

Keep someone posted as to where you plan to work each day, particularly on long hikes into the forest, so that if you do not return in a reasonable time, someone can find you.

Keep hatchets in their sheath except when actually using them, and snap the sheath shut.

First Aid. Keep your individual first-aid kit completely supplied, and know how to use it. Treat all wounds promptly. Each vehicle is supplied with a large first-aid kit – keep it stocked.

Carry matches and possibly a small flashlight. On very long hikes, take extra food, clothing, and matches in case you are caught out in the woods at night. Never build fires in forest duff or leave a campfire until it is dead out.

Check for ticks. The beasties bite and can carry Lyme disease.

Carry plenty of water. Don't expect your partner to carry water for you.

Beware of lightning. Watch for approaching storms. Avoid prominent high exposed ground and tall/lone trees. Abandon field gear, especially that made of metal. Seek shelter in the vehicle if possible, otherwise in thick timber, large caves or in valley bottoms. Crouch on the balls of your feet with your head covered. Separate 100 feet from other crew members.

Safety on the road
It all pays the same, so drive with care, with courtesy, regardless of others' actions, and with common sense. Follow these tips:

Seat belt use is required by all government employees, volunteers, and contractors. Do not ride in the back of pickups.

DRIVE DEFENSIVELY! Expect the other person, whether a vehicle operator or a pedestrian, to do the worst thing and be prepared. Observe all speed regulations and traffic signs.

Do not drive when sleepy, taking medication, or when other personal conditions make it unsafe to drive a vehicle. Get someone else to drive or, if alone, stop driving and nap (out of the public view).

Always drive with your headlights on. This practice increases the visibility of your vehicle. It is particularly important when driving in fog, on dusty roads, traveling in and out of shadows, and any other low light/visibility situations. Turn lights off when you park the vehicle.

Do not operate a vehicle in an unsafe condition. Check your vehicle frequently to keep it in good mechanical condition. Lights, horn, steering, and brakes should be kept in proper adjustment at all times. Make necessary repairs as soon as unsafe condition develops. Report any unsafe conditions to your supervisor.

Keep the vehicle clean. Windows, mirrors, and lights should be kept clean and free of obstructions to increase visibility. Keep the cab and driver area clean so material is not rolling under pedals or distracting the driver.

Shift to a lower gear at the beginning of a grade, if the grade is a long, steep descent.

Adjust vehicle speed to the driving conditions. Wet, icy, or snowy roads and decreased visibility require decreased speed. Be aware of speed when changing from one type of road to another, i.e., Freeway to secondary highway to gravel and adjust speed accordingly.

Don't tailgate. Allow at least three seconds of travel distance between yourself and the vehicle ahead. Under slippery road conditions and poor visibility, allow more distance.

Be aware of your vehicle's idiosyncrasies and adjust your driving accordingly.

Be alert for heavily loaded trucks moving at high speeds when driving on privately-owned log-haul roads. Observe all traffic control signs, particularly signs requiring you to drive on the left side of the road.

Back up safely. Walk around your vehicle to check for hazards before backing and use a spotter to guide you.

Do not drive and navigate at the same time. If the driver needs to look at maps and photos, stop at a safe place, then look at them.

Watch for animals on the road. Most hoofed animals travel in groups, so where there is one, assume there are many, with all just itching to jump out in front of your vehicle. Stop and let the animal move off the road, look for others to follow, then proceed on. If you can not stop in time to avoid hitting an animal, it is generally better to hit it, than to go off the road or hit another vehicle.

Park the vehicle so that it is not a hazard to other drivers. Do not park where dry grass or other potential fuels can come in contact with your vehicle's hot exhaust system.

Keep as far right as is safely possible on blind curves on logging roads. If the curve is blind and less than two lanes wide, slow way down and be ready to take evasive action.

Yield to uphill vehicles on roads wide enough only for one vehicle.

What to do if injured

Treat the injury promptly. If immediate medical attention is required, go directly to a hospital emergency room. Try to make contact with your supervisor or the office to get instructions and assistance. Make sure the doctor fills out his/her part on the CA-1 form.

Inform your supervisor of all injuries and ask which, if any, forms need to be filled out. Supervisors must inform the office at the earliest opportunity.

Fill out Federal accident forms completely with signatures. ALWAYS make a copy for your personal records. Give the completed forms to your supervisor. Have the supervisor check your entries for mistakes, fill out their section, and forward the completed forms to the appropriate person.

Gather Information. If you are in a multi-vehicle accident, provide the other parties with enough written information so that they can easily get in touch with you, your crew supervisor, and the office. In turn, you must get the following information from all involved parties and witnesses -- names, addresses, phone numbers, vehicle license numbers, driver's license numbers, insurance company names and policy numbers, and police report numbers. If possible, do not admit responsibility without first contacting your supervisor.

E. Plot location aids

Each field crew should have a road map with the location of the plots marked and a plot packet for each plot you may visit. The plot packet for each field plot will generally contain old and new photos, previous plot records with plot diagrams, current computer-printed Plot, Subplot, and Condition Class Attribute records, computer-printed current tree tally records, and a plot review sheet.

Use the road map, plot cards and aerial photos from the previous inventories to locate the plot. The county, plot number, and legal description (township, range, section, and forty) are printed on the Plot Attribute record. Plot locations are marked and numbered on the road map. Use the road map to reach the general vicinity of the plot by motor vehicle. Once you are within the area covered by the photos, you may use the photos to find the exact plot location on the ground.

Colocated plots
A subsample of field plots may be visited by Forest Health Monitoring (P3) crews. These plots are established using the 4-subplot design and will have detailed current information on finding the plot, and will usually have GPS coordinates downloaded/printed in the Plot Attribute record.

Plots not previously visited
These plots will have new aerial photos with the field grid location pinpricked on them. Some plots may also have coordinates obtained by digitizing USGS topographic maps or by some other means.

F. Locating the plot on the ground

Locating new plots

1. Locating a plot by inspection: For plots not previously established (i.e. plots without field photos that were pinpricked at the time of previous inventory), use the new photos to proceed to the pinpricked location by photo interpretation. When you reach the point you believe is the pinpricked location, carefully check the pinpricked field grid location on the new photos against the surrounding terrain and pattern of tree crowns and vegetation to confirm that the pinpricked location on the photo and your location on the ground are exactly the same spot. In some cases you may be able to navigate to the plot center using the GPS receiver then pinprick the aerial photograph after confirming your location as described above.

2. Locating a plot with an RP (Reference Point, see page 31) and baseline: You may encounter a plot that is difficult to locate using photo interpretation. In this case you may establish a baseline on the photos to determine true photo azimuth and scale. Once the baseline is established:
   a) Select, tag, pinprick, and record a RP, preferably within 500 feet of the plot. (See page 30).
   b) On the photos, draw a straight line between the RP and pinpricked location.
   c) Determine the azimuth and distance from the RP to the referenced subplot.
   d) Measure out the calculated azimuth and distance to the referenced subplot. Locate the field grid location which is the center of subplot 1 on the standard layout to begin the plot. If a new plot, carefully check the photos against the surrounding terrain and vegetation to make sure you are actually at the field grid location pinpricked on the new photo.

G. Plots with active logging

If the plot area is being logged (timber is being felled, bucked, or yarded) or is unsafe to visit because of active logging, DO NOT ESTABLISH THE PLOT. Note on the plot jacket the status of the logging operation and return the plot to the supervisor. The supervisor will hold the plot until later in the season, when the status of the logging operation will be checked again to see if the plot can be completed.

H. Denied access plots

If access is denied to the field grid location or a portion of a plot, see "Denied Access plots" on page 30.

I. Plot location Tolerance

Plot location:
Tolerance: Remeasured plot: relocated
New plot: located +/- 30.0 ft.
Aerial photograph:
Tolerance: Previous and current pinpricks in correct spot: +/- 1 mm. 100% of the time

3. PLOT LAYOUT AND REFERENCING

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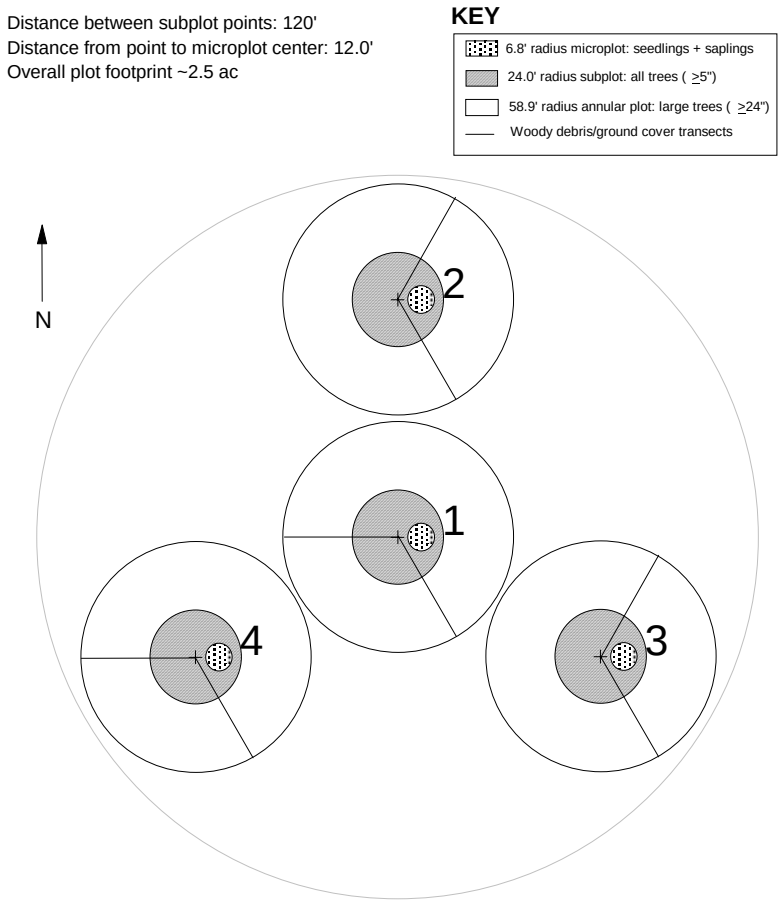
PLOT LAYOUT AND REFERENCING

A. Plot layout at the current annual inventory

In the current annual inventory the 4 subplots are laid out in the pattern below across condition classes. Subplots are never "substituted" or "moved" in order to keep the entire subplot within a condition class.

Standard 4-subplot plot diagram

PNW Forest Inventory and Analysis
Year 2000 Phase II plot design



From	To	Horizontal Distance	Azimuth
Subplot 2	Subplot 3	207.8 ft.	150
Subplot 2	Subplot 4	207.8 ft.	210
Subplot 3	Subplot 4	207.8 ft.	270
Subplot1	Subplot2	120 ft	360
Subplot 1	Subplot 3	120 ft	120
Subplot 1	Subplot 4	120 ft	240

B. Census water, Denied access, Hazardous, and Not in the sample areas

At the current inventory for all subplots (including subplot 1 - plot center)

1. If a subplot center **can** be physically occupied, then any Census water, Denied access, Hazardous, or Not in the sample areas are mapped as separate condition classes. Measurements are taken only in any accessible forest land condition classes.
2. If a subplot center **can not** be physically occupied (i.e. Census water, Denied access, or Hazardous) the subplot will not be installed or referenced. The entire subplot is classified as the subplot center condition, even though a portion of it may be in another condition class. Other subplots are installed using normal procedures.

See mapping Condition Status on page **51** for further instructions.

C. Recognition of condition classes

Each plot area recognized within an inventoried area is divided into condition classes. The area within each subplot's 24-foot fixed-radius plot is mapped using these condition classes. Condition classes are first defined by differences in condition status. Some of these condition classes may be further subdivided by other attributes. The condition class in which the field grid location lies (the center of subplot 1) is always condition class 1. While most subplots encompass only one condition class, some will have two or more classes within their 24-foot radius.

Condition classes are determined in three steps:

1. Plot area is divided into condition classes based on differences in condition status.
2. Accessible forest land condition classes are further divided by differences in 6 mapping variables.
3. Nonforest land condition classes are further divided, in some cases, by differences in nonforest land use.

See the Condition Class Attributes chapter on page **49** for complete instructions.

D. Subplot numbering

Install N# subplots

Install the four subplots in the configuration described above. The subplots are labeled N# (N1, N2, N3, and N4) subplots.

All condition classes present on the subplot (within the 24 ft. fixed-radius) are mapped on the subplot diagram. In accessible forest land and measured rangeland condition classes, trees, snags, saplings, seedlings, and understory vegetation are measured. These data are not measured or collected in any other type of mapped condition classes

E. Referencing the plot

1. Referencing plots not visited previously

If the plot has not been visited previously, the field grid location was pinpricked on the new field photos prior to field visit. The pinprick is marked on the photos with a nearby red dot.

Do the following steps:

a) Find this pinpricked field grid location on the ground. (The location will become the center of subplot 1 on the standard layout).
b) Install a plastic stake at this location on the ground. Check to see that "An exception" on page 31 does not apply.
c) Reference the new stake to nearby two trees; see "Referencing the plastic stake" on page 32.
d) Reference the new stake to an RP; see "The reference point (RP)" on page 31.
e) Circle the pinprick in pencil on the back of the photo and write "PC" (plot center) and the plot number near the circle.
f) Determine and pinprick the ground location of the RP on the new photos using photointerpretation. Circle the pinprick in pencil on the back of the photo and write "RP" near the circle.

2. An exception

The plastic stake is not placed at the field grid location if the 24-foot fixed-radius plot at subplot 1 on the standard layout is entirely nonforest land or either of the following situations occur:

a) the center of subplot 1 is too hazardous to visit (examples: subplot center 1 is in the middle of a pond, or the middle of a freeway, or on the side of a cliff) **OR**
b) placing the plastic stake at the center of subplot 1 is very apt to irritate a landowner (example: subplot center 1 is in the middle of someone's front lawn).

If the exception applies, reference the center of the lowest-numbered subplot on the standard layout that has a forest land condition class present within it's 24-foot fixed-radius plot.

Specifically, do the following steps:

a) Place a plastic stake at the center of this subplot,
b) Reference the new stake to two nearby trees; see "Referencing the plastic stake" on page 32.
c) Reference the new stake to an RP; see "The reference point (RP)" on this page.
d) If a revisited plot, determine and pinprick the location of the field grid location on the new photos using photo interpretation. All plots: use a photo marking pen to circle the pinprick on the back of the photo and write "PC" (plot center) and the plot number near the circle.
e) Determine and pinprick the ground location of the RP on the new photos using photo interpretation. Circle the pinprick in pencil on the back of the photo and write "RP to subplot (insert number)" near the circle (Example: "RP to subplot 3").

Keep in mind that the field grid location in this case, is not at the location of the plastic stake. The field grid location is always the center of subplot 1 on the standard layout regardless of whether it is referenced.

3. The reference point (RP)

The RP references the plastic stake. It is an object (usually a tree) that is prominent, apt to be present at next visit and easily located on the ground.

Selecting an RP: The RP should be distinctive on both the ground and on the new photos. You may reuse an old RP tree on a previously measured plot if it is suitable. If the old RP tree is dead, missing, or difficult to identify on the ground or on the plot photo, select a new RP. If possible, it should be a tree which is not likely to die or be cut before the next inventory. You may select a

snag or other object for an RP (i.e., a distinctive fence post, building corner, telephone pole, etc.). If you use such a RP, describe it on the plot photo and in "Location Description" on the Plot Record.

Tag the RP: Mark the RP tree with new or reused tags. Nail aluminum square tags on two or more sides of the RP tree, 6 feet above ground line, facing directions you expect future crews to approach the RP. Also nail an aluminum square tag on the RP tree below stump height, on the side of the tree facing the plastic stake. When attaching a tag, drive the nail into the tree only enough to anchor the nail firmly into the wood; always leave at least 2 inches of nail exposed.

Pinprick the RP location: Pinprick the ground location of the RP on the new photos UNLESS the RP pinprick would obscure another pinprick. Circle the RP pinprick on the back of the photo and write "RP" and the plot number near the circle (but do not obscure any pinpricks).

Record RP data: Record the species of the RP, it's d.b.h. to the nearest inch, azimuth from RP to plastic stake, and slope distance measured to the nearest foot from RP to the plastic stake on the back of the aerial photo, under "Plot Reference" on the Plot Record, and in the Plot Attributes section of the plot data.

In "Location Description" on the Plot Record, record any information that would aid the next crew in relocating the plot. Describe prominent features present in the plot area that are unlikely to change in the next ten years; examples include details such as slope, aspect, topographic position, recognizable physiographic features (i.e. streams, rock outcrops, benches), human-made features, and unusual or large trees. If any new roads have been built in the plot area since the date of the new field photos, sketch them on the photos if it will help the next crew to find the plot.

Example: "The RP is a large Douglas-fir (over 120 feet tall) in a draw that descends northeast from mainline logging road 1000. Subplot N1 is down slope from the RP and is just down slope and next to a large rock outcrop."

4. Referencing the plastic stake

To reference the plastic stake with nearby trees, **do the following steps:**

a) Select two trees near the plastic stake that form, as closely as possible, a right angle with the stake. If the previous reference trees meet this criterion, reuse them. On a revisited plot, if you select a new reference tree, remove the square tags (if present) from the reference tree it is replacing to avoid confusing the next crew. Trees within 6 feet of the stake are preferable. If live trees are not available, use stumps or sound snags.
b) Nail a square aluminum tag below stump height (<1 foot above the ground) on each reference tree on the side facing the stake. If the trees are also numbered tally trees, attach the tree number tags with the same nails. When attaching a tag, drive the nail into the tree only enough to anchor the nail firmly into the wood; always leave at least 2 inches of nail exposed.
c) In two locations on each reference tree, nail a round aluminum tag 6 feet high facing likely approaches to the subplot.
d) Record data about the reference trees; refer to "Recording reference tree data" on page 33.

F. Referencing the other subplots on the standard layout

One subplot on the standard layout, usually subplot 1, is referenced adequately by the plastic stake and it's nearby reference trees and RP. Do the following steps:

1.Mark subplot center.
Mark subplot center with a metal pin and round, and tie a piece of flagging to the pin.

2. Select reference trees.
Select 2 trees near the pin that form, as closely as possible, a right angle with the pin. Trees within 6 feet of the pin are preferred. If trees are not available, use stumps or sound snags. On subplots established previously, reuse the previous reference trees, or if there are better trees available, use new reference trees. Renew old reference tags as needed.

3. Tag the reference trees.
a) If a tally tree: Nail an aluminum round to each reference tree, 6 feet above ground line, facing the direction you expect future crews to approach the subplot. If the tree is a trackable (tally) tree that does not require a numbered tag, attach an additional aluminum round tag below stump height facing subplot center. When attaching a round tag, drive the nail into the tree only enough to anchor the nail firmly into the wood; always leave at least 2 inches of nail exposed.
b) If not a tally tree: Nail an aluminum round 6 feet above ground line facing the direction you expect future crews to approach the subplot, and nail one aluminum round below stump height facing the subplot center. If the reference is a live tree with a diameter 3.0 in. d.b.h.. or larger, mark where diameter. is measured with an aluminum nail; rules for marking diameter on page **115** apply. When attaching a round tag or marking d.b.h.., drive the nail into the tree only enough to anchor the nail firmly into the wood; always leave at least 2 inches of nail exposed.

4. Record data about the reference trees
Refer to "Recording reference tree data" (next section).

G. Recording reference tree data (all subplots on the standard layout)

Azimuth (subplot center to tree), slope distance to the head of the nail affixing the basal tag or tree number tag, species, and diameter are recorded for each reference tree, snag, or stump. NOTE: Reference tree distance is always slope distance from the subplot center to the head of the nail affixing the basal aluminum tag or tree number tag. This is in addition to the horizontal distance to the center of the tree collected for all tally trees.

1. If a tally tree
If a reference tree or snag is a trackable tally tree, enter “REF” in REMARKS for this tree. Also enter a SLOPE DISTANCE for this tree. SLOPE DISTANCE is the measured distance from the subplot center to the head of the nail at the base of the tree.

2. If not a tally tree
If the reference is not a tally tree or stump, enter a new record for the tree or stump; assign the record a TREE STATUS of 9, and record azimuth, (slope) distance, species, and diameter (diameter for a stump is the average of two width measurements across the top of the stump).

H. Plot layout and referencing MQO

RP selection:
Tolerance: No error in selection criteria

Subplot location:
Tolerance: Remeasured subplot: +/- 0.5 ft. of previous location
New subplot: +/- 5.0 ft.

Subplot reference (tree) selection:
Tolerance: Nor error in selection criteria

4. Plot Level Data
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Plot Level Data

4. PLOT LEVEL DATA

All variables listed in this section are collected on plots with at least one accessible forested condition (PLOT STATUS = 1). For all NONFOREST/NONSAMPLED plots (PLOT STATUS = 2 or PLOT STATUS = 3), see Section 8. In general, plot level data apply to the entire plot, and they are recorded from the center of subplot 1.

4.1 COUNTRY, and STATE OR ISLAND

If available, record the unique FIPS (Federal Information Processing Standard) code identifying the State where the plot center is located. Otherwise, record simply the country name and island.

When collected: All plots
Field width:
Tolerance: No errors
MQO: At least 99% of the time
Values: See Appendix 4, page **235**

4.2 COUNTY

If available, record the unique FIPS (Federal Information Processing Standard) code identifying the county (or unit in AK) where the plot center is located. Otherwise, record the provincial designation that will allow relocation.

When collected: All plots
Field width: 3 digits
Tolerance: No errors
MQO: At least 99% of the time
Values: See Appendix 4, page **235**

4.3 PLOT NUMBER

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

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

4.4 SAMPLE KIND

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.

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). Note that replacement plots require a separate plot file for the previous plot. Replaced plots are assigned PLOT STATUS = 3, SAMPLE KIND = 2, and the appropriate NONSAMPLED REASON code. The plot number for the replacement plot is assigned by NIMS.

4.5 FIELD GUIDE VERSION

Record the version number of the National Core Field Guide that was used to collect the data on this plot. This 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: 1.1 (Maine 1999) and higher

4.6 CURRENT DATE

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

4.6.1 YEAR

Record the year that the plot was completed.

When collected: All plots
Field width: 4 digits
Tolerance: No errors
MQO: At least 99% of the time
Values: Beginning with 1998, constant for a given year

4.6.2 MONTH

Record the month that the plot was completed.

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

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

4.6.3 DAY

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

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

4.7 DECLINATION

Record the azimuth correction used to adjust magnetic north to true north. All azimuths are assumed to be magnetic azimuths unless otherwise designated. The PNW FIA units have historically corrected all compass readings for true north. This field is to be used only in cases where units are adjusting azimuths to correspond to true north; for units using magnetic azimuths, this field will always be set = 0 in the office. This field carries a decimal place because the USGS corrections are provided to the nearest half degree. DECLINATION is defined as:

DECLINATION = (TRUE NORTH - MAGNETIC NORTH)

When collected: CORE OPTIONAL: All plots
Field width: 5 digits including sign. (+xxx.y)
Tolerance: No errors
MQO: At least 99% of the time
Values: See Appendix 4, page **235**

4.8 PLOT STATUS (FORESTED)

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:

0 No accessible forest land (condition class 1) or measured nonforest (present nonforest land use 16-26)
1 At least 1 accessible forest land condition class
2 No accessible forest land, but at least 1 measured nonforest (present nonforest land use 16-26)

4.9 TRAILS OR ROADS

Record the nearest trail or road to the plot. Use the plot photo, maps, or reasonable observations made while traveling to the plot to determine nearest trail or road (within 1 mile straight-line distance of the plot center). If two or more trails or roads are estimated to be equally distant, code the higher quality trail or road (lower code number). Base the coding decision on the condition of the road at the time of the visit.

When collected: All plots with at least one accessible forest land condition class
Field width: 1 digit
Tolerance: No errors
MQO: At least 90% of the time

Values:

0	None within 1 mile
1	Paved road or highway
2	Improved gravel road (has gravel, ditching, and/or other improvements)
3	Improved dirt road (has ditching, culverts, signs, reflectors, or other improvements)
4	Unimproved dirt road/four-wheel drive road (has no signs of any improvements)
5	Human access trail- clearly noticeable and primarily for recreational use

4.10 HORIZONTAL DISTANCE TO IMPROVED ROAD

Record the straight-line distance from plot center (subplot 1) to the nearest improved road. An improved road (TRAILS OR ROADS = 1, 2, or 3) 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
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

4.11 ROAD ACCESS

Record the first road access restrictions encountered while traveling to the plot. These restrictions limit car and truck access to the starting point for the walk to the plot, and may occur on ownerships encountered before reaching the plot area.

When collected: All plots with at least one accessible forest land condition class
Field width: 1 digit
Tolerance: No errors
MQO: At least 90% of the time
Values:

0	None – no road access restrictions
1	Road blocked by locked gate or cable across road
2	Road blocked by a human-made obstruction across road (ditch, mound, etc.)
3	Road blocked by natural occurrences (trees blown over onto road, road or bridge washed out)
4	Posted no motorized vehicle signs; road present, but restricted area such as Wilderness or National Park where vehicles are not allowed
9	Other – specify in plot-level notes

4.12 PUBLIC USE RESTRICTIONS

Record, if any, the restriction posted near or on the plot area that limits public use of the plot area; if more than one restriction occurs for the plot area, record the lowest number restriction present (1-3, 9).

When collected: All plots with at least one accessible forest land condition class
Field width: 1 digit
Tolerance: No errors
MQO: At least 90% of the time
Values:

0	None – no public use restrictions
1	Keep out / no trespassing
2	No hunting or fishing
3	No dumping
9	Other - specify in plot-level notes

4.13 RECREATION USE 1

Record up to 3 signs of recreation use encountered within the accessible forest land portion of any of the four subplots, based on evidence such as campfire rings, compacted areas (from tents), hiking trails, bullet or shotgun casings (if you are not on a military firing range), tree stands, etc. Record the recreation use that has had the most significant impact on the plot area first, then the second and third use. For example, in general numerous four-wheel drive or ATV trails would be coded before camping, and camping before hiking, and hiking before fishing. Use the coding system provided as a hierarchy. Do not repeat codes, except codes 0 and 9. Physical recreation evidence must be present to code 1-9. Also, disregard dumping where no evidence of recreation is present. Examine the plot area for clues before spending an exorbitant amount of time trying to find evidence that normally would not be found in the area; look for the obvious signs first.

When collected: All plots with at least one accessible forest land condition class
Field width: 1 digit
Tolerance: No errors
MQO: At least 90% of the time
Values:

0	No evidence of recreation use
1	Motor vehicle (four wheel drive, ATV, motorcycle, snowmobile)
2	Horse riding, dog team trails, ski trails
3	Camping
4	Hiking
5	Hunting/shooting
6	Fishing
7	Boating – physical evidence such as launch sites or docks
9	Other – recreation use where evidence is present, such as human litter, but purpose is not clear or does not fit into above categories.

4.14 RECREATION USE 2

Record the second most significant recreation use impact. See RECREATION USE 1 for coding instructions.

4.15 RECREATION USE 3

Record the third most significant recreation use impact. See RECREATION USE 1 for coding instructions.

4.16 WATER ON PLOT

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 may be used for recreation, wildlife, hydrology, and timber availability studies.

When collected: All plots with at least one accessible forest land condition class
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
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
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
6	Tidal water
9	Other temporary water – specify in plot notes

4.17 QA STATUS

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

When collected: P2 - All plots
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values:

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

4.18 CREW TYPE

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

When collected: P2 - 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)

4.19 GPS COORDINATES

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

4.19.1 GPS UNIT SETTINGS, DATUM, and COORDINATE SYSTEM

Consult the GPS unit operating manual or other regional instructions to ensure that the GPS unit internal settings, including Datum and Coordinate system, are correctly configured. See Chapter 12 beginning on page **213**

Each FIA unit will determine the Datum to be used in that region. Coordinates collected using any appropriate datum can be converted back to a national standard for reporting purposes.

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

4.19.2 COLLECTING READINGS

Collect at least 180 GPS readings or let the GPS unit average for at least 3 minutes 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 ft 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 $\leq$ 70 ft) 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 ft of plot center. Obtain the azimuth and horizontal distance from the "offset" location to plot center. Record the azimuth and horizontal distance as described on page 45.

Coordinates may be collected further than 200 ft 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, record the azimuth and horizontal distance as described on page 45

In all cases try to obtain at least 180 positions or let the unit average at least 3 minutes before recording the coordinates.

4.19.3 GPS UNIT

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
4 Other brands not capable of field-averaging or post-processing

4.19.4 GPS SERIAL NUMBER

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

4.19.5 COORDINATE SYSTEM

Record a code indicating the type of coordinate system used to obtain readings.

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

1 Geographic coordinate system (Latitude/Longitude)
2 UTM coordinate system

4.19.6 GPS DATUM

Record the datum used for each set of coordinates that are collected.

Values: **2 = WGS 84**

4.19.7 LATITUDE

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

When collected: When COORDINATE SYSTEM = 1

Field width: 8 digits (DDMMSSSS)
Tolerance: +/- 140 ft
MQO: At least 99% of the time

4.19.8 LONGITUDE

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

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

4.19.9 UTM ZONE

Record a 2-digit and 1 character field UTM ZONE as determined by GPS.

When collected: When COORDINATE SYSTEM = 2
Field width: 3 digits: (##C)
Tolerance: No errors
MQO: At least 99% of the time
Values: See Appendix 4 Page **235**

4.19.10 EASTING (X) UTM

Record the Easting coordinate of the plot center as determined by GPS.

When collected: When COORDINATE SYSTEM = 2
Field width: 7 digits
Tolerance: +/- 140 ft
MQO: At least 99% of the time

4.19.11 NORTHING (Y) UTM

Record the Northing coordinate of the plot center as determined by GPS.

When collected: When COORDINATE SYSTEM = 2
Field width: 7 digits
Tolerance: +/- 140 ft
MQO: At least 99% of the time

4.19.12 GPS COLLECTION LOCATION

As described in Section 4.19.2, coordinates may be collected at a location other than the plot center (an “offset” location). Record items 4.19.13 and 4.19.14.

When collected: All plots
Field width: 1 digit
Values: Y = coordinates were collected at center of subplot 1
N = coordinates were collected away from center of subplot 1

4.19.13 AZIMUTH TO PLOT CENTER

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

4.19.14 DISTANCE TO PLOT CENTER

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 Section 1.18.2, if a Laser range finder is used to determine DISTANCE TO PLOT CENTER, offset locations may be up to 999 ft from the plot center. If a range finder is not used, the offset location must be within 200 ft.

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

4.19.15 GPS ELEVATION

Record the elevation above mean sea level of the plot center, in feet, as determined by GPS.

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

4.19.16 GPS ERROR

Record the error as shown on the GPS unit to the nearest foot. As described in Section 4.19.2, make every effort to collect readings only when the error $\leq$ 70 ft. However, if after trying several different times during the day, at several different locations, this is not possible, record reading with an error of up to 999 ft.

When collected: When GPS UNIT =1 or 2
Field width: 3 digits
Tolerance: No errors
MQO: At least 99% of the time
Values: 0 to 70 if possible
71 to 999 if an error of less than 70 cannot be obtained

4.19.17 NUMBER OF READINGS

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: 1 to 999

4.19.18 GPS FILENAME

Record the filename containing the GPS positions collected on the plot.

When collected: When GPS UNIT = 3
Field width: 8 characters.3 characters e.g. R0171519.ssf
Tolerance: No errors
MQO: At least 99% of the time
Values: Letters and numbers

4.19 PLOT-LEVEL NOTES

Use these fields to record notes pertaining to the entire plot. If the notes apply only to a specific subplot or other specific aspect of the plot, then make that clear in the notes.
Use the notes to describe irregularities in the data that are not covered under Condition Class data, Plot data, or Subplot data. For example, the entire plot may be in condition class 1 and have a condition status of 1 (accessible forest land), but there is no tree tally on subplot 2. Explain that the center of subplot 2 falls in the middle of a nonforest inclusion that is less than 1 acre in size, or it is in a river less than 30 ft wide, etc.
Plot notes can also be used to describe diseases, disturbance, treatments, weather conditions, access problems, or anything else that would help describe plot conditions.

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

4.20 P3 HEXAGON NUMBER

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

4.21 P3 PLOT NUMBER

Record the P3 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

5. Condition Class Attributes

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5. CONDITION CLASS

The Forest Inventory and Analysis (FIA) plot is a cluster of four subplots in a fixed pattern. Subplots are never reconfigured or moved in order to confine them to a single condition class; a plot may straddle more than one condition class. Every plot samples at least one condition class: the condition class present at plot center (the center of subplot 1).

5.1 DETERMINATION OF CONDITION CLASS

5.1.1 Step 1: Delineate the plot area by CONDITION CLASS STATUS

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

1. Accessible forest land (See definition on page 57)
2. Nonforest land
3. Noncensus water
4. Census water
5. Denied access area
6. Area too hazardous to visit
7. Area that is not in the sample, e.g., in Canada or Mexico.

Accessible forest land defines the population of interest for FIA purposes. This is the area where most of the data collection is conducted.

5.1.2 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 within the sampled area in any of the following attributes:

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 (see Section 5.5).

5.2 CONDITION CLASS ATTRIBUTES

A CONDITION CLASS NUMBER and a classification for CONDITION STATUS is 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:

5.4.1 Reserved Status =
5.4.2 Owner Group =
5.4.3 Forest Type =
5.4.4 Stand Size =
5.4.5 Regeneration Status =
5.4.6 Tree Density =
……

5.5.1 Owner Class =
5.5.2 Private Owner Industrial Status =
5.5.3 Artificial Regeneration Species =
5.5.4 Stand age =
5.5.5 Dominant tree species =
5.5.6 Disturbance (up to 3 coded) =
5.5.7 Disturbance Year (1 per disturbance) =
5.5.12 Treatment (up to 3 coded) =
5.5.13 Treatment Year (1 per treatment) =
5.5.18 Condition Class slope =
5.5.19 Condition Class aspect =
5.5.20 Physiographic Class =
5.5.21 Present Nonforest land use =

When classifying condition status, owner group, reserved status, and previous and present nonforest use, base the classification on what is present within the area defined by the fixed radius plot (subplot or microplot). When classifying all other condition class variables, base the classification on the entire plot area. See page **29**

Specific instructions for the classification of each attribute follow.

5.2.1 CONDITION CLASS NUMBER

On a plot, assign and record a unique identifying number for each condition class. At the time of the plot establishment, the condition class at plot center (the center of subplot 1) is designated condition class 1. Other condition classes are assigned numbers sequentially at the time each condition class is delineated. On a plot, each sampled condition class must have a unique number that can change at remeasurement to reflect new conditions on the plot.

CONDITION CLASS NUMBER is independent of SUBPLOT NUMBER.

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

CONDITION CLASS DEFINING (DELINEATION) VARIABLES:

5.2.2 CONDITION CLASS STATUS

Record the code that describes the status of the condition. Record for all condition classes sampled on a plot. The instructions in Section 5.2 and 5.3 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 (see definition on page 57)
2. Nonforest land
3. Noncensus water
4. Census water
5. Denied access area
6. Area too hazardous to visit

Area that is not in the sample, e.g., in Canada or Mexico.

5.3 DELINEATING CONDITION CLASSES DIFFERING IN CONDITION STATUS:

The first step in delineating condition classes is to recognize differences in CONDITION 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 ac in size, and each is at least 120.0 ft 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 ac in size and less than 120.0 ft 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 ac in size and less than 120.0 ft 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 ac in size and 120.0 ft 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 (Figures 2 and 3).

    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 ac 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.

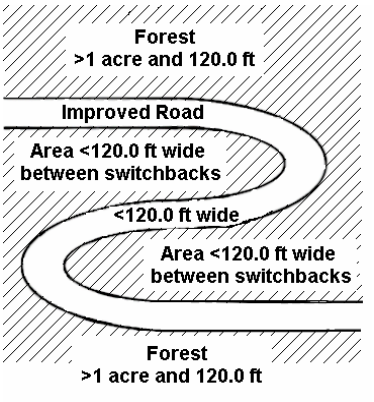


Figure 2. Example of a switchback road.

The area between the switchbacks is coded as Forested Condition Class

The improved road is a Nonforest Condition Class

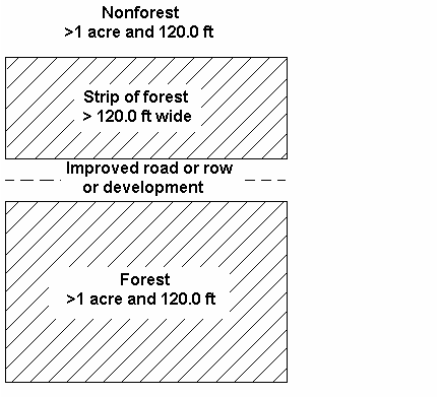


Figure 3. Example of nonforest and forest strips.

The strips of forest at the top and bottom of the diagram are coded as Forested Condition Class.

The improved road and the nonforest area >1 acre and 120 ft wde are both Nonforest Condition Classes

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 ac in size and less than 120.0 ft 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 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 4. Figure 4 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.

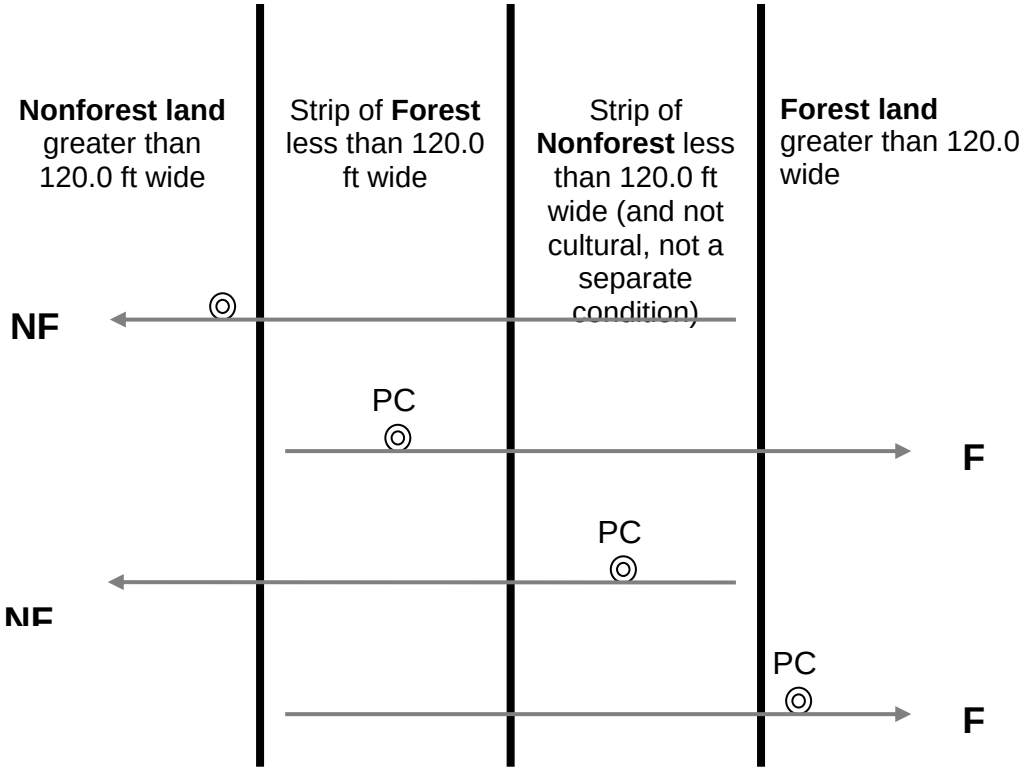


Figure 4. Example of alternating strips of forested and nonforested conditions. PC is the plot center (center of subplot 1).

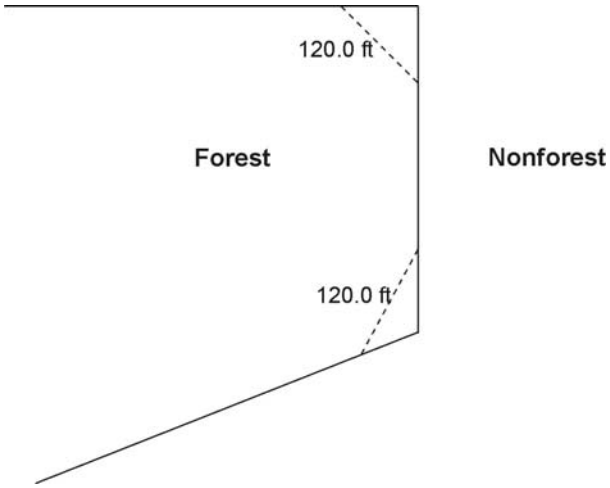


Figure 5. Illustration of the 90 degree corner rule. The dotted lines do not create nonforest conditions.

3. The 120 foot minimum width for delineation does not apply when a corner angle is 90 degrees or greater (Figure 5).

4. Linear water features: natural water features that are linear in shape such as streams and rivers. A linear water feature must meet the definition for Census or noncensus water to be nonforest area. Therefore, a linear water feature must be at least 30.0 ft wide and cover at least 1.0 ac. 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 which 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 ac requirement; use professional judgment and common sense on any linear water feature.

5. Hazardous or denied access conditions within accessible forest land are delineated, regardless of size, as a separate condition.

CONDITION STATUS DEFINITIONS:

5.3.1 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 the following criteria:
The condition has at least 5 percent crown cover by trees of any size, or has had at least 5 percent crown cover in the past. Additionally, the condition is not subject to nonforest use(s) that prevent normal tree regeneration and succession such as regular mowing, intensive grazing, or recreation activities.

A condition class has 5 percent crown cover if the crown area of all trees occupies 5 percent of the total area within that condition class if viewed from above.

To qualify as forest land, the prospective condition must be at least 1.0 ac in size and 120.0 ft wide measured stem-to-stem. Forested strips must be 120.0 ft wide for a continuous length of at least 363.0 ft 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 with no clear and abrupt boundary. In addition, it may be difficult to determine exactly where the forested area meets the minimum crown cover criteria and where it does not. For these cases, determine where the land clearly meets the 5 percent minimum crown cover, and where it clearly is less than required crown cover; divide the zone between these points in half, and determine the side of the zone on which the subplot center is located. Classify the condition class of the subplot based on this line (Figure 6).

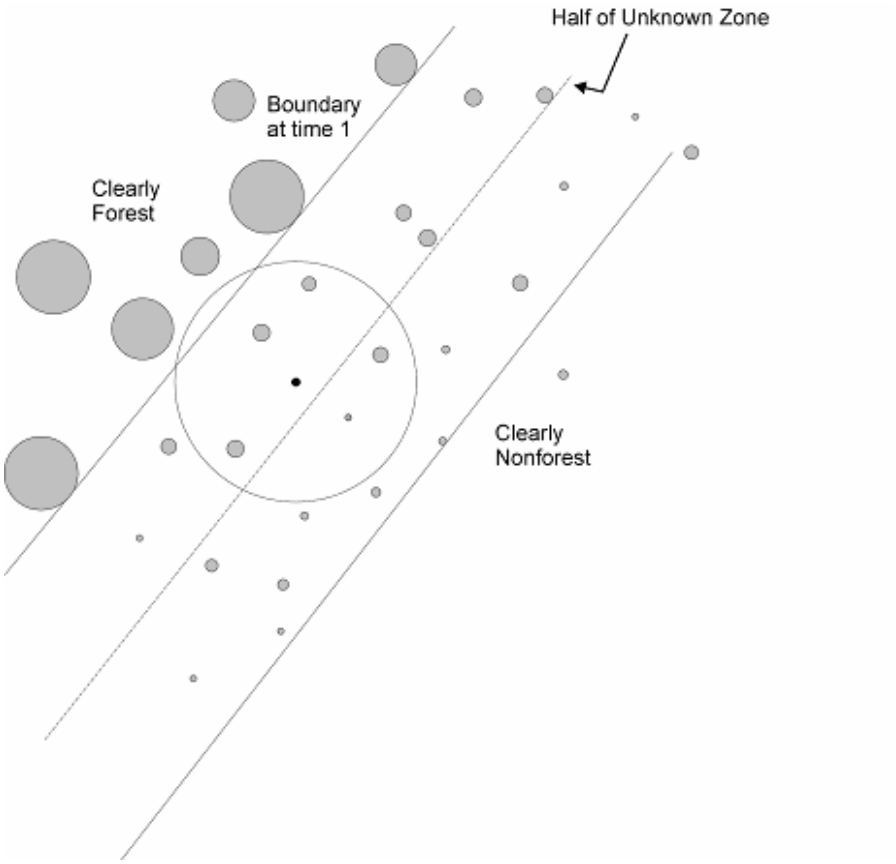


Figure 6. Example of classifying the condition class of the subplot in a transition zone with forest/nonfor encroachment.

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 clearly has 5 percent crown cover 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 does not clearly have 5 percent crown cover where it meets the nonforest, determine where it clearly has 5 percent crown cover (forest) and where it clearly does not have 5 percent crown cover (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 land owner 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 ft) 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 7 and 8. 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.

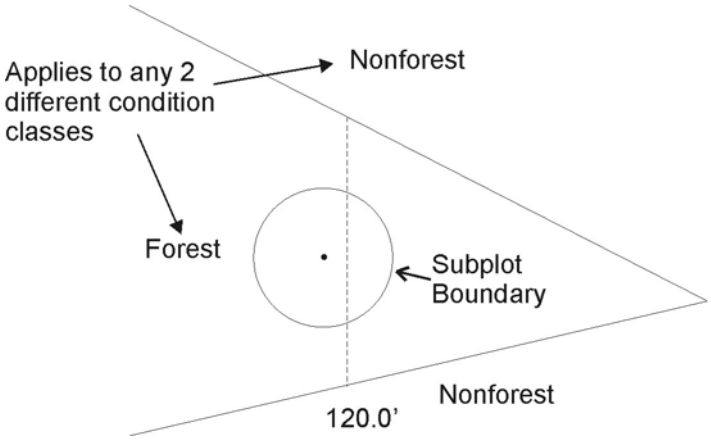


Figure 7. Forest condition narrows within a nonforest condition. Examine the location of the subplot center in reference to the approximate line where the forest narrows to 120.0 ft wide. In this example, the entire subplot is classified as forest.

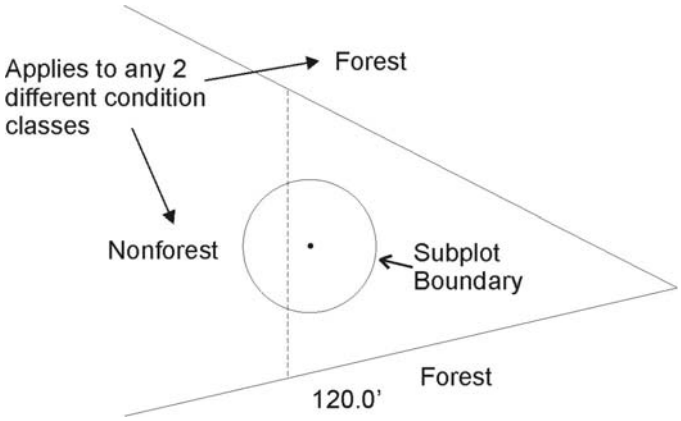


Figure 8. Nonforest condition narrows within a forest condition. Examine the location of the subplot center in reference to the approximate line where the nonforest narrows to 120.0 ft wide. In this example, the entire subplot is classified as forest.

5.3.2 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 STATUS values defined in Sections 5.3.3 through 5.3.7. To qualify, the area must be at least 1.0 ac in size and 120.0 ft wide, with 5 exceptions discussed previously at the beginning of section 5.3. 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 occasion to see if it has become forest land.

Measurements are taken on nonforest lands if the Present Nonforest Land Use is low density agro-forest, grass land, montane grassland/savannah, montane bogs, alpine vegetation, fernlands, grasslands, or subxerophytic dry forests/sclerophyllous scrub (See definitions on page 75)

5.3.3 NONCENSUS WATER

Lakes, reservoirs, ponds, and similar bodies of water 1.0 ac to 4.5 ac in size. Rivers, streams, canals, etc., 30.0 ft to 200 ft wide.

5.3.4 CENSUS WATER

Lakes, reservoirs, ponds, and similar bodies of water 4.5 ac in size and larger; and rivers, streams, canals, etc., more than 200 ft wide (1990 U.S. Census definition).

5.3.5 DENIED ACCESS

Any area within the sampled area on a plot on which access is denied by the legal owner of the land the plot falls on, or by an owner of the only reasonable route to the plot. 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.

5.3.6 HAZARDOUS

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 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.

5.3.7 NOT IN THE SAMPLE

Any area within the sampled area on a plot that is not within the boundaries of the sample population of interest. Examples of areas out of the sample would be plots or portions of plots falling in Mexico or Canada. A condition outside the sample area remains in the potential population of interest and is re-examined at the next occasion to determine if it becomes part of the population of interest. There are no minimum size or width requirements for a condition class delineated as out of the sample.

5.4 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 5.1 applies when delineating contrasting forest condition classes. Specific criteria apply for each of the six attributes and are documented by attribute in subsections within 5.4.1 to 5.4.6. "Stands" are defined by plurality of crown cover 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 ac in size and at least 120.0 ft 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. For each condition class recognized, there are many "ancillary attributes" that help describe the condition will be collected, but will not be used for delineation purposes (see Sections 5.5.1 to 5.5.20).

General instructions for delineating condition classes within accessible forest lands:

1. Distinct boundary within a subplot, or microplot: Separate condition classes ARE recognized if, within a subplot, two (or more) distinctly different condition classes are present and delineated by a distinct, abrupt boundary. The boundary is referenced; see Section 3.0.

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 4 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 seedling-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 5 percent crown cover. 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 ft wide, and 1.0 ac or more in size, cumulative, but not necessarily present on both sides of and adjacent to 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.

   Note: When the width of forest adjacent to a stream is between 120.0 ft and 150.0 ft and the width of the riparian forest is at least 30.0 ft wide, the rules for identifying the non-riparian forest (at least 30.0 ft but less than 120.0 ft) need to be modified. The non-riparian forest can be between 30.0 ft and 120.0 ft 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.

5.4.1 RESERVED STATUS

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. The phrase "withdrawn by law" includes as reserved land, parcels of private land with deeds that specifically prohibit the management of the tract for the production of wood products.

When collected: All accessible forest land (CONDITION STATUS = 1)
And all measured nonforest (CONDITION STATUS = 2 and PRESENT NONFOREST LAND USE = 16-26)
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values:

0	Not reserved
1	Reserved

5.4.2 OWNER GROUP

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 forest land and grass, forb or shrub land condition classes (CONDITION STATUS = 1 or 8)
Field width: 2 digit
Tolerance: No errors
MQO: At least 99% of the time
Values:

10 Forest Service
20 Other Federal
30 State and Local Government
40 Private

5.4.3 FOREST TYPE

Record the code corresponding to the FOREST TYPE that best describes the vegetation in each forested condition class. These FOREST TYPES are taken from Mueller-Dombois and Fosberg, 1998

The instructions in section 5.1 and 5.3 apply when delineating, within accessible forest land, contrasting conditions based on differences in FOREST TYPE.

When collected: All accessible forest land or condition classes (CONDITION 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
Values:

1 Strand or halophytic vegetation - vegetation near the shore containing species adapted to high rates of evaporation by wind and to high salt concentrations from windblown ocean spray or inundation by salt water

2 Mangrove swamps – trees with high salt tolerance growing on tidally inundated shores and in landlocked depressions. Many species have pneumatophores, adaptive structures for aeration of waterlogged root systems.

3 Lowland tropical rainforest – multistoried forest with many canopy-dwelling epiphytes, open ground, and shrub layers. This forest type can extend up the lower slopes with windward rainy exposures

4 Montane rainforest –the predominant type on moist hilltops and mountain slopes in many tropical islands. Forests of low stature that are rich in shrubs and epiphytes.

5 Cloud forest - These forests are covered with clouds or fog much of the time. The trees have low canopies and are often dripping with moisture. The trees are typically small-leafed and covered with masses of epiphytic mosses and liverworts, which also form a deep ground cover.

6 Mesophytic or moist forest – seasonally dry evergreen forests on leeward, drier slopes.

7 Xerophytic – forests found on truly dry, rain-shadow, leeward mountain slopes and lowlands

8 Agroforestry – tree species are included in crop or animal production agricultural ecosystems

9 Plantations – an area planted with tree species for the purpose of timber production. Species planted are mainly eucalypt, mahogany, and pine species that replace indigenous forests and savannas.

5.4.5 STAND SIZE CLASS

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

When collected: All accessible forest land condition classes (CONDITION 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 less than 5 percent **crown cover** of trees of any size.

1 < 5.0 in (seedlings / saplings)
At least 5 percent crown cover in trees of any size; and at least 2/3 of the crown cover is in trees less than 5.0 in DBH.

2 5.0 – 8.9 in (softwoods) / 5.0 – 10.9 in (hardwoods)
At least 5 percent crown cover in trees of any size; and at least 1/3 of the crown cover is in trees greater than 5.0 in DBH **and** the plurality of the crown cover is in softwoods between 5.0 – 8.9 in diameter and/or hardwoods between 5.0 – 10.9 in DBH..

3 9.0 – 19.9 in (softwoods) / 11.0 – 19.9 in (hardwoods)
At least 5 percent crown cover in trees of any size; and at least 1/3 of the crown cover is in trees greater than 5.0 in DBH **and** the plurality of the crown cover is in softwoods between 9.0 – 19.9 in diameter and/or hardwoods between 11.0 – 19.9 in DBH.

4 20.0 – 39.9 in

At least 5 percent crown cover in trees of any size; and at least 1/3 of the crown cover is in trees greater than 5.0 in DBH **and** the plurality of the crown cover is in trees between 20.0 – 39.9 in DBH.

5 40.0 + in
At least 5 percent crown cover in trees of any size; and at least 1/3 of the crown cover is in trees greater than 5.0 in DBH **and** the plurality of the crown cover is in trees ≥ 40.0 in DBH.

6 Cover trees (trees not on species list, used for plots classified as nonforest):
Less than 5 percent crown cover by trees of any size, and greater than 5 percent **crown cover** of species that comprise cover trees.

The instructions in Sections 5.1 and 5.3 apply when delineating, on accessible forest land, contrasting conditions based on differences in STAND SIZE CLASS.

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 large diameter stand from a small diameter stand. Use tree crown cover of all live trees that are not overtopped to differentiate between stand-size classes.

If no other condition class defining variables are different between accessible forest conditions, delineate on differences in STAND SIZE CLASS only for the following combinations:

Between Nonstocked (STAND SIZE CLASS = 0) or cover trees (STAND SIZE CLASS = 6) and any stocked forest land (STAND SIZE CLASS = 1, 2, 3, 4, or 5);
Between STAND SIZE CLASS = 1 and STAND SIZE CLASS = 3, 4, and 5;
Between STAND SIZE CLASS = 2 and STAND SIZE CLASS = 4 and 5; or
Between STAND SIZE CLASS = 3 and STAND SIZE CLASS = 5.

Note: Differing stand size classes can be used to describe separate condition classes, while at the same time not be used to delineate separate condition classes. Example: Two adjacent forested stands of the same forest type, one with a STAND SIZE CLASS = 1 and the other with a STAND SIZE CLASS = 2 could be delineated as separated CONDITION CLASS if one of the other condition class delineation variables differs (based on the rules), i.e. OWNER GROUP differs between the two condition classes. In addition, the STAND SIZE CLASS variables for the two condition classes would be recorded and treated as an ANCILLARY variable.

5.4.6 REGENERATION STATUS

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

When collected: All accessible forest land condition classes (CONDITION 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 5.1 and 5.3 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.

5.4.7 TREE DENSITY

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 which are not overtopped, compared to any previously defined condition class TREE DENSITY.

The instructions in section 5.1 and 5.3 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 only as 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% or less as dense as the denser condition.

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

When collected: All accessible forest land condition classes (CONDITION 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

- the eastern half of an otherwise homogeneous, 20 ac stand has many trees killed by a bark beetle outbreak,

or

- one portion of a stand is partially cut over (with 40 sq. ft basal area per ac) while the other portion is undisturbed (with 100 sq. ft basal area per ac).

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

5.5 ANCILLARY (NON-DELINEATING) VARIABLES

5.5.1 OWNER CLASS

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 forest land (CONDITION STATUS = 1)
And all measured nonforest (CONDITION STATUS = 2 and PRESENT NONFOREST LAND USE = 16-26)
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 within 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
46 Village or communal property

5.5.2 PRIVATE OWNER INDUSTRIAL STATUS

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 below.

NOTE: 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 forest land condition classes (CONDITION 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 **<u>is not</u>** owned by industrial owner with a wood processing plant
1 Land **<u>is</u>** owned by industrial owner with wood processing plant

5.5.3 ARTIFICIAL REGENERATION SPECIES

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 accessible forest land condition classes (CONDITION STATUS = 1) with evidence of artificial regeneration (REGENERATION STATUS = 1)
Field width: 3 digits
Tolerance: No errors

MQO: At least 99% of the time
Values: See TREE SPECIES beginning on page **161**

5.5.4 STAND AGE

The crew botanist should be able to provide an estimate of stand age given that the trees in the stand originated at approximately the same time. In tropical forests, the continuous process of gap phase dynamics often prevails, where individuals die, form a gap, and are replaced by lower-canopy individuals. Often you cannot determine stand age in stands that are not characterized by stand replacing disturbance. The trees on typhoon-prone islands would be expected to re-initiate growth following disturbance at approximately the same time.

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. 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).

Developmental stage and known dates of disturbance are likely to be the only guides to estimating stand age. Good luck.

If continuous tree replacement by gap phase dynamics appears to characterize a stand, record code 998.

Record 999 if this appears unworkable and ludicrous, but please, do the best you can.

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

When collected: All accessible forest land condition classes (CONDITION STATUS = 1)
Field width: 3 digits
Tolerance: +/- 10%
MQO: At least 95% of the time
Values: 000 to 997, 998, 999

5.5.5 DOMINANT TREE SPECIES 1

Record the code corresponding to the TREE SPECIES (page 161) with the plurality of stocking for all live trees in the condition class that are not overtopped.
For example, if a forested condition class contains 30% species A, 30% species B, and 40 % species C, then the DOMINANT TREE SPECIES will be the code for species C.

When collected: All accessible forest land condition classes (CONDITION STATUS = 1)
Field width: 3 digits
Tolerance: no errors
MQO: At least 95% of the time
Values: See Tree Species beginning on page 161

5.5.5.1 DOMINANT TREE SPECIES 2

Record the code for the second most abundant tree species in each condition class.

See Dominant Tree Species 1 for coding instructions

5.5.5.2 DOMINANT TREE SPECIES 3

Record the code for the third most abundant tree species in each condition class
See Dominant Tree Species 1 for coding instructions

5.5.6 DISTURBANCE 1

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 ac 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 forest land (CONDITION STATUS = 1)
And all measured nonforest (CONDITION STATUS = 2 and PRESENT NONFOREST LAND USE = 16-26)
Field width: 2 digits
Tolerance: No errors
MQO: At least 99% of the time
Values:

Code	Definition
00	None - no observable disturbance
10	Insect damage
11	insect damage to understory vegetation
12	insect damage to trees, including seedlings and saplings
20	Disease damage
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
41	beaver (includes flooding caused by beaver)
42	porcupine

43 deer/ungulate
44 bear
45 rabbit
46 domestic animal/livestock (includes grazing):
47 pigs, wild boars
50 Weather damage
51 ice
52 wind (includes typhoon, hurricane, tornado)
53 flooding (weather induced)
54 drought
55 earth movement/avalanches
56 erosion
60 Vegetation (suppression, competition, vines)
70 Unknown / not sure / other (include in NOTES)
80 Human-caused damage – any significant threshold of human-caused damage not described in the DISTURBANCE codes listed above or in the TREATMENT codes listed below. Must include a plot-level note to describe further.

5.5.7 DISTURBANCE YEAR 1

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

When collected: 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

5.5.8 DISTURBANCE 2

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

5.5.9 DISTURBANCE YEAR 2

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

5.5.10 DISTURBANCE 3

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

5.5.11 DISTURBANCE YEAR 3

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

5.5.12 TREATMENT 1

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 ac 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 forest land (CONDITION STATUS = 1)
And all measured nonforest (CONDITION STATUS = 2 and PRESENT NONFOREST LAND USE = 16-26)
Field width: 2 digits
Tolerance: No errors
MQO: At least 99% of the time
Values:

Code	Definition
00	None - No observable treatment.
10	Cutting - The removal of one or more trees from a stand.
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 already listed above) designed to improve the commercial value of the residual stand.

5.5.13 TREATMENT YEAR 1

Record the year in which TREATMENT 1 occurred.

When collected: 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

5.5.14 TREATMENT 2

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

5.5.15 TREATMENT YEAR 2

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

5.5.16 TREATMENT 3

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

5.5.17 TREATMENT YEAR 3

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

5.5.18 CONDITION CLASS SLOPE

Record a 3-digit code indicating the average slope percent of the condition within the plot area. Use the slope percentages recorded by subplot as <u>one</u> aid to determine slope by condition class average.

When collected: All accessible forest land (CONDITION STATUS = 1) And all measured nonforest (CONDITION STATUS = 2 and PRESENT NONFOREST LAND USE = 16-26)
Field width: 3 digits
Tolerance: +/- 10%
MQO: At least 90% of the time
Values: 000 to 155

5.5.19 CONDITION CLASS ASPECT

Record a 3-digit azimuth indicating the direction of slope for the land surface of the condition class. Use the aspects recorded by subplot as <u>one</u> aid to determine aspect by condition class. If the aspect is equally SE, S, SW, code the azimuth of the S aspect. If the aspect is SE, S, SW, but 80 percent of the condition class is SE, code the azimuth of the SE aspect.

When collected: All accessible forest land (CONDITION STATUS = 1) And all measured nonforest (CONDITION STATUS = 2 and PRESENT NONFOREST LAND USE = 16-26)
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

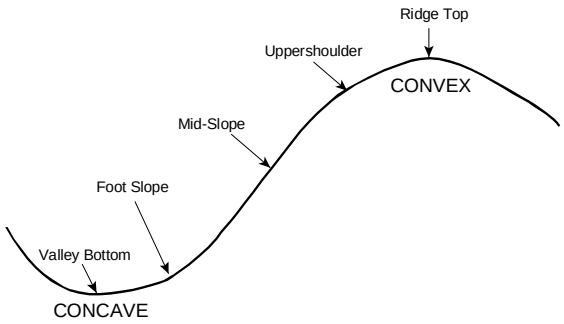
5.5.20 PHYSIOGRAPHIC CLASS

5.5.20.1 SLOPE SHAPE

Record the slope shape over the condition class under consideration. Use the slope shapes recorded by subplot as <u>one</u> aid to determine slope shape by condition class.

When collected: All accessible forest land (CONDITION STATUS = 1)
And all measured nonforest (CONDITION STATUS = 2 and PRESENT NONFOREST LAND USE = 16-26)
Field width: 2 digits
MQO: At least 90% of the time:
Values:

Flat	=	00
Concave	=	10
Convex	=	20



5.5.20.2 SLOPE POSITION

Record the slope position over the condition class under consideration: Use the slope positions recorded by subplot as <u>one</u> aid to determine slope position by condition class.

When collected: All accessible forest land (CONDITION STATUS = 1)
And all measured nonforest (CONDITION STATUS = 2 and PRESENT NONFOREST LAND USE = 16-26)
Field width: 2 digits
MQO: At least 90% of the time
Values:

00	=	Flat
10	=	Uppershoulder
20	=	Midslope
30	=	Footslope
40	=	Valleybottom
50	=	Ridgetop

To more accurately measure the moisture-related effects of topography on vegetation, two separate, calculated indices will be computed in the lab from data gathered in the field: 1.) an index of moisture demand and 2.) an index of moisture supply. For moisture demand, the aspect, slope and elevation at each plot is used to approximate annual moisture demand from "Potential Solar Beam Irradiation on Slopes" tables or equations (Frank and Lee 1966). Moisture supply is estimated from an additive, modified, topographic relative moisture index (TRMI; Parker 1982) constructed using slope shape, percent slope and slope position. Higher moisture supply values occur on footslopes, gentle slopes and/or sites exhibiting slope concavities.

5.5.21 PRESENT NONFOREST / INACCESSIBLE LAND USE

Record a code for all nonforest condition classes. Select a code that best represents the condition class within the sampled area

Gradations of agroforestry will be present on the islands. Follow the usual rules to determine whether to consider agroforests as forests and note the agricultural components.

On all visited plots with an accessible forest land and grass, forb or shrub land condition classes, map all nonforest condition classes present on the 4-subplot standard layout. Do not combine nonforest condition classes present. Example: if nonforest – urban land and nonforest – cropland are both present within a 24 ft radius subplot, map each land clas as a separate condition class.

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

10 Agricultural land - Land managed for crops, pasture, or other agricultural use. The area must be at least 1.0 ac in size and 120.0 ft 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 Low density agro-forest (agro-forest with less than 10 percent cover of tree species)

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

- 21 Grass lands – dominant vegetation is grasses, including *Miscanthus floridulus, Pennisetum polystachion, Saccharum spontaneum, Sporobolus diander, Eragrostis spp., Digitaria spp, and Cenchrus echinatus*
- 22 Montane grassland/savannah – found on mountains that reach above the heavy cloud belt. Mostly grassland mixed with xerophytic shrubs and small trees
- 23 Montane bogs – sedges, grasses and reeds growing at elevations where they are covered with clouds or fog most of the time. These bogs are on gently sloping or level areas with impeded drainage.
- 24 Alpine vegetation – dwarfed vegetation of grasses and cushion-plants growing at high altitudes

25 Fernland – dense tangles of *Dicranopteris* growing on steep slopes usually below 600 m (1,900 ft)
26 Subxerophytic/sclerophyllous scrub – vegetation found on truly dry, rain-shadow, leeward mountain slopes and lowlands, consisting of primarily shrub species

30 Developed - Land used primarily by humans for purposes other than forestry or agriculture. Use the 30 code only for land not better described by one of the following:

31 Cultural: business, 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

40 Other - Land parcels greater than 1.0 ac in size and greater than 120.0 ft 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 Naturally nonvegetated: Barren rock, sand, lava, glaciers

90 Not sampled - Land areas that are not sampled. Use the 90 code only for land not better described by Condition Status 4 through 7 on page 51

6. SUBPLOT DATA

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6. 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.

6.1 SUBPLOT NUMBER

Record the code corresponding to the number of the subplot.

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

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

6.2 SUBPLOT CENTER CONDITION

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

6.3 MICROPLOT CENTER CONDITION

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

When collected: All microplots where subplot center is CONDITION STATUS = 1, 2, 3, or 7
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values: 1 to 9

6.4 SUBPLOT SLOPE

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 predominately of one direction, code the predominate 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 an accessible forest land or measured non-forest condition class (CONDITION STATUS = 1 or CONDITION STATUS = 1 and PRESENT NONFOREST LAND USE = 16 through 26)
Field width: 3 digits
Tolerance: +/- 10%
MQO: At least 90% of the time
Values: 000 to 155

6.5 SUBPLOT ASPECT

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 aspect as follows:

- 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 an accessible forest land or measured non-forest condition class (CONDITION STATUS = 1 or CONDITION STATUS = 1 and PRESENT NONFOREST LAND USE = 16 through 26)

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

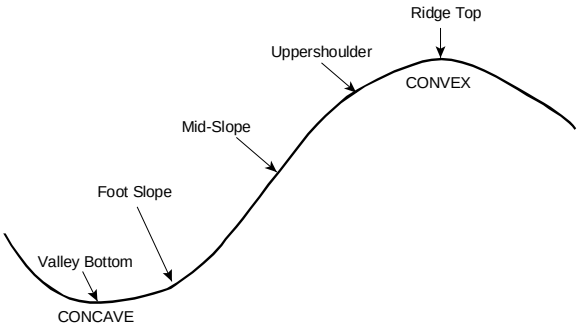
000	no aspect, slope < 5 percent
001	1 degree
002	2 degrees
.	.
.	.
360	360 degrees, due north

6.6 SLOPE SHAPE

Record the slope shape over the subplot under consideration:

When collected: All subplots with an accessible forest land or measured nonforest condition class (CONDITION STATUS = 1 or CONDITION STATUS = 1 and PRESENT NONFOREST LAND USE = 16 through 26)
Field width: 2 digits
MQO: At least 90% of the time
Values:

Flat	=	00
Concave	=	10
Convex	=	20



6.7 SLOPE POSITION

Record the slope position over the subplot under consideration.

When collected: All subplots with an accessible forest land or measured non-forest condition class (CONDITION STATUS = 1 or CONDITION STATUS = 1 and PRESENT NONFOREST LAND USE = 16 through 26)
Field width: 2 digits
MQO: At least 90% of the time
Values:

No Slope	=	00
Uppershoulder	=	10
Midslope	=	20
Footslope	=	30
Valleybottom	=	40
Ridgetop	=	50

To more accurately measure the moisture-related effects of topography on vegetation, two separate, calculated indices will be computed in the lab from data gathered in the field: 1.) an index of moisture demand and 2.) an index of moisture supply. For moisture demand, the aspect, slope and elevation at each plot is used to approximate annual moisture demand from "Potential Solar Beam Irradiation on Slopes" tables or equations (Frank and Lee 1966). Moisture supply is estimated from an additive, modified, topographic relative moisture index (TRMI; Parker 1982) constructed using slope shape, percent slope and slope position. Higher

moisture supply values occur on footslopes, gentle slopes and/or sites exhibiting slope concavities.

6.8 SNOW/WATER DEPTH

Record to the nearest 0.1 ft 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 heights) may be measured with less certainty due to conditions at the time of measurement.

When collected: All subplots with an accessible forest land or measured nonforest condition class (CONDITION STATUS = 1 or CONDITION STATUS = 1 and PRESENT NONFOREST LAND USE = 16 through 26)
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

6.9 SUBPLOT STATUS

Indicate whether or not this subplot currently has at least one accessible forested or measured non-forest condition class

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

0 No accessible forest land condition class
1 At least one accessible forest land condition class
2 A measured nonforest condition class, no forested condition class

SEEDLING COUNT

Stocking and regeneration information are obtained by counting live seedlings within the 6.8 ft radius microplot located 90 degrees and 12.0 ft from each subplot center within each of the four subplots. Conifer seedlings must be at least 0.5 ft in length and less than 1.0 in at d.b.h. in order to qualify for *counting*. Hardwood seedlings must be at least 1.0 ft in length and less than 1.0 in at d.b.h. in order to qualify for counting. Seedlings are counted in groups by species and condition class, up to 5 individuals per species. Counts beyond 5 coded as 6. Only count seedlings occurring in accessible forestland condition classes.

Count all live seedlings that have their base inside the microplot boundary regardless of vigor, damage, or closeness to other trees, but count only one seedling from a clump; a clump is 3 or more live stems that sprouted from a common root base (including stumps).

6.10 SEEDLING COUNT DATA ITEMS

Seedlings are counted within each accessible forestland (condition status 1) and measured nonforest (present nonforest land use 16-26) condition class on each microplot. Record the following data items for each seedling count:

6.11 SUBPLOT NUMBER

Enter Subplot number associated with the microplot. Use the procedures and tolerances outlined on page 78.

6.12 CONDITION CLASS NUMBER

Enter each forested condition class containing counted seedlings. Use the procedures and tolerances outlined on page 53

6.13 SPECIES

Enter each species of seedlings eligible for counting. Use the procedures and tolerances outlined on page 115. A list of species is found in the Tree Species section beginning on page **161**

6.14 SEEDLING COUNT

On each microplot, record the number of live tree seedlings of each species, by condition class. Count up to 5 individuals by species; code 6 if there are more than 5 individuals of any given species in any given condition class.

Multiple “suckers” that originate from the same location, and stump sprouts are considered one seedling. Do not tally or count “layers” (undetached branches partially or completely covered by soil, usually at the base) as seedlings. Do not tally any seedlings that sprout from a live tally tree.

When collected: Each accessible forestland (Condition Status = 1) and measured nonforest (present nonforest land use 16-26) condition class on each microplot
Field width: 1 digit
Values: 0 None
1 to 5 Exact count
6 More than 5 individuals by species by condition class

7. BOUNDARIES AND MAPPING

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7.0 BOUNDARY REFERENCES

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

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

7.1 REFERENCE PROCEDURE

Reference, within the sampled area on each microplot and subplot, the approximate boundary of each condition class that differs from the condition class 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.

Boundary referencing is done by recording azimuths and distances from subplot center to the reference points and/or from microplot center to the reference points (Figures 9 and 10). 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.

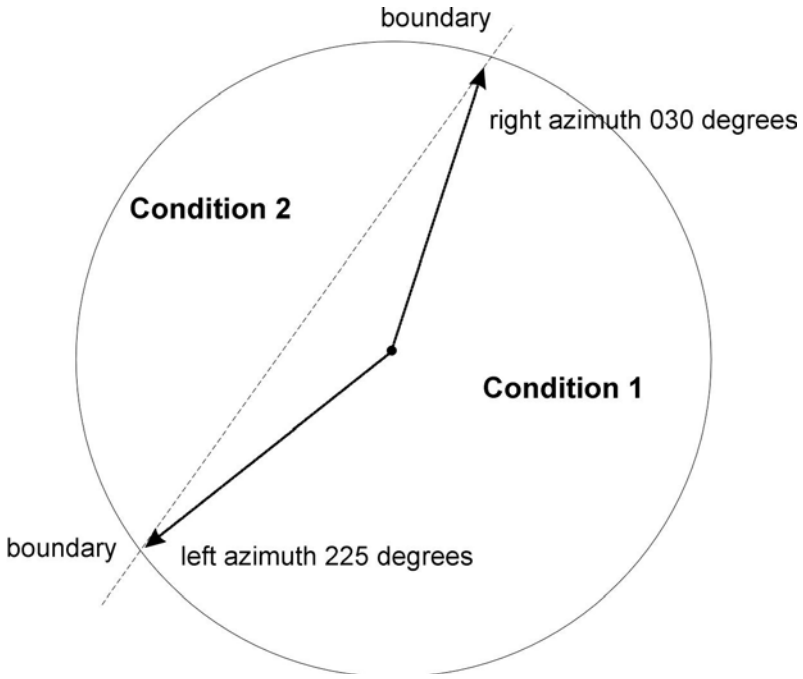


Figure 9. How to measure a straight boundary on a microplot, subplot, or annular plot.

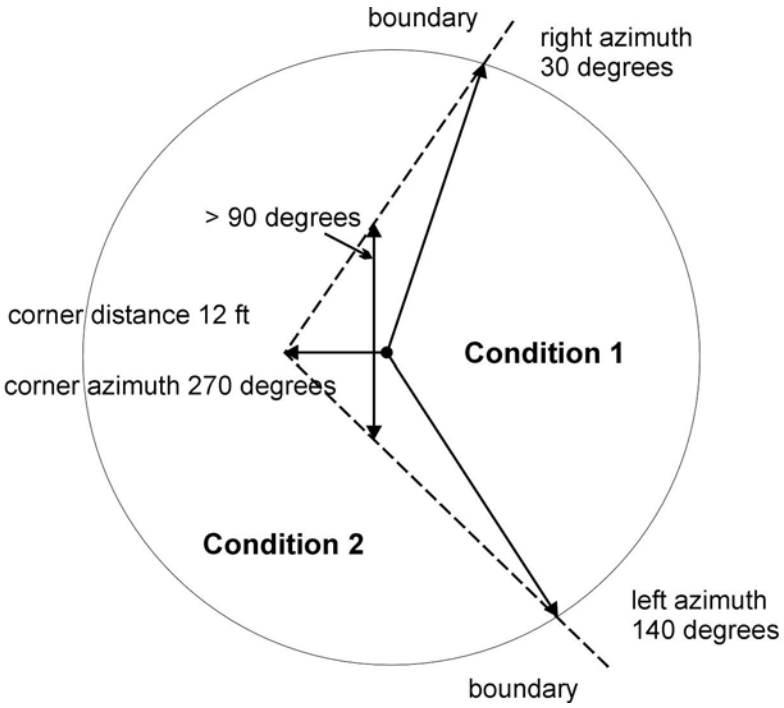


Figure 10. How to measure a boundary with a corner on a subplot or annular plot.

Microplot boundaries are referenced to the microplot center. 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 condition class delineation guidelines starting on page 49. The following additional rules apply when referencing a boundary within a subplot or microplot:

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 MQOs 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% of the subplot or microplot area. This allows for slight variations in azimuths or distances due to the approximate nature of our mapping procedures.

7.2 BOUNDARY DATA

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

7.2.1 SUBPLOT NUMBER

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

7.2.2 PLOT TYPE

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

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

7.2.4 CONTRASTING CONDITION

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 at the microplot center (for boundaries on the microplot), e.g., the condition class present on the other side of the boundary line.

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

7.2.5 LEFT AZIMUTH

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

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

7.2.6 CORNER AZIMUTH

Record the azimuth from the subplot or microplot 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

7.2.7 CORNER DISTANCE

Record the horizontal distance, to the nearest 1 ft, from the subplot or microplot 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:

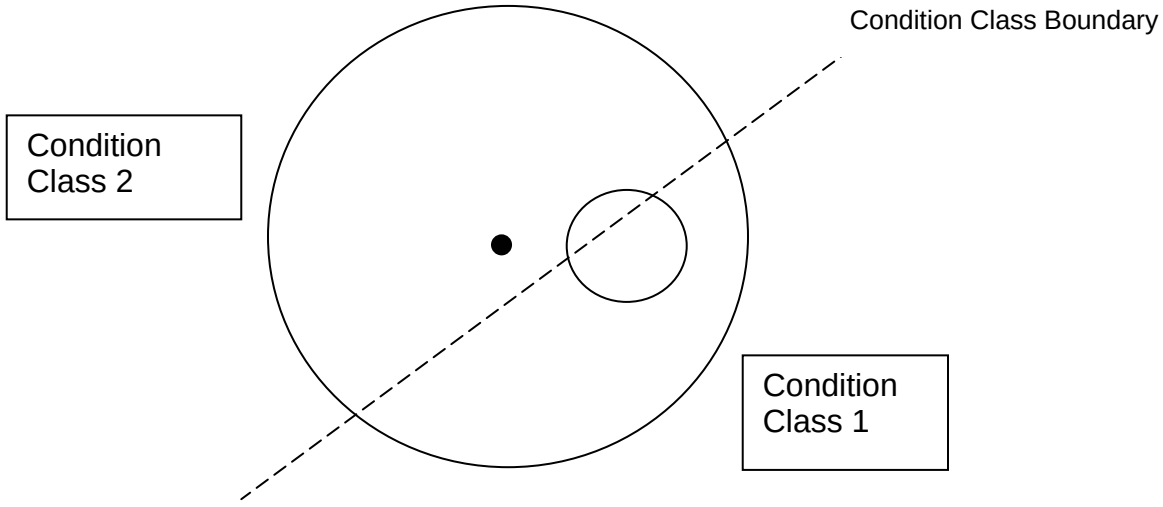
microplot	1	to	7 ft
subplot	1	to	24 ft

7.2.8 RIGHT AZIMUTH

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

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

Example of mapping on Subplot 3



Subplot	Plot type	Contrasting Condition	left azimuth	corner azimuth	corner distance	right azimuth
3	1	1	65	0	0	220
3	2	2	250	0	0	25

8. VEGETATION PROFILE

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8. VEGETATION PROFILE

Information on the abundance, structure, and species composition of understory plant communities has many uses. The data is used to evaluate wildlife habitat suitability, forage availability, grazing potential, species richness and abundance, fire hazard, abundance of non-timber forest products, and potential site productivity. The data also supports identification of plant community types (associations), which allows users to predict plot characteristics not actually measured by FIA. Accurately representing the species present on a site and their change in abundance in response to forest development, disturbance, or management is therefore important to a wide variety of users.

A. Vegetation plot design

Vegetation will be measured on each 24' radius subplot on which **accessible forest-land OR measured nonforest** (present nonforest land use 16-26) condition classes make up 50% of the subplot. (It is important to measure the vegetation before plants are trampled in the course of installing the rest of the plot.

Vegetation will be assessed over all portions of the subplot with forestland or measured nonforest condition classes, regardless of the presence of nonforest inclusions (nonforest inclusions are not to be confused with nonforest conditions). Do not measure the vegetation on those portions of the subplot containing non-measured nonforest condition classes.

Vegetation will be assessed over the entire subplot area, regardless of the presence of two or more condition classes or nonforest inclusions (nonforest inclusions are not to be confused with nonforest conditions). If vegetation on non-accessible condition classes cannot be examined closely (e.g. hazardous or denied access conditions), estimate vegetation on those areas from the best vantage points available.

B. Species records

Individual records are entered for vascular plant species and species groups on each subplot. Mosses and lichens are not measured. Each record is identified by growth habit, species name, height, and cover. In addition, cover of species is aggregated into four plant lifeform groups. The species of each tree, shrub, and forb lifeform group with ≥3% cover, are recorded individually. Any additional species on the *High Priority species list* (Appendix 3, page **233**) are also recorded by species regardless of abundance. Any additional species within a lifeform that collectively have ≥3% cover are recorded and overall cover and height estimated.

For tree species, only seedlings are included in the vegetation cover measurements (i.e. <1.0 in d.b.h. and ≥ 0.5 ft in length (conifers) or ≥1.0 ft in length (hardwoods). For graminoids, plants can be lumped into annual or perennial groups if they don't occur on the *High Priority species list* and their species, or genus, is not known.

Species are classified in two ways: by "growth habit" and by "lifeform". Growth habit identifies the form and growth characteristics of species. A single species may occur in several different growth

habits, depending on conditions. For example, the growth habit of twinflower (*Linnaea borealis*, LIBO3) can be classified as a sub-shrub, a vine, or a forb, and the growth habit for dwarf Oregongrape (*Mahonia nervosa*, MANE2) can be classified as a shrub or a sub-shrub (PLANTS 2000). Lifeform, on the other hand, is an assignment (somewhat arbitrary) of each species into a single group. For example, LIBO3 is always a "forb", and MANE2 is always a "shrub". The plant species lists produced by FIA (since the early 1980s) identify which group each species belongs to. Without this list in the Pacific Islands, you will need to make judgment calls. Try to keep them consistent.

Is it a tree or a shrub?
Cover is estimated for trees that are less than 1.0 in. d.b.h. The list of tree species begins on page **161** Non-trees (plants not found on the tree species list) are recorded using cover estimates, regardless of their diameter.

8.1 SPECIES GROWTH HABIT

Each individual species record must have a growth habit code recorded. If a species has more than one growth habit on the subplot, only record the predominate growth habit on the subplot for the species. Do not split species records on the sole basis of differences in growth habit. Species grouped into lifeforms do not get a growth habit code. Valid growth habit codes for the FIA inventory are derived from the PLANTS database (USDA, NRCS. 2000. The PLANTS database [http://plants.usda.gov/plants]. National Plant Data Center, Baton Rouge, LA 70874-4490).

When collected: All species > 3 percent cover of the subplot and all high priority species
Tolerance: No errors
Values:

PLANTS Growth Habit Code	PLANTS description	FIA plant lifeform group	PLANTS Definition *(added text in italics)*
FB	Forb/herb	Forb	Vascular plant without significant woody tissue above or at the ground. Forbs and herbs may be annual, biennial, or perennial but always lack significant thickening by secondary woody growth and have perennating buds borne at or below the ground surface. Federal Geographic Data Committee (FGDC) definition includes graminoids, forbs, and ferns; in PLANTS, graminoids are separated.
GR	Graminoid	Graminoid	Grass or grass-like plant, including grasses (Poaceae), sedges (Cyperaceae), rushes (Juncaceae), arrow-grasses (Juncaginaceae), and quillworts (Isoetes). An herb in the FGDC classification.
SH	Shrub	Shrub	Perennial, multi-stemmed woody plant that is usually less than 4 to 5 meters or 13 to 16 feet in height. Shrubs typically have several stems arising from or near the ground, but may be taller than 5 meters or single-stemmed under certain environmental conditions. *Includes succulents (e.g. cacti).*
SS	Subshrub	Shrub or Forb	Low-growing shrub usually under 0.5 m or 1.5 feet tall (never exceeding 1 meter or 3 feet tall) at maturity. A dwarf-shrub in the FGDC classification. *Includes succulents (e.g. cacti).*
VI	Vine	Shrub	Twining/climbing plant with relatively long stems, can be woody or herbaceous. FGDC classification considers woody vines to be shrubs and herbaceous vines to be herbs.
TR	Tree	Tree or Shrub	Perennial, woody plant with a single stem (trunk), normally greater than 4 to 5 meters or 13 to 16 feet in height; under certain environmental conditions, some tree species may develop a multi-stemmed or short growth form (less than 4 meters or 13 feet in height).
UN	Unknown		Growth form is unknown.

8.2 SPECIES

Each species record must have a species code recorded. Valid species codes are listed in the FIA plant guide, which is derived from the PLANTS database (USDA, NRCS. 2000. The PLANTS database [http://plants.usda.gov/plants]. National Plant Data Center, Baton Rouge, LA 70874-4490). Many species do not have codes. If the code is unknown, record genus and species instead. If you cannot identify a species while in the field, collect a specimen for later identification (see page 101). If the species of the plant cannot be identified, record the code for its genus if possible. If not, record one of the following generic codes:

Unknown Species Code	Life-form	Lumped Species Code
---	Trees	**TREES**
SHRUB1	Shrubs	**SHRUBS**
FORB1	Forbs (and ferns)	**FORBS**
AAGG1	Annual grasses	**AAGGS**
PPGG1	Perennial grasses	**PAGGS**

If another species of the same life-form can not be identified, it is labeled with the life-form followed by the number 2 (SHRUB2, FORB2, etc.). Up to five unknowns of each life-form may be recorded. Note: unknown tree species is not an option.

A generic record by plant life-form is entered when a group of tree, shrub, forb, annual grass, or perennial grass species, covers 3 or more percent on a vegetation plot but, as individual species, do not **and** are not on the *High Priority species list* (Appendix 3 page **233**). Example: 6 species of forbs are present one species covers 10 percent, and the other 5 species each cover 1 percent. Two records are entered: one record for the species of 10 percent, and a second generic FORBS record for the other 5 species which collectively cover 5 percent.

When collected: All species > 3 percent cover of the subplot and all high priority species

8.3 SPECIES HEIGHT

Record a 2-digit height for each line entry. The entry indicates the average total height above the ground at which a species occurs. If a species occurs at substantially different heights in a subplot, plants can be grouped into two different height groups as long as the cover estimates of each are ≥3%. A species can be in more than one height by repeating the species code on an additional line. Heights are recorded to the nearest foot.

Guidelines for recognizing separate heights for a species are:

- **Graminoid** canopy heights must differ by at least 2 ft.
- **Forb** canopy layers must differ by at least 2 ft.
- **Shrub** canopy layers must differ by at least 4 ft.
- **Tree seedling** layers must differ by at least 4 ft.

When collected: All species > 3 percent cover of the subplot and all high priority species
Tolerance: Grass and forbs: ± 1 ft.
Shrubs and trees: ± 3 ft.Values: 1 to 99

8.4 SPECIES COVER

Estimate the cover of each species that occupies at least 3% of the 24 ft. supblot radius in its respective height group. Cover is estimated to the nearest 1% for each species, as the proportion of the fixed-radius plot **regardless of condition class boundaries** that would be obscured by all plants of the species if viewed from directly above. For each plant, cover is based on a vertically-projected polygon described by the outline of the live foliage of each plant (or foliage that was live during the current growing season for senescing plants), and ignoring any normal spaces occurring between the leaves of a plant (Figure 11; Daubenmire 1959). This best reflects the plant's above- and below-ground zone of dominance.

Base the percent cover estimate on the current years' growth present at the time of the plot visit. Include both living and dead material from the current year. Do not include dead branches of shrubs and trees in the cover polygons. Do not adjust the percent for the time of year during which the visit was made (i.e. if the plants are immature and small because the plot is being completed early in the growing season).

Overlap of plants of the same species is ignored. Visually group plants in a species together into a percent cover. There will often be overlap of plants of different species. Therefore, the total cover for all species summed together on a subplot may exceed 100%. Species that are on the *High Priority species list* (Appendix 3, page **233**) and that cover less than 1% are recorded as 1%. (0% cover is only used for remeasurement, to indicate that a species is no longer present.)

Several approaches can be used to improve the accuracy and repeatability of plant cover estimates. Cover can be "added up" across a plot, keeping in mind that 3% cover on a 24' radius plot = 54 ft^2, or a square that is 7.4 feet on a side (Table 1). Plants can be visually aggregated into multiple 1% cover squares to arrive at a total cover. For species of moderate cover, it may be easiest to estimate cover of each quadrant of the subplot separately and then add them together, or to imagine crowding all the plants into a portion of a plot and estimate the proportion of the plot that would be covered. The cover scatterplots in Figure 12 may also be useful in developing estimates.

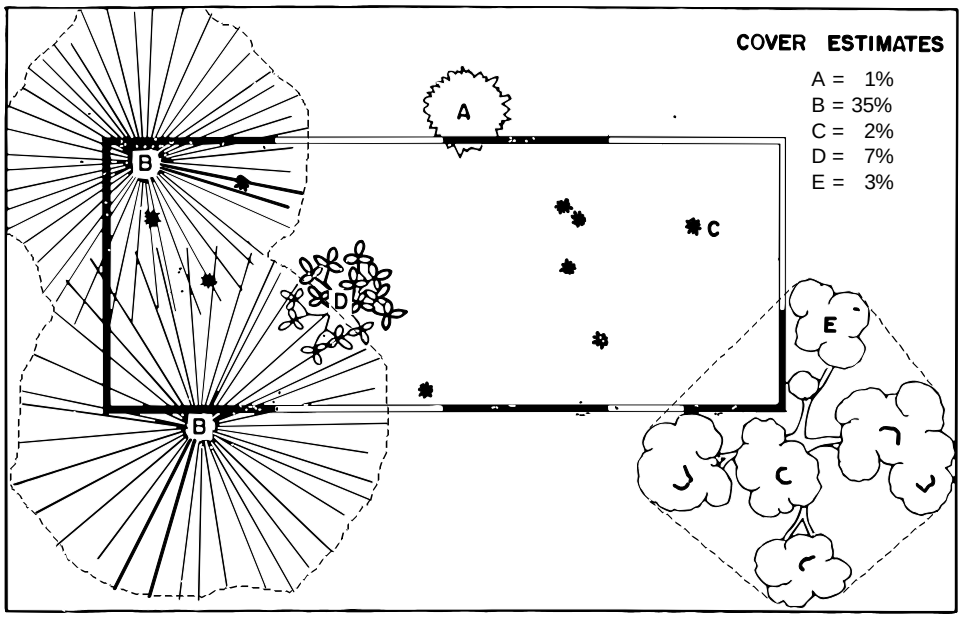

Figure 11. Examples of cover estimates

Table 1: Area represented by different cover estimates, and length of a square with that area.

Subplot radius = 24 feet
Subplot area = 1809 ft^2

Cover	Area (ft^2)	Length on a side (ft)	Radius (ft)	Diameter (ft)
1%	18	4.3	2.4	4.8
3%	54	7.4	4.2	8.4
5%	90	9.5	5.3	10.6
10%	181	13.4	7.6	15.2
15%	271	16.5	9.3	18.6
20%	362	19.0	10.5	21.0
25%	452	21.3	12.0	24.0

When collected: All species >3% cover and all high priority species
Tolerance: Cover estimates should be within one class of actual cover, based on the cover classes:
1-5%, 6-10%, 11-20%, 21-40%, 41-60%, 61-80%, and 81-100%
Values: 0 to 100

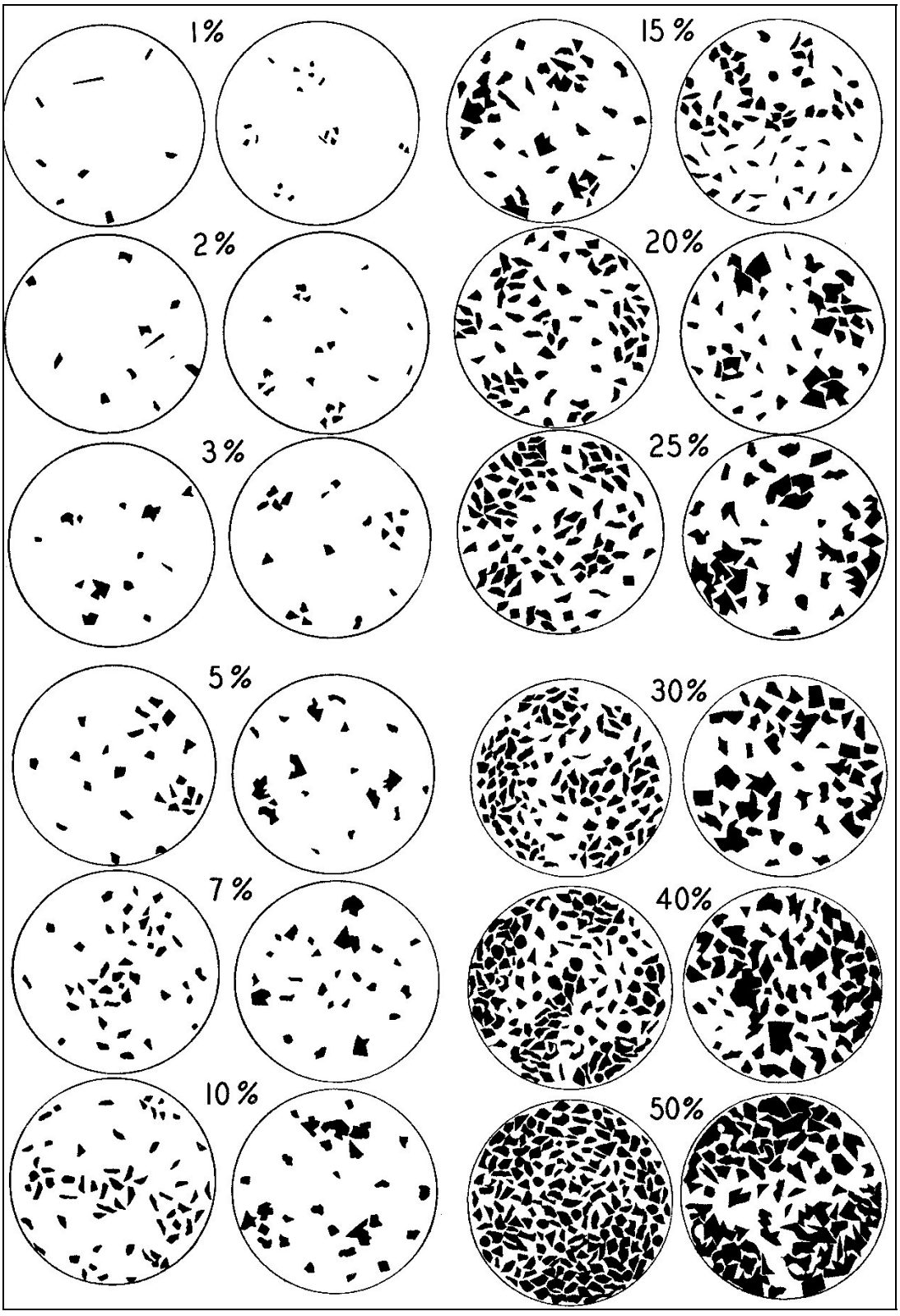

Figure 12: Reference scatterplots for cover estimation (from Terry and Chilingar 1955).

8.5 STAGE OF SHRUB DEVELOPMENT

For each shrub lifeform species recorded on one or more vegetation plots, enter the code below that best describes the shrub's stage of development across all vegetation plots. Do not include standing dead shrubs—only those that have some living tissue. Of all the live and dead stems and branches attached to the living shrubs, estimate the proportion that are dead, and place it in one of the classes below.

Code	Shrub Stage of Development
1	Immature, no dead material (stems and branches) associated with the shrub record.
2	Mature, 1-24 percent dead material associated with the shrub record.
3	Over-mature, 25-49 percent dead material associated with shrub record.
4	Decadent, 50 percent or more dead material associated with shrub record.

When collected: All species >3% cover and all high priority species
Tolerance: No errors
Values: 1 to 4

C. Lifeform and total vegetation records

Individual records are entered for each lifeform and for all vascular plants, and cover estimated for each. Species are defined by lifeform, although some plants can be measured as trees or shrubs depending on their form (see Section 8.2).

8.6 LIFEFORM

Record the lifeform of the vegetation being measured. Enter a record for each lifeform even if there are no plants in that lifeform present. Values are:

TR = tree seedlings
SH = shrubs
FB = forbs
GR = graminoids

When collected: All species >3% cover and all high priority species
Tolerance: No errors
Values: see above

8.7 LIFEFORM COVER

Estimate the cover for each lifeform and for all vegetation on the subplot. Cover is estimated to the nearest 1% for each lifeform, as the proportion of the fixed-radius plot, **regardless of condition class boundaries**, that would be obscured by all plants in the lifeform if viewed from directly above. Total percent cover for a plant lifeform group cannot exceed 100 percent. Total percent cover for a plant lifeform group cannot exceed the sum of percent cover recorded for all individual species

records of that plant group (item 8.4). However, total percent cover for a plant group can be, and often is, less than the sum of cover for all individual species within the group. This happens because of overlap between layers. If cover is greater than 0 but less than 1 percent , enter "01". If no plants of the lifeform are present, enter “0”.

When collected: All species >3% cover and all high priority species
Tolerance: Cover estimates should be within one class of actual cover, based on the cover classes:
1-5%, 6-10%, 11-20%, 21-40%, 41-60%, 61-80%, and 81-100%
Values: 0-100

8.8 TOTAL VEGETATION COVER

Estimate the total cover for all seedlings, shrubs, vines, and forbs on the subplot. Cover is estimated to the nearest 1%, as the proportion of the fixed-radius plot that would be obscured by all plants if viewed from directly above. Total vegetation cover cannot exceed 100 percent. Total percent vegetation cover can be, and often is, less that the sum of lifeform covers on a subplot. This happens because of overlap between layers of vegetation.

When collected: All subplots with at least 50% of the subplot area occupied by forested on measured non-forest condition classes

D. Collection and identification of unknown plants

To improve the quality of vegetation profile data, a formal procedure is followed to identify more of the unknown plant species that are tallied.

Each crew (truck, boat, helicopter) will be supplied with a three-ring binder containing sealable plastic bags for the collection of unidentified specimens. The binders provide some degree of protection to collected plants, and help to prevent their loss. Each bag has a label that should be filled out when a specimen is collected; the label identifies the plot and subplot from which the bagged specimen was collected.

While on the plot, the crew should not spend an inordinate amount of time trying to identify an unknown plant. If the plant can be keyed out quickly using a plant guide, identification should be attempted. If the crew is confident the plot can be completed in one day, they can spend more time trying to identify unknown plants while on the plot. In most cases, though, it will be more effective to collect unknown plants for later identification. If the plant can not be identified and qualifies for tally as a generic life-form record (shrub, forb, fern, grass), enter the record.

Gather as much of the complete plant as is feasible. Include roots, flowers, and seed-heads if possible. Write a brief description of the site from which the plant was collected, the plant community of which it was a member, and any other information which may assist in identification.

Once back at the motel/beach-front condo (with hottub), try to identify the collected specimens the same day that the plot was visited. Use whatever plant guides are available and the Polyclave program which is installed on the laptop computer. Other field team members who might be familiar with the species and/or are good at plant identification may be consulted. Twenty minutes is the recommended maximum amount of time that should be spent on one plant. If the specimen can not

be identified, contact the crew coordinator. If the same plant is collected several times and identification attempts are unsuccessful, the crew coordinator may contact a botanist for identification.

If no attempt can be made to key out a plant the same day it is collected, the specimen should be placed in a plant press (one is in each vehicle). Do not leave the specimen in the plastic bag; specimens left bagged may mildew and mold.
If a plant is successfully identified, the vegetation profile data for that plot should be updated before transferring the plot data to the laptop computer

9. TRACKABLE TREE AND SNAG SELECTION
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9. TRACKABLE TREE AND SNAG SELECTION

A. Introduction

Tree species are measured on accessible forested and measured nonforest (present nonforest land use 16-26) condition classes. See page 57 for definitions of accessible forest land

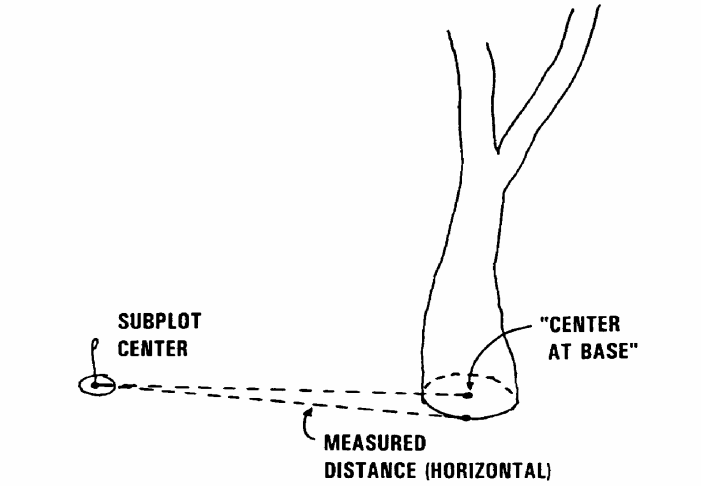
Large trees and snags (≥5.0 in. d.b.h.) are sampled using the 1/24 acre fixed-radius subplot. Each subplot has a fixed-radius of 24.0 feet horizontal.

Saplings (1.0 in. to 4.9 in. d.b.h.) are sampled more efficiently using the small (1/300 acre) fixed-radius microplot. Each microplot has a fixed-radius of 6.8 feet horizontal. Saplings are referenced to the microplot center.

Seedlings (conifers <1.0 in. d.b.h. and ≥0.5 ft. in length; and hardwoods <1.0 in. d.b.h. and ≥1.0 ft. in length) are also sampled most efficiently using the microplot. Seedlings are counted by species and condition class (see "Seedling Count" on page 82) and in some cases, are tallied individually. Seedlings are referenced to the microplot center.

B. Determining if a tree/sapling/seedling is selected on a fixed-radius plot

Trees are selected only when the distance from their bole center at the ground to the subplot center is less than the radius of that subplot/microplot (see figure below).



C. Trackable tree and snag selection

Is it a tree or a branch?:
See the rule for forked trees in tree data 10.9 DIAMETER on page **115**

Is it a stump?:
High stumps meeting size and lean requirements are considered standing dead tally trees and are tallied as such. Identify them as stumps in TREE NOTES

Follow the steps below:

1.) If the condition class is accessible forest land (CONDITION STATUS = 1) or measured nonforest (present nonforest land use 16-26), do the following steps in the condition class:

a) Tally all trees live and ≥5.0 in. d.b.h. that are within the 24.0 ft. subplot.

Assign a TREE STATUS = 1.

b) Tally all trees standing dead, ≥5.0 in. d.b.h.., ≥4.5 feet tall, leaning < 45 degrees, that are within the 24.0 ft. subplot.

Assign a TREE STATUS = 2.

c) Tally all live trees 1.0 to 4.9 in. d.b.h. that are within the 6.8 ft. microplot.

Assign a TREE STATUS = 1.

d) Tally live seedlings (conifers <1.0 in. d.b.h. and ≥0.5 ft. in length; and hardwoods <1.0 in. d.b.h. and ≥1.0 ft. in length) present within the 6.8 ft. microplot if the combined tally of live trees ≥1.0 in. d.b.h. present in the condition class on the subplot is less than 4. Tally seedlings, if present, until the total tally of live trees is 4 in the condition class on the subplot. Tally a seedling only if it meets the requirements specified in the section "Seedling requirements" on page 106.

Assign these seedlings TREE STATUS = 1.

2.) If the condition class is NOT accessible forest land or measured nonforest (present nonforest land use 16-26):

Do not tally live trees, dead trees, or seedlings.

D. Seedling requirements

A seedling is: a live tree less than 1.0 in. d.b.h., a conifer at least 0.5 ft. in length or a hardwood at least 1.0 ft. in length, and established in mineral soil. (The requirements that follow differ from the requirements for "Seedling Count" on page 82).

Tally a seedling only if it meets the following requirements:

1. Select a seedling only if its bole center at the ground is within 6.8 feet (horizontal distance) of microplot center.

2. Select a seedling only if it is expected to live at least 10 more years.

3. Do not tally a suppressed seedling. A seedling is suppressed if it is overtopped by other trees and will not live 10 more years.

4. If a seedling is dominant or codominant and less than 4.5 feet tall, it must be at least 2 feet from any other tally tree. An intermediate or overtopped seedling of any height must be at least 2 feet from any other tally tree. Ignore residual overstory trees ≥5.0 in. d.b.h. when evaluating the crown class of an additional stocking seedling.

5. If a conifer, select a seedling only if it currently is not overtopped and shaded by another conifer and will not be overtopped and shaded by another conifer before reaching 9.0 in. d.b.h. This includes overtopping by other conifers that are within or outside the 6.8 foot fixed-radius plot. Ignore overtopping by conifers ≥9.0 in. d.b.h. and 50 years old (b.h. age) if the conifer seedling is of a shade tolerant species (true firs except noble fir, hemlocks, spruces, and cedars except incense cedar).

   Whether or not a conifer is overtopped is estimated by using the "inverted cone" method. This method projects two straight lines along the branch tips of a tree's cone-shaped crown upward from their intersection at the tree's tip to create an imaginary cone, in the growing space above the tree. If one-third or more of the imaginary cone is occupied by the live crown(s) of other conifer(s), the tree is considered overtopped. If less than one-third of the imaginary cone is occupied, the tree is considered "free-to-grow".

6. Only one hardwood seedling in a hardwood clump can be selected. If more than one seedling in a clump is a candidate for being tallied, select the most dominant seedling candidate. Do not tally seedling-sized suckers that have sprouted from the base of a live, unsuppressed hardwood stem that is ≥5.0 in. d.b.h. A clump is defined as 3 or more live stems that sprouted from a common root system which had originated as part of a earlier tree whose above-ground bole was cut or is no longer alive.

E. Tree and snag selection MQO

Tally tree selection:
Tolerance: Live tree ≥ 5.0 in. on the subplot: No errors
Dead tree ≥ 5.0 in. on the subplot: No errors Sapling: No errors

10. Tree And Sapling Data

10. 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 and measured nonforest 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 growth, mortality, removals; coarse woody debris; wildlife habitats; forest structure and composition; biomass; and carbon sequestration.

All trees with a diameter at least 1.0 in but less than 5.0 in, 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 in or larger, at which time they are tallied on the 24.0 ft subplot and referenced (new azimuth and 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, either diameter at breast height (DBH). Trees that have been temporarily defoliated are still alive.

DEAD TREES (Snags)
Once tallied, dead trees over 5.0 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 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 . Broken portions of trees that are completely separated from their base are not treated as separate trees.

"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 Debris (DWD) if they otherwise meet DWD tally criteria. Live and dead standing tally trees, and partially separated boles of dead tally trees, do not have to be self-supported. They may be supported by other trees, branches, or their crown.
Trees that have been cut above DBH qualify as tally trees, provided they meet the size requirement.

Begin tallying trees at an azimuth of 001 degrees from subplot center and continue clockwise around the subplot. Repeat this sequence for trees on the microplot and again on the annular plot.

10.1 SUBPLOT NUMBER

Record the subplot number where the tree occurs.

When Collected: All live and dead tally 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

10.2 TREE NUMBER

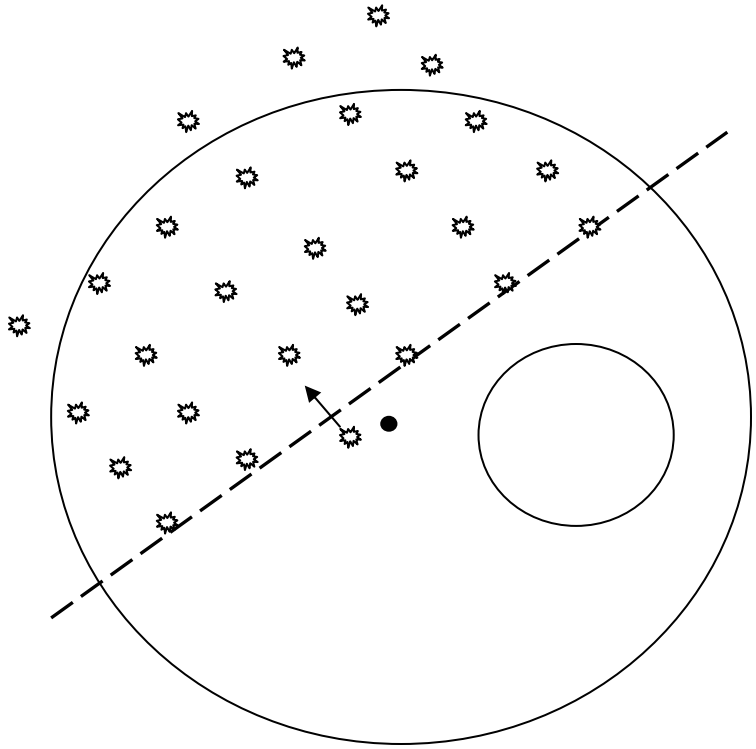
Record a code to uniquely and permanently identify each tree on a given subplot. The TREE NUMBERS must be unique within a subplot – being unique is more important than being sequential. In general, work clockwise from azimuth 001 to 360, and work outwards from subplot center to subplot edge. The tag is placed facing the subplot center.

If TREE RECORD NUMBERs are not assigned in the field, record 000.

When Collected: All live tally trees $\geq$ 1.0 in DBH
Field width: 3 digits
Tolerance: No errors
MQO: At least 99% of the time
Values: 000, 001 to 999

10.3 CONDITION CLASS NUMBER

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 13).



When Collected: All live and standing dead tally trees
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values: 1 to 9

10.4 AZIMUTH

Record the AZIMUTH from the subplot center (for trees $\geq$ 5.0 in DBH) or the microplot center (for trees < 5.0 in DBH), 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 live and standing dead tally trees
Field width: 3 digits
Tolerance: +/- 2 degrees
MQO: At least 90% of the time

Values: 001 to 360

10.5 HORIZONTAL DISTANCE

Record the measured HORIZONTAL DISTANCE, to the nearest 0.1 ft, from the subplot center (for trees ≥ 5.0 in DBH) or microplot center (for trees < 5.0 in DBH) to the pith of the tree at the base

When Collected: All live and standing dead tally trees
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 6.8
Subplot: 00.1 to 24.0

10.6 SLOPE DISTANCE

Record the measured SLOPE DISTANCE, to the nearest 0.1 ft, from the subplot center to the head of the nail that affixes the tree number tag, or to the front of the tree at the base if not tagged with a number.

When Collected: All reference trees
Field width: 3 digits (xx.y)
Tolerance: +/- 1.0 ft
MQO: At least 90% of the time
Values: .1 to 99.9

10.7 TREE STATUS

Record a current TREE STATUS for each tallied tree; this code is used to track the status of sample trees over time: as they first appear, as ingrowth, as they survive, and when they die or are removed. This information is needed to correctly assign volume information to the proper component of volume change.

When Collected: All new live tally trees
All new dead tally trees ≥ 5.0 in d.b.h.
All reference only trees
Field width: 1 digit
Tolerance: No errors
MQO: At least 95% of the time
Values:

1 Live tree – any live tally tree

2 Dead tree -- any dead tally tree > 5.0 in d.b.h

9 Reference Only tree – a subplot reference tree that does not qualify as a tally tree

10.8 SPECIES

Record the appropriate TREE SPECIES code from the list beginning on page 161). If you encounter a species not listed in the Tree Species List 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 codes 9000 and above for unknowns 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. In this case use the sample collections procedures described earlier in this paragraph.

When Collected: All live and standing dead tally trees
Field width: 3 digits
Tolerance: No errors
MQO: At least 99% of the time for genus, at least 95% of the time for species
Values: See TREE SPECIES LIST beginning on page 161

10.9 DIAMETER

Diameters are measured at breast height (DBH) which if 4.5 feet above the ground. Trees with diameters less than 4.9-inches are measured on the 6.8-ft radius microplot, those with diameters of 5.0-inches and larger are measured on the 24-ft radius subplots.

In order to accurately remeasure diameter at the same point on the tree bole at successive visits, mark the point of measurement with an aluminum nail. When marking trees for the first time, measure the diameter after the nail is in place. Use caution to avoid damaging trees with nails. Do not nail trees less than 3.0-inches in diameter, or species vulnerable to introduction of pathogens (e.g., aspen).

If the diameter cannot be physically measured for any reason, estimate the diameter using a relaskop. This procedure is described in Appendix 2, page 231

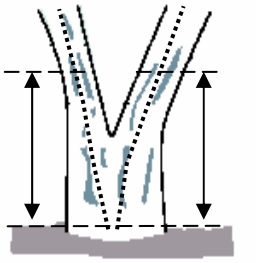
10.9.1 DIAMETER AT BREAST HEIGHT (DBH)

Unless one of the special situations described below is encountered, measure DBH at 4.5 ft 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

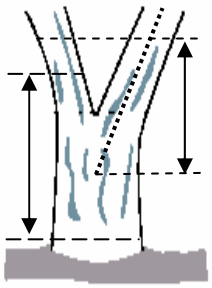
trees are handled differently depending on whether the fork originates below 1.0 ft, between 1.0 and 4.5 ft, or above 4.5 ft.



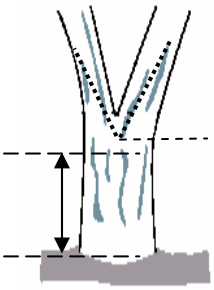
- Trees forked below 1.0 ft. Trees forked in this region are treated as distinctly separate trees (Figure 14). Distances and azimuths are measured individually to the center of each stem where it splits from the stump (Figure 17 A-C). DBH is measured for each stem at 4.5 ft above the ground. When stems originate from pith intersections below 1 ft, 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 ft fork again between 1.0 and 4.5 ft (Figure 17-E), the rules in the next paragraph apply.

- Trees forked between 1.0 ft and 4.5 ft. Trees forked in this region are also counted as separate trees (Figure 15), but only one distance and azimuth (to the central stump) is used for all (Figure 17 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 ft above the pith intersection. When forks originate from pith intersections between 1.0 and 4.5 ft, the limiting distance is the same for all forks--they are either all on, or all off the plot.

  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 ft above the common pith intersection (Figure 17 F).



  Once a stem is tallied as a fork that originated from a pith intersection between 1.0 and 4.5 ft, do not recognize any additional forks that may occur on that stem. Measure the diameter of such stems at the base of the second fork as shown in Figure 17-E (i.e., do not move the point of diameter the entire 3.5 ft above the first fork).



- Trees forked at or above 4.5 ft. Trees forked in this region count as one single tree (Figure 16). If a fork occurs at or immediately above 4.5 ft, measure diameter below the fork just beneath any swelling that would inflate DBH.

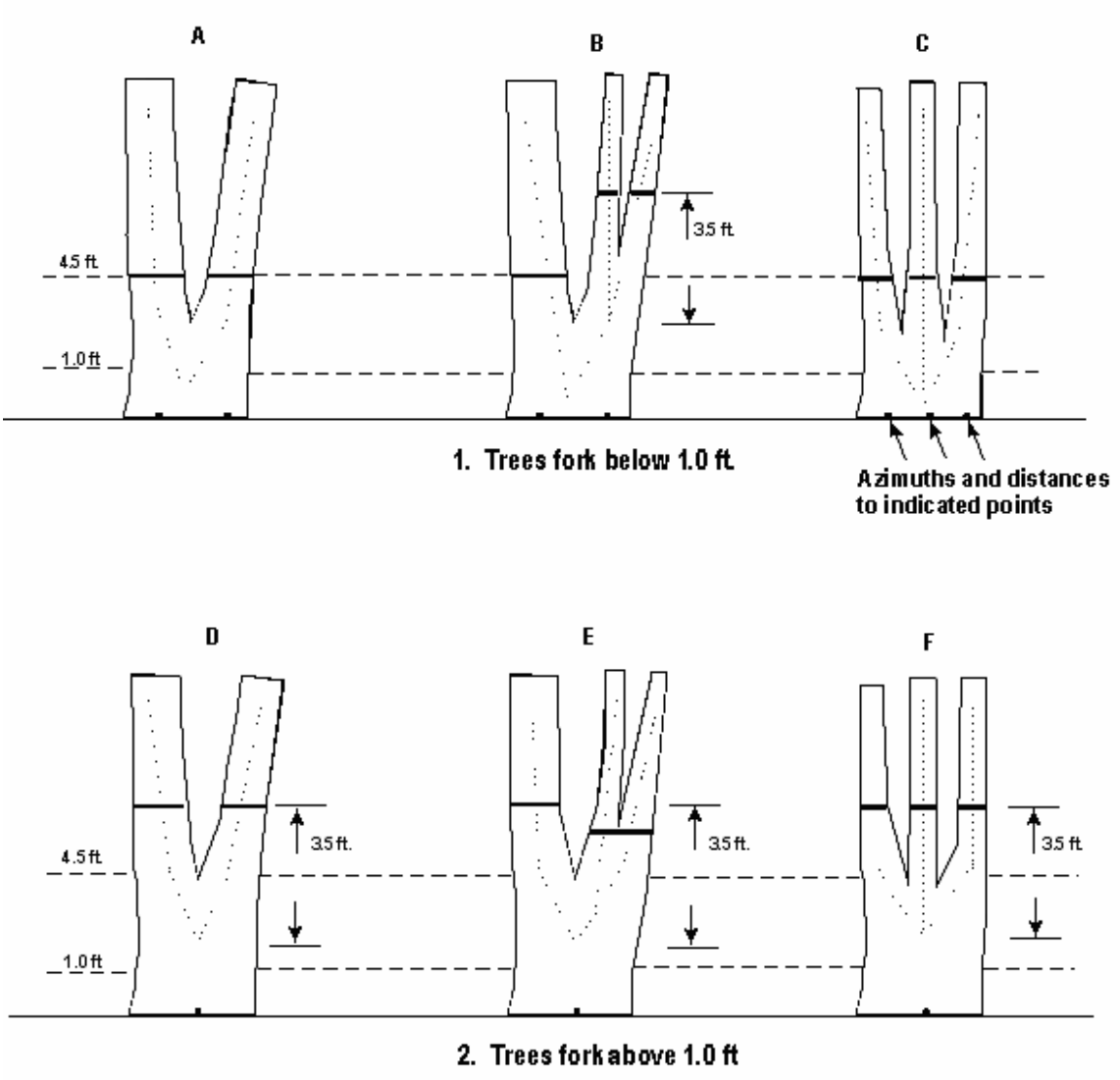
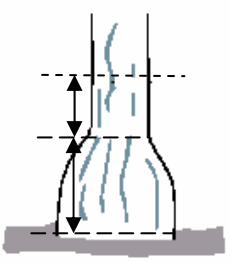


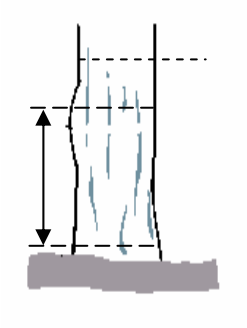
Figure 17. Summary of where to measure DBH, distance, and azimuth on forked trees.

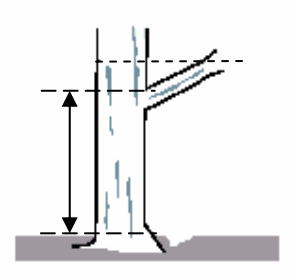
2. Stump Sprouts. Stump sprouts originate between ground level and 4.5 ft on the boles of trees that have died or been cut. Stump sprouts are handled the same as forked trees, with the exception that stump sprouts are not required to be 1/3 the diameter of the dead bole. Stump sprouts originating below 1.0 ft are measured at 4.5 ft from ground line. Stump sprouts originating between 1.0 ft and 4.5 ft are measured at 3.5 ft 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 ft. For multi-stemmed woodland species, treat all new sprouts as part of the same new tree.

3. Tree with butt-swell or bottleneck: Measure these trees 1.5 ft above the end of the swell or bottleneck if the swell or bottleneck extends 3.0 ft or more above the ground (Figure 18).

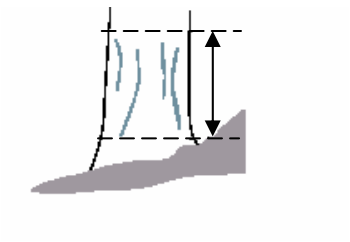


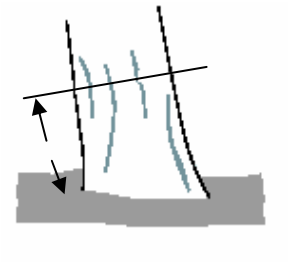
4. Tree with irregularities at DBH: On trees with swellings (Figure 19), bumps, depressions, prop roots, and branches (Figure 20) at DBH, diameter will be measured immediately above the irregularity at the place it ceases to affect normal stem form.





5. Tree on slope: Measure diameter at 4.5 ft from the ground along the bole on the uphill side of the tree (Figure 21).

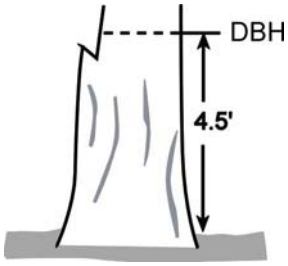




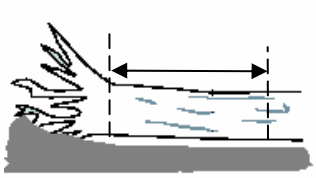
6. Leaning tree: Measure diameter at 4.5 ft from the ground along the bole. The 4.5 ft distance is measured along the underside face of the bole (Figure 22).

7. Turpentine tree: On trees with turpentine face extending above 4.5 ft, estimate the diameter at 10.0 ft above the ground and multiply by 1.1 to estimate DBH outside bark.

8. Independent trees that grow together: If two or more independent stems have grown together at or above the point of DBH, continue to treat them as separate trees. Estimate the diameter of each, set the "DIAMETER CHECK" code to 1, and explain the situation in the notes.



9. 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, of the wood and bark that is still attached to the tree (Figure 23). 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 19).



10. Live windthrown tree: Measure from the top of the root collar along the length to 4.5 ft (Figure 24).

11. Down live tree with tree-form branches growing vertical from main bole. When a down live tree, touching the ground, has vertical (<45° 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 25).

        - If the pith intersection of the main down bole and vertical tree-like branch occurs below 4.5' from the stump along the main bole, treat that branch as a separate tree, and measure DBH 3.5 ' above the pith intersection for both the main bole and the tree-like branch.

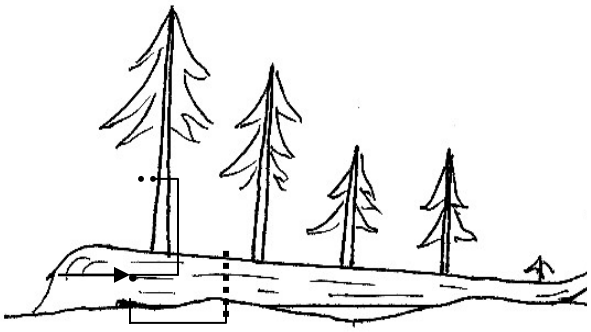


Figure 25. Down tree above duff. Use forking rules.

- If the intersection between the main down bole and the tree-like branch occurs beyond the 4.5’ 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 26). 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.

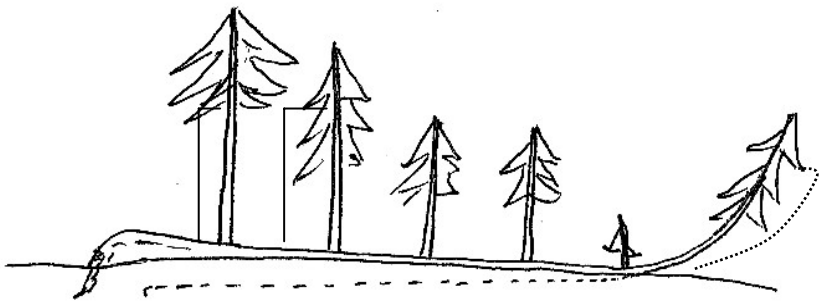


Figure 26. Down tree below duff. Treat each branch as a separate tree.

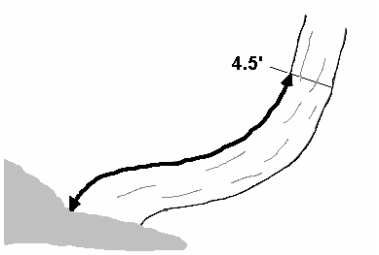


Figure 27. Tree with curved bole

10.9.2 DIAMETER CHECK

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: All live and standing dead tally trees $\geq$ 1.0 in DBH
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values:

0	Diameter measured accurately
1	Diameter estimated

10.9.3 LENGTH TO DIAMETER MEASUREMENT POINT

Record this item when tree diameter measurement locations are not monumented. For those trees measured directly at 4.5 ft above the ground, leave this item blank. If the diameter is not measured at 4.5 ft, record the actual length from the ground, to the nearest 0.1 in, at which the diameter was measured for each tally tree, 1.0 in DBH and larger.

When Collected: All live and dead tally trees $\geq$ 1.0 in DBH
Field width: 3 digits
Tolerance: +/- 0.2 ft
MQO: At least 90% of the time
Values: 0.1 – 15.0

10.9.4 SECOND DIAMETER ON UPPER BOLE

Record the diameter of the main stem on the upper bole. The upper bole diameter should be measured with a relaskop at the point where the main stem tapers to 4 inches or greater. Measure to the nearest inch for all trees >= 5.0 in DBH on the 24 ft. radius subplots.

When Collected: All live and standing dead tally trees >= 5.0 in DBH
Field width: 2 digits

10.9.5 SECOND DIAMETER ON UPPER BOLE HEIGHT

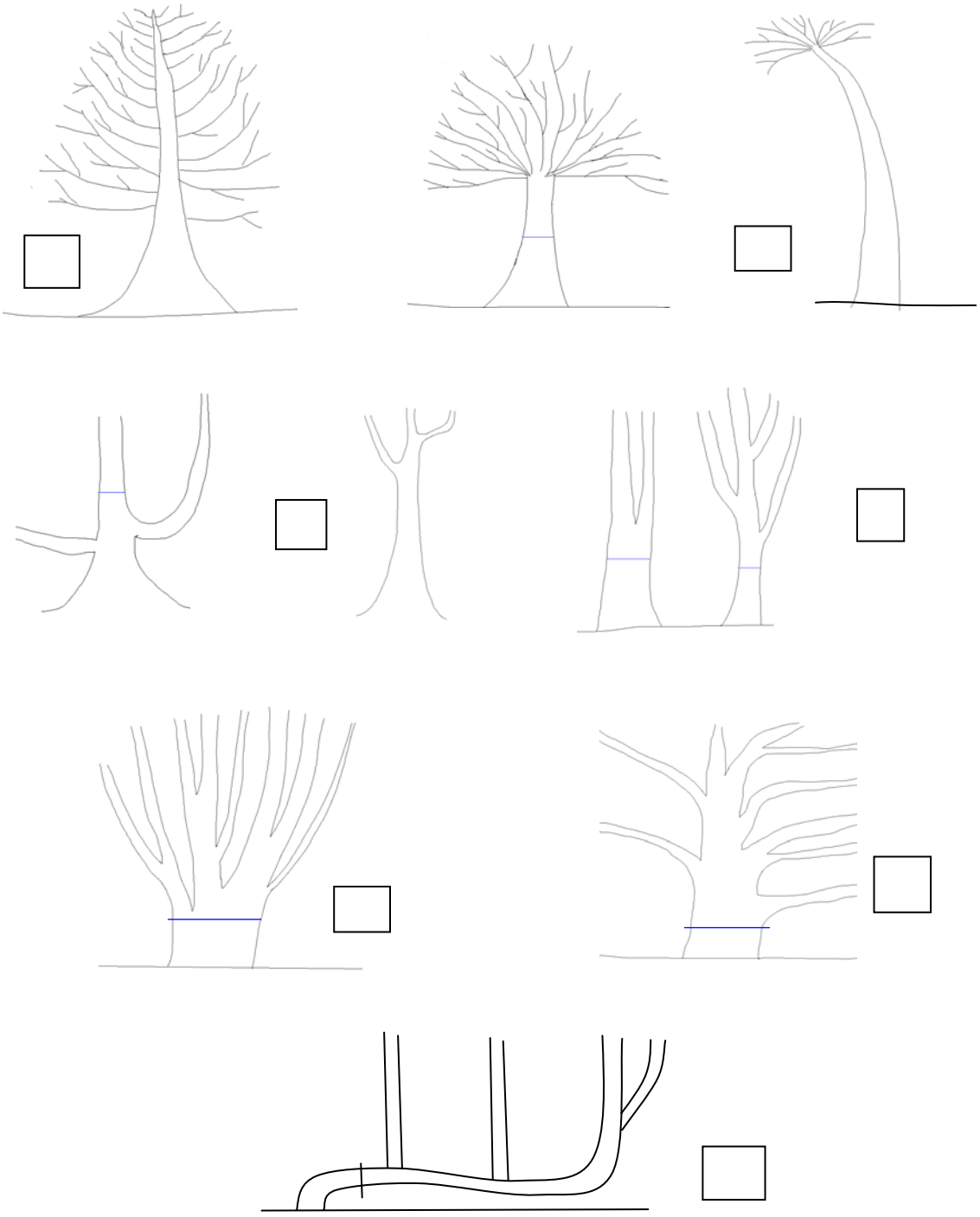
Record the height where the main stem diameter is measured. The main stem diameter should be at least 4 in. at this height. Measure to the nearest foot.

When Collected: All live and standing dead tally trees >= 5.0 in DBH
Field width: 3 digits
Values: 4 in to 999 in

10.10 BRANCHING CHARACTERISTICS

Record the branching form figure number that best represents the density and structure of the branching system

When Collected: All live and standing dead tally trees >= 5.0 in d.b.h.
Field width: 1 digit
Values:



10.11 ROOT MEASUREMENTS FOR TROPICAL TREES

Tropical trees can exhibit prop (or stilted roots), buttressed roots, and various forms of aerial rooting systems. To accurately account for the often significant biomass associated with these special root systems, please measure and note the following.

10.11.1 TYPE OF ROOTING SYSTEM

Record the type of rooting system of tally trees and snags.

When Collected: All live and standing dead tally trees >= 5.0 in d.b.h.
Field width: 1 digit
Values:

0 = Normal roots (Default)
No other root measurements are needed

1 = Prop (Stilted) roots
Record **root diameters**, **rooting height**, and **density code**

2 = Buttressed roots
Record **number of buttresses** and **rooting height**

10.11.2 ROOT DIAMTER 1

Record the largest diameter (to the nearest foot) of the entire prop root system at ground level.

When Collected: All live and standing dead tally trees >= 5.0 in d.b.h.with ROOTING SYSTEM = 1
Field width: 2 digits
Values: 1 ft. to 99 ft

10.11.3 ROOT DIAMETER 2

Record the diameter of the prop root system perpendicular to the largest diameter recorded above, also at ground level and to the nearest foot.

When Collected: All live and standing dead tally trees >= 5.0 in d.b.h. with ROOTING SYSTEM = 1
Field width: 2 digits
Values: 1 ft. to 99 ft

10.11.4 ROOTING HEIGHT

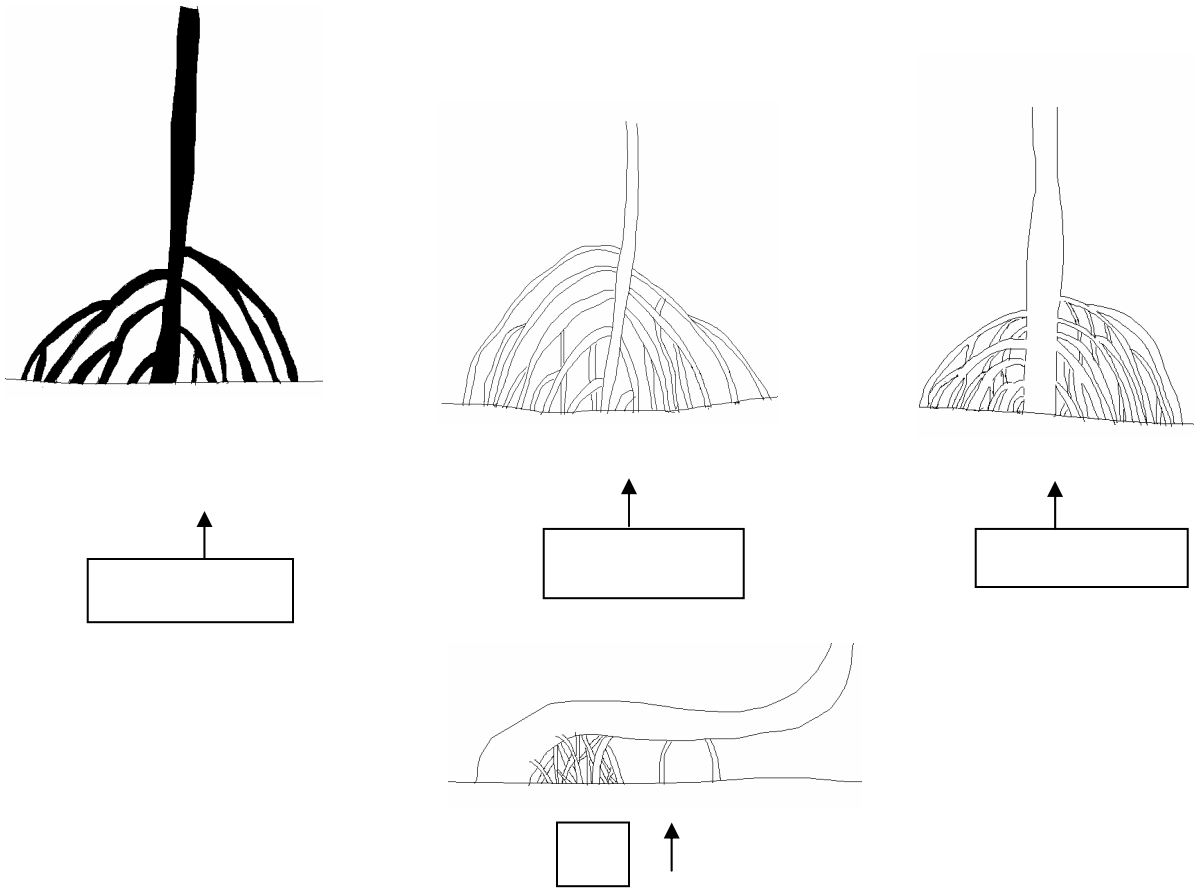
Record the height of the stilted or buttressed root system to the nearest foot, from ground level to the highest point where the stilts or buttresses protrude from the bole of the tree.

When Collected: All live and standing dead tally trees >= 5.0 in d.b.h with ROOTING SYSTEM = 1 or 2.
Field width: 2 digits
Values: 1 ft. to 99 ft

10.11.5 PROP ROOT DENSITY

For prop roots, record the stilted roots figure number that best represents the density and structure of the stilted root system.

When Collected: All live and standing dead tally trees >= 5.0 in d.b.h. with ROOTING SYSTEM = 1
Field width: 2 digits
Values:



10.11.6 NUMBER OF BUTTRESSES

For buttressed roots, record the number of buttresses.

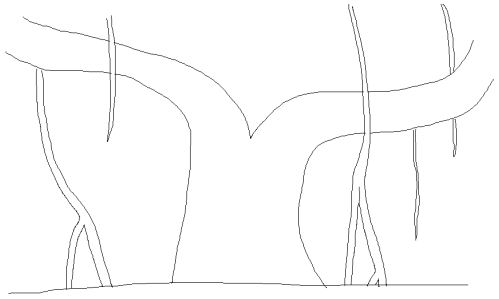
When Collected: All live and standing dead tally trees >= 5.0 in d.b.h. with ROOTING SYSTEM = 2
Field width: 2 digits
Values: 1 to 99.

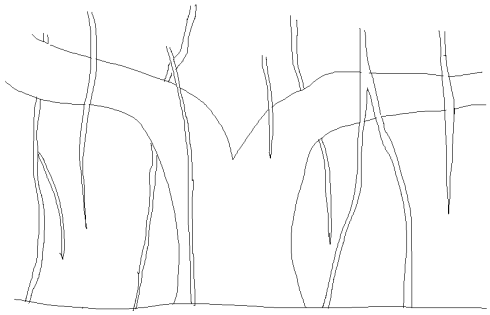
10.11.7 AERIAL ROOT DENSITY

If there are aerial roots, record the aerial root figure number that best represents the density and branching structure of the aerial root system. If there are no aerial roots, record 0 for this column.

When Collected: All live and standing dead tally trees >= 5.0 in d.b.h.
Field width: 1 digit
Values:

0 = No aerial roots





10.12 LEAN ANGLE

Record the code that describes the angle of lean from vertical of the tree, from base to top of ACTUAL LENGTH. Trees supported by other trees or by their own branches are considered standing.

When Collected: All live and standing dead tally trees ≥ 5.0 in DBH
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values:

0 Standing (less than 45 degrees of lean from vertical)
1 Down (more than 45 degrees of lean)

10.13 ROTTEN/MISSING CULL

Record the percent rotten or missing cubic-foot cull for all live tally trees ≥ 5.0 in DBH and all standing dead tally trees ≥ 5.0 in DBH.
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.

When cull is coded because of rot, then a damage must also be coded.

When Collected: All live and standing dead tally trees ≥ 5.0 in DBH
Field width: 2 digits
Tolerance: +/- 10 %
MQO: At least 90% of the time
Values: 0 to 99

10.14 RECONSTRUCTED LENGTH

Record the RECONSTRUCTED LENGTH of the tree, to the nearest 1.0 ft from ground level to the top of the tree. For trees growing on a slope, measure on the uphill side of the tree. If the tree has a missing top (top is broken and completely detached from the tree), estimate what the total length would be if there were no missing or broken top. Forked trees should be treated the same as unforked trees.

When Collected: - All live tally trees
All standing dead tally trees ≥ 5.0 in DBH
Field width: 3 digits
Tolerance: +/- 10 % of true length
MQO: At least 90% of the time
Values: 001 to 400

10.15 ACTUAL LENGTH

For trees with missing tops (top on live trees is completely detached; top on dead trees is greather 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 ft 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.

When Collected: All live tally trees (with broken or missing tops)
All standing dead tally trees (with broken or missing tops) ≥ 5.0 in DBH
Field width: 3 digits
Tolerance: +/- 10 % of true length
MQO: At least 90% of the time
Values: 005 to 400

10.16 LENGTH METHOD

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

When Collected: All live tally trees and all standing dead tally trees ≥ 5.0 in DBH
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values:

B Total and actual lengths are field measured with a measurement instrument (e.g., clinometer, relascope, tape) *Code B = Both heights are measured*

A Total length is visually estimated, actual length is measured with an instrument *Code A = Actual height only is measured*

N Total and actual lengths are visually estimated. *Code N = neither is measured*

10.17 CROWN CLASS

Rate tree crowns in relation to the sunlight received and proximity to neighboring trees (Figure 28). Base the assessment on the position of the crown at the time of observation. Example: a formerly suppressed tree which is now dominant due to tree removal is classified as dominant.

When Collected: All live tally trees
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.

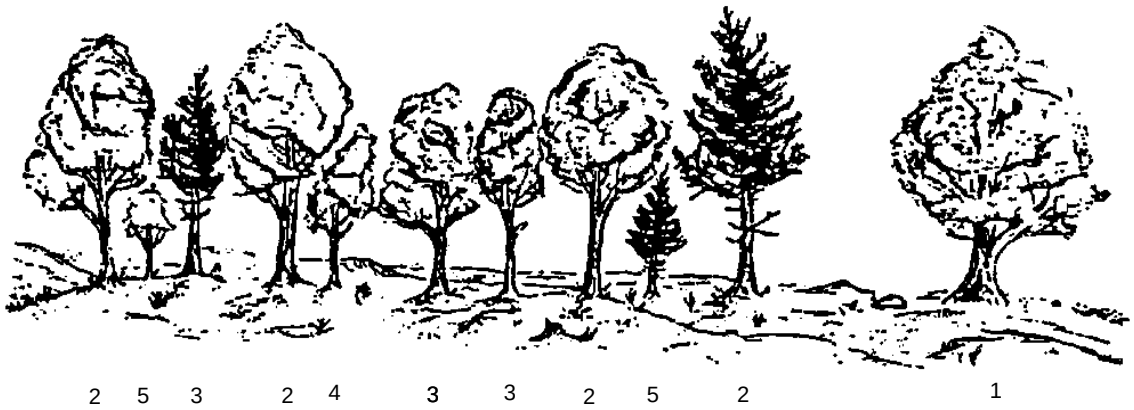
2 Dominant: Trees with crown extending above the general level of the crown canopy and receiving full light from above and partly from the sides. These trees are taller than the average trees in the stand and their crowns are well developed, but they could be somewhat crowded on the sides.

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, intermediates 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.



10.18 UNCOMPACTED LIVE CROWN RATIO

Record the UNCOMPACTED CROWN RATIOs to the nearest 1%. 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 29). 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 in and are within 5 ft of the base of the obvious live crown. The live crown base becomes that point on the main bole perpendicular to the lowest live foliage on the last branch that is included in the live crown. The live crown base is determined by the live foliage and not by the point where a branch intersects with the main bole.

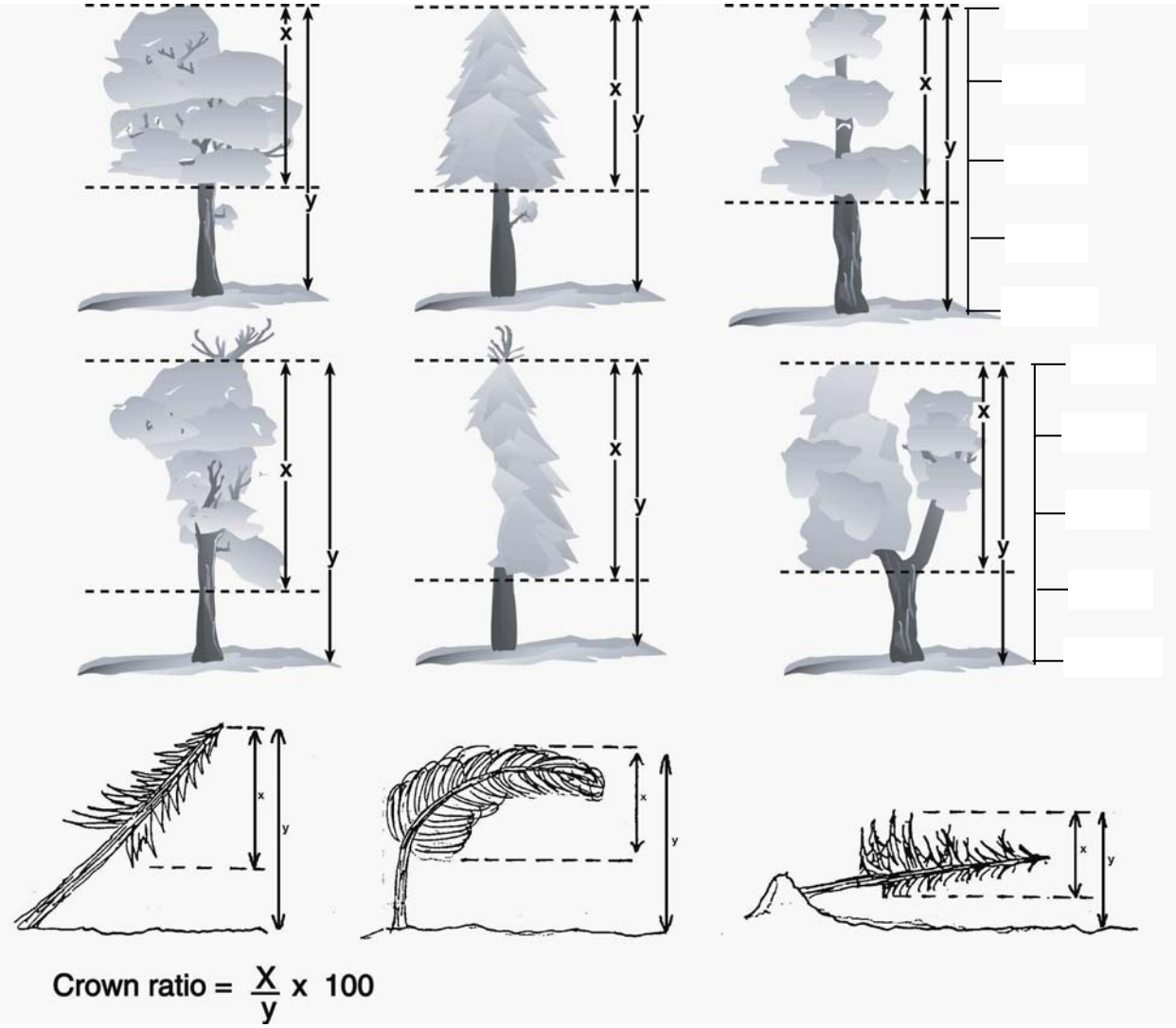
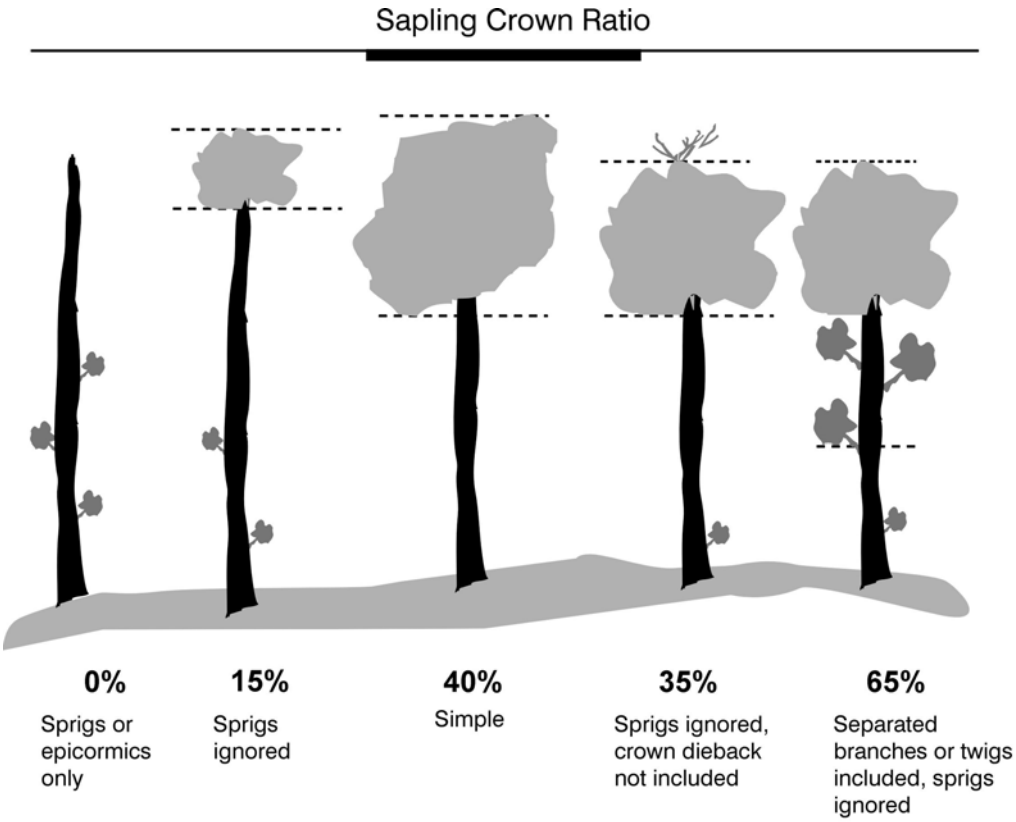


Figure 29. UNCOMPACTED LIVE CROWN RATIO examples.

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 in DBH and larger; the 1 in/5 ft rule does not apply in this case. Do not include sprigs or leaves on the main stem below the lowest live twig (Figure 30).



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

10.19 COMPACTED CROWN RATIO

COMPACTED CROWN RATIO is that portion of the tree supporting live foliage (or in cases 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 31).

Figure 31. Example of Crown Ratio on Open-crown tree (e.g., Terminalia catappa)

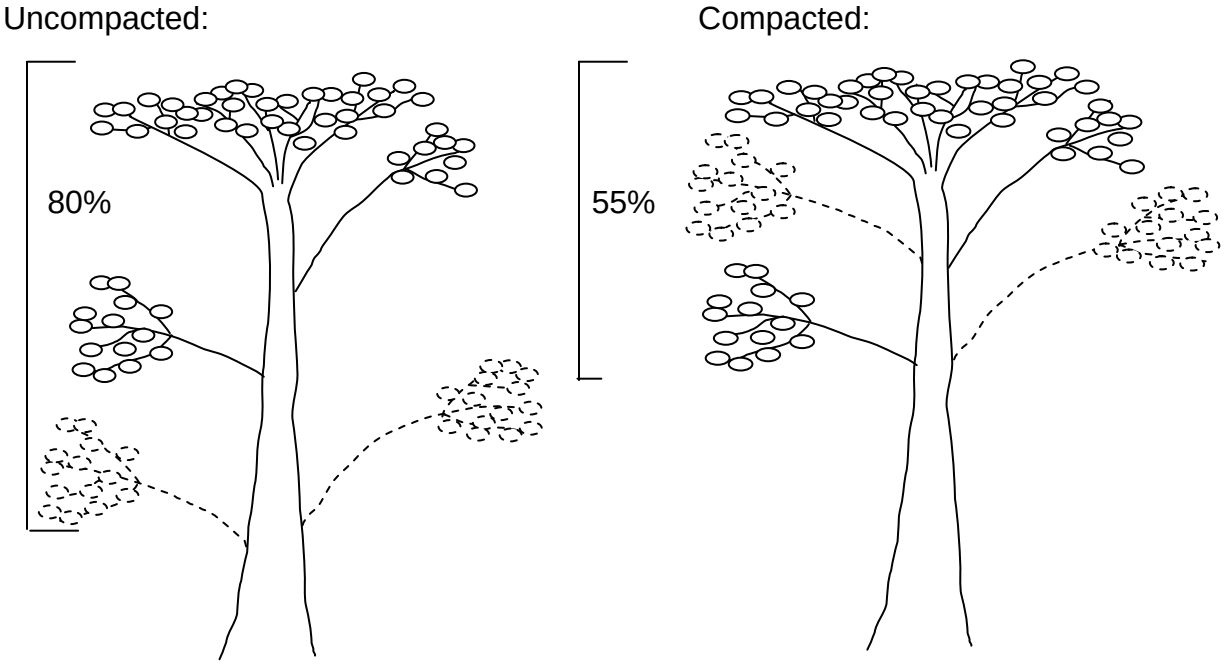
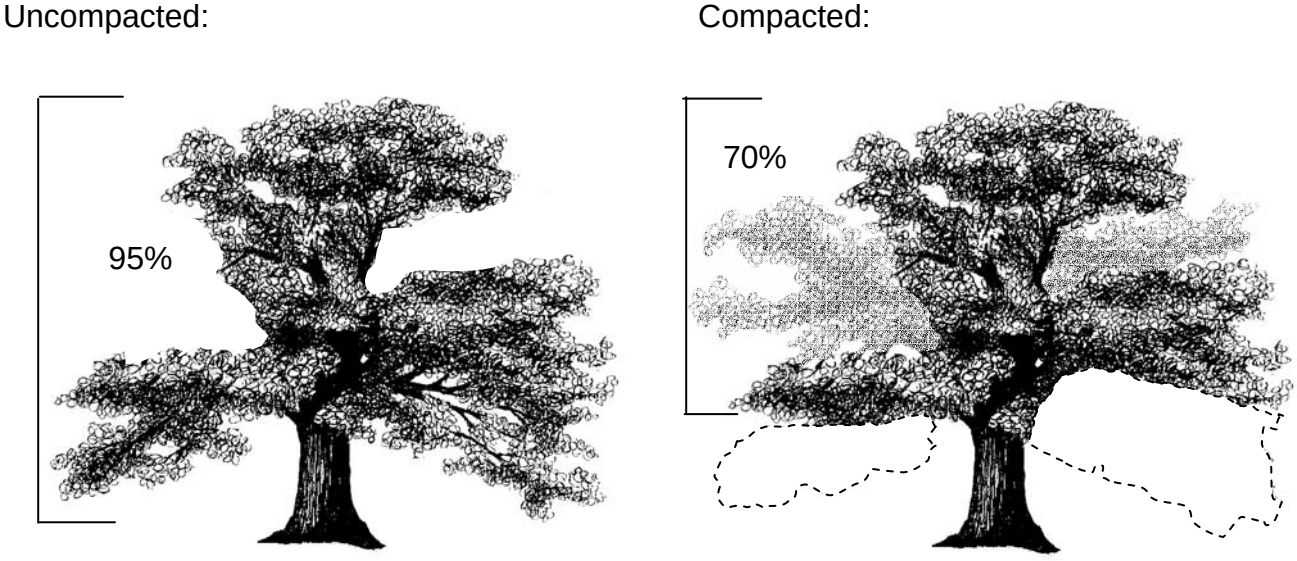


Figure 32. Example of Crown Ratio on Dense-crown tree (e.g., Mangifera indica)



Uncompacted Ratio = 70%
Compacted Ratio = 70%

Figure 33. Compacted and Uncompacted crown ratios will be the same for tree ferns and palm trees except when fronds or large parts of fronds are missing.

When Collected: All live tally trees $\geq$ 1.0 in DBH
Field width: 2 digits
Tolerance: +/- 10 %
MQO: At least 80% of the time
Values: 00 to 99

10.20 TREE DAMAGE

Record up to two different damages per tree. Record damage for all saplings and trees at least 1.0 in DBH. Damage is characterized according to four attributes: location of damage, type of damage, severity of damage, and damaging agent. Damages must meet severity thresholds (defined in section 10.20.3, DAMAGE SEVERITY) in order to be recorded.

The tree is observed from all sides starting at the roots. Damage signs and symptoms are prioritized and recorded based on location in the following order: roots, roots and lower bole, lower bole, lower and upper bole, upper bole, crownstem, and branches recorded as location code 0 (for no damage), or DAMAGE LOCATION 1-9.

Within any given location, the hierarchy of damage follows the numeric order of DAMAGE TYPE possible for that location. The numeric order denotes decreasing significance as the code number goes up, i.e., DAMAGE TYPE 01 is more significant than DAMAGE TYPE 25. A maximum of two damages are recorded for each tree. If a tree has more than two damages that meet the threshold levels, the first two that are observed starting at the roots are recorded.

When multiple damages occur in the same place, the most damaging is recorded. For example, if a canker, DAMAGE TYPE 02, meets the threshold and has a conk growing in it, record only the canker. Another example: if an open wound meets threshold and also has resinosis, record only the open wound.

Damage Summary

If a live tally tree with a DBH of 1 inch or greater has damage, you must code 4 items;

1. DAMAGE LOCATION page 139
2. DAMAGE TYPE page 141
3. DAMAGE SEVERITY page 143
4. DAMAGE AGENT page 156

A. Does the tree have DAMAGE in these locations?

1 = Roots (exposed) and Stump (12 in. in height from ground level)
2 = Roots, stump, and lower bole

Then valid DAMAGE TYPE codes are**:**

01. Canker, gall (>20% circumference)
    Valid SEVERITY codes = 2 through 9
02. Conks, advanced decay, ROT
    Valid SEVERITY codes = 0
03. Open wounds (>20% circumference)
    Valid SEVERITY codes = 2 through 9
04. Resin flowing from bole (>20% circumference)
    Valid SEVERITY codes = 2 through 9
05. Cracks and seams
    Valid SEVERITY codes = 0
11. Broken bole or broken roots within 3 feet of the stump
    Valid SEVERITY codes = 0
12. Brooms on roots or bole
    Valid SEVERITY codes = 0
13. Broken or dead roots beyond 3 feet of the bole (>20% of roots broken or dead)
    Valid SEVERITY codes = 2 through 9
31. Other
    Valid SEVERITY codes = 0

B. Does the tree have DAMAGE in these locations?

3 = Lower Bole (lower half of the trunk between stump and base of live crown
4 = Lower and Upper Bole
5 = Upper Bole (upper half of trunk between stump and base of live crown

Then valid DAMAGE TYPE codes are:

1. Canker, gall (>20% circumference)
   Valid SEVERITY codes = 2 through 9
2. Conks, advanced decay, ROT
   Valid SEVERITY codes = 0
3. Open wounds (>20% circumference)
   Valid SEVERITY codes = 2 through 9
4. Resin flowing from bole (>20% circumference)
   Valid SEVERITY codes = 2 through 9
5. Cracks and seams
   Valid SEVERITY codes = 0
11. Broken bole or broken roots within 3 feet of the stump
    Valid SEVERITY codes = 0
12. Brooms on roots or bole
    Valid SEVERITY codes = 0
31. Other
    Valid SEVERITY codes = 0

C. Does the tree have DAMAGE in these locations?

6 = Crownstem (main stem within the live crown area, above the base of the live crown

Then valid DAMAGE TYPE codes are:

1. Canker, gall (>20% circumference)
   Valid SEVERITY codes = 2 through 9
2. Conks, advanced decay, ROT
   Valid SEVERITY codes = 0
3. Open wounds (>20% circumference)
   Valid SEVERITY codes = 2 through 9
4. Resin flowing from bole (>20% circumference)
   Valid SEVERITY codes = 2 through 9
5. Cracks and seams
   Valid SEVERITY codes = 0

21. Loss of apical dominance, dead terminal (broken or dead top)
    Valid SEVERITY codes = 0 through 9
31. Other
    Valid SEVERITY codes = 0

D. Does the tree have DAMAGE in these locations?

7 = Branches > 1 inch where the branch attaches to the main bole or crown stem

Then valid DAMAGE TYPE codes are:

1. Canker, gall (>20% circumference)
   Valid SEVERITY codes = 2 through 9
2. Conks, advanced decay, ROT
   Valid SEVERITY codes = 0
3. Open wounds (>20% circumference)
   Valid SEVERITY codes = 2 through 9
4. Resin flowing from bole (>20% circumference)
   Valid SEVERITY codes = 2 through 9
5. Cracks and seams
   Valid SEVERITY codes = 0

20. Vines in the crown (>20% of crown affected)
    Valid SEVERITY codes = 2 through 9
22. Broken or dead (>20% of branches affected in the live crown area)
    Valid SEVERITY codes = 2 through 9
23. Excessive branching or brooms (>20% of branches affected)
    Valid SEVERITY codes = 2 through 9
31. Other
    Valid SEVERITY codes = 0

E. Does the tree have DAMAGE in these locations?

8 = Buds and Shoots (the most recent year's growth)

Then valid DAMAGE TYPE codes are:

24. Damaged buds, shoots, or foliage (>30% of buds and shoots damaged > 50%)
    Valid SEVERITY codes = 3 through 9
31. Other
    Valid SEVERITY codes = 0

F. Does the tree have DAMAGE in these locations?

9 = Foliage

Then valid DAMAGE TYPE codes are:

24. Damaged buds, shoots, or foliage (>30% of buds and shoots damaged > 50%)
    Valid SEVERITY codes = 3 through 9
25. Discoloration of foliage (>30% of foliage discolored > 50%)
    Valid SEVERITY codes = 3 through 9
31. Other
    Valid SEVERITY codes = 0

Valid Damage agent codes for all damages:

10 Insects
20 Disease
30 Fire
40 Animal
50 Weather
60 Vegetation (suppression, competition, vines/mile-a-minute, etc)
70 Unknown/not sure/other (include notes
80 Human-caused (cultural, logging, accidental, etc)
90 Physical (hit by falling tree, rockslides, etc)

10.20.1 DAMAGE LOCATION 1

Record the location on the tree where DAMAGE TYPE 1 is found (Figure 34). If the same damage continues into two or more locations, record the appropriate code listed below, or if the combination of locations does not exist (damage extends from crownstem to roots), record the lowest location that best describes the damage (see Figure 35). Multiple damages may occur in the same location, but record the higher priority damage (lower code number) first. If the damages are coincident (a conk within a canker), record only the higher priority damage.

The “base of the live crown” is defined as the horizontal line which would touch the lowest part of the foliage, excluding branches towards the base of the tree which are less than 1.0 inch or more than 5 ft from the rest of the crown. See Section 10.16 on page **129**(UNCOMPACTED LIVE CROWN RATIO) for more details.

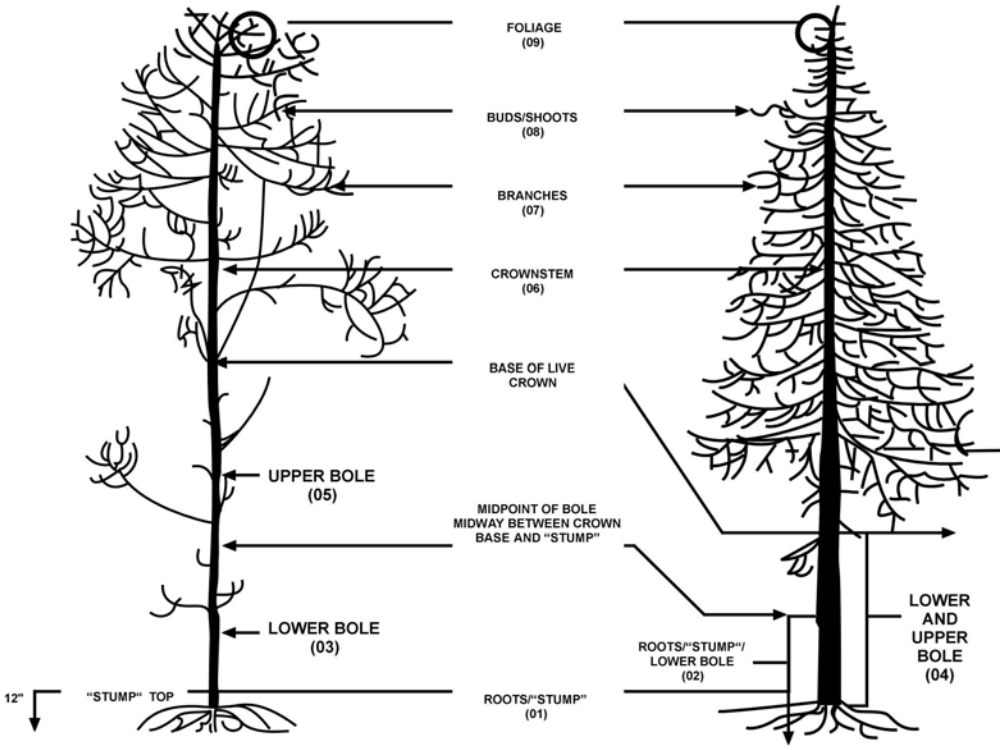


Figure 34. Location codes for damage

When Collected: All live tally trees ≥ 1.0 in DBH
Field width: 1 digit
Tolerance: +/- 1 location class
MQO: At least 80% of the time
Values:

0 No damage
1 Roots (exposed) and stump (12 inches in height from ground level)
2 Roots, stump, and lower bole
3 Lower bole (lower half of the trunk between the stump and base of the live crown)
4 Lower and upper bole
5 Upper bole (upper half of the trunk between stump and base of the live crown)
6 Crownstem (main stem within the live crown area, above the base of the live crown)
7 Branches (>1 in at the point of attachment to the main crown stem within the live crown area)
8 Buds and shoots (the most recent year's growth)
9 Foliage

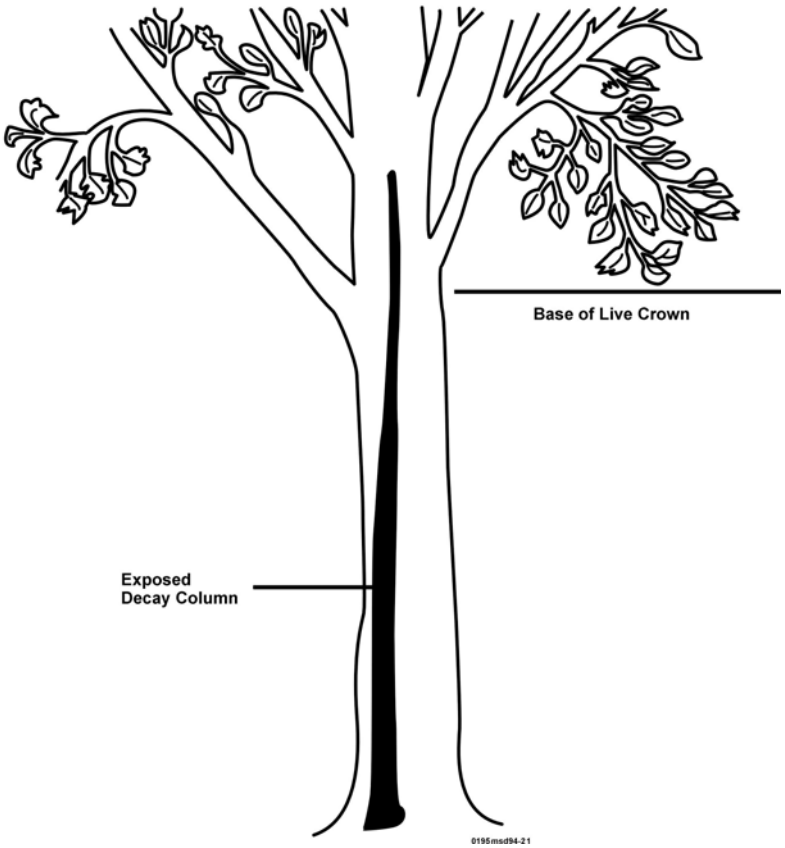


Figure 35. The damage runs from stump to crownstem. Code here should be 02 (roots and "stump" and lower bole) which represents the lowest locations of this multi-location damage.

10.20.2 DAMAGE TYPE 1

Record the first damage type observed that meets the damage threshold definition in the lowest location. Damage categories are recorded based on the numeric order that denotes decreasing significance from damage 01 - 31.

When Collected: All tally trees where DAMAGE LOCATION 1 > 0
Field width: 2 digits
Tolerance: No errors
MQO: At least 80% of the time
Values:

1 Canker, gall: Cankers may be caused by various agents but are most often caused by fungi. The bark and cambium are killed, and this is followed by death of the underlying wood, although the causal agent may or may not penetrate the wood. This results in areas of dead tissue that become deeper and wider, or galling (including galls caused

by rusts), on roots, bole, or branches. Due to the difficulty in distinguishing some abnormal swellings (e.g., burls) from classic galls and cankers, all are recorded as damage 01. A canker may be:

Annual (enlarges only once and does so within an interval briefer than the growth cycle of the tree, usually less than one year),

Diffuse (enlarges without characteristic shape or noticeable callus formation at margins), or

Perennial (enlarges during more than one year - often has a target appearance).

2 Conks, fruiting bodies, and signs of advanced decay: Fruiting bodies on the main bole, crownstem, and at the point of the branch attachment are signs of decay. "Punky wood" is a sign of decay and is evidenced by soft, often moist, and degraded tissue.

Cavities into the main bole that are oriented in such a way that they act as catchment basins for water are signs of decay. Bird cavities are signs of decay.

Rotten branches or branches with conks **are not indicators of decay unless** the threshold is met (>20% of branches are affected).

Rotting stumps associated with coppice regeneration (e.g., northern pin oak, maple) are excluded from coding.

3 Open wounds: An opening or series of openings where bark has been removed or the inner wood has been exposed and no signs of advanced decay are present. Improper pruning wounds that cut into the wood of the main stem are coded as open wounds, if they meet the threshold; those which leave the main stemwood intact are excluded.

4 Resinosis or gummosis: The origin of areas of resin or gum (sap) exudation on branches and trunks.

5 Cracks and seams: Cracks in trees are separations along the radial plane greater than or equal to 5 ft. When they break out to the surface they often are called frost cracks. These cracks are not caused by frost or freezing temperature, though frost can be a major factor in their continued development. Cracks are most often caused by basal wounds or sprout stubs, and expand when temperatures drop rapidly. Seams develop as the tree attempts to seal the crack, although trees have no mechanism to compartmentalize this injury.

Lightning strikes are recorded as cracks when they do not meet the threshold for open wounds.

11 Broken bole or roots (less than 3 ft from bole): Broken roots within 3 ft from bole either from excavation or rootsprung for any reason. For example, those which have been excavated in a road cut or by animals.

Stem broken in the bole area (below the base of the live crown) and tree is still alive.

12 Brooms on roots or bole: Clustering of foliage about a common point on the trunk. Examples include ash yellows witches' brooms on white and green ash and eastern and western conifers infected with dwarf mistletoes.

13 Broken or dead roots (beyond 3 ft): Roots beyond 3 ft from bole that are broken or dead.

20 Vines in the crown: Kudzu, grapevine, ivy, dodder, etc. smothers tree crowns. Vines are rated as a percentage of tree crown affected.

21 Loss of apical dominance, dead terminal: Mortality of the terminal of the crownstem caused by frost, insect, pathogen, or other causes.

22 Broken or dead: Branches that are broken or dead. Branches with no twigs are ignored and not coded as dead. Dead or broken branches attached to the bole or crownstem outside the live crown area are not coded. 20% of the main, first order portion of a branch must be broken for a branch to be coded as such.

23 Excessive branching or brooms within the live crown area: Brooms are a dense clustering of twigs or branches arising from a common point that occur within the live crown area. Includes abnormal clustering of vegetative structures and organs. This includes witches' brooms caused by ash yellows on green and white ash and those caused by dwarf mistletoes.

24 Damaged buds, foliage or shoots: Insect feeding, shredded or distorted foliage, buds or shoots >50% affected, on at least 30% of foliage, buds or shoots. Also includes herbicide or frost-damaged foliage, buds or shoots.

25 Discoloration of foliage: At least 30% of the foliage is more than 50% affected. Affected foliage must be more of some color other than green. If the observer is unsure if the color is green, it is considered green and not discolored.

31 Other: Use when no other explanation is appropriate. Specify in the tree notes section. Code 31 is used to maintain consistency with the Phase 3 crown damage protocols.

10.20.3 DAMAGE SEVERITY 1

Record a code to indicate the amount of affected area (above threshold) in DAMAGE LOCATION 1 recorded for TREE DAMAGE 1. Severity codes vary depending on the type of damage recorded.

Field width: 2 digits
Tolerance: No errors
MQO: At least 80% of the time
Values: The codes and procedures for SEVERITY 1 values are defined for each DAMAGE TYPE 1.

DAMAGE TYPE Code 01 -- Canker, gall

Measure the affected area from the margins (outer edges) of the canker or gall within any 3-ft vertical section in which at least 20% of circumference is affected at the point of occurrence. For location 7, and location 1, 20% of branches and roots beyond 3 ft, respectively, must be affected, then record in 10% classes. See Figure 36.

Severity classes for code 01 (percent of circumference affected):

Classes	Code
20-29	2
30-39	3
40-49	4
50-59	5
60-69	6
70-79	7
80-89	8
90-99	9

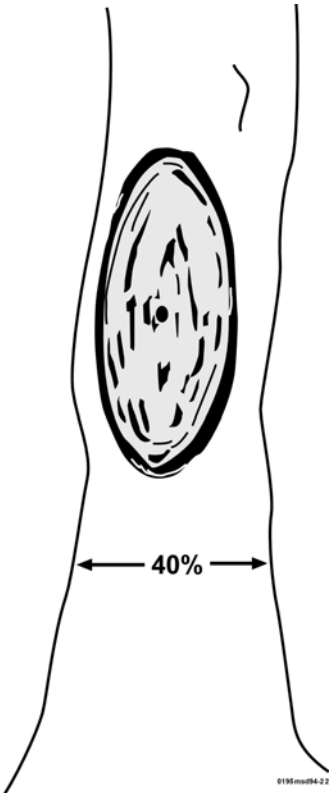


Figure 36. A canker which exceeds threshold. Since 40% of circumference is visible from any side, and since over half the visible side is taken up by the canker, it obviously exceeds the 20% minimum circumference threshold.

DAMAGE TYPE Code 02 -- Conks, fruiting bodies, and signs of advanced decay

Severity classes for code 02: **None**. Enter code 0 regardless of severity, except for roots > 3 ft from the bole, or number of branches affected - 20%

DAMAGE TYPE Code 03 -- Open wounds

The damaged area is measured at the widest point between the margins of the exposed wood within any 3-ft vertical section in which at least 20% of the circumference is affected at the point of occurrence. For location 7, and location 1, 20% of branches and roots beyond 3 ft, respectively, must be affected, then record in 10% classes. See Figure 37.

Severity Classes for code 03 (percent of circumference affected):

Classes	Code
20-29	2
30-39	3
40-49	4
50-59	5
60-69	6
70-79	7
80-89	8
90-99	9

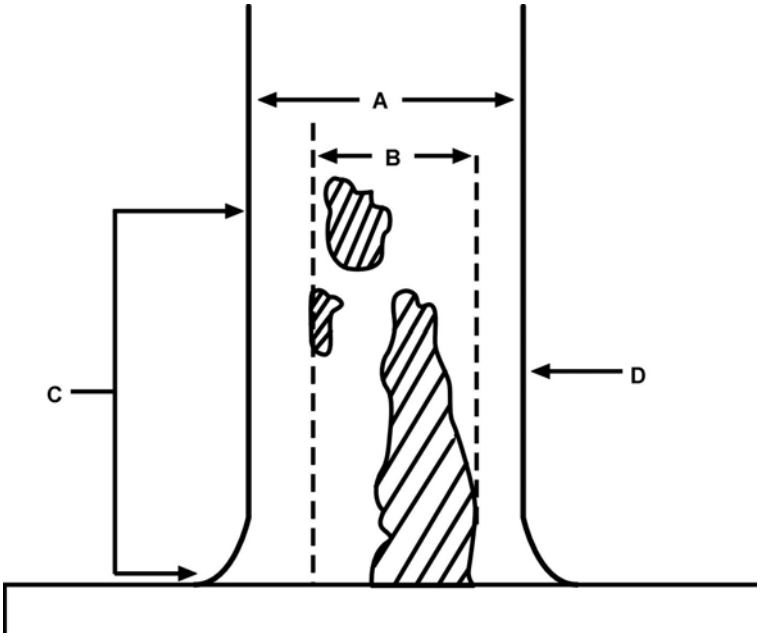


Figure 37. Multiple damage in "stump" and lower bole. A=approximately 40% of tree circumference; B=portion of tree circumference affected by damage; C=vertical distance within one meter; D=midpoint of occurence at which circumference is measured.

DAMAGE TYPE Code 04 -- Resinosis or gummosis

Resinosis or gummosis is measured at the widest point of the origin of the flow width in which at least 20% of the circumference is affected at the point of occurrence. For location 7, and location 1, 20% of branches and roots beyond 3 ft, respectively, must be affected, then record in 10% classes.

Severity classes for code 04 (percent of circumference affected):

Classes	Code
20-29	2
30-39	3
40-49	4
50-59	5
60-69	6
70-79	7
80-89	8
90-99	9

DAMAGE TYPE Code 05 -- Cracks and seams greater than or equal to 5 ft

Severity class for code 05 -- Record "0" for the lowest location in which the crack occurs. For location 7, and location 1, 20% of branches and roots beyond 3 ft, respectively, must be affected, then record in 10% classes.

DAMAGE TYPE Code 11 -- Broken bole or roots less than 3 ft from bole

Severity classes for code 11: None. Enter code 0 regardless of severity.

DAMAGE TYPE Code 12 -- Brooms on roots or bole

Severity classes for code 12: None. Enter code 0 regardless of severity.

DAMAGE TYPE Code 13 -- Broken or dead roots

At least 20% of roots beyond 3 ft from bole that are broken or dead.

Severity classes for code 13 (percent of roots affected):

Classes	Code
20-29	2
30-39	3
40-49	4
50-59	5
60-69	6
70-79	7
80-89	8
90-99	9

DAMAGE TYPE Code 20 -- Vines in crown

Severity classes for code 20 (percent of live crown affected):

Classes	Code
20-29	2
30-39	3
40-49	4
50-59	5
60-69	6
70-79	7
80-89	8
90-99	9

DAMAGE TYPE Code 21 -- Loss of apical dominance, dead terminal

Any occurrence (> 1%) is recorded in 10% classes as a percent of the crownstem affected. Use trees of the same species and general DBH class in the area or look for the detached portion of the crownstem on the ground to aid in estimating percent affected. If a lateral branch has assumed the leader and is above where the previous terminal was, then no damage is recorded.

Severity classes for code 21:

Classes	Code
01-09	0
10-19	1
20-29	2
30-39	3

40-49	4
50-59	5
60-69	6
70-79	7
80-89	8
90-99	9

DAMAGE TYPE Code 22 -- Broken or dead branches (> 1in above the swelling at the point of attachment to the main or crown stem within the live crown area)

At least 20% of branches are broken or dead.

Severity classes for code 22 (percent of branches affected):

Classes	Code
20-29	2
30-39	3
40-49	4
50-59	5
60-69	6
70-79	7
80-89	8
90-99	9

DAMAGE TYPE Code 23 -- Excessive branching or brooms

At least 20% of crownstem or branches affected with excessive branching or brooms.

Severity classes for code 23 (percent of area affected):

Classes	Code
20-29	2
30-39	3
40-49	4
50-59	5
60-69	6
70-79	7
80-89	8
90-99	9

DAMAGE TYPE Code 24 - Damaged buds, shoots or foliage

At least 30% of the buds, shoots or foliage (i.e., chewed or distorted) are more than 50% affected.

Severity classes for code 24:

Classes	Code
30-39	3
40-49	4
50-59	5
60-69	6
70-79	7
80-89	8

90-99	9

DAMAGE TYPE Code 25 - Discoloration of Foliage

At least 30% of the foliage is more than 50% affected.

Severity classes for code 25 (percent affected):

Classes	Code
30-39	3
40-49	4
50-59	5
60-69	6
70-79	7
80-89	8
90-99	9

DAMAGE TYPE Code 31 -- Other

Severity classes for code 31:

None. Enter code 0 regardless of severity. Describe condition in tree notes. Examples are shown in Figures 38-44.

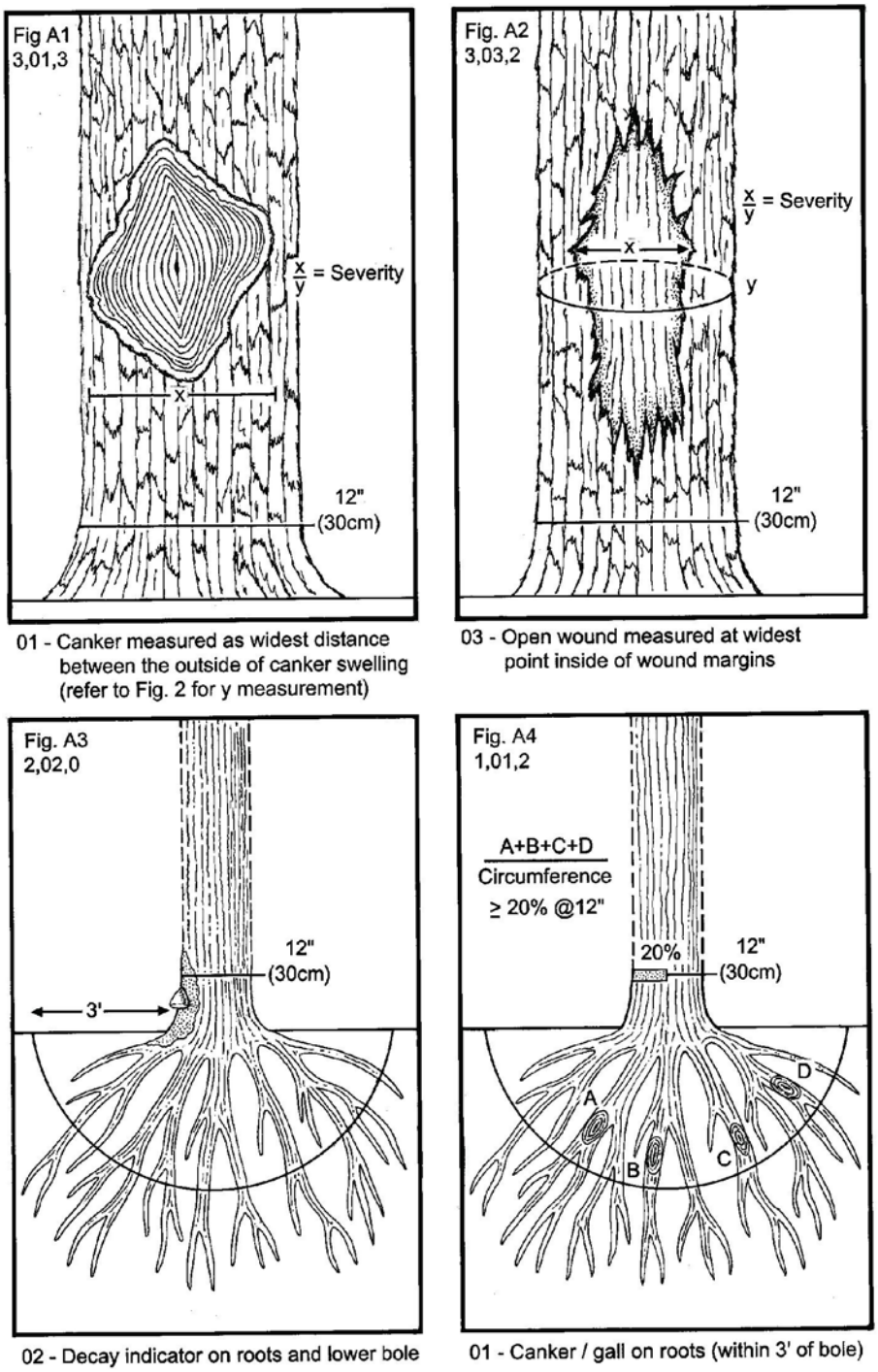


Figure 38. Examples of damage coding.

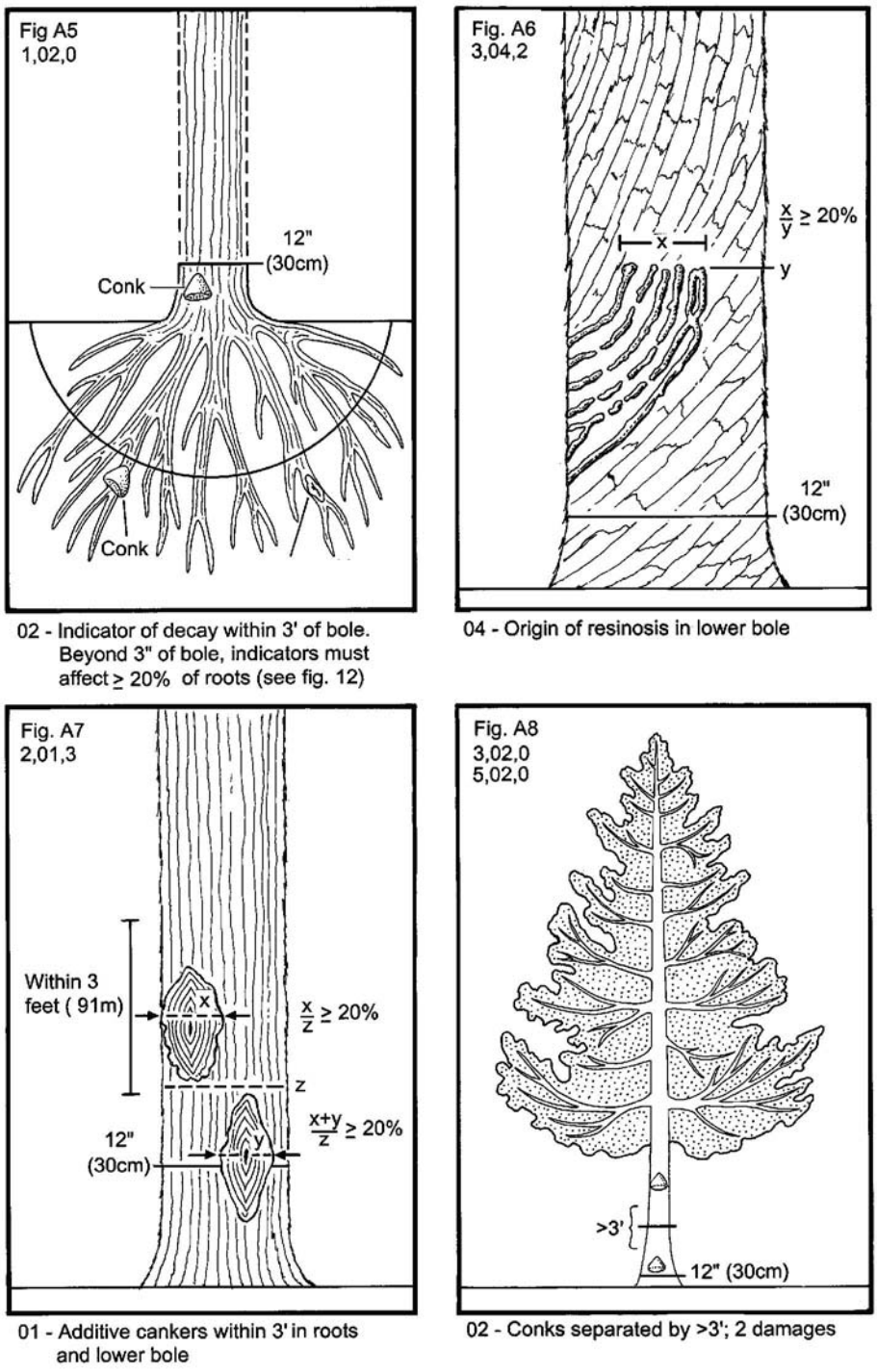
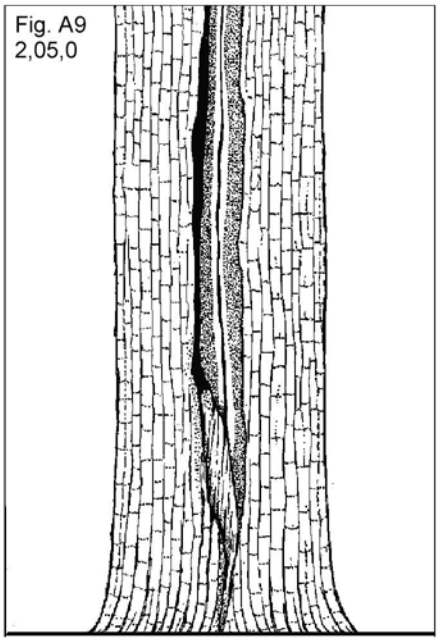
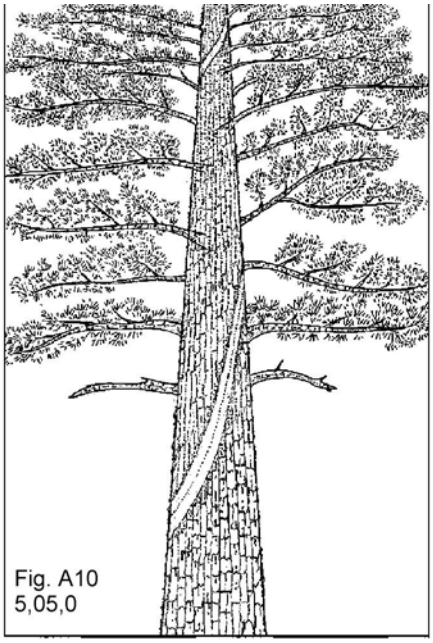


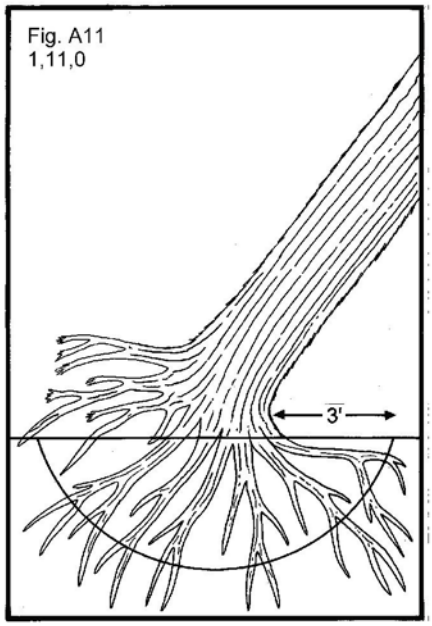
Figure 39. Examples of damage coding.



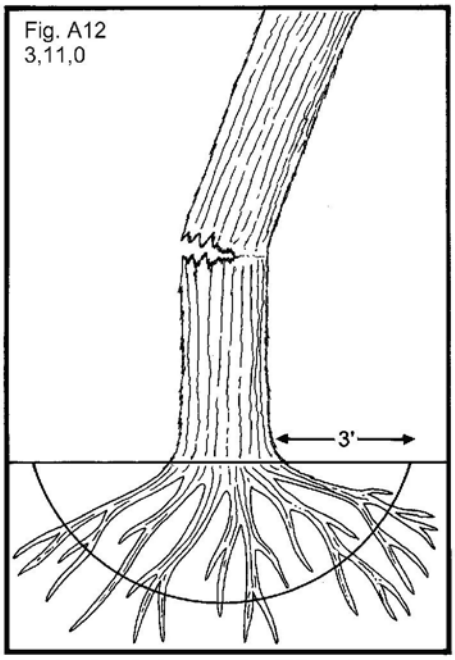
05- Cracks and seams



05 - Lightning strike

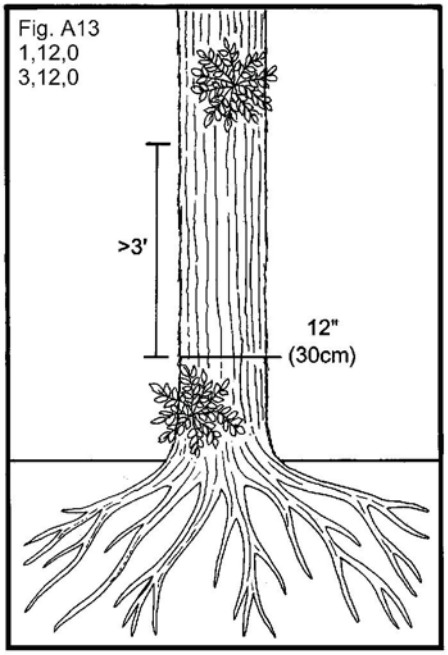


11 - Broken bole or roots <3' from bole, broken roots must be visible

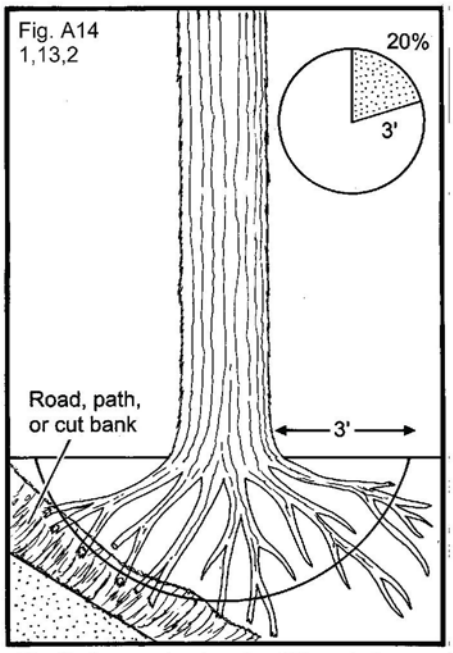


11 - Broken bole or roots <3' from bole

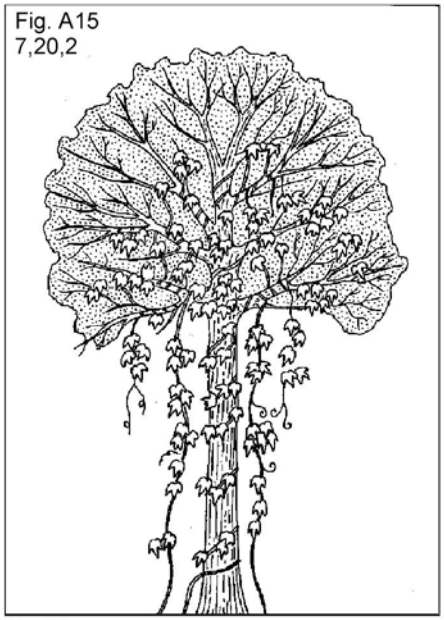
Figure 40. Examples of damage coding.



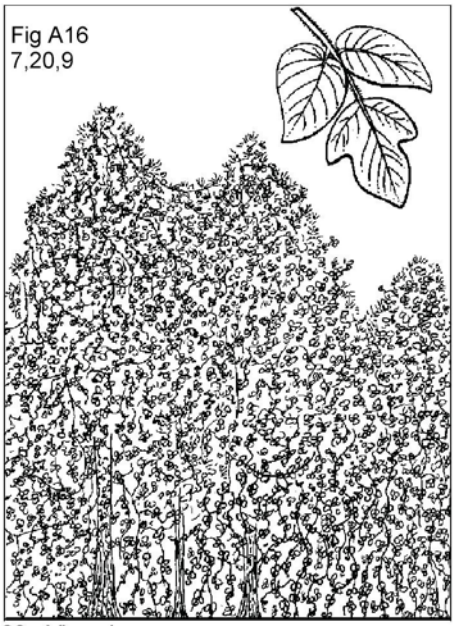
12 - Brooms on roots or bole



13 - Broken or dead roots >3' from bole

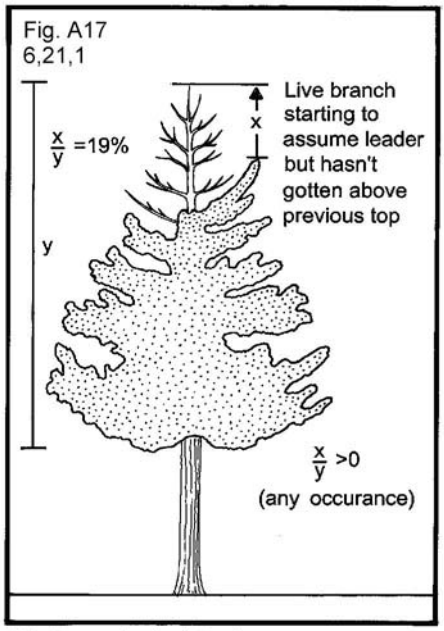


20 - Vines in crown

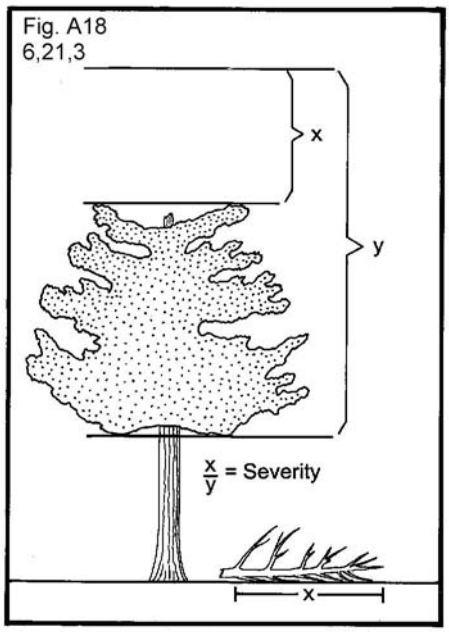


20 - Vines in crown

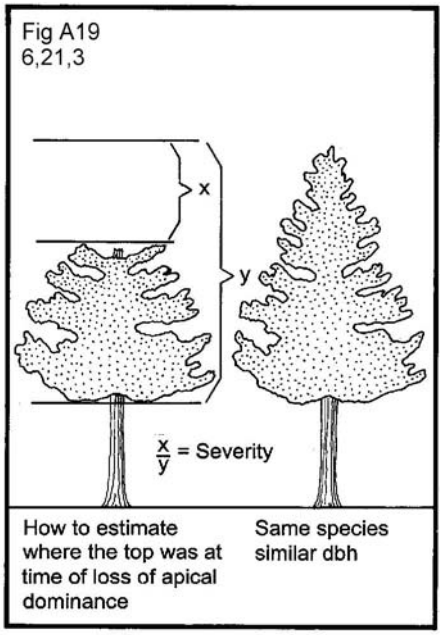
Figure 41. Examples of damage coding.



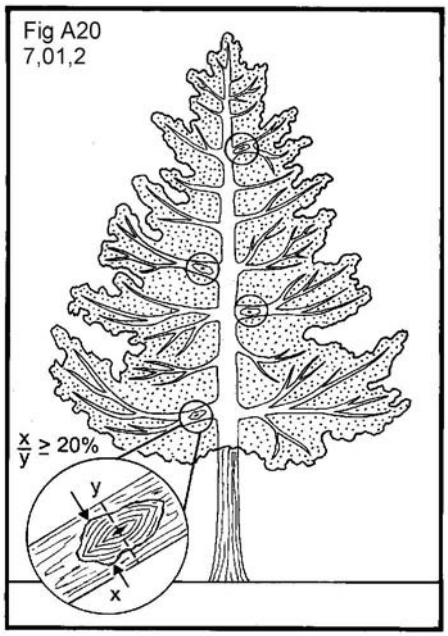
21 - Loss of apical dominance



21 - Loss of apical dominance, look for old top to estimate the top of x and y

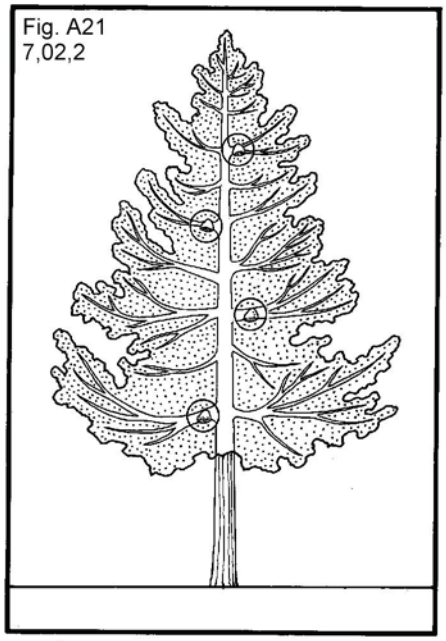


21 - Loss of apical dominance, look for same species of similar dbh

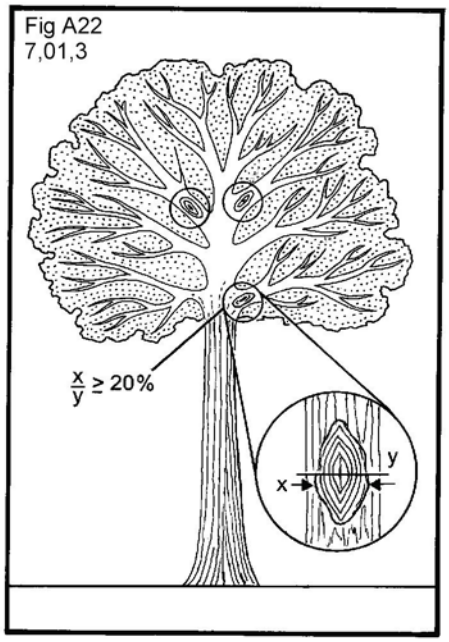


01 - Cankers above the threshold on ≥ 20% of branches

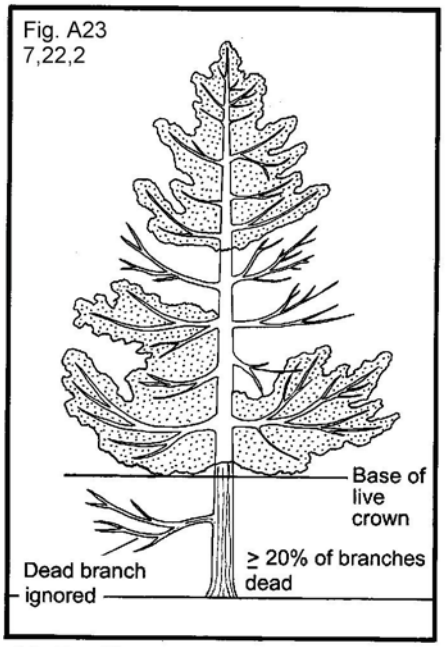
Figure 42. Examples of damage coding.



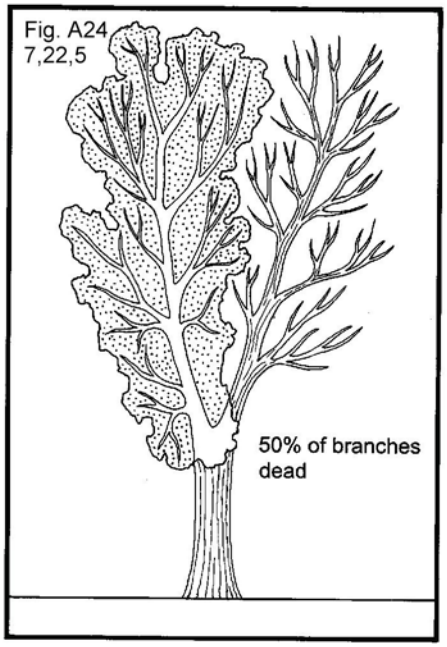
02 - Conks on ≥ 20% of branches



01 - Cankers above threshold on ≥ 20% of branches

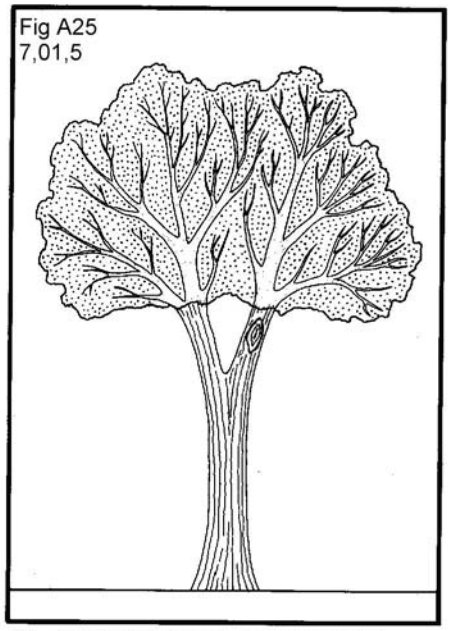


22 - Dead branches within the live crown area. If branches cannot easily be counted, estimate % area of live crown affected

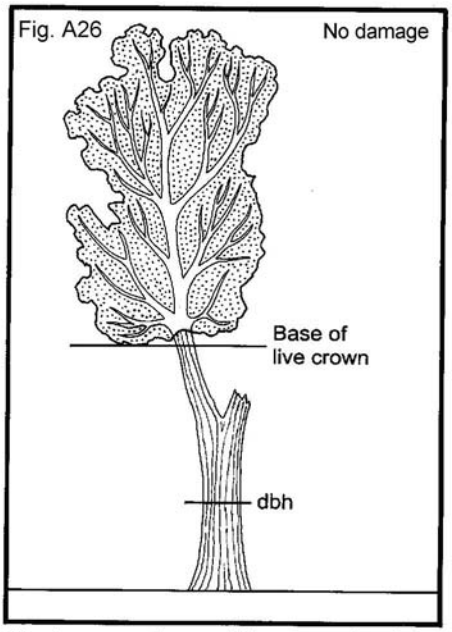


22 - Dead branches; only 2 branches present within live crown area, fines present and ≥20% of branch dead

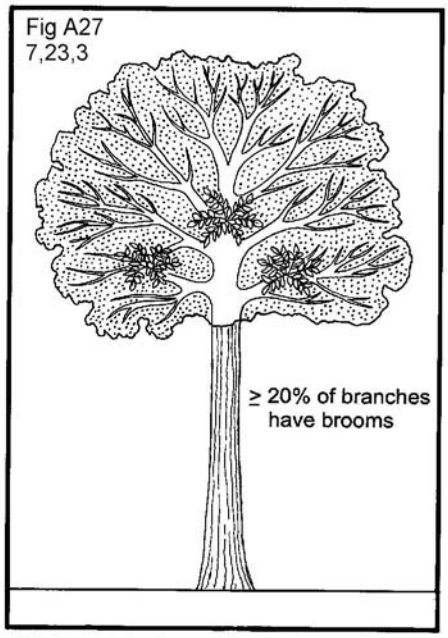
Figure 43. Examples of damage coding.



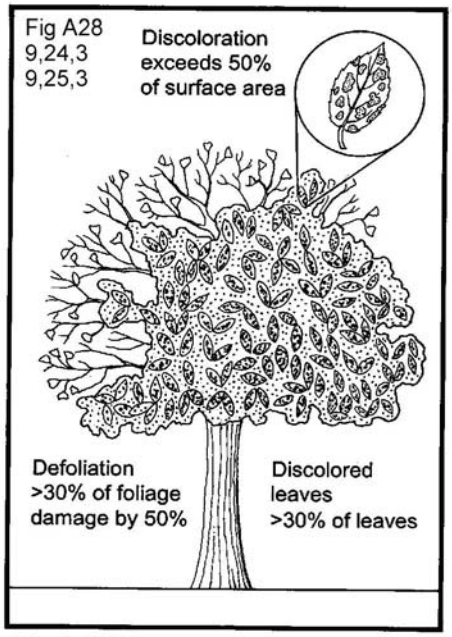
01 - Canker; no crown stem and only 2 branches present



No damage - base of live crown is above old fork, stub is a snag branch



23 - Excessive branching or brooms in crown



24 - Defoliation, 25 - Discoloration

Figure 44. Examples of damage coding.

Procedures to Record Multiple Occurrences of the Same Damage

Damage codes 01 (canker), 03 (open wounds), and 04 (resinosis/gummosis) must meet a threshold of 20 percent of the circumference at the point of occurrence, within any 3-ft section. Multiple cankers or open wounds which are directly above one another pose no more threat to long term tree survival than would a single damage incidence of the same width. However, should multiple damages be located horizontally within any 3-ft section, the translocation of water and nutrients would be significantly affected. The widths of each individual damage are added and compared as a percent, to the total circumference at the midpoint of the 3-ft section (Figure 37).

Procedures to Measure Circumference Affected

A practical approach is to observe every face of the "stump", bole, or crownstem. About 40% of the circumference of a face can be observed at any one time. The damage is measured horizontally between the margins. If the cumulative area affected within a 3-ft section exceeds 1/2 of any face, then the 20% minimum threshold has been met. The percent of the circumference affected by damage is then estimated in 10% classes. If in doubt, measure the damage and circumference at the widest point of occurrence on the bole with a linear tape, and determine the percent affected.

10.20.4 DAMAGING AGENT 1

When known, record the specific name of the damaging agent (genus and species, or common name of fungal pathogens, insects, parasites…) in tree notes. If the damaging agent is unknown record 99.

When Collected: All live tally trees >= 5.0 D.B.H.
Field width: 2 digits
Values:

10	Insect
20	Disease
30	Fire
40	Animal
50	Weather
60	Vegetation (suppression, competition, vines/kudzu)
70	Unknown/not sure/other (include notes)
80	Human-caused (cultural, logging, accidental, etc.)
90	Physical (roots are undermined by erosion, hit by falling tree)

10.20.5 DAMAGE LOCATION 2

Record the location on the tree where TREE DAMAGE 2 is found. Follow the same procedures as for DAMAGE LOCATION 1.

10.20.6 DAMAGE TYPE 2

RECORD the second damage type observed that meets the damage threshold definition in the lowest location. Describe the damage agent in tree notes. Follow the same procedures as for DAMAGE TYPE 1.

10.20.7 DAMAGE SEVERITY 2

Record the amount of affected area (above threshold) in DAMAGE LOCATION 2 recorded for DAMAGE TYPE 2. Follow the same procedures as for DAMAGE SEVERITY 1.

10.20.8 DAMAGING AGENT 2

When known, record the specific name of the damaging agent (genus and species, or common name of fungal pathogens, insects, parasites…). If the damaging agent is unknown record 999.

10.21 DECAY CLASS

Record for each standing dead tally tree, 5.0 inches in diameter and larger, the code indicating the trees stage of decay.

When Collected: All standing dead tally trees $\geq$ 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:

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

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

10.22 EPIPHYTE LOADING

Record a code indicating the extent of epiphyte loading for all live trees ≥ 1.0 in. d.b.h. "Epiphyte" is defined as a plant that uses a tree for support, but does not draw nourishment from it. For our purposes, vines and lianas are considered epipiphytes.
Use the Hawksworth six-class rating system: divide the tree into thirds, and rate each third using the following scale.

Code	Epiphytes	Description
0	No visible epiphytes	None
1	Light epiphytes	< 50 percent of the branches or bole is loaded with epiphytes
2	Heavy epiphytes	> 50 percent of the branches or bole loaded with epiphytes

Sum the three individual ratings to obtain a total epiphyte class (0 to 6) for the tree.

Example: A tree has no loading in top third of crown, many epiphytes in the middle third, and has a few epiphytes in the lower third.

The total score is: 0 + 2 +1 = 3; the code is: "3"

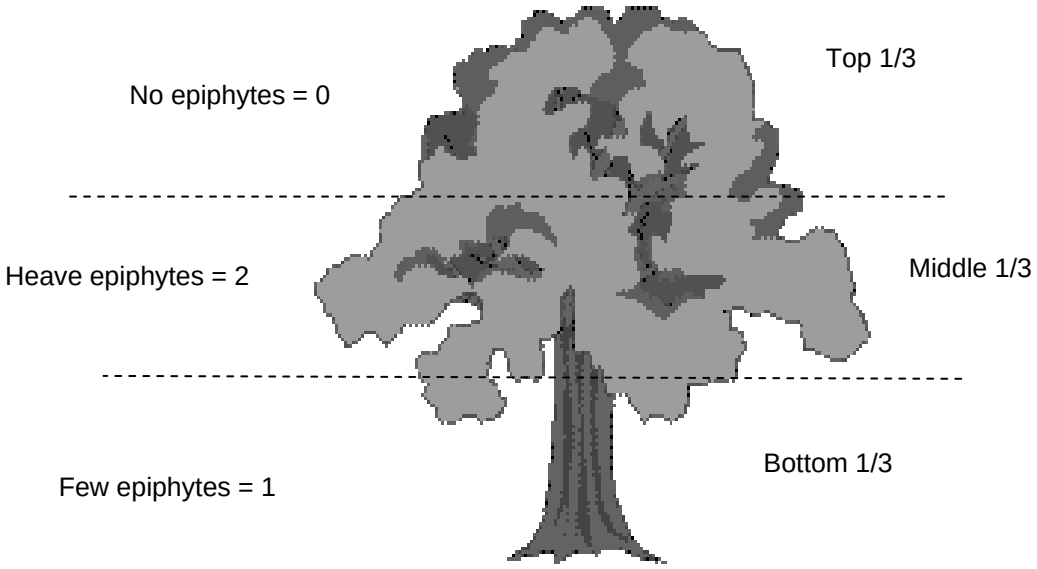


Figure 45. Example of epiphyte loading for tree crowns

When Collected: PACIFIC ISLANDS: All live trees ≥ 1.0 in DBH.
Field width: 1 digit
Tolerance: +/- 1 class
MQO: At least 90% of the time
Values: 0 to 6.

10.23 CLUMP CODE

A clump is defined as 3 or more live stems originating from a root system. Do not tally seedling-sized suckers that have sprouted from the base of a live, unsuppressed stem that is >= 5.0 in DBH.

Clump code is a 1 digit code indicating if a tree, sapling, or seedling is part of a clump. The clump of trees is assigned a clump number, and the number is recorded for each tree tallied that is part of the clump. If a tree is not part of a clump, “0” is recorded for that tree. Clumps with tallied trees are numbered in consecutive order on a subplot starting with “1”.

Example: Maple trees in three different maple clumps are tallied on a subplot. Trees tallied that are in the first clump are coded “1” for clump code. Trees tallied in the second clump are all coded “2”, and each tree tallied in the third clump is coded “3” for the clump code

When collected: All live tally trees
Field width: 1 digit

10.24 PRIORITY DAMAGE

Record a code to describe a damage that does not meet the national minimum thresholds for recording damage, but is of special interest in this region. For example, code any evidence of rhinoceros beetle damage on coconut trees using the instructions in Appendix 5
Field width: 1 digit
Values: See Appendix 5 On page 238

10.24.1 PRIORITY DAMAGE SEVERITY

Record the amount of area affected by the PRIORITY DAMAGE. These damages have no minimum threshold.
Field width: 2 digits
Values: See Appendix 5 On page 238

10.25 TREE NOTES

Record notes pertaining to an individual tree as called for to explain or describe another variable. Record “ref” here for trees that have been tagged as reference trees.
When collected: All live and dead tally trees $\geq$ 1.0 in DBH
Field width: Alphanumeric character field
Tolerance: N/A
MQO: N/A
Values: English language words, phrases and numbers

11. TREE SPECIES LISTS

All Trees: ordered alphabetically

Code	Scientific Name		Code	Scientific Name
278	Acacia confusa		295	Artocarpus nobilis
281	Acacia koa		419	Artocarpus odoratissima
400	Adenanthera pavonina		420	Arytera brackenridgei
401	Aglaia heterotricha		421	Ascarina diffusa
100	Aglaia mariannensis		422	Astronidium navigatorum
800	Aglaia palauensis		807	Astronidium palauense
801	Aglaia ponapensis		423	Astronidium pickeringii
402	Aglaia saltatorum		424	Astronidium samoense
403	Aglaia samoensis		425	Astronidium subcordatum
101	Aidia cochinchinensis		426	Atuna racemosa
405	Albizia chinensis		427	Averrhoa bilimbi
802	Albizia falcataria		428	Averrhoa carambola
102	Albizia lebbeck		695	Avicennia mariana
803	Albizia retusa		429	Baccaurea taitensis
406	Alectryon samoensis		808	Badusa palauensis
407	Aleurites moluccana		430	Barringtonia asiatica
103	Aleurites trisperma		112	Barringtonia racemosa
804	Allophylus ternatus		431	Barringtonia samoensis
408	Allophylus timorensis		809	Bauhinia binata
805	Alphitonia carolinensis		113	Bauhinia monandra
409	Alphitonia zizpyoides		432	Bischofia javanica
410	Alstonia pacifica		433	Boehmeria virgata
104	Anacardium occidentale		434	Broussonetia papyrifera
411	Anacolosa insularis		435	Bruguiera gymnorrhiza
806	Angiopteris evecta		810	Buchanania engleriana
412	Annona muricata		436	Buchanania merrillii
105	Annona reticulata		811	Buchanania palawensis
413	Annona squamosa		437	Burckella richii
106	Antidesma bunius		114	Caesalpinia sappan
415	Antidesma sphaerocarpum		440	Calophyllum inophyllum
416	Antirhea inconspicua		439	Calophyllum neo-ebudicum
107	Araucaria columnaris		812	Calophyllum pelewense
111	Araucaria excelsa		813	Calophyllum soulattri
108	Araucaria heterophylla		814	Campnosperma brevipetiolata
417	Areca catechu		441	Cananga odorata
109	Arenga pinnata		443	Canarium harveyi
293	Artocarpus altilis		815	Canarium hirsutum
294	Artocarpus heterophyllus		816	Canarium indicum
110	Artocarpus mariannensis		444	Canarium ovatum

Code	Scientific Name		Code	Scientific Name
445	Canarium samoense		464	Citrus sinensis
446	Canarium vitiense		827	Claoxylon carolinianum
447	Canthium merrillii		465	Claoxylon echinospermum
448	Carica papaya		828	Claoxylon fallax
817	Caryota mitis		829	Claoxylon longiracemosum
115	Caryota urens		127	Claoxylon marianum
818	Casearia cauliflora		830	Cleistanthus carolinensis
449	Casearia sp. nova		831	Cleistanthus insularis
450	Cassia fistula		128	Coccoloba uvifera
819	Cassia grandis		466	Cocos nucifera
116	Cassia javanica		129	Coffea arabica
820	Cassia siamea		130	Coffea liberica
451	Castilla elastica		832	Colona scabra
452	Casuarina equisetifolia		833	Combretum tetralophum
117	Casuarina litorea		468	Commersonia bartramia
118	Catalpa longissima		469	Coprosma savaiiensis
119	Ceiba pentandra		470	Coprosma strigulosa
453	Celtis harperi		471	Cordia aspera
821	Celtis paniculata		131	Cordia dichotoma
120	Cerbera dilatata		834	Cordia micronesica
822	Cerbera floribunda		835	Cordia sebestena
454	Cerbera manghas		472	Cordia subcordata
455	Cerbera odollam		473	Crateva religiosa
708	Ceriops tagal		132	Crescentia alata
456	Chionanthus vitiensis		474	Crossostylis biflora
457	Chrysophyllum cainito		475	Cryptocarya elegans
50	Cinnamomum camphora		476	Cryptocarya hornei
823	Cinnamomum carolinense		477	Cryptocarya samoensis
824	Cinnamomum pedatinervium		478	Cryptocarya turbinata
825	Cinnamomum sessilifolium		479	Cryptocarya wilderi
458	Cinnamomum verum		133	Cryptomeria japonica
460	Citronella samoensis		480	Cupaniopsis samoensis
461	Citrus aurantifolia		386	Cyathea decurrens
121	Citrus aurantium		691	Cyathea lunulata
122	Citrus grandis		387	Cyathea medullaris
212	Citrus hystrix		836	Cyathea nigricans
124	Citrus limon		837	Cyathea ponapeana
125	Citrus macroptera		1320	Cyathea spp.
462	Citrus maxima		482	Cyathea truncata
126	Citrus medica		134	Cycas circinalis
826	Citrus mitis		838	Cycas revoluta
463	Citrus reticulata			

Code	Scientific Name		Code	Scientific Name
483	Cyclophyllum barbatum		509	Erythrina subumbrans
135	Cynometra ramiflora		510	Erythrina variegata
136	Cyphomandra betacea		511	Erythrospermum acuminatissimum
485	Delonix regia		339	Eucalyptus deglupta
486	Dendrocnide harveyi		213	Eucalyptus globulus
137	Dendrocnide latifolia		340	Eucalyptus pilularis
138	Dictyosperma album		341	Eucalyptus robusta
487	Diospyros discolor		342	Eucalyptus saligna
488	Diospyros ebenaster		343	Eucalyptus sideroxylon
489	Diospyros elliptica		1400	Eucalyptus sp.
839	Diospyros ferrea		848	Eugenia aquea
140	Diospyros kaki		849	Eugenia caryophyllus
490	Diospyros major		143	Eugenia cuminii
491	Diospyros samoensis		144	Eugenia javanica
492	Dipteris conjugata		145	Eugenia malaccensis
141	Discocalyx ponapensis		850	Eugenia nitida
840	Dolichandrone spathacea		851	Eugenia palauensis
713	Dracaena multiflora		214	Eugenia palumbis
842	Drypetes nitida		512	Eugenia reinwardtiana
493	Drypetes vitiensis		1410	Eugenia sp.
494	Durio zibethinus		146	Eugenia stelechantha
495	Dysoxylum forsteri		852	Eugenia suzukii
496	Dysoxylum huntii		147	Eugenia thompsonii
497	Dysoxylum maota		513	Eugenia uniflora
498	Dysoxylum samoense		514	Euphoria longana
1370	Dysoxylum spp.		854	Evodia hortensis
500	Dysoxylum tongense		855	Evodia nitida
843	Elaeis guineensis		856	Evodia palawensis
844	Elaeocarpus carolinensis		857	Evodia ponapensis
501	Elaeocarpus floridanus		858	Evodia trichantha
502	Elaeocarpus graeffei		515	Excoecaria agallocha
503	Elaeocarpus grandis		859	Exorrhiza ponapensis
142	Elaeocarpus joga		516	Fagraea berteriana
845	Elaeocarpus kerstingianus		860	Fagraea ksid
846	Elaeocarpus kusanoi		149	Ficus carica
705	Elaeocarpus tongnus		150	Ficus elastica
504	Elaeocarpus ulianus		517	Ficus godeffroyi
505	Elattostachys falcata		352	Ficus microcarpa
506	Eleocharis dulcis		518	Ficus obliqua
507	Endiandra elaeocarpa		519	Ficus prolixa
329	Eriobotrya japonica		861	Ficus saffordii
508	Erythrina fusca			

Code	Scientific Name		Code	Scientific Name
520	Ficus scabra		547	Hernandia nymphaeifolia
1440	Ficus sp.		155	Hernandia ovigera
521	Ficus tinctoria		156	Hernandia sonora
522	Ficus uniauriculata		157	Heterospathe elata
215	Ficus virens		361	Hevea brasiliensis
863	Finischia chloroxantha		548	Hibiscus tiliaceus
216	Flacourtia rukam		549	Homalium whitmeeanus
524	Flueggea flexuosa		872	Horsfieldia amklaal
525	Funtumia elastica		873	Horsfieldia novo-guineensi
526	Garcinia mangostana		874	Horsfieldia palauensis
864	Garcinia matudai		550	Inocarpus fagifer
527	Garcinia myrtifolia		551	Intsia bijuga
865	Garcinia ponapensis		875	Kayea pacifica
866	Garcinia rumiyo		703	Kleinhovia hospita
528	Garcinia sessilis		554	Lagostromia speciosa
529	Gardenia taitensis		555	Lansium domesticum
530	Garuga floribunda		158	Latania loddigesii
531	Geniostoma rupestre		159	Leucaena insularum
532	Gironniera celtiifolia		556	Leucaena leucocephala
151	Gliricida sepium		558	Litchi chinensis
533	Glochidion cuspidatum		559	Litsea mellea
706	Glochidion ramiflorum		560	Litsea samoensis
869	Gmelina elliptica		160	Livistonia chinensis
867	Gmelina palawensis		561	Lucuma nervosa
868	Gnetum gnemon		562	Lumnitzera littorea
870	Goniothalamus carolinensis		161	Macadamia integrifolia
358	Grevillea robusta		563	Macadamia tetraphylla
535	Grewia crenata		876	Macaranga carolinensis
152	Guaiacum officinale		564	Macaranga grayana
153	Guamia mariannae		565	Macaranga harveyana
536	Guettarda speciosa		566	Macaranga reineckei
537	Guioa lenticifolia		567	Macaranga sp. nova
538	Guioa rhoifolia		568	Macaranga stipulosa
871	Gulubia palauensis		162	Macaranga thompsonii
539	Gyrocarpus americanus		877	Mallotus palauensis
540	Haplolobus floribundus		878	Mallotus tiliaefolius
541	Harpullia arborea		570	Mammea glauca
542	Hedycarya denticulata		163	Mammea odorata
543	Hedycarya dorstenioides		569	Mangifera indica
544	Heritiera littoralis		879	Mangifera minor
154	Heritiera longipetiolata		164	Mangifera odorata
545	Heritiera ornithocephala		165	Manihot glaziovii
546	Hernandia moerenhoutiana		571	Manikara dissecta

Code	Scientific Name		Code	Scientific Name
880	Manilkara hoshinoi		174	Myrica rubra
572	Manilkara samoensis		589	Myristica fatua
882	Manilkara udoido		590	Myristica hypargyraea
166	Manilkara zapota		897	Myristica insularis
573	Maniltoa grandiflora		591	Neisosperma oppositifolia
883	Marattia fraxinea		592	Neonauclea forsteri
715	Maytenus palauica		593	Nephelium lappaceum
884	Medusanthera carolinensis		898	Neubergia celebica
575	Medusanthera samoensis		899	Nypa fruticans
885	Melaleuca quinquenervia		900	Ochroma pyramidale
167	Melanolepis multiglandulosa		594	Ochrosia vitiensis
993	Melia azedarach		595	Omalanthus acuminatus
577	Melicope retusa		596	Omalanthus nutans
578	Melicytus samoensis		901	Ormosia calavensis
579	Melilcope lauterbachii		716	Osmoxylon oliveri
580	Melochia aristata		717	Osmoxylon pachphyllum
168	Merrilliodendron megacarpum		718	Osmoxylon truncatum
581	Meryta macrophylla		902	Pachira aquatica
886	Meryta senfftiana		597	Palaquium stehlinii
582	Metrosideros collina		903	Pandanus aimiriikensis
169	Metroxylon amicarum		905	Pandanus cominsii
887	Metroxylon sagu		906	Pandanus compressus
583	Michelia champaca		907	Pandanus cylindricus
584	Micromelum minutum		908	Pandanus dilatatus
585	Millettia pinnata		909	Pandanus divergens
170	Mimusops elengi		175	Pandanus dubius
586	Morinda citrifolia		910	Pandanus duriocarpus
888	Morinda latibracteata		911	Pandanus enchabiensis
889	Morinda pendunculata		912	Pandanus fischerianus
171	Moringa oleifera		176	Pandanus fragrans
172	Morus alba		913	Pandanus hosinoi
173	Muntingia calabura		914	Pandanus jalvitensis
890	Musa coccinea		915	Pandanus kanehirae
891	Musa nana		916	Pandanus kororensis
892	Musa sapientum		917	Pandanus lakatwa
1650	Musa spp.		918	Pandanus laticanalicula
893	Musa textilis		919	Pandanus macrocephalus
894	Musa tikap		920	Pandanus macrojeanneretia
895	Musa troglodytarum		921	Pandanus menne
896	Mussaenda frondosa		922	Pandanus obliguus
588	Mussaenda raiateensis		923	Pandanus odontoides

Code	Scientific Name		Code	Scientific Name
924	Pandanus palawensis		615	Planchonella torricellensis
925	Pandanus patina		616	Pleiogynium timoriense
926	Pandanus peliliuensis		184	Plumeria obtusa
927	Pandanus ponapensis		185	Plumeria rubra
928	Pandanus pulposus		617	Polyathia sp. nova
929	Pandanus rectangulatus		719	Polyscias grandifolia
598	Pandanus reineckei		618	Polyscias multijuga
930	Pandanus rotundatus		939	Polyscias nodosa
1700	Pandanus sp.		619	Polyscias samoensis
692	Pandanus tectorius		620	Pometia pinnata
931	Pandanus tolotomensis		940	Ponapea hosinoi
932	Pandanus trukensis		941	Ponapea ledermanniana
933	Pandanus utiyamai		186	Pongamia pinnata
934	Pandanus variegatus		621	Pouteria caimito
178	Pangium edule		942	Pouteria calcarea
599	Paraserianthes falcataria		187	Pouteria campechiana
600	Parasponia andersonii		188	Pouteria obovata
935	Parinari corymbosa		189	Pouteria sapota
601	Parinari insularum		190	Premna obtusifolia
936	Parinari laurina		943	Premna pubescens
937	Parkia parvifoliola		622	Premna serratifolia
382	Peltophorum pterocarpum		623	Pritchardia pacifica
602	Pemphis acidula		191	Prunus persica
603	Persea americana		624	Psidium guajava
179	Phoenix dactylifera		625	Psychotria grandistipulata
180	Phoenix sylvestris		626	Psychotria insularum
181	Phyllanthus acidus		192	Psychotria mariana
182	Pimenta pimentadioica		193	Psychotria rotensis
183	Pimenta racemosa		627	Psydrax odorata
938	Pinanga insignis		194	Pterocarpus indicus
605	Pipturus argenteus		944	Ptychosperma kusaiensis
606	Pisonia grandis		945	Ptychosperma palauensis
607	Pisonia umbellifera		628	Rapanea myricifolia
385	Pithecellobium dulce		946	Rauvolfia insularis
608	Pittosporum arborescens		947	Ravenala madagascariensis
609	Pittosporum samoense		629	Reynoldsia lanotoensis
610	Planchonella garberi		630	Reynoldsia pleiosperma
611	Planchonella grayana		631	Rheedula edulis
612	Planchonella linggensis		195	Rhizophora apiculata
613	Planchonella membranacea		632	Rhizophora mangle
614	Planchonella samoensis		196	Rhizophora mucronata

Code	Scientific Name		Code	Scientific Name
633	Rhizophora stylosa		657	Syzgium corynocarpum
634	Rhus taitensis		658	Syzygium brevifolium
948	Rinorea carolinensis		659	Syzygium carolinense
635	Rollinia deliciosa		660	Syzygium clusiifolium
197	Roystonea elata		661	Syzygium dealatum
949	Roystonea oleracea		662	Syzygium inophylloides
950	Samadera indica		663	Syzygium jambos
636	Samanea saman		664	Syzygium richii
637	Sandoricum koetjape		665	Syzygium samarangense
638	Santalum yasi		666	Syzygium samoense
639	Sapindus vitiensis		667	Syzygium savaiiense
951	Sapium indicum		202	Tabebuia pallida
640	Sarcopygme pacifica		960	Tabernaemontana aurantiaca
198	Schefflera actinophylla		668	Tabernaemontana pandacaqui
642	Schefflera samoensis		210	Tabernaemontana rotensis
224	Schinus terebinthifolius		203	Tamarindus indica
643	Schleinitzia insularum		669	Tarenna sambucina
952	Scyphiphora hydrophyllacea		961	Tecoma stans
644	Securinega flexuosa		962	Tectona grandis
953	Semecarpus venenosus		963	Terminalia carolinensis
645	Semecarpus vitiensis		670	Terminalia catappa
954	Serianthes kanehirae		964	Terminalia crassipes
646	Serianthes melanesica		965	Terminalia edulis
199	Serianthes nelsonii		672	Terminalia glabrata
647	Sesbania grandiflora		966	Terminalia kaernbachii
648	Solanum vitiense		673	Terminalia richii
200	Sonneratia alba		674	Terminalia samoensis
649	Sophora tomentosa		675	Theobroma cacao
650	Spathodea campanulata		676	Thespesia populnea
651	Spiraeanthemum samoense		723	Timonius corymbosus
652	Spondias dulcis		724	Timonius mollis
955	Spondias mombin		726	Timonius subauritus
956	Spondias pinnata		727	Timonius timon
957	Stemonurus ammui		678	Tournefortia argentea
653	Sterculia fanaiho		679	Trema cannabina
958	Sterculia palauensis		204	Trema orientalis
654	Streblus anthropophagorum		967	Trichospermum ikutai
201	Streblus pendulinus		968	Trichospermum ledermannii
655	Swietenia macrophylla		680	Trichospermum richii
959	Swietenia mahogoni		123	Triphasia trifolia
722	Symplocos racemosa			
656	Synsepalum dulcificum			
205	Tristiropsis obtusangula			

Code	Scientific Name		Code	Scientific Name
999	Unknown, other			
681	Vavaea amicorum			
682	Veitchia merrillii			
969	Vitex coffassus			
206	Vitex parviflora			
683	Wedelia biflora			
684	Weinmannia affinis			
207	Ximenia americana			
685	Xylocarpus granatum			
686	Xylocarpus moluccensis			
208	Xylosma nelsonii			
688	Xylosma samoense			
689	Xylosma smithianum			
690	Zanthophyllum pinnatum			
209	Zizyphus mauritiana			

Tree Genus Codes

	GENUS CODES						
1000	Acacia spp.		1400	Eucalyptus spp.			
1010	Albizia spp.		1410	Eugenia spp.			
1020	Aglaia spp.		1420	Evodia spp.		1800	Pouteria sp.
1030	Aleurites spp.		1430	Fagraea spp.		1810	Premna sp.
1040	Allophylus spp.		1440	Ficus sp.		1820	Psychotria sp.
1050	Alphitonia spp.		1450	Garcinia sp.		1830	Ptychosperma sp
1060	Annona spp.		1460	Glochidion sp.		1840	Reynoldsia sp.
1070	Antidesma spp.		1470	Gmelina sp.		1850	Rhizophora sp.
1080	Araucaria spp.		1480	Guioa sp.		1860	Spondias sp.
1090	Artocarpus spp.		1490	Hedycarya sp.		1870	Swietenia sp.
1100	Astronidium spp.		1500	Heritiera sp.		1880	Terminalia sp.
1110	Averrhoa spp.		1510	Hernandia sp.		1890	Timonius sp.
1120	Avicennia spp.		1520	Horsfieldia sp.		1900	Trema sp.
1130	Barringtonia spp.		1530	Leucaena sp.		1910	Vitex sp.
1140	Bauhinia spp.		1540	Litsea sp.		1920	Xylocarpus sp.
1150	Buchanania spp.		1550	Macadamia sp			
1160	Calophyllum spp.		1560	Macaranga sp.			
1170	Canarium spp.		1570	Mallotus sp			
1180	Caryota spp.		1580	Mammea sp.			
1190	Casearia spp.		1590	Mangifera sp.			
1200	Cassia spp.		1600	Manilkara sp.			
1210	Casuarina spp.		1610	Medusanthera sp.			
1220	Celtis spp.		1620	Meryta sp.			
1230	Cerbera spp		1630	Metroxylon sp.			
1240	Cinnamomum spp.		1640	Morinda sp.			
1250	Citrus spp.		1650	Musa spp.			
1260	Claoxylon spp.		1660	Mussaenda spp.			
1270	Cleistanthus spp.		1670	Myristica spp.			
1280	Coffea spp.		1680	Omalanthus spp.			
1290	Coprosma spp.		1690	Osmoxylon spp.			
1300	Cordia spp.		1700	Pandanus sp.			
1310	Cryptocarya spp.		1710	Parinari sp.			
1320	Cyathea spp.		1720	Phoenix sp.			
1330	Cycas spp.		1730	Pimenta sp.			
1340	Dendrocnide spp.		1740	Pisonia sp.			
1350	Diospyros spp.		1750	Pittosporum sp.			
1360	Drypetes spp.		1760	Planchonella sp.			
1370	Dysoxylum spp.		1770	Plumeria sp.			
1380	Elaeocarpus spp.		1780	Polyscias sp.			
1390	Erythrina spp.		1790	Ponapea sp.			

All Island Trees: ordered by number code

Code	Scientific Name	Guam	Am. Samoa	Palau	Pohn-pei	Kos-rae	Yap	Chuuk	CNMI	Mar Isl
50	Cinnamomum camphora	GUM								
100	Aglaia mariannensis	GUM							NMI	
101	Aidia cochinchinensis	GUM	AS	PAL	PON				NMI	MAR
102	Albizia lebbeck	GUM		PAL			YAP		NMI	
103	Aleurites trisperma	GUM								
104	Anacardium occidentale	GUM								
105	Annona reticulata	GUM		PAL						
106	Antidesma bunius	GUM		PAL						
107	Araucaria columnaris	GUM							NMI	
108	Araucaria heterophylla	GUM		PAL			YAP			MAR
109	Arenga pinnata	GUM		PAL						
110	Artocarpus mariannensis	GUM		PAL	PON		YAP	TRK	NMI	
111	Araucaria excelsa		AS	PAL						
112	Barringtonia racemosa	GUM		PAL	PON	KOS	YAP	TRK		
113	Bauhinia monandra	GUM		PAL	PON				NMI	
114	Caesalpinia sappan	GUM			PON		YAP		NMI	
115	Caryota urens	GUM								
116	Cassia javanica	GUM								
117	Casuarina litorea	GUM		PAL	PON		YAP	TRK	NMI	MAR
118	Catalpa longissima	GUM								
119	Ceiba pentandra	GUM		PAL	PON	KOS	YAP			MAR
120	Cerbera dilatata	GUM							NMI	
121	Citrus aurantium	GUM								
122	Citrus grandis	GUM		PAL			YAP		NMI	
123	Triphasia trifolia	GUM							NMI	
124	Citrus limon	GUM		PAL						
125	Citrus macroptera	GUM					YAP			
126	Citrus medica	GUM								
127	Claoxylon marianum	GUM							NMI	
128	Coccoloba uvifera	GUM								MAR
129	Coffea arabica	GUM		PAL						
130	Coffea liberica	GUM								
131	Cordia dichotoma	GUM								
132	Crescentia alata	GUM								
133	Cryptomeria japonica	GUM								
134	Cycas circinalis	GUM		PAL	PON	KOS	YAP			MAR
135	Cynometra ramiflora	GUM		PAL	PON					
136	Cyphomandra betacea	GUM								
137	Dendrocnide latifolia	GUM							NMI	

Code	Scientific Name	Guam	Am. Samoa	Palau	Pohn-pei	Kos-rae	Yap	Chuuk	CNMI	Mar Isl
138	Dictyosperma album	GUM								
140	Diospyros kaki	GUM								
141	Discocalyx ponapensis	GUM			PON					
142	Elaeocarpus joga	GUM		PAL					NMI	
143	Eugenia cuminii	GUM		PAL						
144	Eugenia javanica	GUM		PAL	PON		YAP			
145	Eugenia malaccensis	GUM		PAL	PON		YAP	TRK		
146	Eugenia stelechantha	GUM			PON	KOS		TRK	NMI	
147	Eugenia thompsonii	GUM							NMI	
149	Ficus carica	GUM		PAL						MAR
150	Ficus elastica	GUM		PAL	PON		YAP			
151	Gliricida sepium	GUM		PAL						
152	Guaiacum officinale	GUM								
153	Guamia mariannae	GUM							NMI	
154	Heritiera longipetiolata	GUM							NMI	
155	Hernandia ovigera	GUM								
156	Hernandia sonora	GUM		PAL	PON	KOS	YAP	TRK	NMI	MAR
157	Heterospathe elata	GUM		PAL			YAP			
158	Latania loddigesii	GUM								
159	Leucaena insularum	GUM								
160	Livistonia chinensis	GUM								
161	Macadamia integrifolia	GUM		PAL						
162	Macaranga thompsonii	GUM								
163	Mammea odorata	GUM		PAL	PON		YAP	TRK	NMI	
164	Mangifera odorata	GUM							NMI	
165	Manihot glaziovii	GUM								
166	Manilkara zapota	GUM		PAL						
167	Melanolepis multiglandulosa	GUM							NMI	
168	Merrilliodendron megacarpum	GUM							NMI	
169	Metroxylon amicarum	GUM		PAL	PON			TRK		
170	Mimusops elengi	GUM								
171	Moringa oleifera	GUM		PAL						
172	Morus alba	GUM								
173	Muntingia calabura	GUM		PAL			YAP			
174	Myrica rubra	GUM								
175	Pandanus dubius	GUM		PAL	PON	KOS		TRK	NMI	
176	Pandanus fragrans	GUM			PON		YAP			
1700	Pandanus sp.	GUM			PON	KOS	YAP	TRK		MAR
178	Pangium edule	GUM		PAL	PON		YAP		NMI	
179	Phoenix dactylifera	GUM								
180	Phoenix sylvestris	GUM								

Code	Scientific Name	Guam	Am. Samoa	Palau	Pohn-pei	Kos-rae	Yap	Chuuk	CNMI	Mar Isl
181	Phyllanthus acidus	GUM								
182	Pimenta pimentadioica	GUM								
183	Pimenta racemosa	GUM							NMI	
184	Plumeria obtusa	GUM		PAL			YAP			MAR
185	Plumeria rubra	GUM		PAL	PON	KOS	YAP	TRK		MAR
186	Pongamia pinnata	GUM		PAL			YAP			
187	Pouteria campechiana	GUM							NMI	
188	Pouteria obovata	GUM		PAL					NMI	
189	Pouteria sapota	GUM								
190	Premna obtusifolia	GUM		PAL	PON	KOS	YAP	TRK	NMI	MAR
191	Prunus persica	GUM								
192	Psychotria mariana	GUM							NMI	
193	Psychotria rotensis	GUM								
194	Pterocarpus indicus	GUM		PAL			YAP			
195	Rhizophora apiculata	GUM		PAL	PON	KOS				
196	Rhizophora mucronata	GUM		PAL	PON	KOS	YAP	TRK		
197	Roystonea elata	GUM								
198	Schefflera actinophylla	GUM								
199	Serianthes nelsonii	GUM							NMI	
200	Sonneratia alba	GUM		PAL	PON	KOS	YAP	TRK	NMI	MAR
201	Streblus pendulinus	GUM								
202	Tabebuia pallida	GUM								
203	Tamarindus indica	GUM							NMI	
204	Trema orientalis	GUM		PAL					NMI	
205	Tristiropsis obtusangula	GUM		PAL						
206	Vitex parviflora	GUM								
207	Ximenia americana	GUM		PAL					NMI	MAR
208	Xylosma nelsonii	GUM								
209	Zizyphus mauritiana	GUM								
210	Tabernaemontana rotensis	GUM								
212	Citrus hystrix	GUM					YAP			
213	Eucalyptus globulus			PAL						
214	Eugenia palumbis	GUM								
215	Ficus virens	GUM		PAL	PON	KOS	YAP	TRK		
216	Flacourtia rukam		AS							
224	Schinus terebinthifolius	GUM								
278	Acacia confusa	GUM		PAL	PON		YAP	TRK	NMI	
281	Acacia koa	GUM								
293	Artocarpus altilis	GUM	AS	PAL	PON	KOS	YAP	TRK	NMI	MAR
294	Artocarpus heterophyllus	GUM		PAL						
295	Artocarpus nobilis			PAL						
329	Eriobotrya japonica	GUM								

Code	Scientific Name	Guam	Am. Samoa	Palau	Pohn-pei	Kos-rae	Yap	Chuuk	CNMI	Mar Isl
339	Eucalyptus deglupta			PAL						
340	Eucalyptus pilularis			PAL						
341	Eucalyptus robusta			PAL						
342	Eucalyptus saligna			PAL						
343	Eucalyptus sideroxylon			PAL						
352	Ficus microcarpa	GUM		PAL					NMI	
358	Grevillea robusta	GUM		PAL						
361	Hevea brasiliensis	GUM		PAL						
382	Peltophorum pterocarpum	GUM								
385	Pithecellobium dulce	GUM		PAL					NMI	
386	Cyathea decurrens		AS							
387	Cyathea medullaris		AS							
400	Adenanthera pavonina	GUM	AS	PAL	PON	KOS			NMI	
401	Aglaia heterotricha		AS							
402	Aglaia saltatorum		AS							
403	Aglaia samoensis		AS							
405	Albizia chinensis		AS							
406	Alectryon samoensis		AS							
407	Aleurites moluccana	GUM	AS		PON					
408	Allophylus timorensis	GUM		PAL	PON	KOS	YAP	TRK		MAR
409	Alphitonia zizpyoides		AS							
410	Alstonia pacifica		AS							
411	Anacolosa insularis		AS							
412	Annona muricata	GUM	AS	PAL	PON	KOS	YAP	TRK	NMI	MAR
413	Annona squamosa	GUM	AS	PAL					NMI	
415	Antidesma sphaerocarpum		AS							
416	Antirhea inconspicua		AS							
417	Areca catechu	GUM	AS	PAL	PON	KOS	YAP	TRK	NMI	
419	Artocarpus odoratissima		AS							
420	Arytera brackenridgei		AS							
421	Ascarina diffusa		AS							
422	Astronidium navigatorum		AS							
423	Astronidium pickeringii		AS							
424	Astronidium samoense		AS							
425	Astronidium subcordatum		AS							
426	Atuna racemosa		AS							
427	Averrhoa bilimbi	GUM	AS	PAL			YAP		NMI	
428	Averrhoa carambola	GUM	AS	PAL	PON		YAP			
429	Baccaurea taitensis		AS							
430	Barringtonia asiatica	GUM	AS	PAL	PON	KOS	YAP	TRK	NMI	MAR
431	Barringtonia samoensis		AS							
432	Bischofia javanica		AS							

Code	Scientific Name	Guam	Am. Samoa	Palau	Pohn-pei	Kos-rae	Yap	Chuuk	CNMI	Mar Isl
433	Boehmeria virgata		AS							
434	Broussonetia papyrifera		AS							
435	Bruguiera gymnorrhiza	GUM	AS	PAL	PON	KOS	YAP	TRK		MAR
436	Buchanania merrillii		AS							
437	Burckella richii		AS							
439	Calophyllum neo-ebudicum		AS							
440	Calophyllum inophyllum	GUM	AS	PAL	PON	KOS	YAP	TRK	NMI	MAR
441	Cananga odorata	GUM	AS	PAL	PON	KOS		TRK	NMI	
443	Canarium harveyi		AS							
444	Canarium ovatum		AS							
445	Canarium samoense		AS							
446	Canarium vitiense		AS							
447	Canthium merrillii		AS							
448	Carica papaya	GUM	AS	PAL	PON	KOS	YAP	TRK		MAR
449	Casearia sp. Nova		AS							
450	Cassia fistula	GUM	AS	PAL						
451	Castilla elastica		AS							
452	Casuarina equisetifolia		AS	PAL						
453	Celtis harperi		AS							
454	Cerbera manghas		AS	PAL		KOS				
455	Cerbera odollam		AS							
456	Chionanthus vitiensis		AS							
457	Chrysophyllum cainito		AS	PAL						
458	Cinnamomum verum		AS	PAL						
460	Citronella samoensis		AS							
461	Citrus aurantifolia	GUM	AS	PAL	PON	KOS	YAP	TRK		
462	Citrus maxima		AS							
463	Citrus reticulata	GUM	AS	PAL		KOS	YAP			
464	Citrus sinensis	GUM	AS		PON	KOS	YAP			
465	Claoxylon echinospermum		AS							
466	Cocos nucifera	GUM	AS	PAL	PON	KOS	YAP	TRK	NMI	MAR
468	Commersonia bartramia		AS	PAL	PON		YAP	TRK		
469	Coprosma savaiiensis		AS							
470	Coprosma strigulosa		AS							
471	Cordia aspera		AS							
472	Cordia subcordata	GUM	AS	PAL	PON	KOS	YAP	TRK	NMI	MAR
473	Crateva religiosa		AS							
474	Crossostylis biflora		AS							
475	Cryptocarya elegans		AS							
476	Cryptocarya hornei		AS							
477	Cryptocarya samoensis		AS							
478	Cryptocarya turbinate		AS							

Code	Scientific Name	Guam	Am. Samoa	Palau	Pohn-pei	Kos-rae	Yap	Chuuk	CNMI	Mar Isl
479	Cryptocarya wilderi		AS							
480	Cupaniopsis samoensis		AS							
1320	Cyathea spp.		AS	PAL						
482	Cyathea truncata		AS							
483	Cyclophyllum barbatum		AS							
485	Delonix regia	GUM	AS	PAL	PON		YAP		NMI	MAR
486	Dendrocnide harveyi		AS							
487	Diospyros discolor	GUM	AS	PAL						
488	Diospyros ebenaster	GUM	AS							
489	Diospyros elliptica		AS							
490	Diospyros major		AS							
491	Diospyros samoensis		AS							
492	Dipteris conjugata		AS							
493	Drypetes vitiensis		AS							
494	Durio zibethinus		AS							
495	Dysoxylum forsteri		AS							
496	Dysoxylum huntii		AS							
497	Dysoxylum maota		AS							
498	Dysoxylum samoense		AS							
1370	Dysoxylum spp.		AS							
500	Dysoxylum tongense		AS							
501	Elaeocarpus floridanus		AS							
502	Elaeocarpus graeffei		AS							
503	Elaeocarpus grandis		AS							
504	Elaeocarpus ulianus		AS							
505	Elattostachys falcata		AS							
506	Eleocharis dulcis		AS							
507	Endiandra elaeocarpa		AS							
508	Erythrina fusca		AS	PAL	PON					
509	Erythrina subumbrans		AS							
510	Erythrina variegata	GUM	AS	PAL	PON		YAP	TRK	NMI	
511	Erythrospermum acuminatissimum		AS							
512	Eugenia reinwardtiana	GUM	AS	PAL			YAP			
513	Eugenia uniflora		AS							
514	Euphoria longana		AS							
515	Excoecaria agallocha	GUM	AS	PAL			YAP	TRK		
516	Fagraea berteriana	GUM	AS	PAL	PON			TRK		
517	Ficus godeffroyi		AS							
518	Ficus obliqua		AS							
519	Ficus prolixa	GUM	AS	PAL	PON	KOS	YAP	TRK		
520	Ficus scabra		AS							
521	Ficus tinctoria	GUM	AS	PAL	PON	KOS	YAP	TRK	NMI	MAR

Code	Scientific Name	Guam	Am. Samoa	Palau	Pohn-pei	Kos-rae	Yap	Chuuk	CNMI	Mar Isl
522	Ficus uniauriculata		AS							
524	Flueggea flexuosa		AS							
525	Funtumia elastica		AS							
526	Garcinia mangostana		AS	PAL						
527	Garcinia myrtifolia		AS							
528	Garcinia sessilis		AS							
529	Gardenia taitensis `		AS							
530	Garuga floribunda		AS							
531	Geniostoma rupestre		AS							
532	Gironniera celtiifolia		AS	PAL	PON					
533	Glochidion cuspidatum		AS							
535	Grewia crenata	GUM	AS						NMI	
536	Guettarda speciosa	GUM	AS	PAL	PON	KOS	YAP	TRK	NMI	MAR
537	Guioa lenticifolia		AS							
538	Guioa rhoifolia		AS							
539	Gyrocarpus americanus		AS							
540	Haplolobus floribundus		AS							
541	Harpullia arborea		AS							
542	Hedycarya denticulate		AS							
543	Hedycarya dorstenioides		AS							
544	Heritiera littoralis	GUM	AS	PAL	PON	KOS	YAP	TRK		
545	Heritiera ornithocephala		AS							
546	Hernandia moerenhoutiana		AS							
547	Hernandia nymphaeifolia		AS							
548	Hibiscus tiliaceus	GUM	AS	PAL	PON	KOS	YAP	TRK		MAR
549	Homalium whitmeeanus		AS							
550	Inocarpus fagifer	GUM	AS	PAL	PON	KOS	YAP	TRK		MAR
551	Intsia bijuga	GUM	AS	PAL	PON		YAP	TRK	NMI	MAR
554	Lagostromia speciosa		AS							
555	Lansium domesticum	GUM	AS							
556	Leucaena leucocephala	GUM	AS	PAL			YAP		NMI	MAR
558	Litchi chinensis		AS	PAL						
559	Litsea mellea		AS							
560	Litsea samoensis		AS							
561	Lucuma nervosa		AS							
562	Lumnitzera littorea	GUM	AS	PAL	PON	KOS	YAP	TRK		MAR
563	Macadamia tetraphylla		AS							
564	Macaranga grayana		AS							
565	Macaranga harveyana		AS							
566	Macaranga reineckei		AS							
567	Macaranga sp. Nova		AS							
568	Macaranga stipulosa		AS							

Code	Scientific Name	Guam	Am. Samoa	Palau	Pohn-pei	Kos-rae	Yap	Chuuk	CNMI	Mar Isl
569	Mangifera indica	GUM	AS	PAL	PON	KOS	YAP	TRK		
570	Mammea glauca		AS							
571	Manilkara dissecta		AS							
572	Manilkara samoensis		AS							
573	Maniltoa grandiflora		AS							
575	Medusanthera samoensis		AS							
577	Melicope retusa		AS							
578	Melicytus samoensis		AS							
579	Melilcope lauterbachii		AS							
580	Melochia aristata		AS							
581	Meryta macrophylla		AS							
582	Metrosideros collina		AS							
583	Michelia champaca		AS							
584	Micromelum minutum		AS							
585	Millettia pinnata		AS	PAL						
586	Morinda citrifolia	GUM	AS	PAL	PON	KOS	YAP	TRK	NMI	MAR
588	Mussaenda raiateensis		AS							
589	Myristica fatua		AS							
590	Myristica hypargyraea		AS	PAL						
591	Neisosperma oppositifolia	GUM	AS	PAL	PON		YAP	TRK	NMI	MAR
592	Neonauclea forsteri		AS							
593	Nephelium lappaceum	GUM	AS	PAL						
594	Ochrosia vitiensis		AS							
595	Omalanthus acuminatus		AS							
596	Omalanthus nutans		AS							
597	Palaquium stehlinii		AS							
598	Pandanus reineckei		AS							
599	Paraserianthes falcataria		AS							
600	Parasponia andersonii		AS							
601	Parinari insularum		AS							
602	Pemphis acidula		AS	PAL	PON	KOS	YAP	TRK	NMI	MAR
603	Persea americana	GUM	AS	PAL						
605	Pipturus argenteus	GUM	AS	PAL	PON	KOS	YAP	TRK	NMI	MAR
606	Pisonia grandis	GUM	AS	PAL	PON		YAP	TRK	NMI	MAR
607	Pisonia umbellifera	GUM	AS	PAL					NMI	
608	Pittosporum arborescens		AS							
609	Pittosporum samoense		AS							
610	Planchonella garberi		AS							
611	Planchonella grayana		AS							
612	Planchonella linggensis		AS							
613	Planchonella membranacea		AS							
614	Planchonella samoensis		AS							

Code	Scientific Name	Guam	Am. Samoa	Palau	Pohn-pei	Kos-rae	Yap	Chuuk	CNMI	Mar Isl
615	Planchonella torricellensis		AS							
616	Pleiogynium timoriense		AS							
617	Polyathia sp. Nova		AS							
618	Polyscias multijuga		AS							
619	Polyscias samoensis		AS							
620	Pometia pinnata		AS				YAP			
621	Pouteria caimito		AS							
622	Premna serratifolia		AS							
623	Pritchardia pacifica		AS							
624	Psidium guajava	GUM	AS	PAL	PON		YAP		NMI	
625	Psychotria grandistipulata		AS							
626	Psychotria insularum		AS							
627	Psydrax odorata		AS							
628	Rapanea myricifolia		AS							
629	Reynoldsia lanotoensis		AS							
630	Reynoldsia pleiosperma		AS							
631	Rheedula edulis		AS							
632	Rhizophora mangle		AS							
633	Rhizophora stylosa		AS							
634	Rhus taitensis	GUM	AS	PAL			YAP			
635	Rollinia deliciosa		AS							
636	Samanea saman	GUM	AS	PAL		KOS	YAP		NMI	
637	Sandoricum koetjape	GUM	AS							
638	Santalum yasi		AS							
639	Sapindus vitiensis		AS							
640	Sarcopygme pacifica		AS							
642	Schefflera samoensis		AS							
643	Schleinitzia insularum		AS							
644	Securinega flexuosa		AS							
645	Semecarpus vitiensis		AS							
646	Serianthes melanesica		AS							
647	Sesbania grandiflora	GUM	AS	PAL						
648	Solanum vitiense		AS							
649	Sophora tomentosa		AS	PAL	PON					MAR
650	Spathodea campanulata	GUM	AS	PAL			YAP			
651	Spiraeanthemum samoense		AS							
652	Spondias dulcis		AS	PAL				TRK		
653	Sterculia fanaiho		AS							
654	Streblus anthropophagorum		AS							
655	Swietenia macrophylla		AS	PAL						
656	Synsepalum dulcificum		AS							

Code	Scientific Name	Guam	Am. Samoa	Palau	Pohn-pei	Kos-rae	Yap	Chuuk	CNMI	Mar Isl
657	Syzgium corynocarpum		AS							
658	Syzygium brevifolium		AS							
659	Syzygium carolinense		AS							
660	Syzygium clusiifolium		AS							
661	Syzygium dealatum		AS							
662	Syzygium inophylloides		AS							
663	Syzygium jambos		AS							
664	Syzygium richii		AS							
665	Syzygium samarangense		AS							
666	Syzygium samoense		AS							
667	Syzygium savaiiense		AS							
668	Tabernaemontana pandacaqui		AS							
669	Tarenna sambucina	GUM	AS						NMI	
670	Terminalia catappa	GUM	AS	PAL	PON	KOS	YAP	TRK	NMI	MAR
672	Terminalia glabrata		AS							
673	Terminalia richii		AS							
674	Terminalia samoensis	GUM	AS	PAL	PON		YAP	TRK		MAR
675	Theobroma cacao	GUM	AS	PAL			YAP			
676	Thespesia populnea	GUM	AS	PAL	PON	KOS	YAP	TRK	NMI	MAR
678	Tournefortia argentea	GUM	AS	PAL	PON	KOS	YAP	TRK	NMI	MAR
679	Trema cannabina		AS	PAL						
680	Trichospermum richii		AS							
681	Vavaea amicorum		AS							
682	Veitchia merrillii	GUM	AS							
683	Wedelia biflora		AS							
684	Weinmannia affinis		AS							
685	Xylocarpus granatum	GUM	AS	PAL	PON	KOS	YAP	TRK		
686	Xylocarpus moluccensis	GUM	AS	PAL			YAP			
688	Xylosma samoense		AS							
689	Xylosma smithianum		AS							
690	Zanthophyllum pinnatum		AS							
691	Cyathea lunulata	GUM	AS	PAL						
692	Pandanus tectorius	GUM	AS	PAL	PON		YAP		NMI	
695	Avicennia mariana	GUM		PAL			YAP			
701	Polyscias grandifolia	GUM		PAL			YAP	TRK	NMI	
703	Kleinhovia hospita	GUM	AS	PAL	PON			TRK		
705	Elaeocarpus tongnus		AS							
706	Glochidion ramiflorum		AS							
708	Ceriops tagal			PAL						
713	Dracaena multiflora			PAL						
715	Maytenus palauica			PAL						
716	Osmoxylon oliveri			PAL						

Code	Scientific Name	Guam	Am. Samoa	Palau	Pohn-pei	Kos-rae	Yap	Chuuk	CNMI	Mar Isl
717	Osmoxylon pachphyllum			PAL						
718	Osmoxylon truncatum			PAL						
720	Rhizophora lamarkii			PAL						
722	Symplocos racemosa			PAL						
723	Timonius corymbosus			PAL						
724	Timonius mollis			PAL						
726	Timonius subauritus			PAL						
727	Timonius timon			PAL						
800	Aglaia palauensis			PAL						
801	Aglaia ponapensis				PON					
802	Albizia falcataria			PAL						
803	Albizia retusa			PAL						
804	Allophylus ternatus			PAL	PON					
805	Alphitonia carolinensis			PAL						
806	Angiopteris evecta			PAL	PON		YAP			
807	Astronidium palauense			PAL						
808	Badusa palauensis			PAL						
809	Bauhinia binata			PAL						
810	Buchanania engleriana			PAL						
811	Buchanania palawensis			PAL						
812	Calophyllum pelewense			PAL						
813	Calophyllum soulattri			PAL						
814	Campnosperma brevipetiolata			PAL	PON	KOS	YAP			
815	Canarium hirsutum			PAL						
816	Canarium indicum									MAR
817	Caryota mitis			PAL						
818	Casearia cauliflora			PAL						
819	Cassia grandis			PAL						
820	Cassia siamea			PAL			YAP			
821	Celtis paniculata			PAL			YAP			
822	Cerbera floribunda			PAL						
823	Cinnamomum carolinense			PAL	PON	KOS				
824	Cinnamomum pedatinervium			PAL						
825	Cinnamomum sessilifolium				PON					
826	Citrus mitis			PAL			YAP			
827	Claoxylon carolinianum				PON					
828	Claoxylon fallax			PAL						
829	Claoxylon longiracemosum			PAL						
830	Cleistanthus carolinensis			PAL						
831	Cleistanthus insularis			PAL						

Code	Scientific Name	Guam	Am. Samoa	Palau	Pohn-pei	Kos-rae	Yap	Chuuk	CNMI	Mar Isl
832	Colona scabra			PAL						
833	Combretum tetralophum			PAL						
834	Cordia micronesica			PAL						
835	Cordia sebestena			PAL						
836	Cyathea nigricans			PAL	PON					
837	Cyathea ponapeana				PON	KOS				
838	Cycas revoluta			PAL						
839	Diospyros ferrea			PAL			YAP			
840	Dolichandrone spathacea			PAL			YAP			
842	Drypetes nitida			PAL						
843	Elaeis guineensis			PAL	PON					
844	Elaeocarpus carolinensis			PAL	PON	KOS				
845	Elaeocarpus kerstingianus				PON					
846	Elaeocarpus kusanoi				PON					
1400	Eucalyptus sp.			PAL						
848	Eugenia aquea			PAL						
849	Eugenia caryophyllus			PAL						
850	Eugenia nitida			PAL						
851	Eugenia palauensis			PAL						
852	Eugenia suzukii			PAL						
854	Evodia hortensis				PON					
855	Evodia nitida			PAL						
856	Evodia palawensis			PAL						
857	Evodia ponapensis				PON					
858	Evodia trichantha			PAL						
859	Exorrhiza ponapensis				PON					
860	Fagraea ksid			PAL						
861	Ficus saffordii			PAL						
863	Finischia chloroxantha			PAL						
864	Garcinia matudai			PAL						
865	Garcinia ponapensis				PON					
866	Garcinia rumiyo			PAL			YAP			
867	Gmelina palawensis			PAL						
868	Gnetum gnemon			PAL						
869	Gmelina elliptica			PAL						
870	Goniothalamus carolinensis			PAL						
871	Gulubia palauensis			PAL						
872	Horsfieldia amklaal			PAL						
873	Horsfieldia novo-guineensi			PAL						
874	Horsfieldia palauensis			PAL						
875	Kayea pacifica			PAL						
876	Macaranga carolinensis			PAL	PON	KOS	YAP	TRK		

Code	Scientific Name	Guam	Am. Samoa	Palau	Pohn-pei	Kos-rae	Yap	Chuuk	CNMI	Mar Isl
877	Mallotus palauensis			PAL						
878	Mallotus tiliaefolius			PAL						
879	Mangifera minor				PON					
880	Manilkara hoshinoi				PON					
882	Manilkara udoido			PAL						
883	Marattia fraxinea			PAL						
884	Medusanthera carolinensis			PAL						
885	Melaleuca quinquenervia			PAL						
886	Meryta senfftiana			PAL						
887	Metroxylon sagu			PAL						
888	Morinda latibracteata			PAL						
889	Morinda pendunculata			PAL						
890	Musa coccinea			PAL						
891	Musa nana				PON					
892	Musa sapientum			PAL	PON					MAR
893	Musa textilis			PAL	PON					
894	Musa tikap				PON					
895	Musa troglodytarum						YAP			
896	Mussaenda frondosa						YAP			
897	Myristica insularis			PAL	PON					
898	Neubergia celebica			PAL		KOS				
899	Nypa fruticans			PAL	PON	KOS	YAP	TRK		
900	Ochroma pyramidale			PAL						
901	Ormosia calavensis			PAL						
902	Pachira aquatica			PAL						
903	Pandanus aimiriikensis			PAL						
905	Pandanus cominsii				PON					
906	Pandanus compressus			PAL	PON					
907	Pandanus cylindricus				PON			TRK		
908	Pandanus dilatatus				PON					
909	Pandanus divergens			PAL						
910	Pandanus duriocarpus			PAL						
911	Pandanus enchabiensis									MAR
912	Pandanus fischerianus				PON					
913	Pandanus hosinoi				PON					
914	Pandanus jalvitensis				PON	KOS				MAR
915	Pandanus kanehirae			PAL						
916	Pandanus kororensis			PAL						
917	Pandanus lakatwa									MAR
918	Pandanus laticanalicula									MAR
919	Pandanus macrocephalus				PON					MAR
920	Pandanus			PAL						

Code	Scientific Name	Guam	Am. Samoa	Palau	Pohn-pei	Kos-rae	Yap	Chuuk	CNMI	Mar Isl
	macrojeanneretia									
921	Pandanus menne									MAR
922	Pandanus obliguus									MAR
923	Pandanus odontoides				PON					
924	Pandanus palawensis			PAL						
925	Pandanus patina				PON					
926	Pandanus peliliuensis			PAL						
927	Pandanus ponapensis				PON					
928	Pandanus pulposus				PON					MAR
929	Pandanus rectangulatus									MAR
930	Pandanus rotundatus				PON					
931	Pandanus tolotomensis				PON					
932	Pandanus trukensis									MAR
933	Pandanus utiyamai				PON					
934	Pandanus variegatus			PAL						
935	Parinari corymbosa			PAL						
936	Parinari laurina			PAL	PON	KOS	YAP	TRK		
937	Parkia parvifoliola			PAL						
938	Pinanga insignis			PAL						
939	Polyscias nodosa			PAL						
940	Ponapea hosinoi				PON					
941	Ponapea ledermanniana					KOS				
942	Pouteria calcarea			PAL						
943	Premna pubescens			PAL						
944	Ptychosperma kusaiensis					KOS				
945	Ptychosperma palauensis			PAL						
946	Rauvolfia insularis			PAL						
947	Ravenala madagascariensis			PAL						
948	Rinorea carolinensis			PAL						
949	Roystonea oleracea			PAL						
950	Samadera indica			PAL						
951	Sapium indicum			PAL						
952	Scyphiphora hydrophyllacea			PAL			YAP			
953	Semecarpus venenosus			PAL			YAP			
954	Serianthes kanehirae			PAL			YAP			
955	Spondias mombin			PAL						
956	Spondias pinnata			PAL						
957	Stemonurus ammui			PAL						
958	Sterculia palauensis			PAL						
959	Swietenia mahogoni			PAL		KOS	YAP			
960	Tabernaemontana			PAL						

Code	Scientific Name	Guam	Am. Samoa	Palau	Pohn-pei	Kos-rae	Yap	Chuuk	CNMI	Mar Isl
	aurantiaca									
961	Tecoma stans			PAL						
962	Tectona grandis			PAL		KOS				
963	Terminalia carolinensis				PON	KOS				
964	Terminalia crassipes			PAL						
965	Terminalia edulis			PAL						
966	Terminalia kaernbachii			PAL						
967	Trichospermum ikutai						YAP			
968	Trichospermum ledermannii			PAL						
969	Vitex coffassus			PAL						
993	Melia azedarach	GUM			PON		YAP			
999	Unknown, other	GUM	AS	PAL	PON	KOS	YAP	TRK	NMI	MAR
>999	see GENUS CODES									
9000	to 9999 Unknowns									

Palau Tree Species

Code	Scientific Name	Palau Common name		Code	Scientific Name	Palau Common name
278	Acacia confusa	ianangi		293	Artocarpus altilis	arandu, meduu, breadfruit
1011	Acacia spp.			294	Artocarpus heterophyllus	baramits
400	Adenanthera pavonina	telentundalel		110	Artocarpus mariannensis	chebiei, mediuu liou
800	Aglaia palauensis	mesecheues		295	Artocarpus nobilis	
1010	Aglaia spp.			1080	Artocarpus spp.	meduu
101	Aidia racemosa	kerumes, omail		807	Astronidium palauense	meskui
802	Albizia falcataria	ukall ra ngebard		1090	Astronidium spp.	
102	Albizia lebbeck			427	Averrhoa bilimbi	imukurs, oterebekii
803	Albizia retusa	ukall ra ngebard		428	Averrhoa carambola	kemim, ourderteboteb
1000	Albizia spp.			1100	Averrhoa spp.	
1030	Allophylus spp.			695	Avicennia mariana	dadaiit
804	Allophylus ternatus	chebeludes		1110	Avicennia spp.	
408	Allophylus timorensis	ebeludes, chebeludes		808	Badusa palauensis	ralm
805	Alphitonia carolinensis	chelebiob, elebiong		430	Barringtonia asiatica	bdull
1040	Alphitonia spp.			112	Barringtonia racemosa	koranges
806	Angiopteris evecta	dermarm		1120	Barringtonia spp.	
412	Annona muricata	sausab		809	Bauhinia binata	
105	Annona reticulata	ngel ra ngebard		113	Bauhinia monandra	Orchid tree
1050	Annona spp.			1130	Bauhinia spp.	
413	Annona squamosa	ngel ra ngebard		435	Bruguiera gymnorrhiza	kodenges, denges
106	Antidesma bunius	jiam, siam		810	Buchanania engleriana	omail
1060	Antidesma spp.			811	Buchanania palawensis	omail, deuachel
111	Araucaria excelsa			1140	Buchanania spp.	
108	Araucaria heterophylla	norfolk island pine		440	Calophyllum inophyllum	btaches
1070	Araucaria spp.			812	Calophyllum pelewense	chesemolech
417	Areca catechu	buuch, betel nut		813	Calophyllum soulattri	olebtaches, chesemolech
109	Arenga pinnata			1150	Calophyllum spp.	

Code	Scientific Name	Palau Common name		Code	Scientific Name	Palau Common name
814	Campnosperma brevipetiolata	kelela charm, kiu		122	Citrus grandis	siabong
441	Cananga odorata	irang, chirang		124	Citrus limon	lemon, malchianged, debechel
815	Canarium hirsutum	mesecheues		826	Citrus mitis	calamondin, kingkang
1160	Canarium spp.			463	Citrus reticulata	kerekur
448	Carica papaya	bobai, chebingel		1240	Citrus spp.	bekersiu, cheritel
817	Caryota mitis	fish tail palm		828	Claoxylon fallax	
1170	Caryota spp.			829	Claoxylon longiracemosum	
818	Casearia cauliflora	keuert		1250	Claoxylon spp.	
1180	Casearia spp.			830	Cleistanthus carolinensis	
450	Cassia fistula	shower tree		831	Cleistanthus insularis	
819	Cassia grandis	pink shower		1260	Cleistanthus spp.	
820	Cassia siamea	kassod tree		466	Cocos nucifera	lius, coconut
1190	Cassia spp.			129	Coffea arabica	kohi, coffee
452	Casuarina equisetifolia	ngas, ironwood		1270	Coffea spp.	
117	Casuarina litorea	gagu,australian pine		832	Colona scabra	uab, chuchab
1200	Casuarina spp.			833	Combretum tetralophum	ochaol
119	Ceiba pentandra	kalngebard		468	Commersonia bartramia	eremallueang, chermallucheang
821	Celtis paniculata			834	Cordia micronesica	
1210	Celtis spp.			835	Cordia sebestena	kalau, kelau
822	Cerbera floribunda	emeridech		1290	Cordia spp.	
454	Cerbera manghas	emeridech		472	Cordia subcordata	baderirt, badrirs
1220	Cerbera spp			1300	Cryptocarya spp.	
708	Ceriops tagal	biut		691	Cyathea lunulata	eluu, tree fern, cheluu
457	Chrysophyllum cainito	kaimito, kemim, star apple		836	Cyathea nigricans	
823	Cinnamomum carolinense	ochod		1310	Cyathea spp.	
824	Cinnamomum pedatinervium	ochod		134	Cycas circinalis	kokeal, remiang
1230	Cinnamomum spp.			838	Cycas revoluta	remiang
458	Cinnamomum verum	ochod ra ngebard, cinnamontree		1311	Cycas spp.	
461	Citrus aurantifolia	malchianged		135	Cynometra ramiflora	kalengui, ketenguit

Code	Scientific Name	Palau Common name		Code	Scientific Name	Palau Common name
485	Delonix regia	nangyo, nangiosikura		852	Eugenia suzukii	rebotel
487	Diospyros discolor	matib, velvet apple		855	Evodia nitida	kertub
839	Diospyros ferrea			856	Evodia palawensis	beror
1330	Diospyros spp.			1400	Evodia spp.	
712	Dodonaea viscosa			858	Evodia trichantha	
840	Dolichandrone spathacea	rríu		515	Excoecaria agallocha	las, blinding tree
713	Dracaena multiflora.	orredakel		516	Fagraea berteriana	chelilai
842	Drypetes nitida	kevert		860	Fagraea ksid	ksid
1340	Drypetes spp.			1410	Fagraea spp.	
1350	Dysoxylum spp.			149	Ficus carica	uosech (kall)
843	Elaeis guineensis	oil nut palm		150	Ficus elastica	komunokí, rubber plant
844	Elaeocarpus carolinensis			352	Ficus microcarpa	lulk, chinese banyan
142	Elaeocarpus joga	dekemerír		519	Ficus prolixa	lulk, banyan
1360	Elaeocarpus spp.			861	Ficus saffordii	lulk, banyan
508	Erythrina fusca	roro		1420	Ficus sp.	
1370	Erythrina spp.			521	Ficus tinctoria	oseked
510	Erythrina variegata	roro		215	Ficus virens	lulu, banyan
339	Eucalyptus deglupta	eucalyptus		863	Finischia chloroxantha	
213	Eucalyptus globulus			216	Flacourtia rukam	
340	Eucalyptus pilularis			526	Garcinia mangostana	mangostin
341	Eucalyptus robusta	swampy mahogany		864	Garcinia matudai	tilol
342	Eucalyptus saligna			866	Garcinia rumiyo	tilol
343	Eucalyptus sideroxylon			1430	Garcinia sp.	
1380	Eucalyptus spp.			532	Gironniera celtiifolia	
848	Eugenia aquea	edebsachel, chedebsachel		151	Gliricida sepium	
849	Eugenia caryophyllus	cloves		706	Glochidion ramiflorum	
143	Eugenia cuminii	mesekerrak, java plum		1440	Glochidion sp.	
144	Eugenia javanica	rebotel		869	Gmelina elliptica	belau
145	Eugenia malaccensis	kidel		867	Gmelina palawensis	blacheos
850	Eugenia nitida			1450	Gmelina sp.	
851	Eugenia palauensis	orenged		868	Gnetum gnemon	
512	Eugenia reinwardtiana	kesiil		870	Goniothalamus carolinensis	
1390	Eugenia spp.			358	Grevillea robusta	

Code	Scientific Name	Palau Common name		Code	Scientific Name	Palau Common name
536	Guettarda speciosa	belau		1570	Mangifera sp.	
871	Gulubia palauensis	bochela uchererak, uch		1580	Manilkara sp.	
544	Heritiera littoralis	ebibech, chebibecb		882	Manilkara udoido	udeuid
1480	Heritiera sp.			166	Manilkara zapota	sapodilla
156	Hernandia sonora	doko		883	Marattia fraxinea	dermarm
1490	Hernandia sp.			715	Maytenus palauica	
157	Heterospathe elata	demailei, ebouch		884	Medusanthera carolinensis	
361	Hevea brasiliensis			1590	Medusanthera sp.	
548	Hibiscus tiliaceus	cheramall		885	Melaleuca quinquenervia	paperbark guava
872	Horsfieldia amklaal	chemeklachel, eumail		886	Meryta senfftiana	omechidel
873	Horsfieldia novo-guineensi	chersachel		1600	Meryta sp.	
874	Horsfieldia palauensis	chersachel		169	Metroxylon amicarum	ivory-nut palm
1500	Horsfieldia sp.			887	Metroxylon sagu	sago palm
550	Inocarpus fagifer	keam		1610	Metroxylon sp.	
551	Intsia bijuga	dort		585	Millettia pinnata	
875	Kayea pacifica	ketoguit		586	Morinda citrifolia	ngel, kesengelngel
703	Kleinhovia hospita	madudiu		888	Morinda latibracteata	ngel
556	Leucaena leucocephala	telengtund		889	Morinda pendunculata	kesengelengel, ngel
1510	Leucaena sp.			1620	Morinda sp.	
558	Litchi chinensis	litchi		171	Moringa oleifera	malungkai, drumstick tree
562	Lumnitzera littorea	ngemoel, mekekad		173	Muntingia calabura	budo
161	Macadamia integrifolia			890	Musa coccinea	bungeltuu
1530	Macadamia sp			892	Musa sapientum	tuu, banana
876	Macaranga carolinensis	bedel		1630	Musa spp.	
1540	Macaranga sp.			893	Musa textilis	blantalos
877	Mallotus palauensis			590	Myristica hypargyraea	
1550	Mallotus sp			897	Myristica insularis	adepurot
878	Mallotus tiliaefolius			1650	Myristica spp.	
163	Mammea odorata	ongolbeosachel, odebisech		591	Neisosperma oppositifolia	uaoch
1560	Mammea sp.			593	Nephelium lappaceum	rambotang
569	Mangifera indica	ledel, mango		898	Neubergia celebica	kalm, aralm

Code	Scientific Name	Palau Common name		Code	Scientific Name	Palau Common name
899	Nypa fruticans	toechel, teuechel		938	Pinanga insignis	chebouch, demailei
900	Ochroma pyramidale	balsa		605	Pipturus argenteus	oliulakerasus
1660	Omalanthus spp.			606	Pisonia grandis	mesbesibech, chimoi
901	Ormosia calavensis	amansis, edebsungelked, necklace bead tree		1720	Pisonia sp.	
716	Osmoxylon oliveri	kesiamel		607	Pisonia umbellifera	udeuidar bekai
717	Osmoxylon pachphyllum	kesiamel		385	Pithecellobium dulce	kamatsiri
1670	Osmoxylon spp.			184	Plumeria obtusa	elilai ra ngebard
718	Osmoxylon truncatum	kesiamel		185	Plumeria rubra	elilai ra ngebard, chelilairangebard
902	Pachira aquatica	miich era ngebard, guiana chestnut		1721	Plumeria sp.	
903	Pandanus aimiriikensis	chertochet		701	Polyscias grandifolia	bungaruau
906	Pandanus compressus	ongor		939	Polyscias nodosa	bngei
909	Pandanus divergens	ongor		1750	Polyscias sp.	
175	Pandanus dubius	beku, ongor		186	Pongamia pinnata	kisaks
910	Pandanus duriocarpus	ongor		942	Pouteria calcarea	elangel, chelangel
915	Pandanus kanehirae	buuk		188	Pouteria obovata	elangel, chelangel
916	Pandanus kororensis	siu		1770	Pouteria sp.	
920	Pandanus macrojeanneretia	ongor, ertochet		190	Premna obtusifolia (serratifolia)	osem, chosm
924	Pandanus palawensis	ongor, ertochet		943	Premna pubescens	
926	Pandanus peliliuensis	ongor		1780	Premna sp.	
1680	Pandanus sp.			624	Psidium guajava	kuabang, guava
692	Pandanus tectorius	ongor		194	Pterocarpus indicus	las
934	Pandanus variegatus	berrakelongor		945	Ptychosperma palauensis	chesdbuuch
178	Pangium edule	riamel		1800	Ptychosperma sp	
935	Parinari corymbosa (Maranthes)	bkau		946	Rauvolfia insularis	omechidel
936	Parinari laurina (Atuna)	eritem, cheritim		947	Ravenala madagascariensis	travelers palm
1690	Parinari sp.			195	Rhizophora apiculata	bngaol
937	Parkia parvifoliola	kmekumer		720	Rhizophora lamarkii	
602	Pemphis acidula	ngis		196	Rhizophora mucronata	tebechel
603	Persea americana	bata, avacado		1820	Rhizophora sp.	

Code	Scientific Name	Palau Common name		Code	Scientific Name	Palau Common name
633	Rhizophora stylosa			965	Terminalia edulis	esemiich, chesemiich
634	Rhus taitensis	eues, choes		966	Terminalia kaernbachii	tropical almond
948	Rinorea carolinensis			674	Terminalia samoensis	esemiich
949	Roystonea oleracea	royal palm		1850	Terminalia sp.	
950	Samadera indica	etkeam, cheskeam		675	Theobroma cacao	suklatei, cocoa
636	Samanea saman			676	Thespesia populnea	badrerirt
951	Sapium indicum	maskerekur		723	Timonius corymbosus	
952	Scyphiphora hydrophyllacea	kuat		724	Timonius mollis	
953	Semecarpus venenosus	tonget		1860	Timonius sp.	
954	Serianthes kanehirae	ukall		726	Timonius subauritus	
647	Sesbania grandiflora	katurai		727	Timonius timon	
200	Sonneratia alba	churur, urur		678	Tournefortia argentea	rirs, tree heliotrope
649	Sophora tomentosa	dudurs, silver bush		679	Trema cannabina	chelodechoel
650	Spathodea campanulata	african tulip tree		204	Trema orientalis	chelodechoel
652	Spondias dulcis	meseiedel, mesechoes		1870	Trema sp.	
955	Spondias mombin	meseheol		968	Trichospermum ledermannii	elsau, oleiulakersus
956	Spondias pinnata	titímel		205	Tristiropsis obtusangula	
1830	Spondias sp.			999	Unknown, other	
957	Stemonurus ammui	ngmui		969	Vitex coffassus	bars, beokl
958	Sterculia palauensis			1880	Vitex sp.	
655	Swietenia macrophylla	mahogany, honduras mahogany		207	Ximenia americana	kerekurlechol
959	Swietenia mahogoni	mahogany		685	Xylocarpus granatum	meduulokebong
1840	Swietenia sp.			686	Xylocarpus moluccensis	puzzlenut
722	Symplocos racemosa	chebtui, ebtui		1890	Xylocarpus sp.	
960	Tabernaemontana aurantiaca					
961	Tecoma stans					
962	Tectona grandis	tsik, teak				
670	Terminalia catappa	beach almond, miich, otochel				
964	Terminalia crassipes	esemiich, chesemiich				

Guam Tree Species

Code	Scientific Name	GUM Common name		Code	Scientific Name	Common name
278	Acacia confusa	formosa acacia		441	Cananga odorata	ilang-ilang
281	Acacia koa	trokon boforeng		448	Carica papaya	papaya
400	Adenanthera pavonina	kulalis		115	Caryota urens	fishtail palm
100	Aglaia mariannensis	mapuñao		450	Cassia fistula	canafistula, golden shower
101	Aidia cochinchinensis	smak, sumac		116	Cassia javanica	pinkshower
102	Albizia lebbeck	mamis		452	Casuarina equisetifolia	ngas, ironwood
407	Aleurites moluccana	raguar		118	Catalpa longissima	yokewood
103	Aleurites trisperma	lumbang		119	Ceiba pentandra	algodon de manila
408	Allophylus timorensis			120	Cerbera dilatata	chuti
104	Anacardium occidentale	casue, cashew nut		50	Cinnamomum camphora	camphor
412	Annona muricata	laguaná, kasoy, soursop		461	Citrus aurantifolia	lemon
105	Annona reticulata	annonas		121	Citrus aurantium	kahel, sour orange
413	Annona squamosa	ates, sugar apple		122	Citrus grandis	grapefruit, kahet magas
106	Antidesma bunius	biknai		212	Citrus hystrix	limon china
107	Araucaria columnaris	cook pine		124	Citrus limon	lemon reat
108	Araucaria heterophylla	Norfolk island pine		125	Citrus macroptera	kahet, wild orange
417	Areca catechu	puguá		126	Citrus medica	limon real, citron
109	Arenga pinnata	cabo-negro		463	Citrus reticulata	kahenakikiki, tangerine mandarin
293	Artocarpus altilis	lemai, breadfruit		464	Citrus sinensis	cahet, sweet orange
294	Artocarpus heterophyllus	jack fruit		127	Claoxylon marianum	katteknau, katot
110	Artocarpus mariannensis	dugdug, Marianas breadfruit		128	Coccoloba uvifera	sea-grape
427	Averrhoa bilimbi	bilimbi, pikue		466	Cocos nucifera	niyok, coconut palm
428	Averrhoa carambola	bilembines, star fruit		129	Coffea arabica	arabian coffee, café
695	Avicennia mariana			130	Coffea liberica	liberian coffee
430	Barringtonia asiatica	puting		131	Cordia dichotoma	
112	Barringtonia racemosa	langaasag		472	Cordia subcordata	niyoron
113	Bauhinia monandra	Saint Thomas tree, mariposa		132	Crescentia alata	houka, calabash
435	Bruguiera gymnorrhiza			133	Cryptomeria japonica	sugi
114	Caesalpinia sappan	paeao, sappan		691	Cyathea lunulata	chacha, tree fern
440	Calophyllum inophyllum	daok, alexandrian laurel		134	Cycas circinalis	fandan

Code	Scientific Name	GUM Common name		Code	Scientific Name	Common name
135	Cynometra ramiflora	gulos		358	Grevillea robusta	silky-oak
136	Cyphomandra betacea	tree-tomato		535	Grewia crenata	angilao
485	Delonix regia	flame tree, arbol del fuego		152	Guaiacum officinale	lignum-vitae, guayacan
137	Dendrocnide latifolia	kahtat		153	Guamia mariannae	paipai
138	Dictyosperma album	redpalm		536	Guettarda speciosa	pano
487	Diospyros discolor	mabolo, butter fruit		544	Heritiera littoralis	ufa
488	Diospyros ebenaster	black sapote		154	Heritiera longipetiolata	ufa halemtano
140	Diospyros kaki	persimmon		155	Hernandia ovigera	
141	Discocalyx ponapensis	otot		156	Hernandia sonora	nonak
142	Elaeocarpus joga	joga		157	Heterospathe elata	palma brava
329	Eriobotrya japonica	loquat		361	Hevea brasiliensis	para rubber tree
510	Erythrina variegata	gabgab, coral tree		548	Hibiscus tiliaceus	sea-hibiscus, pago
143	Eugenia cuminii	duhat		550	Inocarpus fagifer	budo buoy, tahitian chestnut
144	Eugenia javanica	macupa, wax apple		551	Intsia bijuga	ifil
145	Eugenia malaccensis	makupa, malay apple		703	Kleinhovia hospita	
214	Eugenia palumbis	agatelang		555	Lansium domesticum	langsan
512	Eugenia reinwardtiana	a'abang		158	Latania loddigesii	bluelatan
146	Eugenia stelechantha	luluhut		159	Leucaena insularum	
147	Eugenia thompsonii	atoto		556	Leucaena leucocephala	tantangan
515	Excoecaria agallocha	blinding tree		160	Livistonia chinensis	chinese fan palm
516	Fagraea berteriana			562	Lumnitzera littorea	bakauaine, nana
149	Ficus carica	figs, higos		161	Macadamia integrifolia	macadamia nut tree, pengua
150	Ficus elastica	india-rubbertree		162	Macaranga thompsonii	
352	Ficus microcarpa	nunu		163	Mammea odorata	chopak
519	Ficus prolixa	nunu		569	Mangifera indica	mango
521	Ficus tinctoria	hoda, tagete		164	Mangifera odorata	saipan mango
215	Ficus virens	higo		165	Manihot glaziovii	ceara rubber
151	Gliricida sepium	Madre de cacao		166	Manilkara zapota	chicle

Code	Scientific Name	GUM Common name		Code	Scientific Name	Common name
167	Melanolepis multiglandulosa	alom		607	Pisonia umbellifera	langsat
993	Melia azedarach	para'isu, chinaberry		385	Pithecellobium dulce	Kamachiles
168	Merrilliodendron megacarpum	faniok		184	Plumeria obtuse	Kalachucha
169	Metroxylon amicarum	ivory-nut palm		185	Plumeria rubra	frangipani, flores Mayu
170	Mimusops elengi	bulletwood, elengi		701	Polyscias grandifolia	
586	Morinda citrifolia	lada, indian mulberry		186	Pongamia pinnata	
171	Moringa oleifera	malongay, katdes, horseradish tree		187	Pouteria campechiana	eggfruit
172	Morus alba	seda		188	Pouteria obovata	lalahag
173	Muntingia calabura	calabura, manzanita		189	Pouteria sapota	sapota
587	Musa spp.	Banana		190	Premna obtusifolia	ahgao
174	Myrica rubra	yamamomo, strawberry tree		191	Prunus persica	peach
591	Neisosperma oppositifolia	faag		624	Psidium guajava	guava, abas
593	Nephelium lappaceum	logan		192	Psychotria mariana	aplohkateng
175	Pandanus dubius	pahong		193	Psychotria rotensis	
176	Pandanus fragrans	aggag		194	Pterocarpus indicus	narra
177	Pandanus sp.	kafo		195	Rhizophora apiculata	mangle
692	Pandanus tectorius	kafu		196	Rhizophora mucronata	mangle hembra
178	Pangium edule	rauel		634	Rhus taitensis	lamahu
382	Peltophorum pterocarpum	copperpod		197	Roystonea elata	florida royal palm
603	Persea americana	avocado, alageta		636	Samanea saman	raintree, monkeypod
179	Phoenix dactylifera	datepalm		637	Sandoricum koetjape	santol
180	Phoenix sylvestris	datepalm		198	Schefflera actinophylla	ivy palm
181	Phyllanthus acidus	tahitian gooseberry, iba		224	Schinus terebinthifolius	christmas berry
182	Pimenta pimentadioica	allspice		199	Serianthes nelsonii	hayun lago, trongkon guafi
183	Pimenta racemosa	bay rum		647	Sesbania grandiflora	katurai, hummingbird tree
605	Pipturus argenteus	amahazan		200	Sonneratia alba	mangrove
606	Pisonia grandis	amumo		650	Spathodea campanulata	african tulip tree
				201	Streblus pendulinus	

Code	Scientific Name	GUM Common name		Code	Scientific Name	Common name
202	Tabebuia pallida	pink tabebuia				
210	Tabernaemontana rotensis					
203	Tamarindus indica	tamarind, kalamendo				
669	Tarenna sambucina	sumac-lada				
670	Terminalia catappa	talisai				
674	Terminalia samoensis	talisai ganu				
675	Theobroma cacao	cacao				
676	Thespesia populnea	kilulo, milo				
678	Tournefortia argentea	hunig				
204	Trema orientalis	agaunai				
123	Triphasia trifolia					
205	Tristiropsis obtusangula	fai'a				
682	Veitchia merrillii					
206	Vitex parviflora					
207	Ximenia americana	sour plum, piut				
685	Xylocarpus granatum	lalanyog				
686	Xylocarpus moluccensis	puzzlenut, lamlamyok				
208	Xylosma nelsonii					
209	Zizyphus mauritiana	manzanita, jujube				
999	Unknown/ other					
9000	to 9999 Unknown					

American Samoa Tree Species

Code	Scientific Name	Samoa common name		Code	Scientific Name	Samoa common name
400	Adenanthera pavonina	lopa		436	Buchanania merrillii	
401	Aglaia heterotricha			437	Burckella richii	
402	Aglaia saltatorum			440	Calophyllum inophyllum	fetau
403	Aglaia samoensis			439	Calophyllum neo-ebudicum	tamanu
101	Aidia cochinchinensis			441	Cananga odorata	moso'oi
405	Albizia chinensis	tamalini		443	Canarium harveyi	
406	Alectryon samoensis			444	Canarium ovatum	Pili Nut
407	Aleurites moluccana			445	Canarium samoense	
409	Alphitonia zizpyoides	toi		446	Canarium vitiense	ma'ali
410	Alstonia pacifica			447	Canthium merrillii	
411	Anacolosa insularis			448	Carica papaya	esi, papaya
412	Annona muricata	Soursop		449	Casearia sp. nova	
413	Annona squamosa	Sugar Apple		450	Cassia fistula	
415	Antidesma sphaerocarpum			451	Castilla elastica	pulu mamoe
416	Antirhea inconspicua			452	Casuarina equisetifolia	Casuarina
111	Araucaria excelsa	Norfolk Island Pine		453	Celtis harperi	
417	Areca catechu	betelnut		454	Cerbera manghas	leva
293	Artocarpus altilis			455	Cerbera odollam	
419	Artocarpus odoratissima	Marang		456	Chionanthus vitiensis	
420	Arytera brackenridgei			457	Chrysophyllum cainito	Cainito / Star apple
421	Ascarina diffusa	afia		458	Cinnamomum verum	tinamoni
422	Astronidium navigatorum			460	Citronella samoensis	
423	Astronidium pickeringii			461	Citrus aurantifolia	Lime (Tipolo)
424	Astronidium samoense			462	Citrus maxima	Pommelo (Moli suka)
425	Astronidium subcordatum			463	Citrus reticulata	Tangerine
426	Atuna racemosa			464	Citrus sinensis	orange tree
427	Averrhoa bilimbi	Bilimbi		465	Claoxylon echinospermum	
428	Averrhoa carambola	Star fruit (Vineka)		466	Cocos nucifera	niu
429	Baccaurea taitensis			468	Commersonia bartramia	
430	Barringtonia asiatica	futu		469	Coprosma savaiiensis	
431	Barringtonia samoensis	futu		470	Coprosma strigulosa	
432	Bischofia javanica	'o'a		471	Cordia aspera	
433	Boehmeria virgata			472	Cordia subcordata	tauanave
434	Broussonetia papyrifera	paper mulberry		473	Crateva religiosa	
435	Bruguiera gymnorrhiza	togo		474	Crossostylis biflora	

Code	Scientific Name	Samoa common name		Code	Scientific Name	Samoa common name
475	Cryptocarya elegans			510	Erythrina variegata	gatae
476	Cryptocarya hornei			511	Erythrospermum acuminatissimum	
477	Cryptocarya samoensis			512	Eugenia reinwardtiana	
478	Cryptocarya turbinata			513	Eugenia uniflora	Surinam Cherry
479	Cryptocarya wilderi			514	Euphoria longana	Longan
480	Cupaniopsis samoensis			515	Excoecaria agallocha	
386	Cyathea decurrens	olioli		516	Fagraea berteriana	pualulu
691	Cyathea lunulata	olioli		517	Ficus godeffroyi	mati
387	Cyathea medullaris	olioli		518	Ficus obliqua	aoa
481	Cyathea spp.			519	Ficus prolixa	aoa
482	Cyathea truncata			520	Ficus scabra	
483	Cyclophyllum barbatum			521	Ficus tinctoria	
485	Delonix regia	flame tree		522	Ficus uniauriculata	
486	Dendrocnide harveyi	salato		216	Flacourtia rukam	filimoto
487	Diospyros discolor	Mabolo		524	Flueggea flexuosa	poumuli
488	Diospyros ebenaster			525	Funtumia elastica	pulu vao
489	Diospyros elliptica	'anume		526	Garcinia mangostana	Mangosteen
490	Diospyros major			527	Garcinia myrtifolia	
491	Diospyros samoensis	auli		528	Garcinia sessilis	
492	Dipteris conjugata			529	Gardenia taitensis `	
493	Drypetes vitiensis			530	Garuga floribunda	manuai, vivao
494	Durio zibethinus	Durian		531	Geniostoma rupestre	taipoipo
495	Dysoxylum forsteri			532	Gironniera celtiifolia	
496	Dysoxylum huntii	maota mea		533	Glochidion cuspidatum	masame
497	Dysoxylum maota	maota		706	Glochidion ramiflorum	masame
498	Dysoxylum samoense	mamala		535	Grewia crenata	
499	Dysoxylum spp.			536	Guettarda speciosa	puapua
500	Dysoxylum tongense			537	Guioa lenticifolia	
501	Elaeocarpus floridanus			538	Guioa rhoifolia	
502	Elaeocarpus graeffei			539	Gyrocarpus americanus	
503	Elaeocarpus grandis	sapatua		540	Haplolobus floribundus	
705	Elaeocarpus tongnus	a'amati'e		541	Harpullia arborea	
504	Elaeocarpus ulianus			542	Hedycarya denticulata	
505	Elattostachys falcata	taputo'i		543	Hedycarya dorstenioides	
506	Eleocharis dulcis			544	Heritiera littoralis	
507	Endiandra elaeocarpa			545	Heritiera ornithocephala	
508	Erythrina fusca	lalapa		546	Hernandia moerenhoutiana	pipi
509	Erythrina subumbrans	gatae palagi		547	Hernandia nymphaeifolia	pu'a, Chinese lantern tree

Code	Scientific Name	Samoa common name		Code	Scientific Name	Samoa common name
548	Hibiscus tiliaceus	fau		591	Neisosperma oppositifolia	fao
549	Homalium whitmeeanus			592	Neonauclea forsteri	afa
550	Inocarpus fagifer	ifi		593	Nephelium lappaceum	Rambutan
551	Intsia bijuga	ifilele		594	Ochrosia vitiensis	
703	Kleinhovia hospita	fu'afu'a		595	Omalanthus acuminatus	
554	Lagostromia speciosa	pride of India		596	Omalanthus nutans	fanuamamala
555	Lansium domesticum	Langsat		597	Palaquium stehlinii	gasu
556	Leucaena leucocephala	lusina		598	Pandanus reineckei	gsds
558	Litchi chinensis	Lychee		692	Pandanus tectorius	fasa
559	Litsea mellea			599	Paraserianthes falcataria	tamalini
560	Litsea samoensis	papaono		600	Parasponia andersonii	
561	Lucuma nervosa	Egg Fruit / Canistel		601	Parinari insularum	
562	Lumnitzera littorea			602	Pemphis acidula	
563	Macadamia tetraphylla	Macadamia Nut		603	Persea americana	avacado
564	Macaranga grayana			605	Pipturus argenteus	soga
565	Macaranga harveyana	lau pata		606	Pisonia grandis	pu'avai
566	Macaranga reineckei			607	Pisonia umbellifera	
567	Macaranga sp. nova			608	Pittosporum arborescens	
568	Macaranga stipulosa	lau fatu		609	Pittosporum samoense	
570	Mammea glauca			610	Planchonella garberi	'ala'a
569	Mangifera indica			611	Planchonella grayana	
571	Manilkara dissecta			612	Planchonella linggensis	
572	Manilkara samoensis			613	Planchonella membranacea	
573	Maniltoa grandiflora			614	Planchonella samoensis	mamalava
575	Medusanthera samoensis	matamo		615	Planchonella torricellensis	
577	Melicope retusa			616	Pleiogynium timoriense	
578	Melicytus samoensis			617	Polyathia sp. nova	
579	Melilcope lauterbachii			618	Polyscias multijuga	
580	Melochia aristata	ma'o		619	Polyscias samoensis	
581	Meryta macrophylla	fagufagu		620	Pometia pinnata	tava
582	Metrosideros collina			621	Pouteria caimito	Abiu
583	Michelia champaca	Orange Champak		622	Premna serratifolia	
584	Micromelum minutum			623	Pritchardia pacifica	fau palm
585	Millettia pinnata			624	Psidium guajava	ku'ava
586	Morinda citrifolia	nonu		625	Psychotria grandistipulata	
587	Musa spp.			626	Psychotria insularum	matalafi
588	Mussaenda raiateensis	aloalo vao		627	Psydrax odorata	
589	Myristica fatua	'atone		628	Rapanea myricifolia	togo vao
590	Myristica hypargyraea	'atone 'ulu		629	Reynoldsia lanotoensis	vi vao

Code	Scientific Name	Samoa common name		Code	Scientific Name	Samoa common name
630	Reynoldsia pleiosperma	vi vao		669	Tarenna sambucina	
631	Rheedula edulis	Rheedula		670	Terminalia catappa	talie
632	Rhizophora mangle	togo		672	Terminalia glabrata	
633	Rhizophora stylosa			673	Terminalia richii	malili
634	Rhus taitensis	tavai		674	Terminalia samoensis	talie
635	Rollinia deliciosa	Rollinia		675	Theobroma cacao	cocao
636	Samanea saman			676	Thespesia populnea	milo
637	Sandoricum koetjape	Santol		678	Tournefortia argentea	tausuni
638	Santalum yasi			679	Trema cannabina	magele
639	Sapindus vitiensis			680	Trichospermum richii	
640	Sarcopygme pacifica	u'unu		681	Vavaea amicorum	
642	Schefflera samoensis			682	Veitchia merrillii	Manila palm
643	Schleinitzia insularum			683	Wedelia biflora	
644	Securinega flexuosa	poumuli		684	Weinmannia affinis	
645	Semecarpus vitiensis			685	Xylocarpus granatum	
646	Serianthes melanesica			686	Xylocarpus moluccensis	le'ile'i
647	Sesbania grandiflora			688	Xylosma samoense	
648	Solanum vitiense			689	Xylosma smithianum	
649	Sophora tomentosa	silver bush		690	Zanthophyllum pinnatum	
650	Spathodea campanulata	fa'apisi				
651	Spiraeanthemum samoense					
652	Spondias dulcis					
653	Sterculia fanaiho	fana'io				
654	Streblus anthropophagorum					
655	Swietenia macrophylla					
656	Synsepalum dulcificum	Miracle Berry				
657	Syzgium corynocarpum	seasea				
658	Syzygium brevifolium					
659	Syzygium carolinense					
660	Syzygium clusiifolium	asi vai				
661	Syzygium dealatum	asi vai				
662	Syzygium inophylloides	asi				
663	Syzygium jambos	Rose Apple				
664	Syzygium richii					
665	Syzygium samarangense	nonu vao				
666	Syzygium samoense	fena vao				
667	Syzygium savaiiense					
668	Tabernaemontana pandacaqui					

Federated States of Micronesia Tree Species

Code	Species	Pohnpei common name	Yap Common Name	Kosrae common name	Chuuk common name
278	Acacia confusa	pilampwoia, formosan koa	formosan koa		formosan koa
400	Adenanthera pavonina				
801	Aglaia ponapensis	karasyu, marasau			
101	Aidia cochinchinensis	kahmant			
102	Albizia lebbeck				
407	Aleurites moluccana	sakan			
804	Allophylus ternatus	ungeh			
408	Allophylus timorensis	kitak, nguh	ngu, angel		ngo
806	Angiopteris evecta	payuit, umpai	mongmong		
412	Annona muricata	sae, truka shai	sausau		sasaf
108	Araucaria heterophylla				
417	Areca catechu	pu	pu		pu
293	Artocarpus altilis	mai, kuru	sou, maouli		mai
110	Artocarpus mariannensis	maipah	maifai, maisilog		breadfruit
427	Averrhoa bilimbi				
428	Averrhoa carambola	ansu	arfath		
695	Avicennia mariana				
430	Barringtonia asiatica	wi, kawausu	gul		kun
112	Barringtonia racemosa	wihnmoar, kange	waathul		son
113	Bauhinia monandra	flamboyant			
435	Bruguiera gymnorrhiza	lom, tongo	song		ong
114	Caesalpinia sappan	kasapal	sibukao		
440	Calophyllum inophyllum	tetau, isho, voi	ragich, biyuch		rekich
814	Campnosperma brevipetiolata	thong	ramluw		
441	Cananga odorata	pwurenwai			rekich
448	Carica papaya	mohmiyap	bweibwai		kippwau
820	Cassia siamea				
452	Casuarina equisetifolia	weku	nach		weku
119	Ceiba pentandra	cottin	batte ni gan' ken		
821	Celtis paniculata				
454	Cerbera manghas				
823	Cinnamomum carolinense	mattieu			
825	Cinnamomum sessilifolium	matieu			
461	Citrus aurantifolia	karer, laim	remong		naimis, limes
122	Citrus grandis				
212	Citrus hystrix				
125	Citrus macroptera				
826	Citrus mitis				
463	Citrus reticulata				
464	Citrus sinensis	orens	gurgur		
827	Claoxylon carolinianum	koee			

466	Cocos nucifera	niu	lu		nu
468	Commersonia bartramia	acarido, kahil	gagu, wapof		oun, tupuchol
472	Cordia subcordata	ikoh-ik, kanaw	gulu		anno, alau
836	Cyathea nigricans	kattar			
837	Cyathea ponapeana	kattar			
134	Cycas circinalis	manu atapapo	faltir, frotel		
135	Cynometra ramiflora	kameu			
485	Delonix regia	pilampwoia weitahta	sakuranirow		
839	Diospyros ferrea				
141	Discocalyx ponapensis	kachiel			
840	Dolichandrone spathacea				
843	Elaeis guineensis				
844	Elaeocarpus carolinensis	syatak			
845	Elaeocarpus kerstingianus				
846	Elaeocarpus kusanoi	maratte, opop			
508	Erythrina fusca	pahr			
510	Erythrina variegata	pahr	rar, lolo		par
144	Eugenia javanica	murop	faliap		
145	Eugenia malaccensis	apel	arfath		faniap
512	Eugenia reinwardtiana				
146	Eugenia stelechantha	kirekinwel, kahkarak			attieu
854	Evodia hortensis				
857	Evodia ponapensis				
515	Excoecaria agallocha				ousus
859	Exorrhiza ponapensis	kotop			
516	Fagraea berteriana	sair			seir
150	Ficus elastica	rapah	gak'iynigoma		
519	Ficus prolixa	aoa	giliau, aow au		au
521	Ficus tinctoria	ahwahn, neen	guwan, wach'guy		auwon
215	Ficus virens	kilee-ant, ayau	aou, ifaluk		kiliau, yaawo yewan
865	Garcinia ponapensis	konpuil			
866	Garcinia rumiyo				
532	Gironniera celtiifolia				
536	Guettarda speciosa	eet, pua	wut, blow		mosor
544	Heritiera littoralis	marapinset	rung		zwobott
156	Hernandia sonora	pingapin	gochal		akurang
157	Heterospathe elata				
548	Hibiscus tiliaceus	hau, kalau	hulifui, gaal		sinifo
550	Inocarpus fagifer	marrup	buoy		anilla, kurrak
551	Intsia bijuga	choyo	zort		kuren, tuamis
703	Kleinhovia hospita	kalau-n-ant			monou
556	Leucaena leucocephala				
562	Lumnitzera littorea	weingal	wei		wei, achoro
876	Macaranga carolinensis	apwid	bith		aput
163	Mammea odorata	luas	lifos, lubodal		lifaus

569	Mangifera indica	kangit	manga		manko
879	Mangifera minor	kanit			
880	Manilkara hoshinoi	kohle			
993	Melia azedarach	lelah	prais, indian lilac		
169	Metroxylon amicarum	oahs			abe, hibun
586	Morinda citrifolia	weipwul, nonu	lel, mangalueg		nen, nopur
173	Muntingia calabura				
891	Musa nana	tama			
892	Musa sapientum	tihus			
1650	Musa spp.		wir		
893	Musa textilis	utisel			
894	Musa tikap	tikap			
895	Musa troglodytarum				
896	Mussaenda frondosa				
897	Myristica insularis	karara			
591	Neisosperma oppositifolia	kitee, oomah	umwa, mo		umwa
898	Neubergia celebica				
899	Nypa fruticans	parem	ayeng		kua
905	Pandanus cominsii	matal			
906	Pandanus compressus	paho			
907	Pandanus cylindricus	silaue			sinnau
908	Pandanus dilatatus	kienpel			
175	Pandanus dubius	pakoa, kipar-n-ai			poak
912	Pandanus fischerianus	hara			
176	Pandanus fragrans	pakua	pogo		
913	Pandanus hosinoi	nenketak			
914	Pandanus jalvitensis	pacheren			
919	Pandanus macrocephalus	intekul, pasyure			
923	Pandanus odontoides				
925	Pandanus patina	peet			
927	Pandanus ponapensis	alwan, kipal, taip			
928	Pandanus pulposus	deipw, jomineia			
930	Pandanus rotundatus	magojokojok			
1700	Pandanus sp.				
692	Pandanus tectorius	hara	fach, choi		
931	Pandanus tolotomensis	kiparenwel			
933	Pandanus utiyamai	lajaperik			
178	Pangium edule	durien	rowal		
936	Parinari laurina	ais	adidi, gritin		ais
602	Pemphis acidula	ngi	hangi		chekis
605	Pipturus argenteus	oromah	yaroma		aroma
606	Pisonia grandis	puka	mwog		mok
184	Plumeria obtusa				
185	Plumeria rubra	pomaria	sauer		sour
701	Polyscias grandifolia				
620	Pometia pinnata				

940	Ponapea hosinoi	kattai			
941	Ponapea ledermanniana				
186	Pongamia pinnata				
190	Premna obtusifolia	sobuk, orr, varovaro	yar		umukau, nior
624	Psidium guajava	guahva	abas		
194	Pterocarpus indicus				
944	Ptychosperma kusaiensis				
195	Rhizophora apiculata	aak, akapa			
196	Rhizophora mucronata	akelel	chia, roway		chia
634	Rhus taitensis				
636	Samanea saman				
952	Scyphiphora hydrophyllacea				
953	Semecarpus venenosus				
954	Serianthes kanehirae				
200	Sonneratia alba	kwat, kotoh	abruk		sales
649	Sophora tomentosa	hakapini, rakau haiko, ti rakauhaiko			
650	Spathodea campanulata				
652	Spondias dulcis				mon
959	Swietenia mahogoni				
962	Tectona grandis				
963	Terminalia carolinensis	kehma			
670	Terminalia catappa	tipop, kekepin	kel		asas
674	Terminalia samoensis	win, pua rakau	kil		sin
675	Theobroma cacao				
676	Thespesia populnea	miro, pone	bangbeng		pona, okuran, likokon
678	Tournefortia argentea	titin, sisin, amunusut	chel		amoneset
967	Trichospermum ikutai				
999	Unknown, other				
685	Xylocarpus granatum	brok, pwulok, ploek brok	yamgur		punopun
686	Xylocarpus moluccensis				

Commonwealth of the Northen Mariana Islands Tree Species

Code	Scientific Name	CNMI Common name
278	Acacia confusa	formosa acacia
400	Adenanthera pavonina	kulalis
100	Aglaia mariannensis	mapuñao
101	Aidia cochinchinensis	smak, sumac
102	Albizia lebbeck	mamis
412	Annona muricata	laguaná, kasoy, soursop
413	Annona squamosa	ates, sugar apple
107	Araucaria columnaris	cook pine
417	Areca catechu	puguá
293	Artocarpus altilis	lemai, breadfruit
110	Artocarpus mariannensis	dugdug, Marianas breadfruit
427	Averrhoa bilimbi	bilimbi, pikue
430	Barringtonia asiatica	puting
113	Bauhinia monandra	Saint Thomas tree, mariposa
114	Caesalpinia sappan	paeao, sappan
440	Calophyllum inophyllum	daok, alexandrian laurel
441	Cananga odorata	ilang-ilang
452	Casuarina equisetifolia	gagu,australian pine
120	Cerbera dilatata	chuti
122	Citrus grandis	grapefruit, kahet magas
127	Claoxylon marianum	katteknau, katot
466	Cocos nucifera	niyok, coconut palm
472	Cordia subcordata	niyoron
485	Delonix regia	flame tree, arbol del fuego
137	Dendrocnide latifolia	kahtat
142	Elaeocarpus joga	joga
510	Erythrina variegata	gabgab, coral tree
146	Eugenia stelechantha	luluhut
147	Eugenia thompsonii	atoto
352	Ficus microcarpa	nunu
521	Ficus tinctoria	hoda, tagete
535	Grewia crenata	angilao
153	Guamia mariannae	paipai
536	Guettarda speciosa	pano
154	Heritiera longipetiolata	ufa halemtano
156	Hernandia sonora	nonak
551	Intsia bijuga	ifil
556	Leucaena leucocephala	tantangan
163	Mammea odorata	chopak
164	Mangifera odorata	saipan mango

Code	Scientific Name	CNMI Common name
167	Melanolepis multiglandulosa	alom
168	Merrilliodendron megacarpum	faniok
586	Morinda citrifolia	lada, indian mulberry
591	Neisosperma oppositifolia	faag
175	Pandanus dubius	pahong
692	Pandanus tectorius	kafu
178	Pangium edule	rauel
602	Pemphis acidula	Nigasi
183	Pimenta racemosa	bay rum
605	Pipturus argenteus	amahazan
606	Pisonia grandis	amumo
607	Pisonia umbellifera	langsat
385	Pithecellobium dulce	kamachiles
701	Polyscias grandifolia	
187	Pouteria campechiana	eggfruit
188	Pouteria obovata	lalahag
190	Premna obtusifolia	ahgao
624	Psidium guajava	guava, abas
192	Psychotria mariana	aplohkateng
636	Samanea saman	raintree, monkeypod
199	Serianthes nelsonii	hayun lago, trongkon guafi
200	Sonneratia alba	mangrove
203	Tamarindus indica	tamarind, kalamendo
669	Tarenna sambucina	sumac-lada
670	Terminalia catappa	talisai
676	Thespesia populnea	kilulo, milo
678	Tournefortia argentea	hunig
204	Trema orientalis	agaunai
123	Triphasia trifolia	Lemon de China
999	Unknown, other	
207	Ximenia americana	sour plum, piut
9000	to 9999 Unknown	

Marshall Island Tree Species

Code	Scientific Name	CNMI Common name
278	Acacia confusa	formosa acacia
400	Adenanthera pavonina	kulalis
100	Aglaia mariannensis	mapuñao
101	Aidia cochinchinensis	smak, sumac
102	Albizia lebbeck	mamis
412	Annona muricata	laguaná, kasoy, soursop
413	Annona squamosa	ates, sugar apple
107	Araucaria columnaris	cook pine
417	Areca catechu	puguá
293	Artocarpus altilis	lemai, breadfruit
110	Artocarpus mariannensis	dugdug, Marianas breadfruit
427	Averrhoa bilimbi	bilimbi, pikue
430	Barringtonia asiatica	puting
113	Bauhinia monandra	Saint Thomas tree, mariposa
114	Caesalpinia sappan	paeao, sappan
440	Calophyllum inophyllum	daok, alexandrian laurel
441	Cananga odorata	ilang-ilang
452	Casuarina equisetifolia	gagu,australian pine
120	Cerbera dilatata	chuti
122	Citrus grandis	grapefruit, kahet magas
127	Claoxylon marianum	katteknau, katot
466	Cocos nucifera	niyok, coconut palm
472	Cordia subcordata	niyoron
485	Delonix regia	flame tree, arbol del fuego
137	Dendrocnide latifolia	kahtat
142	Elaeocarpus joga	joga
510	Erythrina variegata	gabgab, coral tree
146	Eugenia stelechantha	luluhut
147	Eugenia thompsonii	atoto
352	Ficus microcarpa	nunu
521	Ficus tinctoria	hoda, tagete
535	Grewia crenata	angilao
153	Guamia mariannae	paipai
536	Guettarda speciosa	pano
154	Heritiera longipetiolata	ufa halemtano
156	Hernandia sonora	nonak
551	Intsia bijuga	ifil
556	Leucaena leucocephala	tantangan
163	Mammea odorata	chopak
164	Mangifera odorata	saipan mango

Code	Scientific Name	CNMI Common name
167	Melanolepis multiglandulosa	alom
168	Merrilliodendron megacarpum	faniok
586	Morinda citrifolia	lada, indian mulberry
591	Neisosperma oppositifolia	faag
175	Pandanus dubius	pahong
692	Pandanus tectorius	kafu
178	Pangium edule	rauel
602	Pemphis acidula	Nigasi
183	Pimenta racemosa	bay rum
605	Pipturus argenteus	amahazan
606	Pisonia grandis	amumo
607	Pisonia umbellifera	langsat
385	Pithecellobium dulce	kamachiles
701	Polyscias grandifolia	
187	Pouteria campechiana	eggfruit
188	Pouteria obovata	lalahag
190	Premna obtusifolia	ahgao
624	Psidium guajava	guava, abas
192	Psychotria mariana	aplohkateng
636	Samanea saman	raintree, monkeypod
199	Serianthes nelsonii	hayun lago, trongkon guafi
200	Sonneratia alba	mangrove
203	Tamarindus indica	tamarind, kalamendo
669	Tarenna sambucina	sumac-lada
670	Terminalia catappa	talisai
676	Thespesia populnea	kilulo, milo
678	Tournefortia argentea	hunig
204	Trema orientalis	agaunai
123	Triphasia trifolia	Lemon de China
999	Unknown, other	
207	Ximenia americana	sour plum, piut
9000	to 9999 Unknown	

11. COORDINATES (GPS)
TABLE OF CONTENTS

GPS Coordinates

12. COORDINATES (GPS)

A. Overview

An objective of the inventory is to obtain accurate coordinates for each field grid location. Coordinates are used to correlate plot information with remotely sensed imagery and data and in relocating the plot at future inventories. On each visited plot, coordinates are collected using GPS recorders when possible. GPS stands for Global Positioning System, a technology that uses signals from satellites to triangulate and compute the coordinates of locations on the ground.

This chapter is written so that the first 7 Sections (A-G) and the final Section (K), are essential for plot coordinate collection. The other Sections (H-J) demonstrates some of the more advanced features of the GPS. Although these advanced features are not entirely necessary for plot work, they can be of much value and save a lot of time if used properly. The procedures are written in a simple, step by step fashion (which makes them appear lengthy at first glance). But after using the GPS a few times, a person will be able to maneuver through the various menus with relative ease and confidence.

B. When and where to collect readings

For each plot visited, attempt to collect a GPS reading that has averaged for at least 3 minutes with 70 feet of error or less. Always start GPS procedures on a plot by trying to collect an adequate set of readings at the center of subplot 1 on the standard layout; the objective is to obtain coordinates at this subplot center, the field grid location. A good plan is to try to collect an adequate set of readings as soon as the center of subplot 1 is located, and, if unsuccessful, to try again shortly before going to the next subplot. **Success** is GPS-generated coordinates for the field grid location (subplot 1) that are based on a reading that has averaged for at least 3 minutes.
If unsuccessful at the field grid location, try to obtain coordinates at a different location. **NOTE:** Allow at least 45 min to an hour between readings to allow for different or new satellites to come into clear view of the receiver. If more than one coordinate is collected, record the coordinate that is closest to subplot 1 center and has averaged for at least 3 minutes. Write any other collected GPS coordinates or any notes regarding GPS use on the front of the plot card. Record the azimuth and distance from the GPS reading location to the center of subplot 1.

C. Recording GPS information

When using the GPS, record the Unit Number of the machine, UTM zone number, the **Easting** and **Northing** (**X** and **Y**) coordinates, the amount of time that readings that were averaged, the error statistic (the error displayed while the machine was averaging readings), the elevation of the reading, and the other items listed under Plot Data in the Husky Data recorder as necessary.

D. GPS keypad layout and commands

The recreational GPS units FIA uses are PPS (Precise Positioning Service) receivers. This means that they can read the encoded information from the satellites that contains the corrections to remove the intentionally introduced errors. Thus, the coordinates that it computes, do not have to be differentially corrected.

GPS keypad commands

PWR: power key turns the unit on and off. To turn the unit on, hit the PWR key, then the ENTER key

ENTER: confirms data entry or menu selections

MENU: provides access to waypoint and setup functions

ESC: cancels the operation of the last button pressed

NAV: accesses the various navigation screens

GOTO: creates a direct route to any waypoint stored in memory, and is used to MARK a position

IN: zooms in the display of the map screen

OUT: zooms out the display of the map screen

LEFT/RIGHT arrow keys move the cursor left or right while entering data

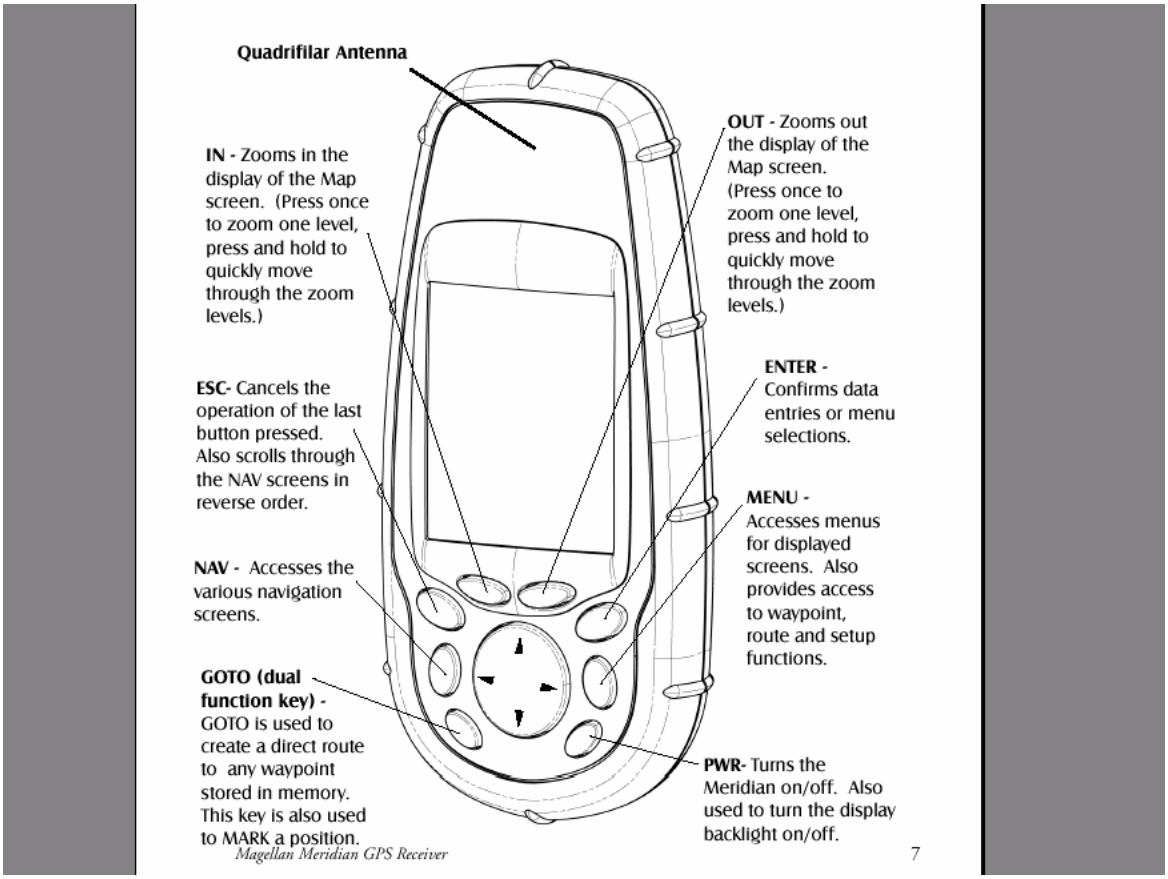
UP/DOWN arrow keys move the cursur up and down while entering data or selecting menu options

Initiate screen backlight:: press and hold the PWR key for 2 seconds

The backlight quickly drains the batteries, so avoid accidently turning on the backlight.

Adjust screen backlight: after turning the screen backlight on, press and hold the PWR key for 2 seconds. Press and hold the PWR key for 2 seconds again to turn the backlight off.

Figure 46. Location of GPS Buttons



E. GPS setup options

Listed below are the parameters to be setup before collecting satellite readings. Once these parameters are set up for the first time they will not need to be reset. Periodically (at least weekly) the unit should be checked to see that the settings have not been inadvertently changed.

IMPORTANT: Make sure that the MAP DATUM being used is the correct DATUM specified for your area. This is set on the SETUP page. Using a different datum will alter the coordinates significantly. Valid datums are:

WGS 84

Press MENU key, use up or down arrow to select **SETUP** option, then press the return key to enter the SETUP pages. To scroll through the following pages use the up/down arrows. Once the desired SETUP menu option is highlighted, press the return key to select it.

Required data for SETUP pages

SETUP UNITS

COORDINATE SYTEM: Primary = UTM
MAP DATUM: Primary = WGS84
ELEV MODE; 3D
TIME FORMAT; Local AM/PM
NAV UNITS: Miles/Ft/MPH
NORTH REFERENCE: True
DAYLIGHT SAVINGS: Disable
POWER OFF TIMER: On/Time/30 minutes

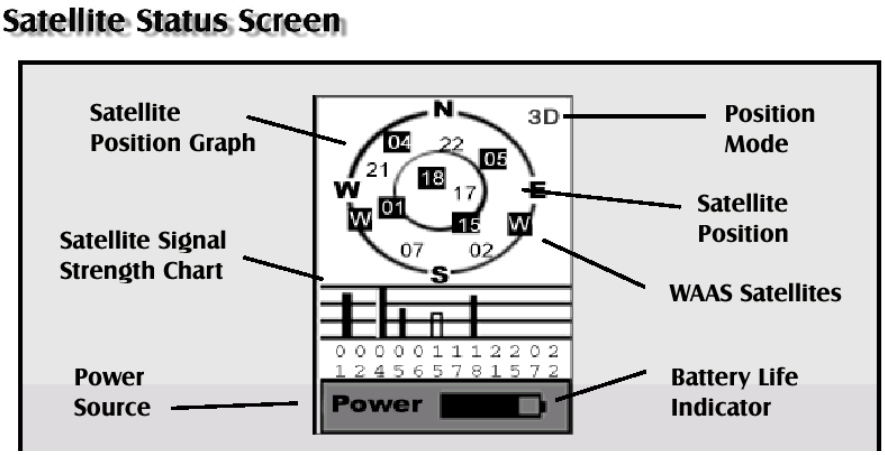
Other options within the setup pages are not used in GPS data collection for standard PNW-FIA inventories. See the Operations and Maintenance Manual for specific information.

F. Operating the GPS on plot

Carry extra batteries at all times. The two AA-alkaline batteries begin to lose power after approximately four hours of use. See Section K. Batteries, for more details.

1. Turn on the GPS unit
2. Check to see if the unit is receiving satellite readings by pressing the NAV key until the satellite status screen is visible. The satellite status screen shows 2 circles at the top of the screen, and the horizontal battery status bar at the bottom. If there are 4 vertical black bars below the 2 circles and above the battery status bar, then the unit is receiving enough satellites to calculate your position.

Figure. 47 GPS Satellite Status Screen



Satellite Position Graph
The two circles indicate satellite elevation as seen from your current position; the outer circle represents the horizon and the inner circle represents 45° from the horizon. The center of the circle is 90° from the horizon, or directly overhead.

Satellite Signal Strength Chart
Clear bar indicates that the Meridian is starting to get information from the satellite. Satellites that are being used to compute your position are shown with solid bars. The height of the bar indicates the relative signal strength.

Power Source
Indicates the source of power being used — POWER (Internal Battery) or POWER EXTERNAL.

Position Mode
3D - position computed is 3-dimensional (elevation is being computed).
2D - position computed is 2-dimensional (elevation is not being computed).
Blank - Meridian is not computing a position fix.

Satellite Position
Where the satellite is located relative to your position.

3. When the unit has locked onto 4 satellites, push the NAV key until the Position Screen is displayed. The Position Screen shows the current UTM coordinates and elevation at the top of the screen. The date, time, and position error are shown in the center of the screen. If the GPS unit is not receiving satellites, the position error will show “Search”, and the UTM coordinates shown at the top of the screen will be the last location where the unit was able to lock onto 4 satellites.

4. In the Position Screen, look below the date and time to find out the position error, or GPS status. You must wait until the GPS status indicates that it is “Averaging” before recording the GPS coordinates. Do not move the GPS while it is in “Averaging” mode. Record the coordinates and elevation after the unit has averaged for at least 3 minutes. The longer the unit averages the coordinates, the more accurate your location will be.

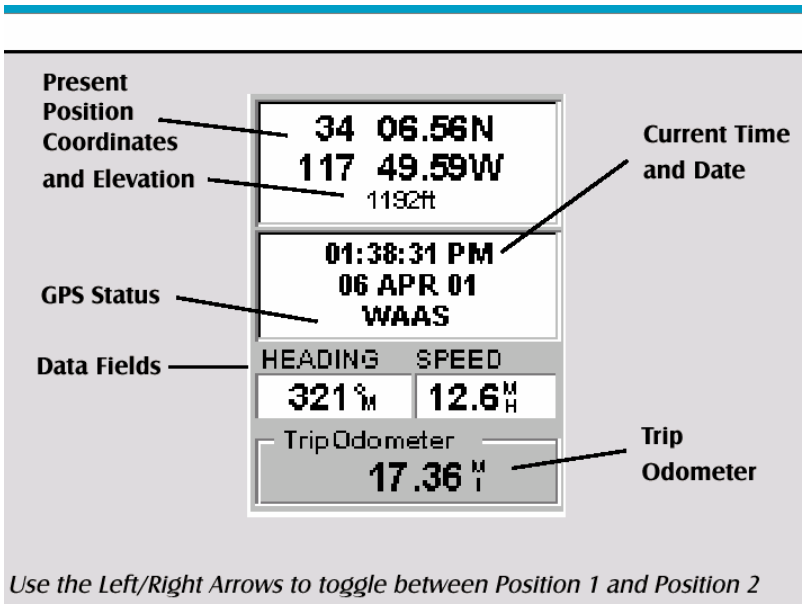


Figure 48. GPS Position Screen

Message	Description
Searching - 1st sat	Searching for 1st satellite.
Searching - 2nd sat	1st satellite found; searching for 2nd satellite
Searching - 3rd sat	Two satellites are being tracked and searching for a third.
Searching - 4th sat	Three satellites are being tracked and searching for the fourth.
Collecting Data	All satellites needed for position fix are being tracked and position is being computed.
Averaging	Meridian is computing fixes; speed is near 0.0 so position is being averaged.
EPE xxft	Estimated Position Error in feet. Meridian is computing fixes while moving.
DGPS	Computed fixes are being differentially corrected.

If the GPS unit is moving, it will not average the coordinates, but will give and EPE (estimated position error) instead. The EPE tells how accurate the GPS readings are to the nearest foot.

5. Record the coordinates, elevation, time of averaging, datum, UTM zone, etc under Plot Data in the Husky data recorder. If the coordinates are recorded at plot center, then azimuth and distance to plot center will be recorded as zero.

G. Collecting coordinates away from plot center

GPS coordinates should always be recorded at plot center when possible.
If for some reason you can't get an adequate set of readings at plot center, you may take readings at another location, and then record the azimuth and distance to plot center so that someone in the office can calculate the coordinates at plot center. Take the GPS unit to a location where you will be able to collect 3 minutes of averaged readings at ± 70ft accuracy, and where you will be able to accurately measure the horizontal distance, azimuth and slope in degrees to plot center. Do not move to a distance more than 200ft away if you don't have a laser range finder.

Record the coordinates, elevation, time coordinates are averaged, UTM zone, azimuth, and distance to plot center under Plot Data in the Husky data recorder.

H. Waypoints (Advanced GPS use)

Creating a waypoint (when coordinates are given)
A waypoint is a fairly precise location (on the ground, for our purposes), that a GPS user may assign a number and/or label to identify. For the purposes of PNW-FIA the location format of choice is called UTM/UPS (Universal Transverse Mercator/Universal Polar Stereographic). This format allows for the following required information: **Zone**- a 2 digit number (01-60) with a letter (C-X) attached. For our purposes, all zones in the western U.S. will be any combination of the numbers **10**,**11** and letters **U**, **T**, or **S**. **Easting**- a seven digit number (usually the first digit will be a zero) that represents distance from the eastern boundary of the particular zone. **Northing**- also a seven digit number that represents distance north of the equator (Northing numbers are usually instrumental in determining what zone the coordinates are in).

To create a new waypoint when the UTM coordinates are given with the plot data, turn on the GPS and then hold down the GOTO button. This will bring up the MARK screen with **SAVE** highlighted. Push either the up or down arrow until the Location field is highlighted. Press ENTER. Edit line 1 of the location field and press ENTER. Edit line 2 of the location field, and press ENTER. Edit the Elevation field, and press ENTER. If you need to edit the icon, name, or message for a waypoint, use the UP/DOWN arrows to highlight the field you wish to change and press ENTER. You are then placed in the edit mode. Use the arrow and ENTER keys to select the icons or letters you wish to use. After you are finished changing the name or message, highlight the OK button and press ENTER to return to the MARK screen
When you have entered all the necessary data, highlight the Save button, and press ENTER.

Marking (storing) your current location
This feature is used to mark/store a current location as a waypoint in the PLGR's internal memory bank. Storing the location of a vehicle, RP, campsite, or starting point is a good example on how you

can use this feature in the field. Stored waypoints can be useful in approaching locations in a different way, taking a different route back to the vehicle, or if you should get lost (see navigating to a waypoint).

To start, make sure the unit is on and you are receiving good signals. Check the Position screen (see Section F. Operating the GPS) and be sure that you are getting readings from at least 4 satellites. If you are moving, the GPS status should have EPE of less than 70 feet. If you are standing still, the GPS status should show that the unit is averaging your position.

Once you have confirmed good signal reception push on the GOTO button and hold it down until the. **MARK** screen appears. You can now select a name to assign as a waypoint for your current location. Push the UP/DOWN arrows until “name” is highlighted, then press ENTER. Use the arrow and ENTER keys to select the letters or symbols you wish to use. After you are finished changing the name highlight the OK button and press ENTER to return to the MARK screen
The GPS’s current location (under the assigned name), is now stored in it’s memory and can be used to navigate with.

I. Navigating with the GPS unit

To begin navigation, you must first have a waypoint stored in the GPS unit (see Section G. Waypoints). Also, unless you have a good sense of azimuth (to the nearest few degrees), a compass will be needed. (**NOTE:** keep the compass away from the body of the GPS to keep it from affecting the magnetic accuracy). Once you know which waypoint number you are going to travel towards, turn the GPS on and then, after the unit has locked onto 4 satellites, push the GOTO button. Highlight “**User**” in the menu, and press the right or left arrow buttons until “Alphabetical” shows in the field under FIND BY at the bottom of the screen. Press the ENTER button. A screen with a keyboard will pop up.

Using the arrow keys to navigate the displayed keyboard, begin typing in the name of the waypoint (destination) you are looking for. For example, suppose your destination was to be the Airport in Saipan. Use the keypad to highlight the letter “A” and press [ENTER]. Notice how the name is changed to the first waypoint stored in the Meridian’s memory that begins with the letter “A” and that the cursor has moved to the next letter in the waypoint name. (You can move the cursor back if you made a mistake by highlighting the “<-” button on the keyboard and press [ENTER].) Since we are looking for the Airport, we need to highlight the “I” next and press [ENTER]. Then the “R” and press [ENTER]. To add a space, highlight the “space bar” and press [ENTER]. (Also, you can use the “->” button to move the cursor to the right if you want to skip the letter the cursor is indicating.) You don’t need to spell out the entire word. The attempt here is to get close to the name so you won’t need to scroll very far during the next step. As a guide, entering the first five letters should be sufficient. When you are satisfied with what you have entered, highlight “OK” and press [ENTER]. The list of all the waypoints for the category you selected, in this case cities, is displayed with the waypoint that was previously selected at the top of the list. Now just use the Up/Down arrows to highlight the waypoint you are looking for and press [ENTER]. For this example, you would highlight Airport Saipan and press [ENTER]. The Map screen is displayed and the Meridian will begin computing all of the necessary information needed to get you to your destination.

If you are not getting satellite signals then you will get the bearing and distance to the waypoint you selected from the last position the GPS unit obtained satellite signals. You may want to move in the general direction of the waypoint and hope that satellites will come into better view, or you may want to let the GPS sit for a few minutes to lock on to some signals.

Once you are sure you are receiving satellites you can press the NAV button to find several screens where you can see the azimuth (Bearing) and distance from your current location to the waypoint. Follow the bearing as you walk towards the waypoint and the distance should steadily decrease. Eventually, as you get closer to the waypoint, the distance will get very small (about 10-30ft), and the bearing will begin to jump around dramatically. This means that you are very close to your destination (so look for the stake and witness trees if the waypoint is subplot 1).

Other data you might see on the navigation screens:
Bearing This is the direction to your destination from your present position, in degrees, from North.
*Distanc*e This is distance (measured in the Nav Units selected in Setup) to your destination.
Speed This is the rate that you are travelling. The unit of measure is selected in Setup - Nav Units.
Heading This is the direction you are moving (measured in degrees). When the heading and bearing are the same, you are travelling on a direct line to your destination.
VMG (Velocity Made Good). This is the speed that you are getting closer to your destination. If the heading and bearing are the same, then VMG will be the same as Speed since all of the speed that you are travelling is being applied to arriving to your destination. However, if you are off course, your VMG will be less than the speed that you are travelling.
CTS (Course To Steer). This is the angle that you need to turn to put you back on course.
ETA (Estimated Time of Arrival). This the local time that you will arrive at your destination based on the rate of speed that you are moving to your destination. (See VMG.)
ETE (Estimated Time Enroute). This is how long, in time, that it will take you to arrive at your destination based upon your present speed to the destination.
XTE (Cross Track Error). XTE is the perpendicular distance from your present position to the course line you should be on to go to your destination.
Turn This is the direction you need to turn to put you on the shortest distance to your destination from your present position.
Elevation This is the distance above sea level that you are presently at.
Time Local time.
Date Current date.

K. Batteries

GPS machines use two AA batteries, which usually last for about four hours of use. Replace the batteries when the Power Indicator (found on the bottom of the satellite locatory screen) is low. The GPS may have trouble locating satellites if the battery is low.

13. LASER 200 INSTRUCTIONS

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13. LASER 200 INSTRUCTIONS

A. Overview

Accurate heights are necessary in our inventory in order to determine volume and for other uses. The Laser can be used to get fast and accurate tree heights. It can also be used to measure distances and % slope. This instrument is more fragile than the GPS units. Some precautions must be taken with the Lasers to keep them working properly. These are:

1. Never look at the sun through the scope. Looking directly at the sun can permanently damage your eyes.
2. Never point the Laser directly at the sun. Exposing the lens system to direct sunlight, even for a brief period, may permanently damage the laser transmitter.
3. Do not expose the Laser to extreme temperatures. It is rated for a temperature range of -22 to +140 deg. F. Don't leave the instrument in the vehicle during the heat of the day.
4. Do not use batteries with "voltage check" features built on the batteries. The battery case of the Laser is too narrow for these batteries, and they could get stuck in the instrument.
5. Do not drop the Laser. Immediately return it to it's case when you get back to the vehicle. There is usually more danger of damaging the instrument in the vehicle than out in the woods.

B. Basic operation

All directions for using the Laser buttons are given assuming you are holding the instrument with the LCD display screen facing you and the 2 round lenses are facing the object you want to measure. The buttons will be referred to as:

L1	the left button closest to you
L2	the left button in the middle
L3	the left button furthest away from you
R1	the right button closest to you
R2	the right button in the middle
R3	the right button furthest away from you

Turn the Laser on by pushing L1 or R1
Turn it off by pushing L2 and L3 at the same time. The Laser may turn itself off after a period of inactivity. Once the instrument is on, push the R1 button to make the red dot appear in the sighting scope. If there is no red sighting dot, repeatedly push the L2 button until the red dot appears and is the correct brightness.
To light up the display screen, press L3. Press L3 again to turn off the light.

C. Settings

Make sure the settings are correct before using the Laser. To set the correct measurement units, go into the main menu and:

1. Press R2 or R3 to scroll through the menu until SYS is displayed in the upper right hand corner of the screen.
2. Press R1. ON or OFF will show in the center of the screen. FILTER will flash at the bottom.
3. Press R2 until OFFSET is flashing. The number displayed should be 0000.00.

4. Press R2 until PIVOT is flashing. The number displayed should be 0000.59. When this number is set at 0.00, the Laser is set to calculate heights using a tripod attached to the center of the instrument. The pivot point is the center of the Laser. We use the pivot value at 0.59 because this sets the pivot point at the rear of the instrument, and this allows you to shoot a height while using your head as the pivot point. To change this number, press L1 until the number you want to change is flashing. Press L2 or L3 until the correct number is showing. When the number is set at 0000.59, press R1.
5. Press R2 until UNITS is flashing. Select F (feet) using the R1 button.
6. Press R2 again and D (degrees) should be flashing. If not, press R1 to toggle on D.
7. Press R2 again and % should be flashing. It should say ON. If not, press R1.
8. Press R3 twice to accept the new settings and back out to the main display.

D. Filter and Reflectors

When you are working in areas of dense brush, you need to make sure the Laser is giving you the distance to the correct target. The best way to do this is to use a reflector as a target and use the filter option on the Laser. The Laser will only lock onto the highly reflective targets and ignore the less reflective brush. To use the filter option:

1. Place a reflector (or have someone hold it) on the tree where it can be seen from the required distance. The Laser will not work in the filter mode without a reflector as a target.
2. Go to the main menu on the Laser and push R2 or R3 until SYS is displayed on the screen.
3. Press R1 to select the SYS option. The FILTER option will blink, and it will say the FILTER is OFF or ON.
4. Push R1 to toggle FILTER between ON and OFF.
5. Press R3 to save the desired setting and to back out into the main display. When the FILTER is on, FILTER will appear at the bottom of the screen when the Laser is measuring distances.

E. Distances and % slope

Horizontal distance (HD): Turn the Laser on. The top-middle of the LCD screen will say HD. Point the red sighting dot at the target. Press R1 and hold it down until the Laser locks on the target, then release. You can tell when the instrument locks onto it's target by sound. It buzzes while it is searching for the target, then beeps when it locks on to a target or there is an error. If you get an error message, simply aim again and press R1.

Slope distance (SD) and Vertical distance (VD): Push R2 or R3 until the correct display is shown. Then aim and press R1 until the Laser locks on target. Or, measure a horizontal distance, then push R2 until the correct display is shown.

% slope: Press R2 or R3 until INC is displayed. Then aim and press R1.

F. Tree heights

The best way to measure a tree height is to make sure you have a clear shot at the leader or a clear shot of the tree trunk. Make sure you are getting a distance to the tree trunk, and not some branches in front of it. If you can't get a clear shot at the leader or the tree trunk, use a reflector (see section D). Once you are in position with your target in sight, go to the main menu:

1. Push R2 or R3 until HT is displayed in the upper left of the screen.
2. Push R1 once, aim at the target, then push R1 until the Laser locks on target. This will measure the horizontal distance.
3. The down arrow will flash. Aim at the base of the tree and push R1 to get the % slope.
4. The up arrow will flash. Aim at the top of the tree and push R1 again to get another % slope.
5. Press R1 once more and the Laser will display the height. Make sure this height is reasonable before recording it in the Husky.

G. Gates

The gate option can extend the Laser's minimum range or restrict its maximum range. It is most often used to help you make sure you are hitting the right target when objects near you or just beyond your target might give you false readings. You don't have to set both gates. You will probably only need to set the short gate because of brush or fog between you and your target. You can set a gate by shooting a target or by entering distances into the instrument. To set a short gate by laser, go to the main menu and:

1. Press R2 or R3 until GATE is shown on the display.
2. Push R1 to select the gate option.
3. Press R1 to toggle the gate between ON and OFF.
4. Push R2. The S indicator will flash.
5. Aim at a target that is at the distance you want to set as the short gate and press R1.
6. Now you can either set a long gate, or press R3 to go back to save the short gate and return to the main menu. The S will be displayed when you are measuring distances to show the short gate is on.

To set a long gate:

7. Push R2. The L indicator will flash.
8. Aim at an appropriate target and press R1
9. Press R3 to save the gate and go back to the main display. The L will be displayed when measuring distances.
   The gates are reset to OFF when the Laser is turned off, but gate values are saved in memory. This means that if you have saved a gate and turn off the instrument, when you turn it back on the gate will be set to OFF. If you go back into the gate option and turn the gate ON, it will remember the last distances you shot for the long and short gates.

To clear out a gate value: Display the gate values by following the instructions in this section (section G). When the desired gate value is displayed, press and hold down R3 until the number is deleted.

H. Cumulative distances

A cumulative distance measurement allows you to move from one target point to the next, stopping at each one to measure the distance to the next target point. The Laser accumulates the measured distances in both slope and horizontal distances (SD and HD) to give you a running total.
To take a cumulative distance, go to the main menu and:

1. Press R2 or R3 until MULTI is displayed on the screen.

2. Press R1 to enter the MULTI option. DIFF will be displayed.
3. Press R2 once. CUM will be displayed.
4. Press R1. Either SEL or a number will be displayed. If SEL is displayed, HD will flash on and off. Press R1 to toggle between HD and SD. Press R2 when the correct indicator is flashing. If a number is displayed, that means there is already a cumulative distance saved on this instrument. You can either clear out this distance by holding down R3 until 0.00 appears, or continue to add to the distance by going to step 5.
5. Aim at the target and press R1 to fire the laser.
6. If you are not satisfied with the measurement, repeat step 5 to retake the measurement. If you are satisfied with the measurement, and wish to add it to your total, press R2. The new total will be displayed.
7. Repeat steps 5 and 6 to add more measurements to the total.

   You can choose whether you want horizontal or slope distances at any time. If a distance has been measured, you can change from slope or horizontal distance by pressing R3 twice. SEL will be displayed. Push R1 to toggle between SD and HD. Press R2 twice to get back to the total distance. Go to step 5 to add more distances.

   The cumulative measurement total is saved in memory even if the instrument is turned off. Turn the instrument on and scroll back to the MULTI-CUM option and resume the procedure with step 5. To clear out the current total and begin another series of measurements, hold down R3 while the cumulative distance is showing until the number is deleted.

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APPENDIX 1 -- SLOPE CORRECTION TABLE

PERCENT	EXPANSION FACTOR	EXPANSION FACTOR RECIPROCAL	--SLOPE DISTANCE-- 12.0 ft.	24.0 ft.	100 ft.	120.0 ft.
10	1.005	0.995	12.06	24.1	100.5	120.6
15	1.01	0.99	12.12	24.3	101.1	121.2
20	1.02	0.98	12.24	24.5	102	122.4
25	1.03	0.97	12.36	24.7	103.1	123.6
30	1.04	0.96	12.48	25.1	104.4	124.8
35	1.06	0.94	12.72	25.4	105.9	127.2
40	1.08	0.93	12.96	25.8	107.7	129.6
45	1.1	0.91	13.2	26.3	109.7	132
50	1.12	0.89	13.44	26.8	111.8	134.4
55	1.14	0.88	13.68	27.4	114.1	136.8
60	1.17	0.86	14.04	28	116.6	140.4
65	1.19	0.84	14.28	28.6	119.3	142.8
70	1.22	0.82	14.64	29.3	122.1	146.4
75	1.25	0.8	15	30	125	150
80	1.28	0.78	15.36	30.7	128.1	153.6
85	1.31	0.76	15.72	31.5	131.2	157.2
90	1.35	0.74	16.2	32.3	134.5	162
95	1.38	0.72	16.56	33.1	137.9	165.6
100	1.41	0.71	16.92	33.9	141.4	169.2
105	1.45	0.69	17.4	34.8	145	174
110	1.49	0.67	17.88	35.7	148.7	178.8
115	1.52	0.66	18.24	36.6	152.4	182.4
120	1.56	0.64	18.72	37.5	156.2	187.2
125	1.6	0.62	19.2	38.4	160.1	192
130	1.64	0.61	19.68	39.4	164	196.8
135	1.68	0.6	20.16	40.3	168	201.6
140	1.72	0.58	20.64	41.3	172	206.4
145	1.76	0.57	21.12	42.3	176.1	211.2
150	1.8	0.55	21.6	43.3	180.3	216
155	1.84	0.54	22.08	44.3	184.5	220.8

APPENDIX 2 -- ESTIMATING DBH WITH RELASKOPS

The relaskop can be used to estimate diameters. The relaskop is only accurate if you are at a known horizontal distance of 33 ft., 66 ft, or 99 ft.

To accurately estimate a diameter, measure out to a horizontal distance of 33, 66, or 99 feet from the tree you want to measure. Look through the small window. The field of vision is divided into 2 halves, upper and lower, by a horizontal line that is the measuring edge. No other point of reading is accurate (see figure 49).

Figure 49

View the point on the tree where you want to estimate the diameter in the upper half. In the lower half you will see a series of bars and scales measuring up the edge (see Figure 49)

To take a reading, press the brake release button. The scale automatically rotates to the angle the instrument is tilted when sighting at the point of measurement. Partially release the brake button to help bring the scale to a faster stop.

The scale between “a” and “b” on Figure 50 is divided into 6 equal width bars (3 light and 3 dark).
The bars between “a” and “b” on the scale are equal to different diameters at different distances from the tree:

Each bar equals 2 inches at a horizontal distance of 33 feet
Each bar equals 4 inches at a horizontal distance of 66 feet
Each bar equals 6 inches at a horizontal distance of 99 feet

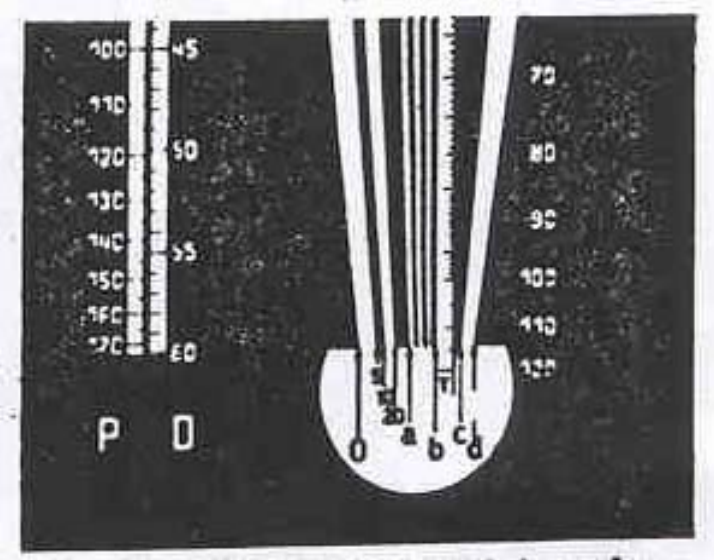


Fig. 50 Lower part of American scale, enlarged to show identification of graduations.

The distance between “0” and “10” on the scale equals the distance between “a” and “b”. At 33 feet, “a” to “b” represents 12 inches of diameter.
To measure a diameter of a tree with DBH of 34 inches, position the relaskop 33 feet from the tree and set the “0” edge of the scale on the left bark edge of the tree. Distance”0” to “10” will represent 12 inches of diameter; distance “10” to “a” will represent another 12 inches of diameter, , and the right bark edge will align with the right edge of the fifth bar between “a” and “b” for 10 more inches of diameter.
Total 12 + 12+ 10 = 34 inches DBH.

In this case the diameter can be read to the nearest 2 inches (and estimated to the nearest 1 inch)

By positioning the relaskop at other distances, such as 66 or 99 feet, different values apply

Since the instrument is self-adjusting for changes in slope, it follows that the diameter at any height above the ground can be estimated without correcting for slope. You still must correct for slope when measuring distance from the tree because all distances must be horizontal.

APPENDIX 3 -- HIGH PRIORITY SPECIES

The following list of species has been identified as high priority for genetic resource operations and activities. These species will be recorded wherever they are found, either on or off of FIA inventory plots. For each species found, record the species name or code, location, size, and abundance code.

1. HIGH PRIORITY SPECIES LIST

PALAU

Species	Common name	Code
Antigonon leptopus	chain-of-love (D)	ANLE4
Clidemia hirta(D)	Koster's curse	CLHI3
Imperata cylindrical	Cogon grass(D)	IMCY
Mikania micrantha	mile-a-minute vine(D)	MIMI5
Psidium cattleianum	strawberry guava	PSCA
Spathodea campanulata	African tulip(D)	650
Timonius timon	liberal	TIMTIM

GUAM

SPECIES	Common name	Code
Artocarpus mariannensis	Marianas breadfruit	110
Calicarpa candicans	hamlag	CALCAN
Cerbera dilatata	chuti	120
Cyathea lunulata	chacha	691
Cyacas circinalis	fadan, fading	134
Elaeocarpus joga	joga, yoga	142
Eugenia palumbis	agatelang	EUGPAL
Eugenia thompsonii	atoto	EUGTHO
Heritiera longipetiolata	ufa	154
Intsia bijuga	ifet, ifil, ifit	551
Leucaena insularum var. guamensis		159
Merrilliodendron megacarpum	faniok	168
Pandanus tectorius	katu, aggag, aggak, caffo	692
Serianthes nelsonii	hagon, lagu	199
Tabermaemontana rotensis		210
Tristiropsis obtusangula	faia	205

2. LOCATION

Record the location of the priority species. If the priority species is found within a subplot, record the species on the standard FIA vegetation tally sheet.

If the priority species if found outside a subplot, record the species on the High Priority Species data sheet. Get GPS coordinates if possible. If coordinates cannot be obtained, describe the location in as much detail as possible, and mark the location on photography and/ or maps

When collected: all high priority species, wherever they are found

3. ABUNDANCE
Record a code for abundance of the species.

When collected: all high priority species, wherever they are found
Values:

1 = Less than 5 plants
2 = 5 to 15 plants
3 = more than 15 plants

4. SIZE
Record a code that best describes the size class of the majority of the priority species

When collected: all high priority species, wherever they are found
Values:

1 < 1.0 in DBH (seedlings)

2 1.0 - 4.9 in (saplings)

3 5.0 – 8.9 in

4 9.0 – 19.9 in

5 20.0 – 39.9 in

6 40.0 + in

APPENDIX 4 -- FIPS CODES, UTM ZONES, AND DECLINATIONS

(FIP Code) State or Territory Island	Latitude ° ' "	Longitude ° ' "	UTM Zone	declination
(66) Guam				
(66) Guam	13º 26' 40" N	144º 44'12" E	55	2 deg. East
(60) American Samoa			2	
(20) Manu'a	14º 15' 00" S	167º 28' 12" W		11 deg. East
(30) Rose	14º 31' 48" S	175º 52' 12" W		11 deg East
(40) Swains	11º 03' 36" S	171º 04' 48" W		11 deg East
(10) Tutuila East	14º 18' 00" S	169º 4'5 00" W		12 deg. East
(50) Tutuila West	14º 20' 00" S	170º 00' 00" W		12 deg. East
(69) Commonwealth of the Northern Marianas			55	
Agrihan	18 46 03 N	145 40 02 E		0 deg.
Alamagan	17 36 06 N	145 50 18 E		1 deg. East
Anatahan	16 21 28 N	145 39 58 E		1 deg. East
Asuncion	19 40 04 N	145 24 16 E		0 deg.
Farallon de Medinilla	16 01 09 N	146 04 39 E		1 deg. East
Farallon de Pajaros	20 32 17 N	144 53 53 E		1 deg. West
Guguan	17 18 54 N	145 50 52 E		1 deg. East
Maug	20 01 24 N	145 13 21 E		0 deg.
Pagan	18 06 39 N	145 46 20 E		0 deg.
Rota	14 09 13 N	145 12 11 E		2 deg. East
Saipan	15 11 33 N	145 44 53 E		1 deg. East
Sarigan	16 42 35 N	145 47 01 E		1 deg. East
Tinian	15 00 48 N	145 37 27 E		1 deg. East
(64) Federated States of Micronesia				
(002) Chuuk				
Etal	05 34 05 N	153 35 10 E	56	6 deg. East
Losap	06 53 44 N	152 44 01 E		5 deg. East
Lukunor	05 30 22 N	153 47 58 E		6 deg. East
Murilo	08 41 16 N	152 20 26 E		5 deg. East
Nama	06 59 48 N	152 34 39 E		5 deg. East
Namoluk	05 55 34 N	153 06 41 E		5 deg. East
Namonuito	08 59 27 N	150 07 22 E	56	4 deg. East
Nomwin	08 25 47 N	151 44 28 E		5 deg. East
Pulap	07 38 41 N	149 25 15 E		4 deg. East
Pulusuk	06 41 31 N	149 18 51 E		4 deg. East
Puluwat	07 21 26 N	149 12 01 E	55	4 deg. East
Satawan	05 19 30 N	153 44 12 E		6 deg. East

Truk	07 25 08 N	151 43 55 E	56	5 deg. East
(005) Kosrae				
Kosrae	05 18 58 N	162 59 02 E	58	8 deg. East
(040) Pohnpei				
Nukuoro	03 50 42 N	155 00 04 E	56	6 deg. East
Oroluk	07 37 44 N	155 09 41 E		6 deg. East
Pakin	07 04 53 N	157 48 20 E		6 deg. East
Pingelap	06 12 47 N	160 41 56 E	57	7 deg. East
Pohnpei	06 57 45 N	158 13 58 E	57	6 deg. East
(060) Yap				
Eauripik	06 41 14 N	143 04 55 E		3 deg. East
Elato	07 31 00 N	146 11 08 E	55	3 deg. East
Fais	09 45 54 N	140 31 20 E		2 deg. East
Faraulep	08 35 52 N	144 33 25 E		3 deg. East
Gaferut	09 13 58 N	145 22 59 E		3 deg. East
Ifilik	07 15 23 N	144 27 03 E		3 deg. East
Lamotrek	07 27 40 N	146 23 33 E		4 deg. East
Ngulu	08 29 37 N	137 21 48 E		1 deg. East
Olimarao	07 42 09 N	145 52 46 E		3 deg. East
Satawal	07 21 29 N	147 02 08 E		4 deg. East
Pikelot	08 05 16 N	147 38 08 E	55	4 deg. East
Sorol	08 08 00 N	140 24 39 E	54	2 deg. East
Ulithi	09 57 41 N	139 36 13 E		1 deg. East
West Fayu	08 05 21 N	146 44 28 E		3 deg. East
Woleai	07 22 32 N	143 54 50 E		3 deg. East
Yap	09 31 46 N	134 36 00 E	53	1 deg. East
(68) Marshall Islands				
Ailinginae	11 08 00 N	166 24 00 E	58	8 deg. East
Ailinglaplap	07 17 00 N	168 47 00 E		9 deg. East
Ailuk	10 12 40 N	169 59 02 E		8 deg. East
Arno	07 04 00 N	171 33 00 E		9 deg. East
Aur	08 16 00 N	171 06 00 E	59	9 deg. East
Bikar	12 12 00 N	170 06 00 E		8 deg. East
Bikini	11 37 00 N	165 33 00 E		7 deg. East
Ebon	04 35 00 N	168 44 00 E		9 deg. East
Enewetak	11 21 00 N	162 20 00 E		7 deg. East
Erikub	09 01 00 N	170 03 00 E		9 deg. East
Jabwot	07 47 00 N	168 59 00 E		8 deg. East
Jaluit	05 51 00 N	169 38 00 E		9 deg. East
Jemo	10 07 00 N	169 33 00 E		8 deg. East
Kili	05 39 00 N	169 04 00 E		9 deg. East
Kwajalein	08 43 00 N	167 44 00 E	58	8 deg. East

Knox	11 07 00 N	166 32 00 E	8 deg. East
Lae	08 55 00 N	166 16 00 E	8 deg. East
Lib	08 19 00 N	167 25 00 E	8 deg. East
Likiep	09 49 00 N	169 18 00 E	8 deg. East
Majuro	07 05 00 N	171 08 00 E	9 deg. East
Maloelap	08 45 00 N	171 03 00 E	9 deg. East
Mejit	10 17 00 N	170 54 00 E	8 deg. East
Mili	06 05 00 N	171 44 00 E	9 deg. East
Namorik	05 36 00 N	168 07 00 E	9 deg. East
Namu	07 32 00 N	168 53 00 E	9 deg. East
Rongelap	11 09 00 N	166 52 00 E	58 8 deg. East
Rongrik	unknown		
Taka	11 07 00 N	169 40 00 E	8 deg. East
Ujelang	09 46 00 N	160 58 00 E	7 deg. East
Ujae	08 56 00 N	165 45 00 E	8 deg. East
Utrik	11 14 00 N	169 51 00 E	8 deg. East
Wotho	10 11 00 N	166 00 00 E	8 deg. East
Wotje	09 28 00 N	170 15 00 E	8 deg. East

(70) Palau			53
Angaur	06 54 00 N	134 09 00 E	1 deg. East
Babeldaob	07 30 00 N	134 36 00 E	1 deg. East
Eil Malk	07 09 09 N	134 21 25 E	1 deg. East
Ngercheu	07 05 20 N	134 16 20 E	1 deg. East
Peleliu	07 00 30 N	134 14 40 E	1 deg. East
Sonsorol	05 19 30 N	132 13 15 E	1 deg. East

(15) Hawaii	
003 Oahu	4
001 Hawaii	5
007 Kauai	4
009 Maui	4
Kahoolawe	4
Molokai	4
Lanai	4
Niihau	4

APPENDIX 5 – PRIORITY DAMAGE AND SEVERITY

Priority Damage codes

These damages are always coded regardless of the severity:
1 Rhinoceros beetle
2 Brown root rot
3 Tinangaha
4 Banana nematodes

Priority Severity codes

1) Rhinoceros beetle:
1. Draw an imaginary horizontal line just above the coconuts (or where they should be)
2. Count the number of fronds that grow above that line
3. Count the number of fronds in #2 that have been damaged by rhinoceros beetles
4. Divide the number of damaged fronds by the number of fronds counted in # 2.
5. Multiply by 100

Record this number as the severity of rhinoceros beetle damage

2) Brown root rot:
Record 0 for the severity of brown root rot.

3) Tinangaha:
Record 0 for the severity of tingangaha

4) Banana nematodes:
Record 0 for the severity of banana nematodes

APPENDIX 6 -- MEASURING HEIGHTS USING A CLINOMETER

Tree heights can be measured using a clinometer and a measuring tape. The clinometer is only accurate if you use the HORIZONTAL DISTANCE from you to the tree when measuring a tree height.

To calculate a tree height, walk away from the tree and find a spot at least 1 tree length away where you can see both the top and bottom of the tree. If the tree is 50 feet tall, then you need to be at least 50 feet away from the tree when you measure the height.

Walk uphill of the tree when measuring a height if possible. It is easier to see both the top and bottom of the tree if you are up hill of it. Also, you do not have to walk as far away from the tree if you go uphill.

Look through your clinometer with one eye, and keep the other eye open. Keep both eyes open, and look up until the top of the tree is even with the horizontal line in the center of the clinometer. When the horizontal line in the clinometer is even with the top of the tree, read the number on the % (percent) scale of the clinometer that is touching the horizontal line in the clinometer. The % scale is usually on the right side on the inside of the clinometer. If you are unsure which scale to use, look into the clinometer and then tilt the clinometer up or down until the % symbol is visible on the scale.

Make sure you are far enough away from the tree so that your reading is not over 120%. The clinometer is not accurate when readings above 120% are used.

Now look through the clinometer with both eyes open and tilt the clinometer down until the horizontal line in the clinometer is even with the base of the tree. Read the number on the % scale that is touching the horizontal line in the clinometer.

The % scale of the clinometer is divided into 1% increments from 0 to + or – 70%. The distance between each small tic mark on the scale is equal to 1%. From + or – 70% and greater, the scale is divided into 2% increments. The distance between each small tic mark on this part of the scale is equal to 2%.

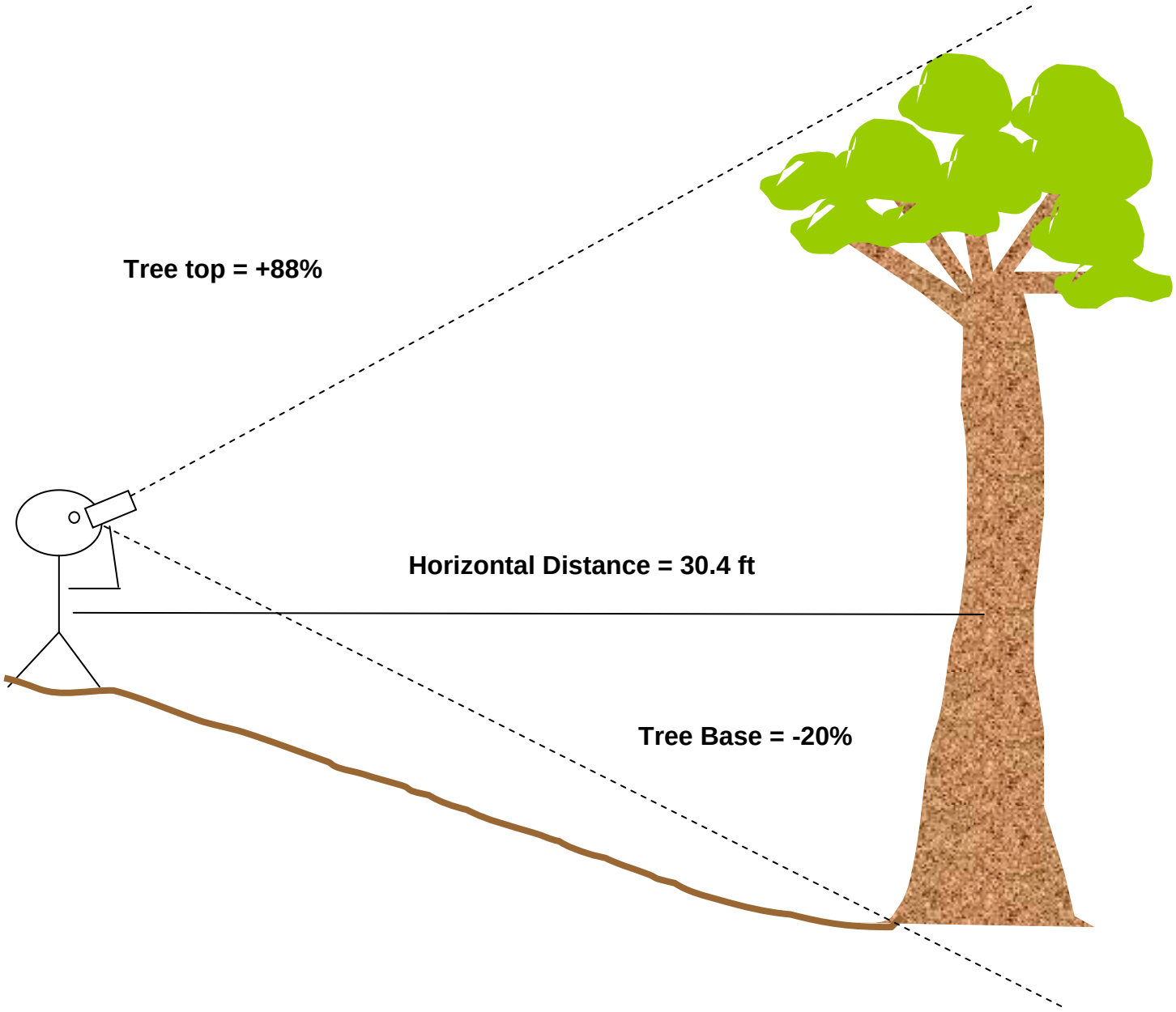
Most of the time you will read a positive number (+) while looking at the top of the tree, and a negative number (-) while looking at the base of the tree. ADD the number you observed while looking at the top of the tree with the number you observed while looking at the base of the tree. This gives you Total Percent.

Special Case:
If you have to go down hill or very far uphill, you may read in your clinometer that both the top and base of the tree are positive numbers on the % scale. Or you may have both the top and base of the tree are negative numbers. If the top and base of the tree are the same sign (either both are positive or both are negative) on the clinometer % scale, then SUBTRACT the tree top number and the tree base number. This gives Total Percent.

Measure the horizontal distance between where you took the readings with the clinometer and the tree. If you went up or down a hill to measure the height, then you must calculate the horizontal distance (see page 242)

Multiplty the Total Percent for your tree times the horizontal distance you just measured or calculated. Then divide this number by 100. This number is the height of your tree.

Example:



To calculate the height of this tree:

$$\frac{(\%\ \text{Tree top}) + \text{or} - (\%\ \text{Tree base}) * (\text{Horizontal Distance})}{100\%}$$

88% + 20% = 108% (these 2 numbers are added, since tree top % is positive and tree base % is negative)

108% * 30.4 feet = 3283.2

3283.2 / 100% = **32.8 feet is the height of this tree**

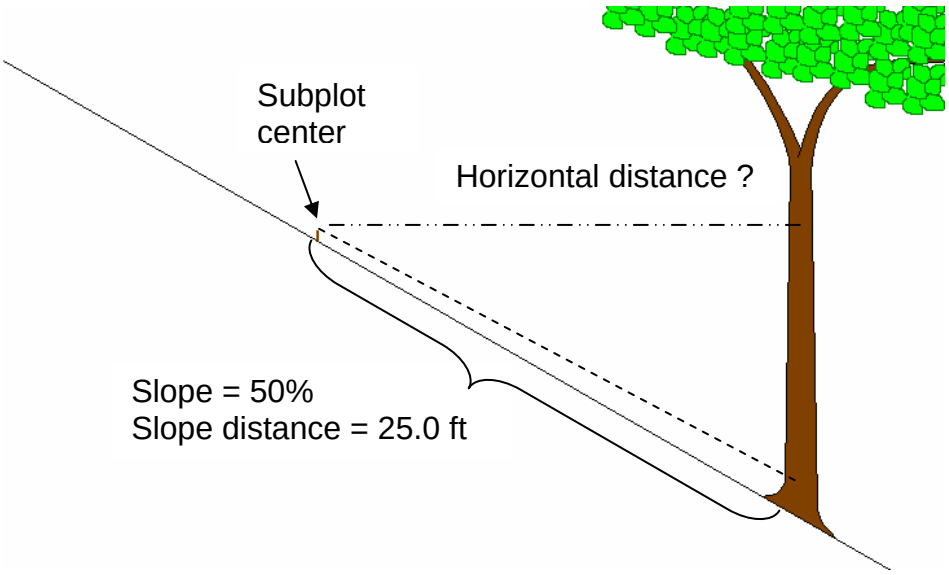
APPENDIX 7 – CALCULATING HORIZONTAL DISTANCE

When horizontal distance cannot be accurately measured it can be calculated by using percent slope, slope distance, and a slope correction table.

To calculate horizontal distance, first measure the slope distance.
Then use your clinometer to get a % slope. You should measure the % slope of the measuring tape. The clinometer should be at the level of your slope distance measuring tape.
Use the Slope Correction Table (see page 229) to look up the expansion factor reciprocal for the % slope of the measuring tape.
Multiply the expansion factor reciprocal by the slope distance you measured.
This gives you the horizontal distance.

The horizontal distance will always be less than the slope distance.

Example:



What is the horizontal distance from subplot center to this tree?

Expansion Factor Reciprocal for 50% slope = .89

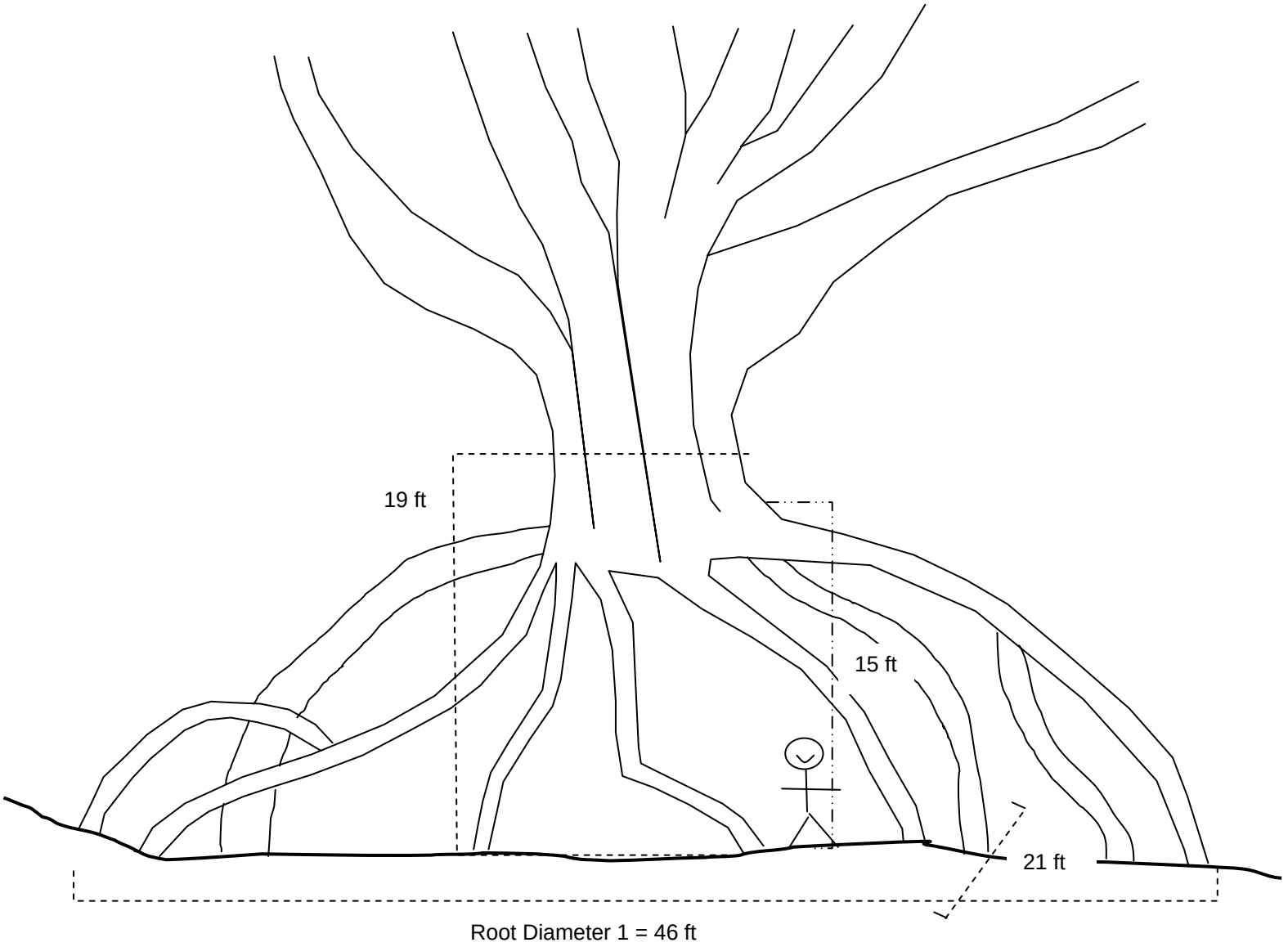
.89 * 25.0 = 22.25 feet

The horizontal distance is 22.25 feet. This tree is within 24.0 feet of subplot center and is over 5.0 inches dbh, so it will qualify as a tally tree.

Slope distance = Horizontal distance when % Slope = 0

APPENDIX 8 – EXAMPLE OF BANYAN TREE MEASUREMENTS

For trees with roots tall enough where it is unreasonable to measure dbh:
Estimate one dbh, even if the tree is forked below 4.5 feet above the roots
Height to dbh = 19 feet.
Diameter is estimated with a relaskop, so Diameter Check = 1
Rooting height is 15 feet.
Type of rooting system = 1
Root diameter 1 = 46 feet
Root diameter 2 = 21 feet
Prop root density = 1
Aerial root density = 0
Branching characteristics = 4



APPENDIX 9 – DETERMINING SCALES AND BASELINES FROM A MAP OR PHOTO

Determining scale measuring object of known size on map or photo

First you must measure the length of an object on the map or photo whose actual length you know. This might be a football field, a city block, or a section of a road. You need to go out to the location mapped or pictured and measure the distance between two identifiable objects. Once you have the two distances, you can find the scale

For example, suppose you have a photo and you need to determine the scale of the photo. Find 2 points on the ground that are visible on the photo and are easy to identify on the ground. Road intersections usually work well because they are usually easy to find on the photos and on the ground. Measure the horizontal distance between these 2 points on the ground (ground distance). Then measure the distance between the 2 points on the photo (photo distance).

If the distance between the 2 points is **1,200 feet** ground distance, and **.4 inches** photo distance, then the scale of the photos is calculated:

$$\frac{\text{1,300 feet ground distance}}{\text{.4 inches photo distance}} * \frac{\text{12 inches}}{\text{1 foot}} = \frac{(1{,}300 * 12)}{.4} = \frac{\text{15,600 ground}}{\text{.4 map}} = \textbf{1:39,000}$$

This means that 1 inch on the photo is equal to 39,000 inches on the ground. Since 1 foot = 12 inches, then 39,000 inches/ 12 feet = 3,250 feet. Therefore, each inch on the photo is equal to 3,250 feet on the ground.

One exception for aerial photos is that this method assumes the two locations are at the same elevation--or that the terrain is flat. If you are using aerial photos, the terrain may not be flat. If there are hills, even moderate ones, the calculations can be thrown off. Try to measure the distance between 2 points on the ground that are similar in elevation.

Determining scale by comparing with another map or photo of known scale

Another way to calculate scale on an unknown map or photo is to compare it to a map with a known scale. For example, suppose you have an aerial photo where the distance between two hills is **3.12 inches**. You have a map of the same area at **1:24,000**, and on the map the distance between the hills is **1.3 inches**. The answer involves a little algebra. Since the ground distance is the same on both photo and map, we can create an expression for this ground distance for both, and then put them on either side of an equation. The ground distance can be found by multiplying the map/photo distance by the scale (in this case, by the inverse of the scale--notice how this makes the units cancel correctly). We need to find, for the photo, how many ground units are represented by one unit on the photo, so we use an *x* for this unknown quantity and solve for it:

$$3.12 \text{ in photo} * \frac{x \text{ ground}}{\text{1 photo}} = 1.3 \text{ in map} * \frac{\text{24,000 ground}}{\text{1 map}} \text{ ; and}$$

3.12 in * *x* ground = 1.3 in * 24,000 ground

$$x = \frac{1.3 \text{ in} * 24{,}000}{3.12 \text{ in}} = 10{,}000$$

The scale for the photo is 1:10,000

Calculating a baseline on a map or photo

A baseline is often used in thick jungle where gps coordinates are difficult to obtain and/or navigation by using maps and aerial photography is difficult. A baseline is used to measure an azimuth and distance from a known point to the plot center. To calculate a baseline:

1. Determine the scale of the map or photo.
2. Measure the photo or map distance from a point of departure to the plot center. The point of departure is a know location that can be identified on the map or photo and can also be identified on the ground (a tree, intersection, house, etc)..
3. Calculate the ground distance using the photo or map scale and the photo or map distance.

For example:
The photo scale is 1:12,000
The photo distance from the corner of a house to the plot center is 1.13 inches. The house must be visible on the photo and identified on the ground.

$$1.13 \text{ inches photo} * \frac{12{,}000 \text{ ground}}{1 \text{ photo}} = 13{,}560 \text{ inches ground distance}$$

$$13{,}560 \text{ inches} * \frac{1 \text{ foot}}{12 \text{ inches}} = 1{,}130 \text{ feet ground distance}$$

Therefore, you must measure 1,130 feet from the corner of the house to arrive at plot center.

The azimuth from the house to the plot center can be calculated by:

1) Measure the azimuth between two points that are visible on the photos and the ground. Straight-line sections of road or powerlines often work well for determining baselines. Shoot the azimuth down one side of the road.
2) Draw a line in pencil on the photo between the 2 points you just measured the azimuth between. Extend this line as far as necessary.
3) Find a place that can be identified on the ground and the photo from which you can measure azimuth and distance to find plot center. This is your point of departure. Draw a line between plot center and the point of departure. This is your baseline. Extend this line as far as necessary so that it intersects the line drawn previously in number 2.
4) Calculate the azimuth from the known point of departure and the plot center using a protractor and the line drawn in number 2.

Adapted from Bryan Baker, Sonoma State University, Principles of map scale, www.sonoma.edu/GIC/Geographica/Mapinterp/Scale.htm, January, 1999

APPENDIX 10 -- COMPLETING AND EDITING PLOTS

Completed plots

A plot is considered “complete” when all data items have been collected and entered into an electronic format, the data has been printed out, edited, and corrected. The field crew and the crew supervisor must edit the data. Members of the field crew must make the editing corrections.

Plot data should be electronically entered within 48 hours of collecting field data. Plot data should be edited, corrected and turned in to the crew supervisor within 1 week of completing field data collection for each plot.

Editing for completeness:

1. Is there at least 10% tree cover over an area of at least 1 acre that is at least 120 ft wide somewhere on the plot?

   Plot Status = 1 (Accessible Forest Land). Fill out all of these forms:
   a. Condition Class Data
   b. Subplot Data
   c. Plot Data, including GPS
   d. Tree Tally
   e. Vegetation Profile
   f. Seedling Count
   g. Vegetation Data

2. Is there less than 10% tree cover and the at least part of the plot can be classified as Measured Nonforest (Present Nonforest Land Use 16 – 26)? Fill out all of these forms:
   a. Condition Class
   b. Subplot
   c. Plot Data, including GPS
   d. Tree tally
   e. Vegetation Profile
   f. Seedling Count
   g. Vegetation Data

3. Is the Plot Status 2,3,4,5,6,7 (nonforest) and Present Nonforest Land Use is not 16 through 26? Then fill out all of these forms
   a. Condition Class Data
   b. Boundary Data (if mapping needed)
   c. Plot Data, including GPS

Plot edits

Plot data should be thoroughly checked for data errors and omissions. The data entry program will catch many data errors, but the plots still need to be edited. The following list will aid in checking for valid data:

Tree Data

Trees are in correct condition class according to subplot boundary mapping

Tree Status is correct

Lean angle makes sense (0=not leaning)

Diameter has 1 decimal place (example: 14.9, 7.0)

Diameter check makes sense (0=measured, 1=estimated)

Ht to diameter has 1 decimal place (example: 4.5)

If root system > 0, appropriate diameters and hts filled out
Root system = 1, all root measurements needed
Root system = 2, fill out # buttresses, rooting height

Root diameters and ht have no decimal places (example: 2 feet)

Rot/cull corresponds to damages (if there is a rot coded in damage, then code a % rot/cull)

If total length different than actual length, damage is coded (6/21/severity/damage agent)

Damages make sense and codes are valid

Damage agent is filled out if there is a damage

Upper diameter ht has no decimal places (example: 44 feet)

Reference trees are marked (need at least 2 reference trees for each subplot)

Diameters and heights are reasonable

If status = 2 (dead tree), then need code for snag decay class and rot/cull

Tree notes make sense

Tree Tally and Vegetation data is recorded for accessible forest land and grass land plots

Vegetation Data

Vegetation is in correct growth form

All veg species have heights

All veg species have scientific names

Each tree species has the correct number code

Plot Data

Plotcard with map and descriptions are filled out
- Can someone pick up this plotcard and find the plot just going by your directions?
- Can they tell what each condition class is?
- Can they tell where the condition class boundaries are?
- Is the plot described in enough detail?

Plot diagram matches subplot attributes

GPS coordinates are recorded. Complete directions to plot are recorded if GPS coordinates were not taken at plot center.

Condition Class Data

Condition class attributes match plot diagram, subplot attributes

Condition class attributes are complete, all condition classes are described

APPENDIX 11 – DATA SHEETS

Plot _______ Guam Tree Tally 2002 Date_________________

Subplot	tree #	CC #	Azimuth	Horiz Dist	Slope Dist	Status	Species	DBH	DBH check	Ht to DBH	Upper Diam	Up Diam Ht	Branch Form	Root Syst	Root Diam 1	Root Diam 2	Root Den/#	Root Ht	Aerial Root	Rot	Lean Angle	Tot Length	Act Length	Length Meth	Crown Class	UnC Crwn R	Comp Ratio	Dam Loc 1	Dam Typ 1	Severity 1	Dam Agent 1	Dam Loc 2	Dam Typ 2	Severity 2	Dam Agent 2	Snag DC	Epiphyte	Hardwd C	Priority Dam	P. Dam Sev
112	**112**	**113**	**113**	114._	114._	**114**	**161**	115._		._			**122**	**123**					**125**	**126**	**126**	**127**	**127**	**127**	**128**	**129**	**131**	**134**	**141**	**143**	**156**					**157**	**158**	**159**		
				._	._			._		._																														
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				._	._			._		._																														

CONDITON CLASS DATA descriptions begin on page **51**

Plot					
Condition Class	1	2	3	4	5
Condition Status					
Reserved Status					
Owner Group					
Forest Type					
Stand Size Class					
Regeneration Status					
Tree Density					
Owner Class					
Private Owner Industrial Status					
Artificial Regeneration Species					
Stand Age					
Dominant Tree Species 1					
Dominant Tree Species 2					
Dominant Tree Species 3					
Disturbance 1					
Disturbance Year 1					
Disturbance 2					
Disturbance Year 2					
Disturbance 3					
Disturbance Year 3					
Treatment 1					
Treatment year 1					
Treatment 2					
Treatment Year 2					
Treatment 3					
Treatment Year 3					
CC Aspect					
CC % Slope					
CC Slope Shape					
CC Slope Position					
Present Nonforest Land Use					

PLOT DATA descriptions begin on page **29**

Island		
County		
Plot		
Sample Kind		
Year		
Month		
Day		
Declination		
Forested		
Trails or Roads		
Horizontal Dist to Improved Road		
Road access		
Public Use Restrictions		
Recreation use 1		
Recreation use 2		
Recreation use 3		
Water on plot		
QA status		
Crew type		
GPS unit		
GPS serial #		
Coordinate System		
UTM zone		
Easting (x)		
Northing (y)		
GPS elevation		
GPS error		
Number of readings		
GPS datum		
GPS filename		
Was GPS collected at center of subplot 1?		
Azimuth to plot center		
Distance to plot center		
Description		

SUBPLOT DATA

Plot				
Subplot	1	2	3	4
Subplot center condition Class				
Microplot Center Condition				
Subplot Status				
Slope				
Aspect				
Slope Shape				
Slope Position				
Water Depth				

Slope shape: 00 = Flat

10 = Concave

20 = Convex

Slope Position: 00 = no slope
10 = upper shoulder
20 = midslope
30 = footslope
40 = valley bottom
50 = ridgetop

MAPPING/BOUNDARY DATA

Subplot	Plot type	Contrasting Condition	Left Azimuth	Corner Azimuth	Corner Distance	Right Azimuth

Plot type: 1 = Subplot
2 = Microplot

Plot Number _____ Date_____

LIFEFORM COVER

Subplot	Total Seedling Cover	Total Shrub Cover	Total Forb Cover	Total Grass Cover	Total Veg Cover
1					
2					
3					
4					

SEEDLING COUNT count up to 6 seedlings of each species on the microplot

Subplot	Condition Class	Species	# of Seedlings

SEEDLING VEGETATION COVER Plot # ________

Subplot	Tree Species	Growth Habit	Average Species Height	% Cover

FORB VEGETATION COVER Plot # ______

Subplot	Genus	Species	Growth Habit	Average Species Ht	% Cover

SHRUB VEGETATION COVER Plot # _________

Subplot	Genus	Species	Growth Habit	Stage of Development	Average Species Ht	% Cover

GRASS VEGETATION COVER   Plot # ________

Subplot	Genus	Species	Growth Habit	Average Species Ht	% Cover

PRIORITY SPECIES Date_____

A list of species is found on page **233**

Species	Abundance	Size	Location

Abundance:
1 = less than 5 plants
2 = 5 to 15 plants
3 = more than 15 plants

Size:
1 = < 1.0 in dbh (seedlings)
2 = 1.0 – 4.9 in dby (saplings)
3 = 5.0 – 8.9 in dbh
4 = 9.0 – 19.9 in dbh
5 = 20.0 – 39.9 in dbh
6 = 40.0 + in dbh

APPENDIX 12 -- METRIC EQUIVALENTS AND AIDS

Length

1 inch	=	2.54 centimeters (cm.)
0.1 feet	=	3.048 centimeters (cm.)
1 foot	=	0.3048 meter (m.)
1 mile	=	1.609 kilometers (km.)

1 centimeter (cm.)	=	.03 foot (ft.)
1 meter (m.)	=	3.2808 feet (ft.)

Area

1 acre	=	0.4 hectare (ha.) (approximately)
5 acres	=	2 hectares (ha.) (approximately)
1,000 acres	=	404.7 hectares (ha.)
1 hectare	=	2.471 acres (ac.)
2.5 hectares	=	6 acres (ac.) (approximately)

Volume

1,000 cubic feet	=	28.3 meters (m^3)
1 cubic foot per acre	=	0.07 cubic meter per hectare (m^3/ha)

Condition class minimum area

0.4 hectares (1 acre)	=	4,000 square meters
	=	40 meters x 100 meters
	=	35 meter radius circle
1 acre	=	118 foot radius circle
	=	209 feet x 209 feet
	=	43,560 square feet

Metric System-length

1 meter = 10 decimeters (dm.)
1 meter = 100 centimeters (cm.)
1 meter = 1,000 millimeters (mm.)

and:

.001 meters = 1 millimeter
.01 meters = 1 centimeter
.1 meters = 1 decimeter
1 meter = 1 meter
10 meters = 1 decameter
100 meters = 1 hectometer
1,000 meters = 1 kilometer

Photo Scales

Scale	Length on Photo	Length on Ground
1:15,840	1 mm.	15.8 meters
1:24,000	1 mm.	24.0 meters
1:31,680	1 mm.	31.7 meters
1:40,000	1 mm.	40.0 meters
1:15,840	1 inch	1,320 feet
	0.1 inch	132 feet
	.05 inch (1/20)	66 feet
1:24,000	1 inch	2,000 feet
	0.1 inch	200 feet
	.05 inch (1/20)	100 feet
1:31,680	1 inch	2,640 feet
	0.1 inch	264 feet
	.05 inch (1/20)	132 feet
1:40,000	1 inch	3,333 feet
	0.1 inch	333 feet
	.05 inch (1/20)	166 feet

APPENDIX 13 -- HELLO LETTER/DATA CONFIDENTIALITY

United States Department of Agriculture | **Forest Service** | **Pacific Northwest Research Station** | **Forestry Sciences Laboratory**
P.O. Box 3890
Portland, Oregon 97208
(503) 808-2000

File Code: 4810

Date: Summer 2001

To Whom It May Concern:

Hello, we are researchers from the USDA Forest Service, Pacific Northwest Research Station. We are obtaining information on the forest resources of the Pacific Northwest from measurements taken on a large number of randomly located sample plots on forestland. We are visiting one of these plots in this general vicinity today.

We locate each plot from a sample selected on an aerial photograph. While at the site we record information pertaining to the type of terrain; tree species, heights, and diameters; insect and disease damage; mortality and regeneration; and the amount and kind of understory vegetation. Many of our field plots were first established in the early 1960's and have been revisited on a 10-year cycle.

With the measurements we take, analysts will develop basic information about the amount, condition, and change in the area's forest resource. Published reports contain data on forest land area and ownership, timber volume, forest growth, mortality and cut, potential productivity, and opportunities for silvicultural treatment.

If you are interested in learning more about our research plans, or care to see publications from previous inventories similar to this one, please contact Otha Terry at (503) 808-2044 or Bob Rhoads at (503) 808-2022 by telephone or by writing to:

Portland Forestry Sciences Laboratory
Forest Inventory and Analysis Program
P. O. Box 3890
Portland, OR 97208-3890

Sincerely,

BOB RHOADS
Team Leader
Forest Inventory and Analysis

APPENDIX 14 -- LANDOWNER CONTACT LETTER

United States Department of Agriculture
Forest Service
Pacific Northwest Research Station
Forestry Sciences Laboratory
P.O. Box 3890
Portland, Oregon 97208
(503) 808-2000

File Code: 4810
Date:

«OWN_NAME»
«ADDRESS_LINE_1»
«ADDRESS_LINE_2»
«ADDRESS_LINE_3»

Dear«OWN_NAME»

The Pacific Northwest Research Station is continuing to collect basic information about forest resources in Oregon. The Forest Inventory and Analysis (FIA) Program at the station participates in a national effort to evaluate the status and condition of our nations forest ecosystems. Data is collected on FIA field plots so that we can determine the amount, condition and trends of Oregon's forested resources. The data will also allow us to detect and understand changes in local and regional forest health.

A grid of permanent plots were established in the 1960's and have been re-measured in the 1970's, 80's and 90's on a 10-year cycle. Recently our program has undergone changes, affecting how the inventory will be conducted. Starting in 2000, a percent of the FIA plots in will be sampled across each state each year on a 5- or 10- year cycle.

Data we collect from the field plot(s) on your property are combined with other plot data from adjoining areas and counties to provide information about resource conditions in the state of Oregon. The data will not be identified in any way with your name or property and will have no bearing on your property taxes. Collected data are summarized, analyzed, and published in statistical and analytical reports for the United States, for Oregon alone, and for various geographic areas within Oregon and are available to the public.

Our records show that this year there is a field plot(s) that falls on your land. The legal description of the location of this plot is Township «TWN», Range«RANGE», Section «SEC», «FORTY». We request your permission to access your land to measure the trees and the vegetation on this plot. We only request your permission to access your land. We do not ask you to change your management practices, nor will our measurements affect any ongoing or planned activities for this site.

Our field staff will be in your area between April 16th and October 30th, 2001. If you wish, they will contact you before entering your land. We realize that working on your land is a privilege and we will respect your landowner rights at all times. We are prepared to honor any special conditions that you may require of us. Enclosed is a reply postcard for

your response and any concerns , such as locked gates or other access problems. If you have any questions regarding this letter or pertaining to this inventory, please feel free to contact Bob Rhoads at 503-808-2022 or Otha Terry at 503-808-2044

We will be happy to share the resource information we gather from your property should you be interested.
Thankyou again for your cooperation in this study. Your participation is greatly appreciated.

SUSAN A. WILLITS
Program Manager
Forest inventory and Analysis

Enclosure
«COUNTY» County (**«CNTY_CODE»**) Plot **«SECDRY_PLT_ID_IN_CNTY»**

United States Department of Agriculture | **Forest Service** | **Pacific Northwest Research Station** | **Forestry Sciences Laboratory**
P.O. Box 3890
Portland, Oregon 97208
(503) 808-2000

File Code: 4810

Date:

R E L E A S E

The USDA FOREST SERVICE assumes liability, pursuant to the Federal Tort Claims Act, for any damages caused by negligence of Forest Service personnel while upon the landowner's property in connection with the inventory of forest resources in the State of Oregon, and the landowner shall not be liable for injuries occurring to Forest Service personnel for any reason except the negligent or wrongful acts of the landowner while they are on the property owned or controlled by the landowner.

County _____

Plot Number _____

Landowner _____

SUSAN A. WILLITS
Program Manager
Forest Inventory and Analysis
Pacific Northwest Research Station
US Department of Agriculture

APPENDIX 15 -- VARIANCE PLOTS

A. Objectives: Variance plots are performed for several purposes:

1. To assess the range of values for collected data;

2. To ensure that documented field plot instructions and accuracy standards are uniformly understood and consistently followed;

3. To assess the ability of individual crew members.

B. Variance plot policies: The following policies for conducting variance plots will be followed:

1. Each person will be checked within the first two weeks of field work and will accompany the variance-plotter to the variance plot.

2. Variance plots will continue during the entire season; each person is assessed multiple times throughout the field season.

3. All variance plot items count equally for each person who did the plot.

C. Types of variance plots:

Hot Variance - an informal inspection 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 variances can be done on test plots or production plots.

Cold Variance - a formal or informal inspection done either as part of the training process, or as part of an ongoing QC program. The inspector re-measures completed work after a crew has turned it in. Data errors are corrected. Cold variances are done on production plots only.

Blind Variance - a formal inspection done without crew data on hand; a full re-installation of the plot for the purpose of obtaining a measure of data variance. The two data sets are maintained separately. Data are NOT corrected. Blind variances are done on production plots only.

D. Variance plot procedures:

1. In the field, the variance plotter checks all tree classifications and measurements. The variance plotter or one of the crew members who originally did the plot makes all of the tree measurements during the variance plot visit . These variance measurements are compared to the original measurements recorded on the data recorder hardcopy for hot and cold variance plots. Items that do not meet accuracy standards are rechecked. Final decisions on accuracy rest with the variance plotter. Errors are circled in red on the original tally sheet, and the correct value written near the circle.

Blind variance plots are recorded as a new plot without any reference to prior measurement. New data sheets are used and the plots are designated as blind varinace

2. Completing the variance plot form. Field plot items on the variance plot form are organized into categories based on what the items are related to. Each category is given a percentage rating based on the amount of items correct. The grading procedures give weights differently to items depending on the item's importance.

APPENDIX 16 – 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 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, GRAZING, OR RECREATION ACTIVITIES

ACRE: A UNIT OF LAND CONTAINING 43,560 SQUARE FEET OF AREA.

AGE AT BREAST-HIGH THE NUMBER OF ANNUAL GROWTH RINGS BETWEEN THE BARK AND THE CENTER OF THE TREE AT 4.5 FEET ABOVE THE ROOT COLLAR ON THE BOLE OF A TREE.

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 EUQIPMENT. THE ARE MUST BE AT LEAST 1.0 ACRE IN SIZE AND 120.0 FT WIDE AT THE POINT OF OCCURANCE

ASPECT THE DIRECTION A SLOPE FACES.

AZIMUTH: ANGLE OR DIRECTION FROM 1 TO 360 DEGREES. THE AZIMUTH PLUS 180 DEGREES IS THE BACK AZIMUTH.

BASAL AREA: (A) OF A TREE: THE CROSS SECTIONAL AREA OF A TREE AT BREAST HEIGHT ON THE STEM. (B) OF A FOREST OR STAND: THE CROSS-SECTIONAL AREA AT BREAST HEIGHT OF ALL TREES WITHIN A UNIT OF AREA.

BASAL AREA FACTOR (BAF): THE BASAL AREA PER UNIT OF AREA CORRESPONDING WITH A GIVEN CRITICAL ANGLE IN VARIABLE-RADIUS PLOT SAMPLING.

BLIND VARIANCE 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 VARIANCES ARE DONE ON PRODUCTION PLOTS ONLY.

BOLE: TRUNK OR MAIN STEM OF A TREE.

BORDERLINE TREE: A TREE THAT IS AT OR NEARLY AT THE LIMITING DISTANCE ASSOCIATED WITH A GIVEN BASAL AREA FACTOR. BORDERLINE TREES REQUIRED PRECISE CHECKING TO DETERMINE IF THEY ARE TO BE SAMPLED.

BREAST HEIGHT: THE STANDARD HEIGHT, 4.5 FEET ABOVE GROUND LEVEL, AT WHICH DIAMETER OF A STANDING TREE OR SNAG IS MEASURED. ON SLOPING GROUND, BREAST HEIGHT IS MEASURED ON THE UPHILL SIDE OF THE BOLE.

CANKER: LOCALIZED INJURY TO STEM, BRANCH OR ROOT; CAUSED BY DISEASE OR INSECTS.

CANOPY: THE COVER OF FOLIAGE FORMED BY TREE CROWNS.

CANOPY CLOSURE THE PERCENTAGE OF GROUND AREA COVERED BY THE VERTICALLY PROJECTED CROSS-SECTIONS OF TREE CROWNS

CENSUS WATER: PERMANENT AREAS OF WATER MORE THAN 4.5 ACRES OR WIDER THAN 200 FEET.

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 VARIANCE 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. DATA ERRORS ARE CORRECTED. COLD VARIANCES ARE DONE ON PRODUCTION PLOTS ONLY.

CLINOMETER AN INSTRUMENT USED TO MEASURE PER CENT SLOPE

CONDITION CLASS CONDITION CLASS IS DEFINED BY DIFFERENCES IN CONDITION STATUS, OR IN ONE OF THE SIX MAPPING VARIABLES: RESERVED STATUS, FOREST TYPE, OWNER GROUP, STAND SIZE, REGENERATION STATUS, AND TREE DENSITY.

CONIFER: CONE-BEARING TREES, MOSTLY EVERGREENS, WITH NEEDLE OR SCALE-LIKE LEAVES BELONGING TO THE BOTANICAL GROUP GYMNOSPERMAE. ALSO REFERRED TO AS SOFTWOODS.

CONK: THE FRUITING BODY OF A WOOD-DESTROYING FUNGUS WHICH PROJECTS FROM THE TRUNK, ROOTS OR OTHER TREE PARTS.

CROOK: ABRUPT BEND OR CURVATURE IN THE BOLE OF A TREE; A CROOK IS A SOUND CULL DEDUCTION FROM GROSS MERCHANTABLE VOLUME.

CROWN: THE PORTION OF A TREE CARRYING THE MAIN BRANCH SYSTEM AND FOLIAGE.

CROWN CLASS: THE SOCIAL POSITION OF A TREE RELATIVE TO ITS ABILITY TO RECEIVE DIRECT SUNLIGHT.

CROWN RATIO: THE PERCENT OF A TREE'S TOTAL HEIGHT WHICH HAS A LIVE CROWN.

CULL: (A) TREES OR LOGS, OR PORTIONS OF LOGS THAT ARE OF MERCHANTABLE SIZE BUT ARE UNUSABLE FOR INDUSTRIAL WOOD PRODUCTS DUE TO DEFECTS (ROT OR FORM). (B) TO CULL A LOG OR PORTION OF A LOG WITH RESPECT TO GROSS MERCHANTABLE VOLUME (C) THE DEDUCTION MADE FROM GROSS VOLUME OF A TREE OR LOG TO ADJUST FOR SOUND OR ROTTEN DEFECTS.

ROUGH CULL: PERCENTAGE DEDUCTION OF VOLUME LOST DUE TO BROKEN OR MISSING PARTS, FORKS OR CROOKS.

CULL ROT: LOSS OF GROSS MERCHANTABLE VOLUME DUE TO ROT. VISUALLY INDICATED BY CONKS, ROTTEN SEAMS, ETC., CODED AS A CATEGORY OF PERCENTAGE OF VOLUME AFFECTED BY THE ROT.

CULTURAL NONFOREST STRINGER: NONFOREST AREA OF CONSTRUCTED ROADS, RAILROADS, POWER-LINES, PIPELINES, AND CANALS WHICH ARE 1.0 ACRES OR LARGER WITH NO MINIMUM WIDTH REQUIREMENT.

CULTURALLY-KILLED TREE: A TREE TALLIED OR RECONSTRUCTED AS LIVE AT OC3 BUT SINCE KILLED BY DIRECT HUMAN ACTIVITY AND NOT UTILIZED. THE TREE CAN BE STANDING, DOWNED, OR FELLED. INCLUDED ARE TREES KILLED BY LOGGING INJURY AND STILL STANDING. A TREE IS CULTURALLY-KILLED ONLY IF IT SHOWS NO SIGN OF LIFE OR IS PARTIALLY UPROOTED , LIVE, AND LEANS $\geq$45 DEGREES.

D.B.H.: DIAMETER BREAST HEIGHT: THE TREE DIAMETER MEASURED AT BREAST HEIGHT--4.5 FEET ABOVE GROUND LEVEL.

DEAD TREE: A TREE TALLIED OR RECONSTRUCTED AS LIVE AT OC3 BUT NOW DEAD. DEATH WAS NATURAL AND NOT DUE TO DIRECT HUMAN ACTIVITY. A TREE IS DEAD ONLY IF IT SHOWS NO SIGH OF LIFE OR IS PARTIALLY UPROOTED, LIVE, AND LEANS $\geq$45 DEGREES.

DEFOLIATOR: AN INSECT, WHICH FEEDS UPON, OR STRIPS LEAVES AND NEEDLES FROM TREES.

DIAMETER THE LENGTH OF A STRAIGHT LINE THROUGH THE CENTER OF AN OBJECT

DOMINANT TREE SPECIES THE TREE SPECIES THAT IS THE MOST ABUNDANT AND NOT OVERTOPPED IN A CONDITION CLASS

EPIPHYTE: A PLANT THAT USES A TREE FOR PHYSICAL SUPPORT, BUT WHICH DOES NOT DRAW NOURISHMENT FROM THE TREE

EVEN-AGED STAND: A STAND IN WHICH INDIVIDUAL TREES ORIGINATED AT APPROXIMATELY THE SAME TIME. SPECIFICALLY, THE STAND MUST NOT BE CLASSIFIED AS NONSTOCKED, AND AT LEAST 70 PERCENT OF THE LIVE TREES PRESENT MUST BE WITHIN 30 YEARS OF ONE ANOTHER IN TOTAL AGE.

FIELD GRID LOCATION: THE CENTER OF SUBPLOT 1 ON THE STANDARD PLOT LAYOUT. THE FIELD GRID LOCATION IS PINPRICKED ON PLOT PHOTOS IF THE PLOT WAS PREVIOUSLY VISITED; THIS INCLUDES ESTABLISHED PLOTS THAT CAN'T BE FOUND. THE FIELD GRID LOCATION IS PINPRICKED ON THE NEW PHOTOS FOR PLOTS THAT WERE NOT VISITED PREVIOUSLY.

FIXED-RADIUS PLOT: A CIRCULAR SAMPLED AREA WITH A SPECIFIED RADIUS IN WHICH ALL TREES OF A GIVEN SIZE, SHRUBS, OR OTHER ITEMS ARE TALLIED.

FORB: A BROAD-LEAVED HERBACEOUS PLANT AS DISTINGUISHED FROM GRASSES, SHRUBS AND TREES.

FOREST TYPE: CLASSIFICATION OF A FOREST SITE BASED ON THE TREE SPECIES PRESENT THAT MOST DOMINANTS THE GROWING SPACE OF THE SITE.

GLC: GROUND LAND CLASS.

GROUND LAND CLASS: A CLASSIFICATION OF LAND BY USE. THE MINIMUM AREA FOR CLASSIFICATION IS 1.0 ACRE. EACH MAPPED CONDITION CLASS REQUIRES A GROUND LAND CLASS.

HARDWOODS: BROAD-LEAVED AND DECIDUOUS TREES AS OPPOSED TO HAVING NEEDLES. TREES BELONGING TO THE BOTANICAL GROUP ANGIOSPERMAE.

HARVESTED TREE: A TREE TALLIED OR RECONSTRUCTED AS LIVE AND >5.O IN. D.B.H. AT A PREVIOUS INVENTORY, BUT SINCE HARVESTED FOR INDUSTRIAL SUPPLY, FIREWOOD, LOCAL USE, OR INCIDENTAL REASONS.

HEARTWOOD:	THE INNER, NONLIVING CORE OF WOOD IN A TREE BOLE, GENERALLY DARKER THAN SAPWOOD.
HECTARE:	A METRIC UNIT OF AREA EQUAL TO 10,000 SQUARE METERS. 2.47 ACRES.
HORIZONTAL DISTANCE	THE AMOUNT OF SEPARATION BETWEEN TWO POINTS THAT IS MEASURED AS IF BOTH POINTS ARE ON THE SAME PLANE; HORIZONTAL DISTANCE MUST BE CALCULATED FROM SLOPE DISTANCE IF THE 2 POINTS CANNOT BE MEASURED ALONG THE SAME PLANE
HOT VARIANCE	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 VARIANCES CAN BE DONE ON TRAINING PLOTS OR PRODUCTION PLOTS.
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 CONDION, EXCEPTH THAT IT IS NOT LARGE ENOUGH TO QUALIFY. FOR EXAMPLE, A ½ ACRE POND WITHIN A FORESTED STAND.
INCREMENT:	THE INCREMENT IN D.B.H. OF A TREE IN A SPECIFIED PERIOD OF TIME.
INGROWTH TREE:	A TREE THAT HAS GROWN PAST A DIAMETER THRESHOLD ON A FIXED-RADIUS PLOT SINCE PREVIOUS INVENTORY.
INSPECTION CREW	A CREW OF QUALIFIED QC/QA INDIVIDUALS WHOSE PRIMARY RESPONSIBILITY IS THE TRAINING, CERTIFICATION AND INSPECTION OF PRODUCTION CREWS.
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.
MORTALITY TREE:	SEE DEAD TREE.
MQO	MEASUREMENT QUALITY OBJECTIVE – 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.

MYCELIUM: THE VEGETATIVE PART OF A FUNGUS; A MASS OF THREAD-LIKE FILAMENTS.

NONFOREST INCLUSION: AN AREA THAT IS NONFOREST BUT LESS THAN 1.0 ACRE IN SIZE. WHEN PART OR ALL OF A FIXED OR VARIABLE-RADIUS PLOT FALLS WITHIN A NONFOREST INCLUSION, THE INCLUSION IS SAMPLED AS PART OF THE SURROUNDING FOREST LAND.

NONSTOCKABLE: A FOREST LAND CONDITION CLASS IS NONSTOCKED IF: 1) THE AVERAGE DIAMETER OF LIVE TREES IN THE CONDITION CLASS IS <5.O IN.. D.B.H. AND <100 FREE-TO-GROW SEEDLINGS AND SAPLINGS PER ACRE ARE DISTRIBUTED BROADLY ACROSS THE CONDITION CLASS. OR: 2) THE AVERAGE DIAMETER OF LIVE TREES IN THE CONDITION CLASS IS ≥5.0 IN. D.B.H. AND TREE CANOPY COVER IS < 10 PERCENT. OR: 3) THE CONDITION CLASS WAS RECENTLY CLEARCUT AND HAS NOT BEEN REPLANTED.

PASTURE: PASTURE IS RANGELAND THAT HAS BE PLOWED AND ARTIFICIALLY SEEDED TO GRASS OR OTHER FORAGE SPECIES LIKE CLOVER TO FEED DOMESTIC LIVESTOCK. OFTEN, IT IS IRRIGATED AND FENCED.

PC: PLOT CENTER. THE FIELD GRID LOCATION ON THE GROUND FOR EACH FIELD PLOT. ON ESTABLISHED PLOTS VISITED AT OC3, PLOT CENTER IS AT THE OC3 CEDAR STAKE. ON MISSING OR LOST PLOTS, PLOT CENTER IS THE PINPRICKED LOCATION ON THE OC3 PLOT PHOTOS. ON NEW PLOTS, PLOT CENTER IS THE PINPRICKED LOCATION ON THE OC4 PLOT PHOTOS.

PI: PHOTO INTERPRETATION.

POLETIMBER: A TREE 5.0 TO 8.9 IN. D.B.H.

POLETIMBER STAND A STAND IN WHICH THE AVERAGE DIAMETER OF THE TREES PRESENT IS 5.0 TO 8.9 in. D.B.H.

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.

RANGELAND: LAND DOMINATED BY NATURAL PLANT COVER COMPOSED PRINCIPALLY OF NATIVE OR EXOTIC GRASSES, FORBS, OR SHRUBS. NATURAL RANGELAND IS UNIMPROVED, I.E., IT IS NOT IRRIGATED, AND HAS NOT BEEN SEEDED ARTIFICIALLY.

REGENERATION STATUS A STAND DESCRIPTOR THAT INDICATES WHETHER A STAND HAS BEEN NATURALLY OR ARTIFICIALLY REGENERATED.

REGIONAL DRIFT THE TENDENCY FOR STANDARDS, METHODS AND INTERPRETATIONS TO DRIFT APART OVER TIME AS EACH UNIT IMPLEMENTS THE FIA CORE PROTOCOL.

REGENERATION: A YOUNG, PRECOMMERCIAL-SIZED STAND, OR THE UNDERSTORY TREE COMPONENT OF A MULTISTORIED STAND.

RELASKOP AN INSTRUMENT USED TO ESTIMATE TREE DIAMETERS FROM A DISTANCE

RELEASE: FREEING A TREE FROM IMMEDIATE COMPETITION BY REMOVING OTHER TREE OR NONTREE COMPETITION.

RESIDUAL OVERSTORY: A TREE THAT HAS SURVIVED FROM THE PREVIOUS STAND AND IS USUALLY LARGER OR OLDER THAN TREES WHICH ORIGINATED AS PART OF THE PRESENT STAND.

ROT: DECAY. DECOMPOSITION OF WOOD BY FUNGI OR BACTERIA.

ROUNDWOOD: SECTIONS OF TREE STEMS, WITH OR WITHOUT BARK. INCLUDES LOGS, BOLTS, POSTS, PILINGS AND OTHER PRODUCTS STILL "IN THE ROUND".

RP: REFERENCE POINT. AN OBJECT (USUALLY A TREE), WHICH CAN BE LOCATED ON THE GROUND AND IDENTIFIED ON THE PHOTO. IT WILL BE TAGGED AND REFERENCED TO THE CEDAR STAKE IN ORDER TO FACILITATE RELOCATING THE PLOT.

SAPLING: A TREE 1.0 TO 4.9 IN. D.B.H.

SAPWOOD: THE OUTER LAYERS OF WOOD BETWEEN THE HEARTWOOD AND INNER BARK. GENERALLY LIGHTER IN COLOR THAN HEARTWOOD.

SAWTIMBER STAND, SMALL A STAND IN WHICH THE AVERAGE DIAMETER OF THE LIVE TREES PRESENT IS 9.0 TO 21.0 IN. D.B.H.

SAWTIMBER STAND, LARGE A STAND IN WHICH THE AVERAGE DIAMETER OF THE LIVE TREES PRESENT IS GREATER THAN 21.0 IN. D.B.H.

SDI STAND DENSITY INDEX.

SEEDLING: A LIVE TREE LESS THAN 1.0 IN. D.B.H. THAT IS AT LEAST 0.5 FEET IN HEIGHT (CONIFERS) OR 1.0 FEET IN HEIGHT (HARDWOODS) AND ESTABLISHED IN MINERAL SOIL.

SEEDLING-SAPLING STAND A STAND IN WHICH THE AVERAGE DIAMETER OF THE LIVE TREES PRESENT IS LESS THAN 5.O IN. D.B.H.

SILVICULTURE: THE SCIENCE AND PRACTICE OF GROWING AND TENDING FOREST CROPS FOR SPECIFIED OBJECTIVES.

SITE: THE AGGREGATE OF ALL ENVIRONMENTAL CONDITIONS AFFECTING THE SURVIVAL AND GROWTH OF A PLANT COMMUNITY ON A SPECIFIC AREA.

SITE CLASS: A CLASSIFICATION OF POTENTIAL AVERAGE ANNUAL ABILITY OF A FOREST LAND SITE TO PRODUCE WOOD--FOR THE PERIOD BETWEEN THE TIME OF STAND ESTABLISHMENT AND THE TIME WHEN AVERAGE ANNUAL WOOD PRODUCTION PEAKS-- WERE THE SITE FULLY STOCKED WITH DESIRABLE TREES.

SITE INDEX: A MEASURE OF PRODUCTIVITY INHERENT ON A FOREST SITE THAT IS SIMPLE NUMERICAL VALUE BASED UPON TREE HEIGHT AT A SPECIFIED AGE.

SLOPE DISTANCE THE AMOUNT OF SEPARATION BETWEEN 2 POINTS AS MEASURED ALONG AN INCLINE. SLOPE DISTANCE = HORIZONTAL DISTANCE WHEN THE % SLOPE BETWEEN THE 2 POINTS IS ZERO. WHEN MEASURING SLOPE DISTANCE FOR REFERENCE TREES, SLOPE DISTANCE IS MEASURED FROM THE HEAD OF THE NAIL AT THE BASE OF THE TREE TO SUBPLOT CENTER

SNAG: A STANDING DEAD TREE. IN THE CURRENT INVENTORY, A SNAG MUST BE $\geq$5.O IN. DBH AND $\geq$4.5 FEET TALL, AND HAVE A BOLE WHICH DOES NOT TOUCH THE GROUND. A SNAG MAY BE EITHER SELF-SUPPORTED BY ITS ROOTS, OR SUPPORTED BY ANOTHER TREE OR SNAG.

SOFTWOODS: CONIFEROUS TREES, USUALLY EVERGREEN, HAVING NEEDLE OR SCALE-LIKE LEAVES.

STAND AGE: THE TOTAL AGE OF A FOREST STAND THAT BEST CHARACTERIZED THE STAND. STANDS ARE EVEN- OR UNEVEN-AGED.

STANDING DEAD TREE: SEE SNAG.

STAND DENSITY INDEX: THE MAXIMUM NUMBER OF TREES PER UNIT AREA A FOREST SITE WILL SUPPORT WHEN THE STAND D.B.H. IS 10 INCHES RELATIVE TO THE MAXIMUM EXPECTED NUMBER IF THE SITE WERE CAPABLE OF SUPPORTING A NORMAL STAND.

STAND SIZE:	A CLASSIFICATION OF STANDS BASED ON TREE SIZE. STAND SIZES ARE LARGE SAWTIMBER, SMALL SAWTIMBER, POLETIMBER, AND SEEDLING-SAPLING STANDS. IF LESS THAN 10 PERCENT STOCKED WITH LIVE TREES, THE SITE IS CALLED NONSTOCKED.
STOCKING:	A QUALITATIVE EXPRESSION BASED ON COMPARING THE EXISTING NUMBER OF TREES PRESENT ON A FOREST SITE TO THE NUMBER NEEDED TO ACHIEVE THE MOST OPTIMAL GROWTH, VOLUME, OR VALUE POSSIBLE ON THE SITE.
SUNSCALD:	DAMAGE TO THE CAMBIUM CAUSED BY OVEREXPOSURE TO SUN .
SWEEP:	A BROAD ARC IN A BOLE OR LOG. A SOUND CULL DEFECT.
TALLY TREE	A TREE, SAPLING, OR SEEDLING THAT IS SELECTED TO BE MEASURED ACCORDING TO THE RULES IN THIS MANUAL.
TERMINAL LEADER:	THE TOPMOST SHOOT OF A TREE.
TRACHEID:	PART OF WOOD STRUCTURE: A LONG, TUBELIKE CELL IN WOOD TISSUE.
TRACKABLE TREE:	A SAMPLED TREE THAT IS REFERENCED AND REMEASURED IN SUCCESSIVE INVENTORIES ON PERMANENT PLOTS.
TRAINING PLOT	A PLOT ESTABLISHED FOR TRAINING OR CERTIFICATION PURPOSES ONLY. IT DOES NOT BELONG TO THE 6000-ACRE GRID DATABASE.
TREE	A TREE IS A WOODY PLANT THAT HAS AN ERRECT PERENNIAL STEM OR TRUNK AT MATURITY THAT IS AT LEAST 3.0 IN. DIAMETER AT BREAST HEIGHT (4.5 FEET) AND A TOTAL HEIGHT OF AT LEAST 12 FEET. (Ag. Handbook No. 541, 1979, ed., p. 3).
UNEVEN-AGED STAND:	A STAND THAT IS NOT CLASSIFIED AS NONSTOCKED AND THAT HAS LESS THAN 70 PERCENT OF THE TREES PRESENT WITHIN 30 YEARS OF ONE ANOTHER IN TOTAL AGE.
WILT:	DROOPING OF FOLIAGE; OFTEN A DISEASE SYMPTOM.

APPENDIX 17 – INDEX

APPENDIX 17 -- BLANK PAGES FOR NOTES

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