



# FOREST SERVICE HANDBOOK PACIFIC SOUTHWEST REGION (R5) VALLEJO, CALIFORNIA

## FSH 2409.12 - TIMBER CRUISING HANDBOOK

### CHAPTER 40 - CRUISE PLANNING DATA RECORDING, AND CRUISE REPORTING

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#### **Digest:**

41.1 - 6a. Removed sentence "Forest Supervisors may set error standards for any sale with an estimated value less than \$2,000."

41.1 - 6b. Added Section "For High Value Product Sales."

41.1 - 6c. Added Section "For Low Value Product Sales."

41.1 - Exhibit 01 – Added Row – High Value Timber Product Sales.

41.1 - Exhibit 01 – Added Row – Low Value Timber Product Sales.

41.1 - Exhibit 01 – Added Sentence – "For sales with an estimated value of \$250,000, the sample error for a scaled sale at the 95 percent confidence level must be plus or minus 20 percent, for a Tree measurement sale the sampling error must be plus or minus 10 percent."

42.41 Changed – The word "Book" to "Reference Guide."

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## 41 - CRUISE PLANNING

### 41.1 - Sampling Error Standards.

6. Use the following error standards for the indicated stand components:
  - a. Select the sale-as-a-whole Sampling Error Standard to use based on the type of material being sold (sawtimber, non-sawtimber, other products); the sale bid value estimated at the time of cruise planning; and whether the sale is to be sold on a tree measurement or scaled basis. (It is not necessary to redesign or adjust a cruise to a different sample error standard if the estimated value is later proven to be inaccurate.) Stewardship and traditional timber sale contracts have the same standards.
  - b. For High Value Product Sales with an equal to or greater than \$250,000, the maximum sampling error at the 95 percent Probability Level, for a scaled sale must be  $\pm 20$  percent or less, for tree measurement sale must be  $\pm 10$  percent or less.
  - c. Low Value Timber Product Sales with less than \$2,000 value containing biomass products (Product Code 08 and 20), or firewood (Product Code 07) use a 50 percent sampling error at a "t" value of 2. If the product is sawlogs (Product Code 01) use the minimum stratum error (40 percent for Scaled and 30 percent for Tree Measurement sales at t=2)
    - (1) Sawtimber Sales (Traditional Timber Sales). Material sold as sawtimber generally meets the minimum size requirements for sawtimber included in the forest inventory, often 10 inches DBH (diameter at breast height) or greater.
    - (2) Use the Fall, Buck, and Scale procedure explained in FSH 2409.12, section 22.42 for tree measurement sales where the estimated value of the sale is \$250,000 or more, and the defect is 25 percent or more.

Accuracy standards are different for sawtimber and non-sawtimber components of a timber sale. When a timber sale includes both products, do not combine the cruise errors to meet the sale accuracy standard. Each product retains its own accuracy standard.

Example:

A tree measurement sale has a total estimated value of \$40,000. The sale includes both sawtimber and biomass. In this case, because the value of the sale is so high, the value of the sale is based on the value of the sawtimber; the value of the biomass in a sale of this value is negligible. The sampling error standard for the sawtimber volume is listed in the parent text FSH 2409.12, section 41.1 Exhibit 01 as 18 percent for a sawtimber sale with a value between \$20,000 and \$45,000. The sampling error standard for the biomass (biomass being an "other product" in Exhibit 01 below) is always 25 percent in tree measurement sawtimber sales where the value of the sale is more than \$2,000.

- (3) Other Product Sales. This includes small sales of standing trees sold as miscellaneous convertible forest products. Exhibit 01 is applicable to other product sales with estimated advertised amounts of \$2,000 or more.

- (4) Stratum Volume Error Standard. The maximum sampling error for any one stratum that represents more than 10 percent of the total sale volume is 40 percent for scaled sales and 30 percent for tree measurement sales.
- d. Salvage Timber Sales. Salvage sales often present situations that make meeting the previous standards difficult or inappropriate. Different standards for salvage sales may be used with approval from the Regional Forester.

**41.1 - Exhibit 01 - Maximum Sampling Error (95 Percent Probability Level)**

Sale Type	Estimated Advertised Value of Sale	Sample Error Percent Scaled	Sample Error Percent Tree Measurement
High Value Timber Product Sales	≥ \$250,000	20.0 percent	10.0 percent
Low Value Timber Product Sales	\$0.00 to \$2,000	50.0 percent	40.0 percent
Small Timber Sales	\$2,000 to \$5,000	35.0 percent	25.0 percent
Other Product Sales	\$2,000 or more	35.0 percent	25.0 percent

See FSH 2409.12 Chapter 40, 41.1 Exhibit 01 for sales more than \$5,000.

For sales with an estimated value of \$250,000, the sample error for a scaled sale at the 95 percent confidence level must be plus or minus 20 percent, for a Tree measurement sale the sampling error must be plus or minus 10 percent.

**41.3 - Methods and Sampling Intensity**

In order to better estimate the volume distribution of log sizes for use with the R5 timber appraisal system, the following minimum sample sizes shall be met:

For Sawlog cruises, each major species or species group shall have at least 20 measured trees. A major species is defined as one that comprises 10 percent or more of the sale value. Similar species may be included in the same species group, for example, ponderosa pine and Jeffrey pine. In addition, each sample group should have a minimum of 20 trees. Minor species may be combined in one sample group.

For area based (plot) cruises, there shall be a minimum of 20 plots.

**41.7 - Special Instructions**

5. Cruise Planning - Deleting Cruised Volume. Many events can lead to deleting areas and volume from a sale in the sale preparation phase. When designing a cruise, plan for change. This means organizing the initial cruise design to facilitate change. Often, this can be accomplished by tracking tallies and measured samples by species, diameter class, cutting unit or portions of cutting units (especially when identifiable portions of cutting units may be at a higher risk of later being deleted from the unit.) Strategies may include: (1) tallying and mapping by unit or sub-unit features; (2) tracking tree tallies by dbh and species; (3) using sample groups by dbh class and/or species; and (4) using insurance trees.

The cleanest way to make cruise adjustments when volume must be deleted, if possible, is to simply delete the tallies (or KPI's) and measure trees from the data and re-run it. If it is not possible to identify the deleted volume from the original cruise data, the volume to be deleted can be cruised as a block. The resulting error for the volume remaining in the sale is:

$$E_{rem} = \frac{\sqrt{(V_t * E_t)^2 + (V_{del} * E_{del})^2}}{(V_t - V_{del})}$$

E rem = sampling error of remaining volume

Vt = total volume

Et = sampling error of total volume

V del = deleted volume

E del = sampling error of deleted volume

Use a deletion cruise, using the procedure above, when timber must be deleted from a sale cruise. The following procedures illustrated in exhibit 01 may also be used for deleting volume from a cruise.

6. For cruises that do not meet sampling error standards, the following procedures may be used to bring the cruise into compliance with standards:
  - a. Tree Based Cruises: measure insurance trees.
  - b. Area Based (plot) Cruises: add additional plots. Additional plots must be systematically placed throughout the whole stratum. For F3P, measure insurance trees.

**41.7 Exhibit 01 - Cruise Methods to Delete Individual Trees or Delete Areas**

Cruise Method	Deleting Individual Trees	Deleting Areas
100 Percent Cruise Method	<ul style="list-style-type: none"> <li>• Deleting a Species Delete all trees of the species from the cruise.</li> <li>• Deleting a Diameter Class Delete all trees of the diameter class from the cruise.</li> </ul>	<ul style="list-style-type: none"> <li>• Entire Units Delete all measured trees from the cruise within the unit.</li> <li>• Partial Units Identify the trees in the area to be removed (This might mean going back to the field). Delete the measured trees from the cruise.</li> </ul>
Sample Tree Cruise Method	<ul style="list-style-type: none"> <li>• Deleting a Species Delete all of the count and measured trees for that species from the cruise.  If you cannot identify the count trees by species, re-tally the species and delete the tally from the cruise.</li> <li>• Deleting a Diameter Class If you cannot identify the count trees by the diameter class to be deleted, re-cruise the strata or re-tally the diameter class to be removed and delete the tally from the count trees and the measured trees that fall in the diameter class.</li> </ul>	<ul style="list-style-type: none"> <li>• Deleting a Unit Delete all of the count and measured trees for that unit from the cruise.</li> <li>• Deleting a Partial Unit Visit the area to be removed. Tally the trees and identify the measure trees within the area to be removed. Delete the tallied tree counts (by sample group) and the measured trees from the cruise.</li> </ul>
3P Cruise Method	<ul style="list-style-type: none"> <li>• Deleting a Species If sample grouped by species, delete the sum of the KPI and all measured trees for that species.  If did not sample group by species, re-cruise strata or cruise the trees to be deleted.</li> <li>• Deleting a Diameter Class If sampled grouped by diameter class, delete the sum of the KPI and all measured trees for that sample group.  If you did not sample group by diameter class, cruise the trees to be deleted or re-cruise strata.</li> </ul>	<ul style="list-style-type: none"> <li>• Deleting a Unit Delete the sum of the KPI and all measured trees within the removed unit.</li> <li>• Deleting a Partial Unit Re-cruise the unit keeping the same KZ value.  Re-cruise the strata with different KZ values if necessary  Cruise the trees to be deleted.</li> </ul>

Cruise Method	Deleting Individual Trees	Deleting Areas
Sample Tree - 3P Cruise Method	<ul style="list-style-type: none"> <li>• Deleting a Species If sample grouped by species, delete the count, the sum of the KPI, and all measured trees for that species.  If did not sample group by species, re-cruise strata.</li> <li>• Deleting a Diameter Class If sample grouped by diameter class, delete the count, the sum of the kpi and all measured trees for that sample group.  If you did not sample group by diameter class, re-cruise strata</li> </ul>	<ul style="list-style-type: none"> <li>• Deleting a Unit Delete the count, the sum of the KPI, and all measured trees within the removed unit.</li> <li>• Deleting a Partial Unit Re-cruise the unit keeping the same frequency and KZ value.  Re-cruise the strata with different frequencies and KZ values if necessary</li> </ul>
Variable Plot Cruise Method	<ul style="list-style-type: none"> <li>• Deleting A Species Delete all the measured trees for that species from each plot.</li> <li>• Deleting a Diameter Class. Delete all of the measured trees for that diameter class from each plot.</li> <li>• Caution  Do not change the number of plots in the strata. If a plot contains only the removed species or diameter class, a zero tree plot must be added to the strata</li> </ul>	<ul style="list-style-type: none"> <li>• Deleting a Unit Delete all of the plots for that unit from the cruise.</li> <li>• Deleting a Partial Unit Identify and delete all plots from the removed area.  Update the unit acres</li> </ul>
Fixed Plot Cruise Method	<ul style="list-style-type: none"> <li>• Deleting A Species Delete all the measured trees for that species from each plot.</li> <li>• Deleting a Diameter Class. Delete all of the measured trees for that diameter class from each plot.</li> <li>• Caution  Do not change the number of plots in the strata. If a plot contains only the removed species or diameter class, a zero tree plot must be added to the strata</li> </ul>	<ul style="list-style-type: none"> <li>• Deleting a Unit Delete all of the plots for that unit from the cruise.</li> <li>Deleting a Partial Unit Identify and delete all plots from the removed area.  Update the unit acres</li> </ul>

Cruise Method	Deleting Individual Trees	Deleting Areas
Point Count/Measure Cruise Method	<ul style="list-style-type: none"> <li>• Deleting a Species                If you can identify the count trees by species, delete all the count and measured trees from the plots for the species to be removed                 If not, revisit all of the plots and identify the species counts. Delete all the count and measured trees for the species to be removed.</li> <li>• Deleting a Diameter Class                Revisit all of the plots and identify the counts by diameter class. Delete all count and measured trees for the diameter class to be removed.</li> <li>• Caution                Do not change the number of plots in the strata. If a plot contains only the removed species or diameters, that plot will be a zero tree plot.</li> </ul>	<ul style="list-style-type: none"> <li>• Deleting a Unit                Delete all of the plots for that unit from the cruise.</li> <li>• Deleting a Partial Unit                Identify and delete all plots (count and measure) from the removed area.                 Update the unit acres.</li> </ul>
Fixed Plot - 3P Cruise Method	<ul style="list-style-type: none"> <li>• Deleting a Species                If sampled grouped by species, delete the sum of the KPI and all measure trees for that species.                 If did not sample by species (or otherwise keep a separate tally of KPI by species), either cruise the trees to be deleted or re-cruise the strata.</li> <li>• Deleting a Diameter Class                If you did not sample group by diameter class, cruise the trees to be deleted or re-cruise strata.</li> </ul>	<ul style="list-style-type: none"> <li>• Deleting a Unit                Delete all plots within the removed unit.</li> <li>• Deleting a Partial Unit                Identify and delete all plots from the removed area.                 Update the unit acres.</li> </ul>
3P Point (Biomass) Cruise Method	<ul style="list-style-type: none"> <li>• Deleting a Species                Re-cruise the strata</li> <li>• Deleting a Diameter Class                Re-cruise the strata</li> </ul>	<ul style="list-style-type: none"> <li>• Deleting a Unit                Delete all plots within the removed unit.</li> <li>• Deleting a Partial Unit                Identify and delete all plots from the removed area.                 Update the Unit Acres.</li> </ul>

**End 41.7 Exhibit 01 - Cruise Methods to Delete Individual Trees or Delete Areas**

## **42 - DATA RECORDING**

### **42.4 - Forms and Electronic Data Recorders**

#### **42.41 - Forms**

Use the Timber Cruise Reference Guide, form R5-2400-28A for hard copy recording of cruise data.

#### **42.42 - Electronic Data Recorders**

Use the National Cruise System software developed by the Forest Management Service Center of the Washington Office to collect timber cruise data with electronic data recorders.

## **43 - CRUISE REPORTING**

### **43.2 - Volume, Value, and Sampling Error Reporting**

Use FS Cruiser software on field data recorders or personal computers to build data files for use with the National Cruise System. Generate cruise summary reports from the Cruise Processing software.