The Forest Inventory and Analysis Database:

Population Estimation User Guide (Edition: November, 2018)

Contents

Estimation Guide Updates

Preface

Abstract
Keywords
Authors
Background
Acknowledgments

Chapter 8: Using Population-by-Evaluation Type Views 8-1

Literature Cited

Appendix

Appendix A: Values and Descriptions in REF_POP_ATTRIBUTE

Estimation Guide Updates

Changes from the Previous Database Version

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Updates

Database users should be aware that changes are made for each version of FIADB. Sometimes the changes are minimal, such as simply rewriting explanatory text for clarification or adding new codes to a particular attribute.

Users who desire to have a hard-copy version can easily print only the sections that are of interest. For each chapter and appendix, the header information located in the top margin of each page details when the chapter or appendix was last modified. In addition, the page numbering for each chapter and appendix, located in the bottom margin of each page, is independent from other chapters and appendices. Therefore, for future versions, if a particular chapter or appendix has not been modified, it will not need to be printed again.

In edition November, 2018, the following major modifications were made to edition March, 2017.

- **This is a major revision from the previous version with changes in all sections. Users are encouraged to read all sections.**
- Chapter 2, Selecting the Attribute of Interest, was deleted, and the following chapters were each moved up in order. Note there is no longer a chapter 9.
- Chapter 7. Estimates of Change over Time, (formerly chapter 8), has been revised extensively. Users should read this chapter carefully.
- Appendix A was updated to match the REF_POP_ATTRIBUTE table in the current release of the FIADB.

Hard-copy printing:

To print sections from this PDF document, it will be necessary to specify the continuous page number range for the desired section to be printed. Table H outlines the start page and end page for each document section. This guide is intended to be printed on both sides of the paper.

Table A: Page range for individual document sections (for hard-copy printing).

Document section	start page	end page
Table of Contents	1	2
Estimation Guide Updates	3	4
Preface	5	8
Chapter 1: Introduction	9	10
Chapter 2: Selecting an Appropriate Sample and Attribute of Interest	11	16
Chapter 3: Linking the Appropriate Tables	17	26
Chapter 4: Producing Estimates with Sampling Errors	27	40
Chapter 5: Restricting the Attribute of Interest to a Smaller Subset of the Population	41	44
Chapter 6: Changing the Attribute of Interest with User-Defined Criteria	45	48
Chapter 7: Estimates of Change of Time	49	102
Chapter 8: Using Population-by-Evaluation Type Views	103	106
Literature Cited	107	108
Appendix A: Values and Descriptions in RED_POP_ATTRIBUTE	109	166

Preface

Preface Contents:

Heading
Abstract
Authors
Background
Acknowledgments

Abstract

This document is based on previous documentation of the nationally standardized Forest Inventory and Analysis database (Hansen and others 1992; Woudenberg and Farrenkopf 1995; Miles and others 2001; Woudenberg and others 2010). Examples for producing population-level estimates are presented. This database provides a consistent framework for storing forest inventory data across all ownerships for the entire United States. These data are available to the public.

Keywords:
Forest Inventory and Analysis, inventory database, estimation, user manual, user guide, monitoring

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Background

The Forest Inventory and Analysis (FIA) research program has been in existence since mandated by Congress in 1928. FIA's primary objective is to determine the extent, condition, volume, growth, and use of trees on the Nation's forest land. Before 1999, all inventories were conducted on a periodic basis. The passage of the 1998 Farm Bill requires FIA to collect data annually on plots within each State. This kind of up-to-date information is essential to frame realistic forest policies and programs. USDA Forest Service regional research stations are responsible for conducting these inventories and publishing summary reports for individual States.

In addition to published reports, the Forest Service provides data collected in each inventory to those interested in further analysis. This report describes a standard format in which data can be obtained. This standard format, referred to as the Forest Inventory and Analysis Database (FIADB) structure, was developed to provide users with as much data as possible in a consistent manner among States. A number of inventories conducted prior to the implementation of the annual inventory are available in the FIADB. However, various data attributes may be empty or the items may have been collected or computed differently. Annual inventories use a common plot design and common data collection procedures nationwide, resulting in greater consistency among FIA work units than earlier inventories. Data field definitions note inconsistencies caused by different sampling designs and processing methods.

Acknowledgments

In addition to those listed as authors, the following people provided additional contributions to this document:

Chapter 1: Introduction

This guide presents procedures that can be used to obtain population estimates (and associated sampling errors) for standard FIA attributes from the measurement data stored in the FIADB. These estimates follow the equations presented in Bechtold and Patterson (2005, chapter 4). Many of the procedures are available as SQL (structured query language for requesting information from a database) in the REF_POP_ATTRIBUTE table.

Population estimates for many attributes can be generated using FIA web-based tools. The tools: EVALIDator and Design and Analysis Toolkit for Inventory and Monitoring (DATIM) allow any user (who may or may not understand the underlying structure of the FIADB) to produce their own estimates. Advanced users can also produce estimates by either creating their own scripts, or they can copy, paste and modify the examples in this document.

For those familiar with previous publications, this edition of the Population Estimation User Guide presents a revision in the estimation scripts from Oracle SQL to PostgreSQL. The change is made to allow more flexibility in the software platforms used to run the scripts - PostgreSQL scripts can be run in both Oracle and the open source PostgreSQL platforms.

Currently, the FIADB data are available for download in two formats, as either comma delimited files or as a package to establish a PostgreSQL database for working offline. MS Access download files were once available but are now deprecated because of the 2 gigabyte size limitation, of which data for some States have already exceeded. The new download option for PostgreSQL databases is not hindered by size.

The data and tools page is at https://www.fia.fs.fed.us/tools-data/. From there, the instructions for installing PostgreSQL software and download data files can be found at the FIA DataMart (https://apps.fs.usda.gov/fia/datamart/datamart.html).

The FIADB can be used to estimate many attributes (e.g., forest area, timberland area, number of trees, net volume, biomass) from many different samples (typically State-wide inventories for a specific year or set of years). Therefore, the number of estimates that can be made from the FIADB is very large, and continues to increase as more data are added to the FIADB. This guide provides examples of a few estimation procedures that can be modified by the user. **The FIADB is continually updated. Therefore, the resulting estimates shown as output are examples only and are not necessarily the exact numbers a user will obtain using current data.**

In addition to the naming conventions used in the FIADB, reference is made to the notation and terminology used in Bechtold and Patterson (2005). To fully understand the statistical basis of the estimation, readers may find it useful to refer to that publication as they review this guide.

This guide is divided into chapters that describe the basic steps required for traditional population-level estimates with sampling error (chapters 2-4). Additional steps are presented for those interested in custom-level and change-over-time analyses (chapters 5-7). Chapter 8 explains how users who have the ability to directly query the FIADB can incorporate expansion views in their scripts.

Chapter 2: Selecting an Appropriate Sample and Attribute of Interest

In order to compute a sample-based population estimate[1] for an attribute of interest, the appropriate sample and stratification must be identified. In FIA estimation, the sample is a set of plots that were selected for the attribute of interest that was observed. The stratification consists of an assignment of plots to strata (non-overlapping areas of a known or estimated size) that in aggregate, define the population of interest. There is an assignment of plots to every stratum, and all plots are assigned to one, and only one stratum, for each evaluation. FIA uses the term "evaluation" to describe this process of storing different stratifications of data either for an individual set of data or for the changing sets of data through time. An evaluation describes the area being evaluated (often a State), the time period of the evaluation, and the type of estimates the evaluation can be used to compute (e.g., area, volume, growth, removals, and mortality). Thus, an evaluation is a set of plots defined in the FIADB that can be used to make a statistically valid sample-based estimate for a population (area of land) based on a specific stratification.

Each evaluation used by FIA is identified, named, and stored as a single entry in the POP_EVAL table. The important data items in the POP_EVAL table are listed in table 2-1 for all evaluations that are loaded into the FIADB for data collected in Minnesota through 2006. RSCD (Region or Station Code) and EVALID (Evaluation Identifier) are the natural identifiers of a specific record. EVAL_DESCR provides a description of the evaluation, indicating a periodic or annual inventory. Table 2-1 shows annual inventories for MN started in 1999 and are based on 5 years of measurements. STATECD and LOCATION_NM describe the geographic extent of the population that was sampled and REPORT_YEAR_NM describes the years in which the sample was taken. For older periodic inventories, REPORT_YEAR_NM typically reflects a single reporting year (the one used in the FIA publications), even though the plots may have been measured over several years. Annual inventories (taken since 1999) list the years of data measurements used in the estimation. There are usually multiple evaluations for a specific year because not all plots observed have every attribute of interest, and/or different stratifications are used in the estimation of different attributes of interest. For example, volume estimation can be done on plots measured at only one point in time. However, growth estimates require repeat measurements. Thus, evaluations for the estimation of change (e.g., growth, removals, etc.) only use plots that are repeat measurements.

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1.   Beginning with FIADB version 1.6.02, there are population-by-evaluation-type views available to users who query the FIADB within the Forest Service firewall. These views allow users to select the appropriate population more directly. See chapter 8 for more information about using these views.

Table 2-1: Important POP_EVAL entries for Minnesota through 2006 from the FIADB.

RSCD	EVALID	EVAL DESCR	STATECD	LOCATION NM	REPORT YEAR NM
23	277701	MINNESOTA 1977: CURRENT AREA	27	Minnesota	1977
23	277702	MINNESOTA 1977: CURRENT VOLUME	27	Minnesota	1977
23	277703	MINNESOTA 1977: GROWTH (PERIODIC)	27	Minnesota	1977
23	277704	MINNESOTA 1977: MORTALITY (PERIODIC)	27	Minnesota	1977
23	277705	MINNESOTA 1977: REMOVALS (PERIODIC)	27	Minnesota	1977
23	279001	MINNESOTA 1990: CURRENT AREA (PERIODIC)	27	Minnesota	1990
23	279002	MINNESOTA 1990: CURRENT VOLUME (PERIODIC)	27	Minnesota	1990
23	279003	MINNESOTA 1990: GROWTH (PERIODIC)	27	Minnesota	1990
23	279004	MINNESOTA 1990: MORTALITY (PERIODIC)	27	Minnesota	1990
23	279005	MINNESOTA 1990: REMOVALS (PERIODIC)	27	Minnesota	1990
23	279006	MINNESOTA 1990: CHANGE (PERIODIC)	27	Minnesota	1990
23	270300	MINNESOTA 2003: 1999-2003: ALL AREA	27	Minnesota	1999;2000;2001; 2002;2003
23	270301	MINNESOTA 2003: 1999-2003: CURRENT AREA, CURRENT VOLUME	27	Minnesota	1999;2000;2001; 2002;2003
23	270302	MINNESOTA 2003: 1990 TO 1999-2003: GROWTH, REMOVALS, MORTALITY	27	Minnesota	1999;2000;2001; 2002;2003
23	270400	MINNESOTA_2004: 2000-2004: ALL AREA	27	Minnesota	2000;2001;2002; 2003;2004
23	270401	MINNESOTA 2004: 2000-2004: CURRENT AREA, CURRENT VOLUME	27	Minnesota	2000;2001;2002; 2003;2004
23	270500	MINNESOTA 2005: 2001-2005: ALL AREA	27	Minnesota	2001;2002;2003; 2004;2005
23	270501	MINNESOTA 2005: 2001-2005: CURRENT AREA, CURRENT VOLUME	27	Minnesota	2001;2002;2003; 2004;2005
23	270600	MINNESOTA 2006: 2002-2006: ALL AREA	27	Minnesota	2002;2003;2004; 2005;2006
23	270601	MINNESOTA 2006: 2002-2006: CURRENT AREA, CURRENT VOLUME	27	Minnesota	2002;2003;2004; 2005;2006
23	270700	MINNESOTA 2007: 2003-2007: ALL AREA	27	Minnesota	2003;2004;2005; 2006;2007

RSCD	EVALID	EVAL DESCR	STATECD	LOCATION NM	REPORT YEAR NM
23	270701	MINNESOTA 2007: 2003-2007: CURRENT AREA, CURRENT VOLUME	27	Minnesota	2003;2004;2005; 2006;2007
23	270402	MINNESOTA 2004: 1999 TO 2004: GROWTH, REMOVALS, MORTALITY	27	Minnesota	2004
23	270502	MINNESOTA 2005: 1999-2000 TO 2004-2005: GROWTH, REMOVALS, MORTALITY	27	Minnesota	2004;2005
23	270602	MINNESOTA 2006: 1999-2001 TO 2004-2006: GROWTH, REMOVALS, MORTALITY	27	Minnesota	2004;2005;2006

An evaluation group is the set of evaluations that are included in a typical FIA report for a State. For example the evaluations that went into the report entitled "Minnesota's forests 1999-2003 (Part A.)" (Miles and others 2007) are identified by EVALIDs 270300, 270301 and 270302, and are collectively identified by a single record in the POP_EVAL_GRP table where POP_EVAL_GRP.EVAL_GRP = 272003. Table 2-2 lists selected columns for all evaluation groups that are loaded into FIADB for data collected in Minnesota through 2006.

Table 2-2: Selected POP_EVAL_GRP entries for Minnesota through 2006 from the FIADB.

RSCD	EVAL_GRP	EVAL_GRP_DESCR	STATECD
23	271977	MINNESOTA 1977: CURRENT AREA, CURRENT VOLUME, GROWTH, REMOVALS, MORTALITY	27
23	271990	MINNESOTA 1990: CURRENT AREA, CURRENT VOLUME, GROWTH, REMOVALS, MORTALITY, CHANGE	27
23	272003	MINNESOTA 2003: ALL AREA, CURRENT AREA, CURRENT VOLUME, GROWTH, REMOVALS, MORTALITY	27
23	272004	MINNESOTA 2004: ALL AREA, CURRENT AREA, CURRENT VOLUME, GROWTH, REMOVALS, MORTALITY	27
23	272005	MINNESOTA 2005: ALL AREA, CURRENT AREA, CURRENT VOLUME, GROWTH, REMOVALS, MORTALITY	27
23	272006	MINNESOTA 2006: ALL AREA, CURRENT AREA, CURRENT VOLUME, GROWTH, REMOVALS, MORTALITY	27

POP_EVAL_GRP.EVAL_GRP identifies the evaluation group by its State FIPS code (first 2 digits) and a year (last 4 digits), which is the year commonly associated with estimates (if EVAL_GRP does not follow this format, see the EVAL_GRP_DESCR for the precise identification). In table 2-2 we see evaluation groups for two periodic inventory estimates (1977 and 1990), and four annual estimates (2003, 2004, 2005 and 2006). The POP_EVAL_TYP table provides a link between the evaluation groups in POP_EVAL_GRP and the evaluations in POP_EVAL. POP_EVAL_TYP.EVAL_TYP identifies the evaluation type - 'EXPCURR', 'EXPVOL', 'EXPDWM', 'EXPREGEN', 'EXPGROW', 'EXPMORT', 'EXPREMV', 'EXPCHNG' or 'EXPALL' - that can be estimated from a specific evaluation.

The POP_EVAL_TYP table allows users to query the appropriate evaluation by identifying only the eval_grp (STATECD*10000 + INVYR) and evaluation type (EVAL_TYP), and

allows for different types of evaluations to be added in the future. In the example below, the appropriate evaluation is selected for the estimation of volume attributes (EVAL_TYP = EXPVOL) for the Minnesota 2003 annual inventory.

```
SELECT pev.cn, pev.evalid, pev.eval_descr
  FROM fs_fiadb.pop_eval_grp peg
  JOIN fs_fiadb.pop_eval_typ pet
    ON (pet.eval_grp_cn = peg.cn)
  JOIN fs_fiadb.pop_eval pev
    ON (pev.cn = pet.eval_cn)
 WHERE peg.eval_grp = 272003
 AND pet.eval_typ = 'EXPVOL'
```

In this case, POP_EVAL.EVALID = 270301 and is valid for current area and current volume estimates as shown in the following output:

CN	EVALID	EVAL_GRP_DESCR
197440374010661	270301	MINNESOTA 2003: 1999-2003: CURRENT AREA, CURRENT VOLUME

Various attributes of interest can be estimated for each EVAL_TYP. The most common attributes of interest are described in the REF_POP_ATTRIBUTE table (appendix A). These include estimates for conditions, trees (larger than seedlings), seedlings (trees less than 1 inch d.b.h./d.r.c.), and down woody materials associated with specific evaluation types.

Condition attributes are area estimates associated with the EXPALL, EXPCHNG, and EXPCURR evaluation types. EXPALL has an area estimate for sampled and nonsampled land and water. EXPALL is only appropriate for area estimation where the area of hazardous and denied access are of interest. All other evaluations treat hazardous and denied access as non-measured and adjust the estimate to account for these areas. EXPCURR has area estimates for forest land, timberland, and all sampled land and water. EXPCHNG has estimates for area change from remeasured plots.

Tree attributes are estimates for the number, volume, biomass (weight), and carbon of trees. Estimates are available for trees of various size, status, and class such as sapling, live, standing dead, growing-stock and sawtimber, and for various trees parts such as aboveground, belowground, merchantable bole, sound bole, sawlog, stump, top and limbs. Tree attributes are associated with EXPVOL, EXPGROW, EXPMORT and EXPREMV evaluation types. EXPVOL has carbon, biomass, volume, and number of tree estimates. EXPGROW has estimates for gross growth, net growth (gross growth minus mortality), and net change (net growth - removals) by carbon, biomass, and volume. EXPMORT has estimates of tree mortality by carbon, biomass, volume, and number of trees. EXPREMV has estimates of tree removals by carbon, biomass, volume, and number of trees. EXPREMV estimates are available for harvest and other (land-use change) removals. Seedling attributes are estimates for number of seedlings (EVAL_TYP = EXPVOL) and carbon of seedlings (EVAL_TYP = EXPCURR).

Forest carbon estimates associated with EXPCURR are based on modeled tree and stand-level attributes and include forest pools such as organic soil, live belowground, dead wood, litter and live aboveground. Down woody materials attributes are associated with

EXPDWM and include estimates for the number, volume, biomass, and carbon of down woody materials.

REF_POP_ATTRIBUTE contains a unique id (ATTRIBUTE_NBR), a description of the attribute (ATTRIBUTE_DESCR), an associated evaluation type (EVAL_TYP), and the SQL statement or query (SQL_QUERY) that produces each estimate. Examples from SQL_QUERY are presented in upcoming chapters.

Chapter 3: Linking the Appropriate Tables

This chapter presents examples of SQL from REF_POP_ATTRIBUTE.SQL_QUERY for calculating estimates of area, number of trees, number of seedlings, and tree volume. Prior to these examples, a generic script (Example 3-1) is presented.

Any script presented in this document runs in Oracle. After variables (variables are indicated with the precursor '&') are replaced with literal values then each script will work in PostgreSQL. Oracle accepts variables such as &FIADB_SCHEMA (e.g., fs_fiadb) and &EVAL_GRP (e.g., 272003) shown in the examples. The user is prompted to enter a value for each variable upon running a script in Oracle. PostgreSQL does not accept these variables.

The scripts have three main sections including the select clause where the population estimate is specified for output, the join clause where the required data tables are joined, and the where clause defining additional restrictions to identify the population of interest.

The select clause usually contains an expression for the sum of the unadjusted observations of the attribute of interest (e.g., TREE.TPA_UNADJ) multiplied by an adjustment factor (e.g., POP_STRATUM.ADJ_FACTOR_SUB). This expression is multiplied by an area expansion factor (POP_STRATUM.EXPNS).

POP_STRATUM.EXPNS is the area the sampled unit represents. The sampled unit is usually a plot and the expansion is the area that a stratum represents divided by the number of sampled plots in that stratum. The stratum adjustment factor accounts for partially nonsampled plots (nonsampled due to access denied, hazardous portions, or portions outside of population boundary; see POP_STRATUM table) and is the inverse of the mean proportion of the sample plot areas that were within the sampled population. Following the notation of Bechtold and Patterson (2005), this adjustment factor is $1 / p_{mh}$ (see equation 4.2, page 49). Area estimates use either ADJ_FACTOR_MACR (area estimates based on the macroplot) or ADJ_FACTOR_SUBP (area estimates based on the subplot) for the adjustment. The adjustment of tree- and seedling-level estimates is based on the plot on which the tree or seedling was sampled (seedlings and trees <5 inches diameter are sampled on the microplot, larger trees are sampled on the subplot or macroplot depending on diameter). For the sum of unadjusted observations, Bechtold and Pattterson (2005) use P_{hid} (see equation 4.1, page 47) and y_{hid} (see equation 4.8, page 53) for the estimation of condition (area) and tree attributes, respectively.

Estimation requires linking the plot (PLOT, COND, TREE, and SEEDLING tables) to the stratification information (POP_PLOT_STRATUM_ASSGN, POP_STRATUM, and POP_ESTN_UNIT) for the selected evaluation (POP_EVAL, POP_EVAL_GRP, and POP_EVAL_TYP) that defines the sample. Those links are provided in the join clause (lines 03 through 11 do not change).

- Line 04 joins the evaluation group, for which the estimate is being made, with the evaluation types (e.g., area, tree volume).

- Line 05 joins evaluation types to the evaluation identifier (label used to define the set of plots that make up the estimation population).

- Line 06 joins the evaluation identifier to the associated evaluation unit records (geographic areas identified as estimation units).

- Line 07 joins the estimation unit to the strata records (area within estimation unit).

- Line 08 joins the stratum record to the plots within that stratum.
- Line 09 joins the plot record to the strata assigned to the plot.
- Line 10 joins the plot record to the PLOTGEOM records (geographic attributes such as congressional district assigned at plot level)
- Line 11 joins the condition records to the plot.
- Lines 12 or 13 include either the TREE table or SEEDLING table, and neither line should be included for condition-level estimates.

In the where clause, replace &EVAL_GRP with the desired evaluation group and specify the evaluation type.

See figure 3-1 for a schematic of links of some of the FIADB tables.

The following table shows some common aliases or abbreviations that may be used within a SQL script to reduce the overall length of the script and improve readability.

Common aliases for FIADB tables:

Alias	Table name
p	PLOT
c	COND
t	TREE
s	SEEDLING
ppsa	POP_PLOT_STRATUM_ASSGN
psm	POP_STRATUM
peu	POP_ESTN_UNIT
pet	POP_EVAL_TYP
peg	POP_EVAL_GRP
pev	POP_EVAL
rs	REF_SPECIES

Tables with selection criteria often used when querying classifications of land and groups of trees as shown below:

Identifying land classes (COND table):

Classification	Selection criteria
Forest land	COND_STATUS_CD = 1
Timberland	COND_STATUS_CD = 1, SITECLCD <7, RESERVCD = 0
Nonforest land	COND_STATUS_CD = 2
Reserved forest land	COND_STATUS_CD = 1, RESERVCD = 1
Unreserved forest land	COND_STATUS_CD = 1, RESERVCD = 0
Productive forest land	COND_STATUS_CD = 1, SITECLCD <7
Unproductive forest land	COND_STATUS_CD = 1, SITECLCD = 7

Identifying tree characteristics:

Classification	Selection criteria
Live trees	TREE.STATUSCD = 1
Standing dead trees	TREE.STATUSCD = 2, TREE.STANDING_DEAD_CD = 1
Growing-stock trees	TREE.STATUSCD = 1, TREE.TREECLCD = 2

Example 3-1: Standard estimation script.

Line	Script
01	--select clause SELECT SUM(**EXPRESSION** * POP_STRATUM.EXPNS **-- specify expression**
02	) estimated_value
03	--join clause FROM **&FIADB_SCHEMA.**POP_EVAL_GRP PEG
04	JOIN **&FIADB_SCHEMA.**POP_EVAL_TYP PET ON (PET.EVAL_GRP_CN = PEG.CN)
05	JOIN **&FIADB_SCHEMA.**POP_EVAL PEV ON (PEV.CN = PET.EVAL_CN)
06	JOIN **&FIADB_SCHEMA.**POP_ESTN_UNIT PEU ON (PEV.CN = PEU.EVAL_CN)
07	JOIN **&FIADB_SCHEMA**.POP_STRATUM POP_STRATUM ON (PEU.CN = POP_STRATUM.ESTN_UNIT_CN)
08	JOIN **&FIADB_SCHEMA.**POP_PLOT_STRATUM_ASSGN ON (POP_PLOT_STRATUM_ASSGN.STRATUM_CN = POP_STRATUM.CN)
09	JOIN **&FIADB_SCHEMA.**PLOT ON (POP_PLOT_STRATUM_ASSGN.PLT_CN = PLOT.CN)
10	JOIN **&FIADB_SCHEMA.**PLOTGEOM ON (PLOT.CN = PLOTGEOM.CN)
11	JOIN **&FIADB_SCHEMA.**COND ON (COND.PLT_CN = PLOT.CN)
12	**JOIN &FIADB_SCHEMA.TREE TREE ON TREE.PLT_CN = COND.PLT_CN** **AND TREE.CONDID = COND.CONDID)** *--tree table must be included for tree-level estimates*
13	**JOIN &FIADB_SCHEMA.SEEDLING SEEDLING ON (SEEDLING.PLT_CN = COND.PLT_CN** **AND SEEDLING.CONDID = COND.CONDID)** *-- seedling table must be included for seedling-level estimates*
14	--where clause **WHERE**
15	PEG.EVAL_GRP = **&EVAL_GRP** *--specify evaluation group*
16	AND PET.EVAL_TYP = '**EVAL_TYP**' *--specify evaluation type*
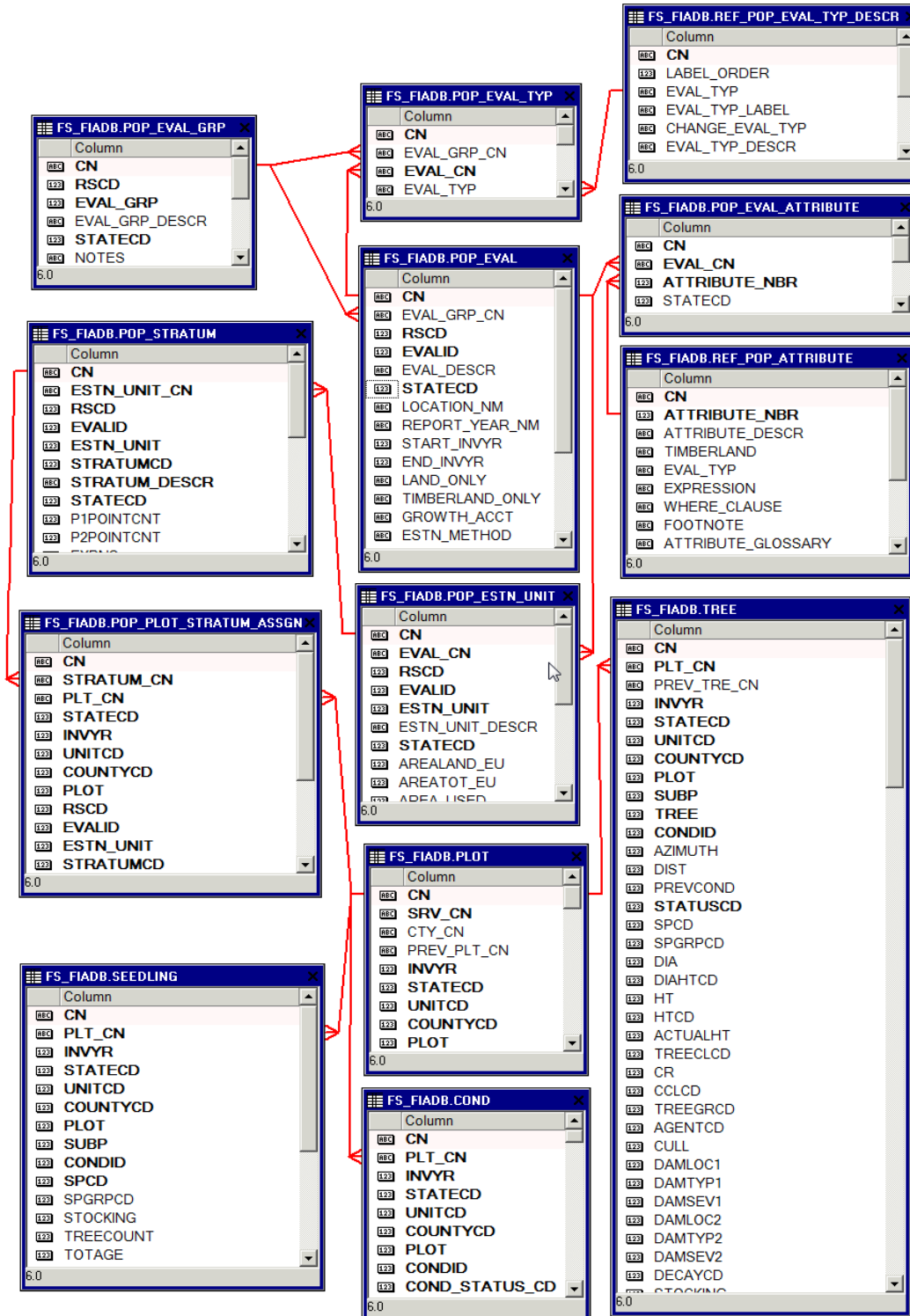
Figure 3-1: An abbreviated diagram of select FIADB tables. Note that there are more columns in each table than are shown.

The following four examples (3-2, 3-3, 3-4, and 3-5) are scripts available in REF_POP_ATTRIBUTE.SQL_QUERY (identified by ATTRIBUTE_NBR) that estimate condition-, tree-, and seedling-level attributes for the Minnesota 2003 inventory. Here the sections in bold are the sections that changed from the generic estimation script.

Note: The resulting estimates shown as output are examples only and are not necessarily the exact numbers a user will obtain using current data.

Example 3-2: Area of timberland, in acres (ATTRIBUTE_NBR 3), Minnesota 2003 (&EVAL_GRP = 272003).

```
-- select clause
SELECT SUM((COND.CONDPROP_UNADJ * CASE COND.PROP_BASIS
        WHEN 'MACR' THEN
          POP_STRATUM.ADJ_FACTOR_MACR
        ELSE
          POP_STRATUM.ADJ_FACTOR_SUBP
        END) * POP_STRATUM.EXPNS) AS ESTIMATED_VALUE
-- join clause
  FROM &FIADB_SCHEMA.POP_EVAL_GRP PEG
  JOIN &FIADB_SCHEMA.POP_EVAL_TYP PET
    ON (PET.EVAL_GRP_CN = PEG.CN)
  JOIN &FIADB_SCHEMA.POP_EVAL PEV
    ON (PEV.CN = PET.EVAL_CN)
  JOIN &FIADB_SCHEMA.POP_ESTN_UNIT PEU
    ON (PEV.CN = PEU.EVAL_CN)
  JOIN &FIADB_SCHEMA.POP_STRATUM POP_STRATUM
    ON (PEU.CN = POP_STRATUM.ESTN_UNIT_CN)
  JOIN &FIADB_SCHEMA.POP_PLOT_STRATUM_ASSGN
    ON (POP_PLOT_STRATUM_ASSGN.STRATUM_CN = POP_STRATUM.CN)
  JOIN &FIADB_SCHEMA.PLOT
    ON (POP_PLOT_STRATUM_ASSGN.PLT_CN = PLOT.CN)
  JOIN &FIADB_SCHEMA.PLOTGEOM
    ON (PLOT.CN = PLOTGEOM.CN)
  JOIN &FIADB_SCHEMA.COND
    ON (COND.PLT_CN = PLOT.CN)
-- where clause
  WHERE COND.RESERVCD = 0
    AND COND.SITECLCD IN (1, 2, 3, 4, 5, 6)
    AND COND.COND_STATUS_CD = 1
    AND COND.CONDPROP_UNADJ IS NOT NULL
    AND PET.EVAL_TYP = 'EXPCURR'
    AND PEG.EVAL_GRP = &EVAL_GRP
    AND 1 = 1
```

The example above produces an estimate of acres of timberland:

Item	Value
ESTIMATE	14,488,398

Example 3-3: Number of live trees (at least 1 inch d.b.h./d.r.c.), in trees, on forest land (ATTRIBUTE_NBR 4), Minnesota 2003 (&EVAL_GRP = 272003).

```sql
SELECT SUM((COALESCE(TREE.TPA_UNADJ * CASE
                WHEN TREE.DIA IS NULL THEN
                 POP_STRATUM.ADJ_FACTOR_SUBP
                ELSE
                 CASE LEAST(TREE.DIA, 5 - 0.001)
                   WHEN TREE.DIA THEN
                    POP_STRATUM.ADJ_FACTOR_MICR
                   ELSE
                    CASE LEAST(TREE.DIA,
                        COALESCE(PLOT.MACRO_BREAKPOINT_DIA, 9999) - 0.001)
                      WHEN TREE.DIA THEN
                       POP_STRATUM.ADJ_FACTOR_SUBP
                      ELSE
                       POP_STRATUM.ADJ_FACTOR_MACR
                     END
                    END
                END,
                0)) * POP_STRATUM.EXPNS) AS ESTIMATED_VALUE
-- join clause
  FROM &FIADB_SCHEMA.POP_EVAL_GRP PEG
  JOIN &FIADB_SCHEMA.POP_EVAL_TYP PET
    ON (PET.EVAL_GRP_CN = PEG.CN)
  JOIN &FIADB_SCHEMA.POP_EVAL PEV
    ON (PEV.CN = PET.EVAL_CN)
  JOIN &FIADB_SCHEMA.POP_ESTN_UNIT PEU
    ON (PEV.CN = PEU.EVAL_CN)
  JOIN &FIADB_SCHEMA.POP_STRATUM POP_STRATUM
    ON (PEU.CN = POP_STRATUM.ESTN_UNIT_CN)
  JOIN &FIADB_SCHEMA.POP_PLOT_STRATUM_ASSGN
    ON (POP_PLOT_STRATUM_ASSGN.STRATUM_CN = POP_STRATUM.CN)
  JOIN &FIADB_SCHEMA.PLOT
    ON (POP_PLOT_STRATUM_ASSGN.PLT_CN = PLOT.CN)
  JOIN &FIADB_SCHEMA.PLOTGEOM
    ON (PLOT.CN = PLOTGEOM.CN)
  JOIN &FIADB_SCHEMA.COND
    ON (COND.PLT_CN = PLOT.CN)
-- tree table must be included for seedling-level estimates
  JOIN &FIADB_SCHEMA.TREE
    ON (TREE.PLT_CN = COND.PLT_CN AND TREE.CONDID = COND.CONDID)
-- where clause
 WHERE TREE.STATUSCD = 1
   AND COND.COND_STATUS_CD = 1
   AND PET.EVAL_TYP = 'EXPVOL'
   AND PEG.EVAL_GRP = &EVAL_GRP
   AND 1 = 1
```

The example above produces an estimate of total number of live trees on forest land:

Item	Value
ESTIMATE	12,078,196,211

Example 3-4: Number of live seedlings (less than 1 inch d.b.h./d.r.c.), in seedlings, on timberland (ATTRIBUTE_NBR 46), Minnesota 2003 (&EVAL_GRP = 272003).

```
--- select clause
SELECT SUM((SEEDLING.TPA_UNADJ * POP_STRATUM.ADJ_FACTOR_MICR) *
        POP_STRATUM.EXPNS) AS ESTIMATED_VALUE
-- join clause
  FROM &FIADB_SCHEMA.POP_EVAL_GRP PEG
  JOIN &FIADB_SCHEMA.POP_EVAL_TYP PET
    ON (PET.EVAL_GRP_CN = PEG.CN)
  JOIN &FIADB_SCHEMA.POP_EVAL PEV
    ON (PEV.CN = PET.EVAL_CN)
  JOIN &FIADB_SCHEMA.POP_ESTN_UNIT PEU
    ON (PEV.CN = PEU.EVAL_CN)
  JOIN &FIADB_SCHEMA.POP_STRATUM POP_STRATUM
    ON (PEU.CN = POP_STRATUM.ESTN_UNIT_CN)
  JOIN &FIADB_SCHEMA.POP_PLOT_STRATUM_ASSGN
    ON (POP_PLOT_STRATUM_ASSGN.STRATUM_CN = POP_STRATUM.CN)
  JOIN &FIADB_SCHEMA.PLOT
    ON (POP_PLOT_STRATUM_ASSGN.PLT_CN = PLOT.CN)
  JOIN &FIADB_SCHEMA.PLOTGEOM
    ON (PLOT.CN = PLOTGEOM.CN)
  JOIN &FIADB_SCHEMA.COND
    ON (COND.PLT_CN = PLOT.CN)
-- seedling table must be included for seedling-level estimates
  JOIN &FIADB_SCHEMA.SEEDLING
    ON (SEEDLING.PLT_CN = COND.PLT_CN AND SEEDLING.CONDID = COND.CONDID)
-- where clause
 WHERE COND.COND_STATUS_CD = 1
   AND COND.RESERVCD = 0
   AND COND.SITECLCD IN (1, 2, 3, 4, 5, 6)
   AND SEEDLING.TPA_UNADJ IS NOT NULL
   AND PET.EVAL_TYP = 'EXPVOL'
   AND PEG.EVAL_GRP = &EVAL_GRP
   AND 1 = 1
```

The example above produces an estimate of total number of live seedlings on timberland:

Item	Value
ESTIMATE	36,531,715,033

Example 3-5: Net merchantable bole volume of growing-stock trees (at least 5 inches d.b.h.), in cubic feet, on timberland (ATTRIBUTE_NBR 18), Minnesota 2003 (&EVAL_GRP = 272003).

```
-- select clause
SELECT SUM((TREE.TPA_UNADJ * TREE.VOLCFNET * CASE
        WHEN TREE.DIA IS NULL THEN
         POP_STRATUM.ADJ_FACTOR_SUBP
        ELSE
         CASE LEAST(TREE.DIA, 5 - 0.001)
           WHEN TREE.DIA THEN
            POP_STRATUM.ADJ_FACTOR_MICR
           ELSE
            CASE LEAST(TREE.DIA,
               COALESCE(PLOT.MACRO_BREAKPOINT_DIA, 9999) - 0.001)
             WHEN TREE.DIA THEN
              POP_STRATUM.ADJ_FACTOR_SUBP
             ELSE
              POP_STRATUM.ADJ_FACTOR_MACR
            END
         END
       END) * POP_STRATUM.EXPNS) AS ESTIMATED_VALUE
-- join clause
 FROM &FIADB_SCHEMA.POP_EVAL_GRP PEG
 JOIN &FIADB_SCHEMA.POP_EVAL_TYP PET
  ON (PET.EVAL_GRP_CN = PEG.CN)
 JOIN &FIADB_SCHEMA.POP_EVAL PEV
  ON (PEV.CN = PET.EVAL_CN)
 JOIN &FIADB_SCHEMA.POP_ESTN_UNIT PEU
  ON (PEV.CN = PEU.EVAL_CN)
 JOIN &FIADB_SCHEMA.POP_STRATUM POP_STRATUM
  ON (PEU.CN = POP_STRATUM.ESTN_UNIT_CN)
 JOIN &FIADB_SCHEMA.POP_PLOT_STRATUM_ASSGN
  ON (POP_PLOT_STRATUM_ASSGN.STRATUM_CN = POP_STRATUM.CN)
 JOIN &FIADB_SCHEMA.PLOT
  ON (POP_PLOT_STRATUM_ASSGN.PLT_CN = PLOT.CN)
 JOIN &FIADB_SCHEMA.PLOTGEOM
  ON (PLOT.CN = PLOTGEOM.CN)
 JOIN &FIADB_SCHEMA.COND
  ON (COND.PLT_CN = PLOT.CN)
-- tree table must be included for seedling-level estimates
 JOIN &FIADB_SCHEMA.TREE
  ON (TREE.PLT_CN = COND.PLT_CN AND TREE.CONDID = COND.CONDID)
-- where clause
 WHERE TREE.STATUSCD = 1
  AND TREE.TREECLCD = 2
  AND COND.RESERVCD = 0
  AND COND.SITECLCD IN (1, 2, 3, 4, 5, 6)
  AND COND.COND_STATUS_CD = 1
  AND TREE.TPA_UNADJ IS NOT NULL
  AND TREE.VOLCFNET IS NOT NULL
```

```
AND TREE.VOLCFNET > 0
AND PET.EVAL_TYP = 'EXPVOL'
AND PEG.EVAL_GRP = &EVAL_GRP
AND 1 = 1
```

The example above produces the following estimate of total growing-stock volume in cubic feet on timberland:

Item	Value
ESTIMATE	14,912,684,892

Important Note: Users who access data from periodic inventories should restrict the estimation to the standard timberland estimates. Timberland attributes are identified by REF_POP_ATTRIBUTE.TIMBERLAND = 'Y'. In most cases, for periodic inventories, the FIADB contains only condition-level information on reserved and unproductive forest lands, and tree-level information on timberland. Furthermore, the SQL offered in REF_POP_ATTRIBUTE.SQL_QUERY is only valid for annual-to-annual change estimates (i.e., all plots were measured at least twice in the annual inventory). Change estimates are those associated with EXPGROW, EXPMORT, EXPREMV, and EXPCHNG evaluation types.

Chapter 4: Producing Estimates with Sampling Errors

Producing population estimates and associated sampling error estimates (variance of the estimate) is more complicated. Example 4-1 produces estimates of timberland area, in acres, with sampling errors. The example follows the notation used in Bechtold and Patterson (2005, equation 4.14 on page 55). Portions in bold can be changed to specify a different estimate attribute of interest (lines 3-4, 73, 89-126). The line numbers have been added for reference. Lines 3-4 are metadata indicating the estimate attribute. Line 73 indicates the evaluation type associated with the estimate attribute.

Lines 89-126 are a modified version of the SQL in REF_POP_ATTRIBUTE.SQL_QUERY for the attribute of interest. The modifications are indicated by the comments in the example. These modifications change the result from a population total estimate to estimates per plot. These per-plot and squared per-plot values are summarized by stratum in the phase_summary section. The phase_1_summary has the other required elements by stratum. Phase_summary and phase_1_summary are used in the estimate_by_estn_unit section to calculate the estimates and sampling errors by estimation unit. Estimation-unit level values are summed to complete the population estimate. ESTIMATE is the resulting estimate. SE_OF_ESTIMATE is the sampling error (one standard error or 68 percent confidence level). SE_OF_ESTIMATE_PCT is the sampling error by percent of the estimate. VAR_OF_ESTIMATE is the variance. All samples (plots with zero and nonzero observations) in any stratum that has at least one nonzero observation contribute to the variance calculation. Multiply sampling error by 1.98 for the 95 percent confidence level.

Besides returning the estimates and sampling errors, this script outputs several other statistics. TOTAL_PLOTS is the total number of plots in the sample (TOTAL_PLOTS), which includes all plots in any estimation unit where an estimation unit had at least one nonzero observation. NON_ZERO_PLOTS is the number of plots where the attribute of interest was observed. TOT_POP_AC is the acreage represented by plots used in the variance calculation. It includes all plots from any estimation unit where there is at least one stratum that had a nonzero observation.

In addition to the Oracle variables mentioned previously, this script has &FILTER and &GRP_BY_ATTRIB. &FILTER allows a user to specify an optional constraint limiting estimates to a specific domain of interest such as a specific owner, forest type or tree species. For example, 'and cond.owngrpcd in (10,20,30) and cond.stdszcd = 1' will limit estimates to public ownership of large stands. Some analyses require limiting change estimates to areas that were previously and currently forest. This is achieved by specifying 'and pcond.cond_status_cd = 1 and cond.cond_status_cd=1'. The filter is indicated in the output by FILTER.

A value for &GRP_BY_ATTRIB is required for the script to run and groups estimates by the values of a specified plot (PLOT table) or condition (COND table) attribute. For example, specifying COND.FORTYPCD will output a separate volume estimate and associated sampling errors for each forest type. A tree attribute (TREE table) can be specified when making tree level estimates. So, specifying TREE.SPCD will output a separate volume estimate and associated sampling errors for each tree species. If a single estimate at the

State level is desired, then specify PLOT.STATECD. The group by values are indicated in the output as GROUP_BY_FIELD.

Example 4-1: Area of timberland, in acres, with sampling error (ATTRIBUTE_NBR 3).

Line	Script
1	select eval_grp,
2	eval_grp_descr,
3	**3 attribute_nbr,**
4	**'Area of timberland, in acres' attribute_descr,**
5	coalesce(cast(grp_by_attrib as varchar(4000)), 'Not available') group_by_field,
6	'&filter' filter,
7	sum(estimate_by_estn_unit.estimate) estimate,
8	case
9	when sum(estimate_by_estn_unit.estimate) <> 0 then
10	abs(sqrt(sum(estimate_by_estn_unit.var_of_estimate)) /
11	sum(estimate_by_estn_unit.estimate) * 100)
12	else
13	0
14	end as se_of_estimate_pct,
15	sqrt(sum(estimate_by_estn_unit.var_of_estimate)) se_of_estimate,
16	sum(estimate_by_estn_unit.var_of_estimate) var_of_estimate,
17	sum(estimate_by_estn_unit.total_plots) total_plots,
18	sum(estimate_by_estn_unit.non_zero_plots) non_zero_plots,
19	sum(estimate_by_estn_unit.tot_pop_area_acres) tot_pop_ac
20	from (select pop_eval_grp_cn,
21	eval_grp,
22	eval_grp_descr,
23	SUM(coalesce(ysum_hd, 0) * phase_1_summary.expns) estimate,
24	phase_1_summary.n total_plots,
25	SUM(phase_summary.number_plots_in_domain) domain_plots,
26	SUM(phase_summary.non_zero_plots) non_zero_plots,
27	total_area * total_area / phase_1_summary.n *
28	((SUM(w_h * phase_1_summary.n_h *
29	(((coalesce(ysum_hd_sqr, 0) / phase_1_summary.n_h) -
30	((coalesce(ysum_hd, 0) / phase_1_summary.n_h) *
31	(coalesce(ysum_hd, 0) / phase_1_summary.n_h))) /
32	(phase_1_summary.n_h - 1)))) +
33	1 / phase_1_summary.n *
34	(SUM((1 - w_h) * phase_1_summary.n_h *
35	(((coalesce(ysum_hd_sqr, 0) / phase_1_summary.n_h) -
36	((coalesce(ysum_hd, 0) / phase_1_summary.n_h) *

Line	Script
37	(coalesce(ysum_hd, 0) / phase_1_summary.n_h))) /
38	(phase_1_summary.n_h - 1))))) var_of_estimate,
39	total_area tot_pop_area_acres,
40	grp_by_attrib
41	from (select PEV.cn eval_cn,
42	PEG.eval_grp,
43	PEG.eval_grp_descr,
44	PEG.cn pop_eval_grp_cn,
45	POP_STRATUM.estn_unit_cn,
46	POP_STRATUM.expns,
47	POP_STRATUM.cn pop_stratum_cn,
48	p1pointcnt /
49	(select sum(str.p1pointcnt)
50	from &FIADB_SCHEMA.pop_stratum str
51	where str.estn_unit_cn = pop_stratum.estn_unit_cn) w_h,
52	(select sum(str.p1pointcnt)
53	from &FIADB_SCHEMA.pop_stratum str
54	where str.estn_unit_cn = pop_stratum.estn_unit_cn) n_prime,
55	p1pointcnt n_prime_h,
56	(select sum(eu_s.area_used)
57	from &FIADB_SCHEMA.pop_estn_unit eu_s
58	where eu_s.cn = pop_stratum.estn_unit_cn) total_area,
59	(select sum(str.p2pointcnt)
60	from &FIADB_SCHEMA.pop_stratum str
61	where str.estn_unit_cn = pop_stratum.estn_unit_cn) n,
62	POP_STRATUM.p2pointcnt n_h
63	FROM &FIADB_SCHEMA.POP_EVAL_GRP PEG
64	JOIN &FIADB_SCHEMA.POP_EVAL_TYP PET
65	ON (PET.EVAL_GRP_CN = PEG.CN)
66	JOIN &FIADB_SCHEMA.POP_EVAL PEV
67	ON (PEV.CN = PET.EVAL_CN)
68	JOIN &FIADB_SCHEMA.POP_ESTN_UNIT PEU
69	ON (PEV.CN = PEU.EVAL_CN)
70	JOIN &FIADB_SCHEMA.POP_STRATUM POP_STRATUM
71	ON (PEU.CN = POP_STRATUM.ESTN_UNIT_CN)
72	where PEG.eval_grp in (&eval_grp)
73	and PET.eval_typ = **'EXPCURR'**) phase_1_summary
74	left outer join (select pop_stratum_cn,
75	estn_unit_cn,
76	eval_cn,

Line	Script
77	sum(y_hid_adjusted) ysum_hd,
78	sum(y_hid_adjusted * y_hid_adjusted) ysum_hd_sqr,
79	count(*) number_plots_in_domain,
80	SUM(case y_hid_adjusted
81	when 0 then
82	0
83	when NULL then
84	0
85	else
86	1
87	end) non_zero_plots,
88	grp_by_attrib
89	from (**SELECT SUM((COND.CONDPROP_UNADJ ***
90	**CASE COND.PROP_BASIS**
91	**WHEN 'MACR' THEN**
92	**POP_STRATUM.ADJ_FACTOR_MACR**
93	**ELSE**
94	**POP_STRATUM.ADJ_FACTOR_SUBP**
95	**END)) AS y_hid_adjusted,** *-- edit to ref_pop_attribute.sql_query*
96	**peu.cn estn_unit_cn,** *-- addition to ref_pop_attribute.sql_query*
97	**pev.cn eval_cn,** *-- addition to ref_pop_attribute.sql_query*
98	**pop_stratum.cn pop_stratum_cn,** *-- addition to* *-- ref_pop_attribute.sql_query*
99	**plot.cn plt_cn,** *-- addition to ref_pop_attribute.sql_query*
100	**&grp_by_attrib grp_by_attrib** *-- addition to* *-- ref_pop_attribute.sql_query*
101	**FROM &FIADB_SCHEMA.POP_EVAL_GRP PEG**
102	**JOIN &FIADB_SCHEMA.POP_EVAL_TYP PET**
103	**ON (PET.EVAL_GRP_CN = PEG.CN)**
104	**JOIN &FIADB_SCHEMA.POP_EVAL PEV**
105	**ON (PEV.CN = PET.EVAL_CN)**
106	**JOIN &FIADB_SCHEMA.POP_ESTN_UNIT PEU**
107	**ON (PEV.CN = PEU.EVAL_CN)**
108	**JOIN &FIADB_SCHEMA.POP_STRATUM POP_STRATUM**
109	**ON (PEU.CN = POP_STRATUM.ESTN_UNIT_CN)**
110	**JOIN &FIADB_SCHEMA.POP_PLOT_STRATUM_ASSGN**
111	**ON (POP_PLOT_STRATUM_ASSGN.STRATUM_CN =**
112	**POP_STRATUM.CN)**
113	**JOIN &FIADB_SCHEMA.PLOT**
114	**ON (POP_PLOT_STRATUM_ASSGN.PLT_CN =**

Line	Script
115	PLOT.CN)
116	JOIN &FIADB_SCHEMA.PLOTGEOM
117	ON (PLOT.CN = PLOTGEOM.CN)
118	JOIN &FIADB_SCHEMA.COND
119	ON (COND.PLT_CN = PLOT.CN)
120	WHERE COND.RESERVCD = 0
121	AND COND.SITECLCD IN (1, 2, 3, 4, 5, 6)
122	AND COND.COND_STATUS_CD = 1
123	AND COND.CONDPROP_UNADJ IS NOT NULL
124	AND PET.EVAL_TYP = 'EXPCURR'
125	AND PEG.EVAL_GRP in (&EVAL_GRP) *-- edit to* *-- ref_pop_attribute.sqj_query*
126	AND 1 = 1
127	&filter
128	group by peu.cn,
129	pev.cn,
130	pop_stratum.cn,
131	plot.cn,
132	&grp_by_attrib) plot_summary
133	group by pop_stratum_cn,
134	estn_unit_cn,
135	eval_cn,
136	grp_by_attrib) phase_summary
137	on (phase_1_summary.pop_stratum_cn =
138	phase_summary.pop_stratum_cn and
139	phase_1_summary.eval_cn = phase_summary.eval_cn and
140	phase_1_summary.estn_unit_cn = phase_summary.estn_unit_cn)
141	group by phase_1_summary.pop_eval_grp_cn,
142	phase_1_summary.eval_grp,
143	phase_1_summary.eval_grp_descr,
144	phase_1_summary.estn_unit_cn,
145	phase_1_summary.total_area,
146	phase_1_summary.n,
147	grp_by_attrib) estimate_by_estn_unit
148	where non_zero_plots is not null
149	group by pop_eval_grp_cn,
150	eval_grp,
151	eval_grp_descr,
152	coalesce(cast(grp_by_attrib as varchar(4000)), 'Not available')

Results using Example 4-1, area of timberland by owner group (&GRP_BY_ATTRIB = cond.owngrpcd) on public land with large stands (&FILTER = and cond.owngrpcd in (10,20,30) and cond.stdszcd = 1) for Minnesota 2003 (&EVAL_GRP = 272003) as follows:

EVAL_GRP	GROUP_BY_FIELD	FILTER	ESTIMATE	SE_OF_ESTIMATE_PCT
272003	10	and cond.owngrpcd in (10,20,30) and cond.stdszcd = 1	504,221	6.7
272003	20	and cond.owngrpcd in (10,20,30) and cond.stdszcd = 1	9,505	58.8
272003	30	and cond.owngrpcd in (10,20,30) and cond.stdszcd = 1	1,131,470	4.8

SE_OF_ESTIMATE	VAR_OF_ESTIMATE	TOTAL_PLOTS	NON_ZERO_PLOTS	TOT_POP_AC
33,577.8	1,127,466,446.6	2,200	187	7,351,632
5,585.3	31,196,022.6	1,449	3	4,933,245
53,795.0	2,893,899,325.5	13,805	444	46,359,517

Example 4-2: Number of live trees (at least 1 inch d.b.h./d.r.c.), in trees, on forest land with sampling error (ATTRIBUTE_NBR 4). Portions in bold differ from example 4-1.

```
select eval_grp,
    eval_grp_descr,
    4 attribute_nbr,
    'Number of live trees (at least 1 inch d.b.h./d.r.c.), in trees, on forest land'  attribute_descr,
    coalesce(cast(grp_by_attrib as varchar(4000)), 'Not available') group_by_field,
    '&filter' filter,
    sum(estimate_by_estn_unit.estimate) estimate,
    case
      when sum(estimate_by_estn_unit.estimate) <> 0 then
        abs(sqrt(sum(estimate_by_estn_unit.var_of_estimate)) /
          sum(estimate_by_estn_unit.estimate) * 100)
      else
        0
    end as se_of_estimate_pct,
    sqrt(sum(estimate_by_estn_unit.var_of_estimate)) se_of_estimate,
    sum(estimate_by_estn_unit.var_of_estimate) var_of_estimate,
    sum(estimate_by_estn_unit.total_plots) total_plots,
    sum(estimate_by_estn_unit.non_zero_plots) non_zero_plots,
    sum(estimate_by_estn_unit.tot_pop_area_acres) tot_pop_ac
  from (select pop_eval_grp_cn,
          eval_grp,
          eval_grp_descr,
          SUM(coalesce(ysum_hd, 0) * phase_1_summary.expns) estimate,
```

```
                    phase_1_summary.n total_plots,
                    SUM(phase_summary.number_plots_in_domain) domain_plots,
                    SUM(phase_summary.non_zero_plots) non_zero_plots,
                    total_area * total_area / phase_1_summary.n *
                    ((SUM(w_h * phase_1_summary.n_h *
                        (((coalesce(ysum_hd_sqr, 0) / phase_1_summary.n_h) -
                        ((coalesce(ysum_hd, 0) / phase_1_summary.n_h) *
                        (coalesce(ysum_hd, 0) / phase_1_summary.n_h))) /
                        (phase_1_summary.n_h - 1)))) +
                    1 / phase_1_summary.n *
                    (SUM((1 - w_h) * phase_1_summary.n_h *
                        (((coalesce(ysum_hd_sqr, 0) / phase_1_summary.n_h) -
                        ((coalesce(ysum_hd, 0) / phase_1_summary.n_h) *
                        (coalesce(ysum_hd, 0) / phase_1_summary.n_h))) /
                        (phase_1_summary.n_h - 1))))) var_of_estimate,
                total_area tot_pop_area_acres,
                grp_by_attrib
            from (select PEV.cn eval_cn,
                    PEG.eval_grp,
                    PEG.eval_grp_descr,
                    PEG.cn pop_eval_grp_cn,
                    POP_STRATUM.estn_unit_cn,
                    POP_STRATUM.expns,
                    POP_STRATUM.cn pop_stratum_cn,
                    p1pointcnt /
                    (select sum(str.p1pointcnt)
                        from &FIADB_SCHEMA.pop_stratum str
                      where str.estn_unit_cn = pop_stratum.estn_unit_cn) w_h,
                    (select sum(str.p1pointcnt)
                        from &FIADB_SCHEMA.pop_stratum str
                      where str.estn_unit_cn = pop_stratum.estn_unit_cn) n_prime,
                    p1pointcnt n_prime_h,
                    (select sum(eu_s.area_used)
                        from &FIADB_SCHEMA.pop_estn_unit eu_s
                      where eu_s.cn = pop_stratum.estn_unit_cn) total_area,
                    (select sum(str.p2pointcnt)
                        from &FIADB_SCHEMA.pop_stratum str
                      where str.estn_unit_cn = pop_stratum.estn_unit_cn) n,
                    POP_STRATUM.p2pointcnt n_h
                 FROM &FIADB_SCHEMA.POP_EVAL_GRP PEG
                 JOIN &FIADB_SCHEMA.POP_EVAL_TYP PET
                   ON (PET.EVAL_GRP_CN = PEG.CN)
                 JOIN &FIADB_SCHEMA.POP_EVAL PEV
                   ON (PEV.CN = PET.EVAL_CN)
                 JOIN &FIADB_SCHEMA.POP_ESTN_UNIT PEU
                   ON (PEV.CN = PEU.EVAL_CN)
                 JOIN &FIADB_SCHEMA.POP_STRATUM POP_STRATUM
                   ON (PEU.CN = POP_STRATUM.ESTN_UNIT_CN)
                 where PEG.eval_grp in (&eval_grp)
                   and PET.eval_typ = 'EXPVOL') phase_1_summary
            left outer join (select pop_stratum_cn,
```

```
                          estn_unit_cn,
                          eval_cn,
                          sum(y_hid_adjusted) ysum_hd,
                          sum(y_hid_adjusted * y_hid_adjusted) ysum_hd_sqr,
                          count(*) number_plots_in_domain,
                          SUM(case y_hid_adjusted
                              when 0 then
                                0
                              when NULL then
                                0
                              else
                                1
                            end) non_zero_plots,
                        grp_by_attrib
                        from (SELECT SUM((COALESCE(TREE.TPA_UNADJ * CASE
                                      WHEN TREE.DIA IS NULL THEN
                                        POP_STRATUM.ADJ_FACTOR_SUBP
                                      ELSE
                                       CASE LEAST(TREE.DIA, 5 - 0.001)
                                         WHEN TREE.DIA THEN
                                          POP_STRATUM.ADJ_FACTOR_MICR
                                         ELSE
                                          CASE
                                           LEAST(TREE.DIA,
                                               COALESCE(PLOT.MACRO_BREAKPOINT_DIA,
                                                   9999) - 0.001)
                                             WHEN TREE.DIA THEN
                                              POP_STRATUM.ADJ_FACTOR_SUBP
                                             ELSE
                                              POP_STRATUM.ADJ_FACTOR_MACR
                                           END
                                         END
                                       END,
                                       0))) AS y_hid_adjusted, -- edit to ref_pop_attribute.sql_query
                            peu.cn estn_unit_cn, -- addition to ref_pop_attribute.sql_query
                            pev.cn eval_cn, -- addition to ref_pop_attribute.sql_query
                            pop_stratum.cn pop_stratum_cn, -- addition to
                                                          -- ref_pop_attribute.sql_query
                            plot.cn plt_cn, -- addition to ref_pop_attribute.sql_query
                            &grp_by_attrib grp_by_attrib -- addition to ref_pop_attribute.sql_query
                        FROM &FIADB_SCHEMA.POP_EVAL_GRP PEG
                        JOIN &FIADB_SCHEMA.POP_EVAL_TYP PET
                          ON (PET.EVAL_GRP_CN = PEG.CN)
                        JOIN &FIADB_SCHEMA.POP_EVAL PEV
                          ON (PEV.CN = PET.EVAL_CN)
                        JOIN &FIADB_SCHEMA.POP_ESTN_UNIT PEU
                          ON (PEV.CN = PEU.EVAL_CN)
                        JOIN &FIADB_SCHEMA.POP_STRATUM POP_STRATUM
                          ON (PEU.CN = POP_STRATUM.ESTN_UNIT_CN)
                        JOIN &FIADB_SCHEMA.POP_PLOT_STRATUM_ASSGN
                          ON (POP_PLOT_STRATUM_ASSGN.STRATUM_CN =
```

```
                                 POP_STRATUM.CN)
                              JOIN &FIADB_SCHEMA.PLOT
                                ON (POP_PLOT_STRATUM_ASSGN.PLT_CN =
                                  PLOT.CN)
                              JOIN &FIADB_SCHEMA.PLOTGEOM
                                ON (PLOT.CN = PLOTGEOM.CN)
                              JOIN &FIADB_SCHEMA.COND
                                ON (COND.PLT_CN = PLOT.CN)
                              JOIN &FIADB_SCHEMA.TREE
                                ON (TREE.PLT_CN = COND.PLT_CN AND
                                  TREE.CONDID = COND.CONDID)
                             WHERE TREE.STATUSCD = 1
                               AND COND.COND_STATUS_CD = 1
                               AND PET.EVAL_TYP = 'EXPVOL'
                               AND PEG.EVAL_GRP in (&EVAL_GRP)
                               AND 1 = 1 -- edit to ref_pop_attribute.sql_query
                                &filter
                             group by peu.cn,
                                     pev.cn,
                                     pop_stratum.cn,
                                     plot.cn,
                                     &grp_by_attrib) plot_summary
                     group by pop_stratum_cn,
                             estn_unit_cn,
                             eval_cn,
                             grp_by_attrib) phase_summary
             on (phase_1_summary.pop_stratum_cn =
                phase_summary.pop_stratum_cn and
                phase_1_summary.eval_cn = phase_summary.eval_cn and
                phase_1_summary.estn_unit_cn = phase_summary.estn_unit_cn)
          group by phase_1_summary.pop_eval_grp_cn,
                 phase_1_summary.eval_grp,
                 phase_1_summary.eval_grp_descr,
                 phase_1_summary.estn_unit_cn,
                 phase_1_summary.total_area,
                 phase_1_summary.n,
                 grp_by_attrib) estimate_by_estn_unit
       where non_zero_plots is not null
       group by pop_eval_grp_cn,
             eval_grp,
             eval_grp_descr,
             coalesce(cast(grp_by_attrib as varchar(4000)), 'Not available')
```

Results using Example 4-2, number of live trees (at least 1 inch d.b.h./d.r.c.), in trees, on forest land by owner group (&GRP_BY_ATTRIB = cond.owngrpcd) on public land with large stands (&FILTER = and cond.owngrpcd in (10,20,30) and cond.stdszcd = 1) for Minnesota 2003 (&EVAL_GRP = 272003) as follows:

EVAL_GRP	GROUP_BY_ FIELD	FILTER	ESTIMATE	SE_OF_EST IMATE_PCT
272003	10	and cond.owngrpcd in (10,20,30) and cond.stdszcd = 1	397,627,015	7.3
272003	20	and cond.owngrpcd in (10,20,30) and cond.stdszcd = 1	48,493,577	21.7
272003	30	and cond.owngrpcd in (10,20,30) and cond.stdszcd = 1	699,188,224	5.8

SE_OF_ESTIMATE	VAR_OF_ESTIMATE	TOTAL_PLOTS	NON_ZERO _PLOTS	TOT_POP_AC
29,057,984.6	844,366,468,275,072.0	2,473	238	8,446,182
10,523,559.0	110,745,293,363,924.0	2,350	29	7,966,041
40,470,601.7	1,637,869,605,314,840.0	14,175	489	47,798,600

Example 4-3: Number of live seedlings (less than 1 inch d.b.h./d.r.c.), in seedlings, on timberland with sampling error (ATTRIBUTE_NBR 46). Portions in bold differ from example 4-1.

```
select eval_grp,
     eval_grp_descr,
     46 attribute_nbr,
     'Number of live seedlings (less than 1 inch d.b.h./d.r.c.), in seedlings, on timberland'
attribute_descr,
     coalesce(cast(grp_by_attrib as varchar(4000)), 'Not available') group_by_field,
     '&filter' filter,
     sum(estimate_by_estn_unit.estimate) estimate,
     case
       when sum(estimate_by_estn_unit.estimate) <> 0 then
         abs(sqrt(sum(estimate_by_estn_unit.var_of_estimate)) /
            sum(estimate_by_estn_unit.estimate) * 100)
       else
         0
     end as se_of_estimate_pct,
     sqrt(sum(estimate_by_estn_unit.var_of_estimate)) se_of_estimate,
     sum(estimate_by_estn_unit.var_of_estimate) var_of_estimate,
     sum(estimate_by_estn_unit.total_plots) total_plots,
     sum(estimate_by_estn_unit.non_zero_plots) non_zero_plots,
     sum(estimate_by_estn_unit.tot_pop_area_acres) tot_pop_ac
  from (select pop_eval_grp_cn,
          eval_grp,
          eval_grp_descr,
          SUM(coalesce(ysum_hd, 0) * phase_1_summary.expns) estimate,
```

```
                        phase_1_summary.n total_plots,
                        SUM(phase_summary.number_plots_in_domain) domain_plots,
                        SUM(phase_summary.non_zero_plots) non_zero_plots,
                        total_area * total_area / phase_1_summary.n *
                        ((SUM(w_h * phase_1_summary.n_h *
                            (((coalesce(ysum_hd_sqr, 0) / phase_1_summary.n_h) -
                            ((coalesce(ysum_hd, 0) / phase_1_summary.n_h) *
                            (coalesce(ysum_hd, 0) / phase_1_summary.n_h))) /
                            (phase_1_summary.n_h - 1)))) +
                        1 / phase_1_summary.n *
                        (SUM((1 - w_h) * phase_1_summary.n_h *
                            (((coalesce(ysum_hd_sqr, 0) / phase_1_summary.n_h) -
                            ((coalesce(ysum_hd, 0) / phase_1_summary.n_h) *
                            (coalesce(ysum_hd, 0) / phase_1_summary.n_h))) /
                            (phase_1_summary.n_h - 1))))) var_of_estimate,
                     total_area tot_pop_area_acres,
                     grp_by_attrib
                 from (select PEV.cn eval_cn,
                             PEG.eval_grp,
                             PEG.eval_grp_descr,
                             PEG.cn pop_eval_grp_cn,
                             POP_STRATUM.estn_unit_cn,
                             POP_STRATUM.expns,
                             POP_STRATUM.cn pop_stratum_cn,
                             p1pointcnt /
                             (select sum(str.p1pointcnt)
                               from &FIADB_SCHEMA.pop_stratum str
                               where str.estn_unit_cn = pop_stratum.estn_unit_cn) w_h,
                             (select sum(str.p1pointcnt)
                               from &FIADB_SCHEMA.pop_stratum str
                               where str.estn_unit_cn = pop_stratum.estn_unit_cn) n_prime,
                             p1pointcnt n_prime_h,
                             (select sum(eu_s.area_used)
                               from &FIADB_SCHEMA.pop_estn_unit eu_s
                               where eu_s.cn = pop_stratum.estn_unit_cn) total_area,
                             (select sum(str.p2pointcnt)
                               from &FIADB_SCHEMA.pop_stratum str
                               where str.estn_unit_cn = pop_stratum.estn_unit_cn) n,
                             POP_STRATUM.p2pointcnt n_h
                       FROM &FIADB_SCHEMA.POP_EVAL_GRP PEG
                       JOIN &FIADB_SCHEMA.POP_EVAL_TYP PET
                         ON (PET.EVAL_GRP_CN = PEG.CN)
                       JOIN &FIADB_SCHEMA.POP_EVAL PEV
                         ON (PEV.CN = PET.EVAL_CN)
                       JOIN &FIADB_SCHEMA.POP_ESTN_UNIT PEU
                         ON (PEV.CN = PEU.EVAL_CN)
                       JOIN &FIADB_SCHEMA.POP_STRATUM POP_STRATUM
                         ON (PEU.CN = POP_STRATUM.ESTN_UNIT_CN)
                      where PEG.eval_grp in (&eval_grp)
                        and PET.eval_typ = 'EXPVOL') phase_1_summary
                 left outer join (select pop_stratum_cn,
```

```
                                    estn_unit_cn,
                                    eval_cn,
                                    sum(y_hid_adjusted) ysum_hd,
                                    sum(y_hid_adjusted * y_hid_adjusted) ysum_hd_sqr,
                                    count(*) number_plots_in_domain,
                                    SUM(case y_hid_adjusted
                                        when 0 then
                                          0
                                        when NULL then
                                          0
                                        else
                                          1
                                      end) non_zero_plots,
                                  grp_by_attrib
                                from (SELECT SUM((SEEDLING.TPA_UNADJ *
          POP_STRATUM.ADJ_FACTOR_MICR))
                                            AS y_hid_adjusted, -- edit to ref_pop_attribute.sql_query
                                  peu.cn estn_unit_cn, -- addition to ref_pop_attribute.sql_query
                                  pev.cn eval_cn, -- addition to ref_pop_attribute.sql_query
                                  pop_stratum.cn pop_stratum_cn, -- addition to
                                                            -- ref_pop_attribute.sql_query
                                  plot.cn plt_cn, -- addition to ref_pop_attribute.sql_query
                                  &grp_by_attrib grp_by_attrib -- addition to ref_pop_attribute.sql_query
                                FROM &FIADB_SCHEMA.POP_EVAL_GRP PEG
                                JOIN &FIADB_SCHEMA.POP_EVAL_TYP PET
                                  ON (PET.EVAL_GRP_CN = PEG.CN)
                                JOIN &FIADB_SCHEMA.POP_EVAL PEV
                                  ON (PEV.CN = PET.EVAL_CN)
                                JOIN &FIADB_SCHEMA.POP_ESTN_UNIT PEU
                                  ON (PEV.CN = PEU.EVAL_CN)
                                JOIN &FIADB_SCHEMA.POP_STRATUM POP_STRATUM
                                  ON (PEU.CN = POP_STRATUM.ESTN_UNIT_CN)
                                JOIN &FIADB_SCHEMA.POP_PLOT_STRATUM_ASSGN
                                  ON (POP_PLOT_STRATUM_ASSGN.STRATUM_CN =
                                    POP_STRATUM.CN)
                                JOIN &FIADB_SCHEMA.PLOT
                                  ON (POP_PLOT_STRATUM_ASSGN.PLT_CN =
                                    PLOT.CN)
                                JOIN &FIADB_SCHEMA.PLOTGEOM
                                  ON (PLOT.CN = PLOTGEOM.CN)
                                JOIN &FIADB_SCHEMA.COND
                                  ON (COND.PLT_CN = PLOT.CN)
                                JOIN &FIADB_SCHEMA.SEEDLING
                                  ON (SEEDLING.PLT_CN = COND.PLT_CN AND
                                    SEEDLING.CONDID = COND.CONDID)
                                WHERE COND.COND_STATUS_CD = 1
                                  AND COND.RESERVCD = 0
                                  AND COND.SITECLCD IN (1, 2, 3, 4, 5, 6)
                                  AND SEEDLING.TPA_UNADJ IS NOT NULL
                                  AND PET.EVAL_TYP = 'EXPVOL'
                                  AND PEG.EVAL_GRP in (&EVAL_GRP)
```

```
                              AND 1 = 1-- edit to ref_pop_attribute.sql_query
                              &filter
                              group by peu.cn,
                                      pev.cn,
                                      pop_stratum.cn,
                                      plot.cn,
                                      &grp_by_attrib) plot_summary
                      group by pop_stratum_cn,
                              estn_unit_cn,
                              eval_cn,
                              grp_by_attrib) phase_summary
                on (phase_1_summary.pop_stratum_cn =
                    phase_summary.pop_stratum_cn and
                    phase_1_summary.eval_cn = phase_summary.eval_cn and
                    phase_1_summary.estn_unit_cn = phase_summary.estn_unit_cn)
                group by phase_1_summary.pop_eval_grp_cn,
                        phase_1_summary.eval_grp,
                        phase_1_summary.eval_grp_descr,
                        phase_1_summary.estn_unit_cn,
                        phase_1_summary.total_area,
                        phase_1_summary.n,
                        grp_by_attrib) estimate_by_estn_unit
          where non_zero_plots is not null
          group by pop_eval_grp_cn,
                  eval_grp,
                  eval_grp_descr,
              coalesce(cast(grp_by_attrib as varchar(4000)), 'Not available')
```

Results using Example 4-3, number of live seedlings (less than 1 inch d.b.h./d.r.c.), in seedlings, on timberland by owner group (&GRP_BY_ATTRIB = cond.owngrpcd) on public land with large stands (&FILTER = and cond.owngrpcd in (10,20,30) and cond.stdszcd = 1) for Minnesota 2003 (&EVAL_GRP = 272003) As follows:

EVAL_GRP	GROUP_BY _FIELD	FILTER	ESTIMATE	SE_OF_EST IMATE_PCT
272003	10	and cond.owngrpcd in (10,20,30) and cond.stdszcd = 1	1,459,127,452	9.7
272003	20	and cond.owngrpcd in (10,20,30) and cond.stdszcd = 1	27,134,293	66.4
272003	30	and cond.owngrpcd in (10,20,30) and cond.stdszcd = 1	2,843,181,653	7.7

SE_OF_ESTIMATE	VAR_OF_ESTIMATE	TOTAL_PLOTS	NON_ZERO _PLOTS	TOT_POP_AC
141,414,345.8	19,998,017,186,712,500.0	1,964	173	6,557,481
18,020,400.5	324,734,835,483,213.0	1,449	3	4,933,245
220,152,792.0	48,467,251,816,005,500.0	11,065	385	37,325,626

Chapter 5: Restricting the Attribute of Interest to a Smaller Subset of the Population

The estimation procedures presented in examples 3-1 through 3-5 and 4-1 through 4-4 can all be modified to restrict the estimation to a subset, referred to as the domain of interest. An example of a domain would be only sawtimber stands on publicly owned timberland. In effect, the attributes identified in the REF_POP_ATTRIBUTE table are a combination of an attribute (e.g., area, number of trees, volume, number of seedlings) and a domain (e.g., forest land, timberland, ownership, growing-stock trees). In example 3-2, the attribute of interest is area, and the domain of interest is restricted to timberland only. In example 3-3, the attribute of interest is number of trees, and the domain of interest is restricted to live trees on forest land with diameters 1 inch and larger. In example 3-4, the attribute of interest is number of seedlings, and the domain of interest is restricted to timberland. In example 3-5, the attribute of interest is volume of growing-stock trees, and the domain of interest is restricted to timberland.

In the next example, the domain of interest in example 3-3 is further restricted to a specific species (SPCD = 129, eastern white pine), diameter (DIA ≥20, trees 20 inches in diameter and larger), and ownership (OWNGRPCD = 40, private owners only). The procedure now provides an estimate of the total number of live eastern white pine, 20 inches and larger on privately owned forest land.

Example 5-1: Number of live eastern white pine trees 20 inches in diameter and larger, in trees, on privately owned forest land (ATTRIBUTE_NBR 4 modified), Minnesota 2003 (&EVAL_GRP = 272003).

```
--- select clause
SELECT SUM((COALESCE(TREE.TPA_UNADJ * CASE
              WHEN TREE.DIA IS NULL THEN
                POP_STRATUM.ADJ_FACTOR_SUBP
              ELSE
               CASE LEAST(TREE.DIA, 5 - 0.001)
                 WHEN TREE.DIA THEN
                  POP_STRATUM.ADJ_FACTOR_MICR
                 ELSE
                  CASE LEAST(TREE.DIA,
                      COALESCE(PLOT.MACRO_BREAKPOINT_DIA, 9999) - 0.001)
                    WHEN TREE.DIA THEN
                     POP_STRATUM.ADJ_FACTOR_SUBP
                    ELSE
                     POP_STRATUM.ADJ_FACTOR_MACR
                  END
               END
            END,
            0)) * POP_STRATUM.EXPNS) AS ESTIMATED_VALUE
-- join clause
  FROM &FIADB_SCHEMA.POP_EVAL_GRP PEG
  JOIN &FIADB_SCHEMA.POP_EVAL_TYP PET
    ON (PET.EVAL_GRP_CN = PEG.CN)
```

```
   JOIN &FIADB_SCHEMA.POP_EVAL PEV
     ON (PEV.CN = PET.EVAL_CN)
   JOIN &FIADB_SCHEMA.POP_ESTN_UNIT PEU
     ON (PEV.CN = PEU.EVAL_CN)
   JOIN &FIADB_SCHEMA.POP_STRATUM POP_STRATUM
     ON (PEU.CN = POP_STRATUM.ESTN_UNIT_CN)
   JOIN &FIADB_SCHEMA.POP_PLOT_STRATUM_ASSGN
     ON (POP_PLOT_STRATUM_ASSGN.STRATUM_CN = POP_STRATUM.CN)
   JOIN &FIADB_SCHEMA.PLOT
     ON (POP_PLOT_STRATUM_ASSGN.PLT_CN = PLOT.CN)
   JOIN &FIADB_SCHEMA.PLOTGEOM
     ON (PLOT.CN = PLOTGEOM.CN)
   JOIN &FIADB_SCHEMA.COND
     ON (COND.PLT_CN = PLOT.CN)
-- tree table must be included for seedling-level estimates
   JOIN &FIADB_SCHEMA.TREE
     ON (TREE.PLT_CN = COND.PLT_CN AND TREE.CONDID = COND.CONDID)
-- where clause
  WHERE TREE.STATUSCD = 1
   AND COND.COND_STATUS_CD = 1
   AND COND.OWNGRPCD = 40 --additional user-defined where clause
   AND TREE.SPCD = 129 --additional user-defined where clause
   AND TREE.DIA >= 20.0 --additional user-defined where clause
   AND PET.EVAL_TYP = 'EXPVOL'
   AND PEG.EVAL_GRP = &EVAL_GRP
   AND 1 = 1
```

The example above produces an estimate of the total number of live eastern white pine, 20 inches in diameter and larger on privately owned forest land:

Item	Value
ESTIMATE	519,317

Adding the same restrictions to the where clause in example 4-2 provides an estimate with sampling error:

Item	Value
EVAL_GRP	272003
ESTIMATE	519,317
SE_OF_ESTIMATE_PCT	25.1
VAR_OF_ESTIMATE	17,051,491,226
TOTAL_PLOTS	16,041
NONZERO_PLOTS	20
TOTAL_POPULATION_ACRES	54,002,539

The estimated 519,317 eastern white pine trees, 20 inches in diameter and larger on privately owned forest land has a sample error of 25.1 percent. Live eastern white pine 20

inches in diameter or larger on private forest land were observed on a total of 20 plots in the State.

Chapter 6: Changing the Attribute of Interest with User-Defined Criteria

Estimates using FIA data are not restricted to just those attributes found within the database - users can define their own condition-level attributes of interest. The standard condition-level attributes of interest are sampled land area and all land area, expressed in acres. Sampled land area (adjusted for denied access and hazardous conditions that were not sampled) is the one used for nearly all standard FIA tables that report area estimates. All land area (where denied access and hazardous are considered part of the sample) is only used in estimation that treats denied access (plots on land where field crews were unable to obtain the owner's permission to measure the plot) and hazardous (conditions that were deemed too hazardous to measure the plots) as part of the sample attribute of interest. Most of the other condition-level attributes that FIA observes are typically used to categorize the condition, and are most often applied as restrictions on the population in defining the domain, and do not lend themselves as an attribute of interest. For example, BALIVE (the basal area of live trees 1 inch diameter and larger) is mainly used to categorize forest land area rather than as an attribute of interest in population-level estimation. Users are more interested in knowing how many acres of forest land meets some basal area requirement (say between 50 and 100 square feet per acre), rather than the total basal area of forest land in a State.

An example of a user-defined condition-level attribute of interest, for which an estimate of a total might be of interest, would be total land value (see example 6-1). Here the user would supply a function that assigns value ($ per acre) to forest land, based on attributes in FIADB. As an example, we use a very arbitrary function of site index and basal area of live tree - value per acre = 1000 + (site index x 3) + (basal area x 4), and limit the domain of interest to only private timberland. Modifying example 3-1 produces the following script and estimate of total value. Because the function is a condition-level value per acre, it is simply included in the expression as a multiplication factor, and the domain restriction (private timberland) is added to the where clause.

Example 6-1:   Estimated dollar value of private timberland (user-defined function),
Minnesota 2003 (&EVAL_GRP = 272003).

```
-- select clause
SELECT SUM((COND.CONDPROP_UNADJ * CASE COND.PROP_BASIS
        WHEN 'MACR' THEN
         POP_STRATUM.ADJ_FACTOR_MACR
        ELSE
         POP_STRATUM.ADJ_FACTOR_SUBP
              * (1000 + COND.SICOND * 3 + COND.BALIVE * 4)
               --additional user-defined value function
       END) * POP_STRATUM.EXPNS) AS ESTIMATED_VALUE
-- join clause
  FROM &FIADB_SCHEMA.POP_EVAL_GRP PEG
  JOIN &FIADB_SCHEMA.POP_EVAL_TYP PET
   ON (PET.EVAL_GRP_CN = PEG.CN)
  JOIN &FIADB_SCHEMA.POP_EVAL PEV
   ON (PEV.CN = PET.EVAL_CN)
  JOIN &FIADB_SCHEMA.POP_ESTN_UNIT PEU
   ON (PEV.CN = PEU.EVAL_CN)
  JOIN &FIADB_SCHEMA.POP_STRATUM POP_STRATUM
   ON (PEU.CN = POP_STRATUM.ESTN_UNIT_CN)
  JOIN &FIADB_SCHEMA.POP_PLOT_STRATUM_ASSGN
   ON (POP_PLOT_STRATUM_ASSGN.STRATUM_CN = POP_STRATUM.CN)
  JOIN &FIADB_SCHEMA.PLOT
   ON (POP_PLOT_STRATUM_ASSGN.PLT_CN = PLOT.CN)
  JOIN &FIADB_SCHEMA.PLOTGEOM
   ON (PLOT.CN = PLOTGEOM.CN)
  JOIN &FIADB_SCHEMA.COND
   ON (COND.PLT_CN = PLOT.CN)
-- where clause
 WHERE COND.RESERVCD = 0
   AND COND.SITECLCD IN (1, 2, 3, 4, 5, 6)
   AND COND.COND_STATUS_CD = 1
   AND COND.CONDPROP_UNADJ IS NOT NULL
   AND PET.EVAL_TYP = 'EXPCURR'
   AND COND.OWNGRPCD = 40 -- additional user-defined where clause
   AND PEG.EVAL_GRP = &EVAL_GRP
   AND 1 = 1
```

The example above produces an estimate:

Item	Value
ESTIMATE	10,402,769,126

And the same modification to example 4-1 produces an estimate with sampling errors:

Item	Value
EVAL_GRP	272003
ESTIMATE	10,402,769,126
SE_OF_ESTIMATE_PCT	1.3
VAR_OF_ESTIMATE	17,902,006,332,174,300
TOTAL_PLOTS	16,041
NON_ZERO_PLOTS	2,347
TOTAL_POPULATION_ACRES	54,002,539

Based on this function, the estimated total value of private timberland in the State is 10.4 billion dollars. This value function is used only as an example, any type of user-defined function that assigns quantities, such as value ($ per acre), wildlife population level (animals per acre), productivity (yield per acre), or carbon sequestration potential (tons per acre) could be used as long as it is a function of data items in the FIADB, and/or data attributes from other sources that can be linked to FIA plots.

Chapter 7: Estimates of Change over Time

A number of the attributes described in the REF_POP_ATTRIBUTE table are related to change over time and are based on computed attributes that utilize data from two points in time from the same plot. Users often want to: (1) obtain estimates that reflect changes in attributes over the remeasurement of the plot, and (2) classify these standard estimates by attributes from the previous visit, current visit, or by changes in attributes over time (e.g., diameter class). Examples of these types of estimations are as follow:

• Change in area over time by past and current land use, forest type, or other condition attributes.

• Number of trees on forest land that changed to nonforest land.

• Removals of trees on forest land of a specific forest type that changed to a different forest type.

• Mortality of trees that were in a specific diameter range in the previous measurement.

• Change in the number of seedlings per acre over time for a specific forest type.

The estimation of these and many other change attributes require properly selecting the appropriate set of plots that were measured at both points in time and linking data from these two measurements (see 7.1 Calculating change).

7.1   Calculating change

Prior to 1999, FIA used periodic inventories with different plot designs. Since 1999, the new annual inventory uses a national standard, 4-subplot fixed-area plot design. For change estimation, using periodic-to-periodic, periodic-to-annual, as well as annual-to-annual remeasurement plots, there are evaluations for net growth, removals, and mortality. Most change estimates are only available for annual-to-annual remeasurement plots including the area change evaluation. The SQL available in REF_POP_ATTRIBUTE.SQL_QUERY only works for annual-to-annual change estimation. See chapter 2, Selecting an Appropriate Sample and Attribute of Interest, for additional details on evaluation types. Here we explain parts of a change estimate script for volume in an example that works for each remeasurement type.

Example 7-1 is valid for periodic-to-periodic, periodic-to-annual, and annual-to-annual remeasurement. Results for each remeasurement type are presented for Minnesota. The attribute 'average annual net growth of merchantable bole volume of growing-stock trees (at least 5 inches d.b.h.), in cubic feet, on timberland' is usually available for every remeasurement type and is used in this case. Bold portions of this script are discussed later in this section.

Example 7-1: Average annual net growth of merchantable bole volume of growing-stock trees (at least 5 inches d.b.h.), in cubic feet, on timberland.

Line	Script
1	*--select clause*
2	SELECT SUM((GRM.TPAGROW_UNADJ * (**CASE**
3	**WHEN COALESCE(GRM.SUBPTYP_GRM, 0) = 0 THEN**
4	**0**
5	**WHEN GRM.SUBPTYP_GRM = 1 THEN**
6	**POP_STRATUM.ADJ_FACTOR_SUBP**
7	**WHEN GRM.SUBPTYP_GRM = 2 THEN**
8	**POP_STRATUM.ADJ_FACTOR_MICR**
9	**WHEN GRM.SUBPTYP_GRM = 3 THEN**
10	**POP_STRATUM.ADJ_FACTOR_MACR**
11	**ELSE**
12	**0**
13	**END**) * GRM.ANN_NET_GROWTH) * POP_STRATUM.EXPNS) AS ESTIMATED_VALUE
14	*-- join clause*
15	FROM &FIADB_SCHEMA.POP_EVAL_GRP PEG
16	JOIN &FIADB_SCHEMA.POP_EVAL_TYP PET
17	ON (PET.EVAL_GRP_CN = PEG.CN)
18	JOIN &FIADB_SCHEMA.POP_EVAL PEV
19	ON (PEV.CN = PET.EVAL_CN)
20	JOIN &FIADB_SCHEMA.POP_ESTN_UNIT PEU
21	ON (PEV.CN = PEU.EVAL_CN)
22	JOIN &FIADB_SCHEMA.POP_STRATUM POP_STRATUM

Line	Script
23	ON (PEU.CN = POP_STRATUM.ESTN_UNIT_CN)
24	JOIN &FIADB_SCHEMA.POP_PLOT_STRATUM_ASSGN
25	ON (POP_PLOT_STRATUM_ASSGN.STRATUM_CN = POP_STRATUM.CN)
26	JOIN &FIADB_SCHEMA.PLOT PLOT
27	ON (POP_PLOT_STRATUM_ASSGN.PLT_CN = PLOT.CN)
28	JOIN &FIADB_SCHEMA.PLOTGEOM PLOTGEOM
29	ON (PLOT.CN = PLOTGEOM.CN)
30	JOIN &FIADB_SCHEMA.COND COND
31	ON (COND.PLT_CN = PLOT.CN)
32	JOIN (SELECT P.PREV_PLT_CN, T.*
33	FROM &FIADB_SCHEMA.PLOT P, &FIADB_SCHEMA.TREE T
34	WHERE P.CN = T.PLT_CN) TREE
35	ON ((TREE.CONDID = COND.CONDID) AND (TREE.PLT_CN = COND.PLT_CN))
36	JOIN (SELECT TRE_CN,
37	**SUBP_COMPONENT_GS_TIMBER AS COMPONENT,**
38	**SUBP_SUBPTYP_GRM_GS_TIMBER AS SUBPTYP_GRM,**
39	**SUBP_TPAGROW_UNADJ_GS_TIMBER AS TPAGROW_UNADJ,**
40	**GROWCFGS_TIMBER AS ANN_NET_GROWTH**
41	FROM &FIADB_SCHEMA.TREE_GRM_COMPONENT) GRM
42	ON (TREE.CN = GRM.TRE_CN)
43	**LEFT OUTER JOIN &FIADB_SCHEMA.PLOT PPLOT**
44	**ON (PLOT.PREV_PLT_CN = PPLOT.CN)**
45	**LEFT OUTER JOIN &FIADB_SCHEMA.COND PCOND**
46	**ON ((TREE.PREVCOND = PCOND.CONDID) AND**
47	**(TREE.PREV_PLT_CN = PCOND.PLT_CN))**
48	**LEFT OUTER JOIN &FIADB_SCHEMA.TREE PTREE**
49	**ON (TREE.PREV_TRE_CN = PTREE.CN)**
50	*-- where clause*
51	WHERE PEG.EVAL_GRP = &EVAL_GRP
52	and PET.eval_typ = 'EXPGROW'

The example above produces the following estimates for Minnesota 1990, Minnesota 2003, and Minnesota 2017:

Remeasurement type	&EVAL_GRP	Item	Value
PERIODIC-TO-PERIODIC	**271990**	**ESTIMATE MN 2003**	374,861,619
PERIODIC-TO-ANNUAL	**272003**	**ESTIMATE MN 2003**	404,282,075
ANNUAL-TO-ANNUAL	**272017**	**ESTIMATE MN 2017**	410,632,609

In annual-to-annual evaluations, the link between the current and previous plot is available and is useful when summarizing results by previous plot attributes (e.g., previous owner). The link is not available in periodic-to-periodic and periodic-to-annual estimation so summaries by previous plot attributes are not possible.

Example 7-1 uses left outer joins to link current plots, conditions, and trees to previous instances of the like (lines 43-49). If there are no previous instances available, the left outer join ensures that the current instances are maintained in the query. Hence, this query allows the user to summarize by previous attributes when they are available, otherwise, by current attributes.

For example 7-2, past and current attributes were added as grouping variables to example 7-1. Stand sizes (current_stdszcd and past_stdszcd) 1, 2, 3, and 5 represent large, medium, small, and nonstocked stand sizes, respectively. Condition status codes (past_cond_status_cd and current_cond_status_cd) 1, 2, 3, and 4 represent forest land, nonforest land, noncensus water, and census water. In this case, null or '-' represents nontimberland conditions.

Example 7-2: Average annual net growth of merchantable bole volume of growing-stock trees (at least 5 inches d.b.h.), in cubic feet, on timberland by past and current condition status code and stand-size class. Bold section added to example 7-1.

```
--select clause
SELECT pcond.cond_status_cd past_cond_status_cd,
    cond.cond_status_cd current_cond_status_cd,
    pcond.stdszcd past_stdszcd,
    cond.stdszcd current_stdszcd, -- current and past attributes
    SUM((GRM.TPAGROW_UNADJ * (CASE
        WHEN COALESCE(GRM.SUBPTYP_GRM, 0) = 0 THEN
         0
        WHEN GRM.SUBPTYP_GRM = 1 THEN
         POP_STRATUM.ADJ_FACTOR_SUBP
        WHEN GRM.SUBPTYP_GRM = 2 THEN
         POP_STRATUM.ADJ_FACTOR_MICR
        WHEN GRM.SUBPTYP_GRM = 3 THEN
         POP_STRATUM.ADJ_FACTOR_MACR
        ELSE
         0
       END) * GRM.ANN_NET_GROWTH) * POP_STRATUM.EXPNS) AS ESTIMATED_VALUE
    -- join clause
    FROM &FIADB_SCHEMA.POP_EVAL_GRP PEG
    JOIN &FIADB_SCHEMA.POP_EVAL_TYP PET
      ON (PET.EVAL_GRP_CN = PEG.CN)
    JOIN &FIADB_SCHEMA.POP_EVAL PEV
      ON (PEV.CN = PET.EVAL_CN)
    JOIN &FIADB_SCHEMA.POP_ESTN_UNIT PEU
      ON (PEV.CN = PEU.EVAL_CN)
    JOIN &FIADB_SCHEMA.POP_STRATUM POP_STRATUM
      ON (PEU.CN = POP_STRATUM.ESTN_UNIT_CN)
    JOIN &FIADB_SCHEMA.POP_PLOT_STRATUM_ASSGN
      ON (POP_PLOT_STRATUM_ASSGN.STRATUM_CN = POP_STRATUM.CN)
    JOIN &FIADB_SCHEMA.PLOT PLOT
      ON (POP_PLOT_STRATUM_ASSGN.PLT_CN = PLOT.CN)
```

```
JOIN &FIADB_SCHEMA.PLOTGEOM PLOTGEOM
  ON (PLOT.CN = PLOTGEOM.CN)
JOIN &FIADB_SCHEMA.COND COND
  ON (COND.PLT_CN = PLOT.CN)
JOIN (SELECT P.PREV_PLT_CN, T.*
      FROM &FIADB_SCHEMA.PLOT P, &FIADB_SCHEMA.TREE T
     WHERE P.CN = T.PLT_CN) TREE
  ON ((TREE.CONDID = COND.CONDID) AND (TREE.PLT_CN = COND.PLT_CN))
JOIN (SELECT TRE_CN,
         SUBP_COMPONENT_GS_TIMBER     AS COMPONENT,
         SUBP_SUBPTYP_GRM_GS_TIMBER   AS SUBPTYP_GRM,
         SUBP_TPAGROW_UNADJ_GS_TIMBER AS TPAGROW_UNADJ,
         GROWCFGS_TIMBER              AS ANN_NET_GROWTH
      FROM &FIADB_SCHEMA.TREE_GRM_COMPONENT) GRM
  ON (TREE.CN = GRM.TRE_CN)
LEFT OUTER JOIN &FIADB_SCHEMA.PLOT PPLOT
  ON (PLOT.PREV_PLT_CN = PPLOT.CN)
LEFT OUTER JOIN &FIADB_SCHEMA.COND PCOND
  ON ((TREE.PREVCOND = PCOND.CONDID) AND
     (TREE.PREV_PLT_CN = PCOND.PLT_CN))
LEFT OUTER JOIN &FIADB_SCHEMA.TREE PTREE
  ON (TREE.PREV_TRE_CN = PTREE.CN)
-- where clause
WHERE PEG.EVAL_GRP = &EVAL_GRP
  and PET.eval_typ = 'EXPGROW'
group by pcond.cond_status_cd,
      cond.cond_status_cd,
      pcond.stdszcd,
      cond.stdszcd
order by pcond.cond_status_cd,
      cond.cond_status_cd,
      pcond.stdszcd,
    cond.stdszcd -- group and order by current and past attributes
```

The example above produces the following estimates for Minnesota 2017, an annual-to-annual inventory.

PAST_COND_STATUS_CD	CURRENT_COND_STATUS_CD	CURRENT_STDSZCD	PAST_STDSZCD	ESTIMATE
1	1	1	1	95,255,811
1	1	1	2	2,340,249
1	1	1	3	-2,104,598
1	1	1	5	-548,355
1	1	2	1	21,540,867
1	1	2	2	166,753,017
1	1	2	3	-5,836,962

PAST_COND_STATUS_CD	CURRENT_COND_STATUS_CD	CURRENT_STDSZCD	PAST_STDSZCD	ESTIMATE
1	1	2	5	400,012
1	1	3	1	2,732,652
1	1	3	2	53,750,593
1	1	3	3	53,067,137
1	1	3	5	123,288
1	1	5	1	36,400
1	1	5	2	272,292
1	1	5	3	122,540
1	1	5	5	-4,527
1	2	1	-	134,821
1	2	2	-	373,338
1	2	3	-	35,594
1	2	5	-	1,809
1	3	1	-	-95,634
1	3	3	-	0
1	4	1	-	-197,542
1	4	2	-	1,535
1	5	1	-	0
1	5	2	-	0
1	5	3	-	0
2	1	-	1	11,019,442
2	1	-	2	9,077,233
2	1	-	3	1,392,579
2	1	-	5	404,360
3	1	-	1	0
3	1	-	2	3,961
3	1	-	5	0
4	1	-	1	0
4	1	-	2	580,705

Example 7-2 will work for inventories with no ties to previous plot visits but past attributes (e.g., past stand size class) will be associated with null indicating there is no previous information available.

Calculating change in volume differs in a number of ways from calculating current volume. Scripts calculating current volume use TREE.DIA to determine subplot type, which is used to identify the appropriate adjustment factor that compensates for nonsampled area (see example 3-5). While this is valid for current estimates such as volume, it is not valid for remeasurement estimates for two reasons. First, TREE.DIA is not always populated on removal and mortality trees. Second, on remeasurement plots, the correctly applied subplot type is not directly related to tree diameter at time 2. For example, on removal

and mortality trees, the tree remeasurement expansion factor is based on the previous plot type, which could be different than the current plot type. For remeasurement, the correct adjustment factor is available from the TREE_GRM_COMPONENT table (example 7-1, lines 2-13).

Scripts calculating current volume acquire the trees per acre value from the current sample tree (e.g., TREE.TPAGROW_UNADJ) based upon the current land basis. In some instances, the correct trees per acre value should be based upon the previous land basis. This occurs on trees that were previously 1.0-4.9 inches on the microplot on timberland at time 1, then grew over the 5.0-inch threshold at time 2 (at threshold size the tree is tallied with the subplot) and the condition no longer qualifies as timberland, but is still forest land. This can occur when the COND.RESERVCD changes from 0 to 1. For the timberland land basis, the tree is a diversion at the midpoint between time 1 and time 2 with a TPAGROW_UNADJ value based on the microplot (74.965282 trees per acre), but the same tree is ingrowth on forest land and is assigned the subplot TPAGROW_UNADJ value (6.018046 trees per acre). Because the TREE table only stores one value for trees per acre, an alternative, TREE_GRM_COMPONENT, has the correct trees per acre value (example 7-1, line 39).

The growth component and estimate type are also required to calculate change in volume. Example 7-1 (line 37) uses TREE_GRM_COMPONENT. SUBP_COMPONENT_GS_TIMBER to specify the growth component as trees at least 5 inches d.b.h. on timberland for the estimation type TREE_GRM_COMPONENT.GROWCFGS_TIMBER (line 40), which is net annual merchantable cubic-foot growth of a growing-stock tree on timberland.

TREE_GRM_COMPONENT stores information used to compute net growth, removals, and mortality estimates for remeasurement trees. Each remeasurement tree is represented by a single record. Details about the land basis (forest land or timberland), component of change (e.g., survivor tree), and estimation type (all live, growing stock, or sawtimber) are incorporated into the columns in various combinations. Using the components in TREE_GRM_COMPONENT, the previous two examples can be modified to estimate many variations of net growth, removals, and mortality by past (when available) and current attributes. See the TREE_GRM_COMPONENT table in Chapter 3 of The Forest Inventory and Analysis Database: Database Description and User Guide for Phase 2 (Burrill et. al. 2018) for more information.

The following tabulation was compiled from example 7-2 results. The code labels have been added to the last row and column headings, and each cell in table 7-1 is the appropriate value from example 7-2.

Table 7-1: Average annual net growth of merchantable bole volume of growing-stock trees (at least 5 inches d.b.h.), in cubic feet, on timberland by past and current condition status code and stand size class, Minnesota, 2017.

PAST_COND_STATUS_CD	PAST_STDSZCD	CURRENT_COND_STATUS_CD				Total on timberland	2 Nonforest land	3 Noncensus water	4 Census water	Total
		CURRENT_STDSZCD								
		1 Large diameter	2 Medium diameter	3 Small diameter	5 Non-stocked					
	1 Large diameter	95,255,811	2,340,249	-2,104,598	-548,355	94,943,107	134,821	-95,634	-197,542	94,784,752
	2 Medium diameter	21,540,867	166,753,017	-5,836,962	400,012	182,856,934	373,338	-	1,535	183,231,807
	3 Small diameter	2,732,652	53,750,593	53,067,137	123,288	109,673,670	35,594	-	-	109,709,264
	5 Non-stocked	36,400	272,292	122,540	-4,527	426,705	1,809	-	-	428,514
Total on timberland		119,565,730	223,116,151	45,248,117	-29,582	387,900,416	545,562	-95,634	-196,007	388,154,337
2 Nonforest land		11,019,442	9,077,223	1,392,579	404,360	21,893,614	-	-	-	21,893,614
3 Noncensus water		-	3,961	-	-	3,961	-	-	-	3,961
4 Census water		-	580,705	-	-	580,705	-	-	-	580,705
Total annual net growth		130,585,172	232,778,050	46,640,696	374,778	410,378,696	545,562	-95,634	-196,007	410,632,617

7.2 Annual net growth estimation using the accounting method

The annual net growth estimates in the previous examples are summaries of annual net growth on each tree by current or past attributes. However, these scripts do not account for volume shifts across classified attributes that can change value between time 1 and time 2. To account for volume that moves into and out of a single class between time 1 and time 2, one can assign the beginning (a negative value) and end volume (a positive value) to the initial and final class for the attribute of interest, the accounting method.

FIA uses the annual net growth equation defined by Bechtold and Patterson (2005):

(Volume t2 - Volume t1) / REMPER

where REMPER is the remeasurement period in years, t2 is time 2, and t1 is time 1.

To compute the annual net growth on a tree that had a volume of 1.705 cubic feet at time 1 and a volume of 3.835 cubic feet at time 2 and remeasurement period of 5.5 years, the equation solves as follows:

(3.835 cubic feet - 1.705 cubic feet) / 5.5 years = 0.387 cubic feet per year

The previous annual net growth examples summarized this end result (0.387 cubic feet per year but expanded to the population level) to a previous or current classification. While those are valid analyses, the results may not match actual shifts in volume across classified attributes that change between time 1 and time 2 (e.g., stand-size class). To match shifts in volume across a classified attribute such as stand-size class, users can employ the accounting method, which uses an algebraically equivalent form of the standard equation.

(Volume t2 - Volume t1) / REMPER

can also be expressed as:

(Volume t2 / REMPER) - (Volume t1 / REMPER)

So the same tree can be represented as:

(3.835 cubic feet / 5.5 years) - (1.705 cubic feet / 5.5 years)

0.697 cubic feet per year - 0.310 cubic feet per year = 0.387 cubic feet per year

Instead of summarizing the end result of the equation, the accounting method assigns the time 1 annualized volume (-0.310 cubic feet per year) to the time 1 attribute value and the time 2 annualized volume (0.697 cubic feet per year) to the time 2 attribute value.

This effectively accounts for outgrowth from the time 1 class and ingrowth into the time 2 class. In the case where the time 1 class and the time 2 class have the same value, the net result is assigned to that class (0.387 cubic feet per year). If the attribute changes value over the remeasurement period, then the beginning annualized volume is deducted from the initial class and the ending annualized volume is added to the time 2 class.

In the current FIADB version only certain remeasurement evaluations have the necessary data to employ the accounting method. The evaluations that can use the accounting method are identified by POP_EVAL.GROWTH_ACCT = 'Y'. It is currently not available on periodic-to-periodic or periodic-to-annual remeasurement plots.

Example 7-3 employs the net growth accounting method. The SQL is from REF_POP_ATTRIBUTE.SQL_QUERY (ATTRIBUTE_NBR = 208) with additions to summarize by stand-size class. Group by and order by clauses were added along with a case statement in the select clause. Unless noted otherwise, SQL from SQL_QUERY where EVAL_TYP = EXPGROW utilizes the accounting method.

The BEGINEND table (without a join) is used to split the record into two time periods (time 1 and time 2). This allows the beginning estimate to be summarized by the time 1 attribute and the end (or midpoint) estimate to be summarized by the time 2 attribute. The script is similar to example 7-1. Joins are created to previous plot, previous cond and previous tree attributes. The TREE table is joined to the TREE_GRM_COMPONENT table. The land basis, change component (e.g., SUBP_COMPONENT_GS_TIMBER), plot type for change (e.g., SUBP_SUBPTYP_GRM_GS_TIMBER), and trees per acre (e.g., SUBP_TPAGROW_UNADJ_GS_TIMBER) are acquired from TREE_GRM_COMPPONENT. If necessary, the appropriate diameter at time 1 (DIA_BEGIN), time 2 (DIA_END) or the midpoint (DIA_MIDPT) are also available from TREE_GRM_COMPONENT.

Unlike example 7-1, the tree component (e.g., survivor, ingrowth, mortality, cut [removal], diversion, and reversion from TREE_GRM_COMPONENT.COMPONENT) dictates the appropriate volume to use. The time 1 volume is from TREE_GRM_BEGIN. Time 2 volume is from TREE and the midpoint volume is from TREE_GRM_MIDPT. In cases with diversion and cut trees, midpoint volume estimates are used in lieu of the ending estimates. Mortality trees contribute negative time 1 volume and 0 at the midpoint (midpoint volume - [midpoint volume - time 1 volume] = - time 1 volume; see Section 7.3 Net growth components for more information).

Depending on the summary attribute, cut, diversion, and mortality trees may use either the previous or midpoint attribute value. At this time, only two attributes (diameter and stand age) have been identified as attributes that can be defined at the midpoint on cut, diversion, and mortality trees. In all other cases, the previous attribute value is assigned cut, diversion, and mortality trees. Example 7-3 assigns the previous stand-size class for cut, diversion, and mortality trees.

Example 7-3: Average annual net growth of merchantable bole volume of growing-stock trees (at least 5 inches d.b.h.), in cubic feet, on timberland by stand-size class using the accounting method (ATTRIBUTE_NBR 208 modified), Minnesota 2017 (&EVAL_GRP = 272017).

```
--select clause
SELECT CASE be.oneortwo
        WHEN 1 THEN --if time 1, then use past stand-size code
         pcond.stdszcd
        WHEN 2 THEN
          -- for survivor, ingrowth and reversion trees, use time 2 stand-size code
         CASE grm.component
          WHEN 'SURVIVOR' THEN
           cond.stdszcd
          WHEN 'INGROWTH' THEN
           cond.stdszcd
          WHEN 'REVERSION1' THEN
```

```
              cond.stdszcd
            WHEN 'REVERSION2' THEN
              cond.stdszcd
            ELSE
              pcond.stdszcd
          -- use the past stand-size code on all other component values (diversions,
          -- removals and mortality) at time 2
          END
       END AS stdszcd,
       SUM((GRM.TPAGROW_UNADJ * (CASE
            WHEN COALESCE(GRM.SUBPTYP_GRM, 0) = 0 THEN
              (0)
            WHEN GRM.SUBPTYP_GRM = 1 THEN
             POP_STRATUM.ADJ_FACTOR_SUBP
            WHEN GRM.SUBPTYP_GRM = 2 THEN
             POP_STRATUM.ADJ_FACTOR_MICR
            WHEN GRM.SUBPTYP_GRM = 3 THEN
             POP_STRATUM.ADJ_FACTOR_MACR
            ELSE
             (0)
           END) -- acquire adjustment factor for nonsampled are from GRM,
                 -- TREE_GRM_COMPONENT table
               * (CASE
            WHEN BE.ONEORTWO = 2 THEN -- add to split TREE_GRM_COMPONENT into time 1 and time 2
             (CASE
               WHEN (GRM.COMPONENT = 'SURVIVOR' OR GRM.COMPONENT = 'INGROWTH' OR
                  GRM.COMPONENT LIKE 'REVERSION%') THEN
                (TREE.VOLCFNET / PLOT.REMPER)
               WHEN (GRM.COMPONENT LIKE 'CUT%' OR GRM.COMPONENT LIKE 'DIVERSION%')      THEN
                (TRE_MIDPT.VOLCFNET / PLOT.REMPER)
               ELSE
                (0)
              END) -- for time 2, use end estimate for survivor, ingrowth and
                           -- reversion trees, otherwise use midpoint estimate for cut and
                           -- diversion trees; mortality contributes 0; divide by remper to
                           -- annualize
            ELSE
             (CASE
               WHEN (GRM.COMPONENT = 'SURVIVOR' OR GRM.COMPONENT = 'CUT1' OR
                  GRM.COMPONENT = 'DIVERSION1' OR GRM.COMPONENT = 'MORTALITY1') THEN
                CASE
                 WHEN TRE_BEGIN.TRE_CN IS NOT NULL THEN
                  - (TRE_BEGIN.VOLCFNET / PLOT.REMPER)
                 ELSE
                  - (PTREE.VOLCFNET / PLOT.REMPER)
                END -- for time 1, set the beginning estimate negative; ingrowth
                           -- contributes 0; divide by remper to annualize; use time 1
                           -- estimate from TREE_GRM_BEGIN when available
               ELSE
                (0)
              END)
```

```
                END)) * POP_STRATUM.EXPNS) AS ESTIMATED_VALUE
        -- join clause
         FROM &FIADB_SCHEMA.BEGINEND BE, &FIADB_SCHEMA.POP_EVAL_GRP PEG
         JOIN &FIADB_SCHEMA.POP_EVAL_TYP PET
           ON (PET.EVAL_GRP_CN = PEG.CN)
         JOIN &FIADB_SCHEMA.POP_EVAL PEV
           ON (PEV.CN = PET.EVAL_CN)
         JOIN &FIADB_SCHEMA.POP_ESTN_UNIT PEU
           ON (PEV.CN = PEU.EVAL_CN)
         JOIN &FIADB_SCHEMA.POP_STRATUM POP_STRATUM
           ON (PEU.CN = POP_STRATUM.ESTN_UNIT_CN)
         JOIN &FIADB_SCHEMA.POP_PLOT_STRATUM_ASSGN POP_PLOT_STRATUM_ASSGN
           ON (POP_STRATUM.CN = POP_PLOT_STRATUM_ASSGN.STRATUM_CN)
         JOIN &FIADB_SCHEMA.PLOT PLOT
           ON (POP_PLOT_STRATUM_ASSGN.PLT_CN = PLOT.CN)
         JOIN &FIADB_SCHEMA.PLOTGEOM PLOTGEOM
           ON (PLOT.CN = PLOTGEOM.CN)
         JOIN &FIADB_SCHEMA.PLOT PPLOT
          ON (PLOT.PREV_PLT_CN = PPLOT.CN)  -- join plot to previous plot, limits query to
                                                       -- annual-to-annual remeasurement
         JOIN &FIADB_SCHEMA.COND PCOND
          ON (PLOT.PREV_PLT_CN = PCOND.PLT_CN)  -- join plot to previous cond, limits
                                                       -- query to annual-to-annual remeasurement
         JOIN &FIADB_SCHEMA.COND COND
           ON (PLOT.CN = COND.PLT_CN)
         JOIN &FIADB_SCHEMA.TREE TREE
            ON (TREE.CONDID = COND.CONDID AND TREE.PLT_CN = PLOT.CN AND
          TREE.PREVCOND = PCOND.CONDID)  -- join tree to previous cond, limits query to
                                                       -- annual-to-annual remeasurement
         LEFT OUTER JOIN &FIADB_SCHEMA.TREE PTREE
          ON (TREE.PREV_TRE_CN = PTREE.CN)  -- join tree to previous tree; outer joins run
                                                       -- even if no previous attributes available
         LEFT OUTER JOIN &FIADB_SCHEMA.TREE_GRM_BEGIN TRE_BEGIN
          ON (TREE.CN = TRE_BEGIN.TRE_CN)  -- join to time 1 recalculated tree measurements;
                                                -- needed in curcumstances when diameter
                                                -- measurement point moves on tree or species id -- changes
         LEFT OUTER JOIN &FIADB_SCHEMA.TREE_GRM_MIDPT TRE_MIDPT
          ON (TREE.CN = TRE_MIDPT.TRE_CN)  -- join to midpoint tree measurements;
                                                       -- needed if a mortality, removal, diversion or
                                                       -- reversion
         LEFT OUTER JOIN (SELECT TRE_CN,
                        DIA_BEGIN,
                        DIA_MIDPT,
                        DIA_END,
                        SUBP_COMPONENT_GS_TIMBER     AS COMPONENT,
                        SUBP_SUBPTYP_GRM_GS_TIMBER   AS SUBPTYP_GRM,
                        SUBP_TPAGROW_UNADJ_GS_TIMBER AS TPAGROW_UNADJ
                      FROM &FIADB_SCHEMA.TREE_GRM_COMPONENT) GRM
          ON (TREE.CN = GRM.TRE_CN)
        -- acquire begin (time 1), midpoint and end (time 2) diameters; acquire appropriate
        -- change component classifications and nonsampled area adjustment factor
```

```
-- where  clause
WHERE 1 = 1
  AND PET.EVAL_TYP = 'EXPGROW'
  AND PEG.EVAL_GRP = &EVAL_GRP
  AND 1 = 1
GROUP BY CASE be.oneortwo
        WHEN 1 THEN
          pcond.stdszcd
        WHEN 2 THEN
         CASE grm.component
           WHEN 'SURVIVOR' THEN
            cond.stdszcd
           WHEN 'INGROWTH' THEN
            cond.stdszcd
           WHEN 'REVERSION1' THEN
            cond.stdszcd
           WHEN 'REVERSION2' THEN
            cond.stdszcd
           ELSE
            pcond.stdszcd
         END
       END
ORDER BY CASE be.oneortwo
        WHEN 1 THEN
         pcond.stdszcd
        WHEN 2 THEN
         CASE grm.component
           WHEN 'SURVIVOR' THEN
            cond.stdszcd
           WHEN 'INGROWTH' THEN
            cond.stdszcd
           WHEN 'REVERSION1' THEN
            cond.stdszcd
           WHEN 'REVERSION2' THEN
            cond.stdszcd
           ELSE
            pcond.stdszcd
         END
       END
```

Example 7-3 produces the following estimates using the accounting method (description of STDSZCD code added for clarity):

STDSZCD	DESCRIPTION	ESTIMATE_ACCOUNTING
NULL	Nonforest land or water	0
1	Large diameter stands	231,838,995
2	Medium diameter stands	171,826,083
3	Small diameter stands	6,134,032
5	nonstocked stands	833,500
-	**Sum**	**410,632,609**

This results in an estimated stand-size class distribution that is quite different from the distribution in any of the previous estimates. Note there is also a slight difference in the total estimate of growth due to rounding.

DESCRIPTION	Example 7-3 ESTIMATE_ ACCOUNTING	Example 7-2 ESTIMATE_ CURRENT	Example 7-2 ESTIMATE_ PAST
Nonforest land or water	0	130,585,172	94,784,752
Large diameter stands	231,838,995	232,778,050	183,231,807
Medium diameter stands	171,826,083	46,640,696	109,709,264
Small diameter stands	6,134,032	374,778	428,514
nonstocked stands	833,500	253,921	22,478,280
Sum	**410,632,609**	**410,632,617**	**410,632,617**

The accounting script assigns the annual net growth on reverted and diverted conditions to the current and previous stand-size classes, respectively. As a result, there is not an estimate of annual net growth on nonforest conditions using the accounting script.

Comparison of annual net change in inventory to annual net growth accounting

The results from the annual net growth accounting script are more in line with the shifts in inventory volume within each class than with summaries by the current or past stand-size class alone (or even in combination as shown in example 7-2). Because not all inventory plots are remeasured, it is not possible to match the exact change in inventory volume estimates (which includes plots that are not remeasured) by summing annual net growth and removals from just those plots that are remeasured, but the trends should be similar, especially as the proportion of remeasured plots increases.

For comparison, we use this formula for net change:

Annual Net Growth - Annual Removals = Annual Net Change

which can be expressed as:

Annual Net Growth = Annual Net Change + Annual Removals

The tabulation below shows inventory estimates for live trees on forest land in MN 2007 and 2012 from the EXPVOL evaluation (EVALID = 270701 and 271201). Given that Minnesota is on a five-year remeasurement period, an approximate net annual change is derived by taking the difference in volume in each class and dividing by an average five-year remeasurement period. By adding in the average annual removal rate (using the past stand-size class distribution), a net annual growth rate for each stand-size class can be approximated from the difference in the inventory volume estimates. Given the stated limitations of comparing estimates from inventory and remeasurement plots, the accounting method is the best overall match of the various annual net growth estimates on the remeasurement plots to the approximate annual net growth from the inventory plots within each stand-size class.

Stand-size Class	MN 2007 INVENTORY	MN 2012 INVENTORY	Approx. Annual Net Change	Annual Removals (Past Stand-size class)	Approx. Annual Net Growth
Large diameter	9,255,425,066	9,835,727,120	116,060,411	117,935,659	233,996,070
Medium diameter	7,399,550,291	7,601,756,660	40,441,274	98,051,083	138,492,357
Small diameter	1,284,708,806	1,360,245,166	15,107,272	4,867,651	19,974,923
Nonstocked	14,781,817	11,068,118	-742,740	54,769	-687,971
Sum	17,954,465,986	18,808,797,062	170,866,217	220,909,162	391,775,379

The estimates of inventory volume on forest land in MN 2007 and MN 2012 could be derived from only the remeasurement plots in the MN 2012 EXPGROW evaluation and the beginning and ending volume estimates. Also, the actual remeasurement period for each plot can be applied to each tree record instead of using an average five-year remeasurement period. Doing so results in a much better match with the annual net growth estimate, as it should because this is how the annual net growth estimates are derived. The only differences in annual net growth using this method are due to rounding error. The user should be aware that the inventory estimates from the remeasured plots will not match the EXPVOL evaluation estimates.

Stand-size Class	MN 2007 INVENTORY ON REMEASURED PLOTS ONLY	MN 2012 INVENTORY ON REMEASURED PLOTS ONLY	Annual Net Change	Annual Removals (Past Stand-size class)	Annual Net Growth Calculated
Large diameter	9,684,442,547	10,397,218,332	138,042,048	117,935,659	255,977,699
Medium diameter	7,900,146,909	8,028,293,352	24,659,624	98,051,083	122,710,705
Small diameter	1,362,673,299	1,427,956,148	13,402,261	4,867,651	18,269,914
Nonstocked	36,526,699	12,211,956	-4,832,958	54,769	-4,778,189
Sum	18,893,789,454	19,865,679,788	171,270,975	220,909,162	392,180,129

Which annual net growth script is "right"?

Because all of the estimates above are valid, which option should be used: accounting, current, or previous? It depends on the question at hand, but FIA recommends using accounting for most attributes that can change class between two points in time because it accounts for volume shifts into and out of each class. But there could be situations where users may not want to use the accounting method for such attributes.

The scripts in REF_POP_ATTRIBUTE.SQL_QUERY that employ accounting can be modified to summarize by previous and current attributes. Example 7-4 is the SQL for ATTRIBUTE_NBR 208 (see example 7-3) modified to summarize by previous and current stand-size class. Remove either the past or current attribute from the script if the summary of interest is only focusing on one time.

Example 7-4: Average annual net growth of merchantable bole volume of growing-stock trees (at least 5 inches d.b.h.), in cubic feet, on timberland by past and current stand-size class.

```
--select clause
SELECT  pcond.stdszcd past_stdszcd,
     cond.stdszcd current_stdszcd, -- current and past stand-size class
     SUM((GRM.TPAGROW_UNADJ * (CASE
        WHEN COALESCE(GRM.SUBPTYP_GRM, 0) = 0 THEN
         (0)
        WHEN GRM.SUBPTYP_GRM = 1 THEN
         POP_STRATUM.ADJ_FACTOR_SUBP
        WHEN GRM.SUBPTYP_GRM = 2 THEN
         POP_STRATUM.ADJ_FACTOR_MICR
        WHEN GRM.SUBPTYP_GRM = 3 THEN
         POP_STRATUM.ADJ_FACTOR_MACR
        ELSE
         (0)
        END) -- acquire adjustment factor for nonsampled are from GRM,
              -- TREE_GRM_COMPONENT table
```

```
                    * (CASE
                   WHEN BE.ONEORTWO = 2 THEN -- add to split TREE_GRM_COMPONENT into time 1 and time 2
                     (CASE
                      WHEN (GRM.COMPONENT = 'SURVIVOR' OR GRM.COMPONENT = 'INGROWTH' OR
                          GRM.COMPONENT LIKE 'REVERSION%') THEN
                       (TREE.VOLCFNET / PLOT.REMPER)
                      WHEN (GRM.COMPONENT LIKE 'CUT%' OR GRM.COMPONENT LIKE 'DIVERSION%')      THEN
                       (TRE_MIDPT.VOLCFNET / PLOT.REMPER)
                      ELSE
                       (0)
                     END) -- for time 2, use end estimate for survivor, ingrowth and
                            -- reversion trees, otherwise use midpoint estimate for cut and
                            -- diversion trees; mortality contributes 0; divide by remper to
                            -- annualize
                               ELSE
                     (CASE
                      WHEN (GRM.COMPONENT = 'SURVIVOR' OR GRM.COMPONENT = 'CUT1' OR
                          GRM.COMPONENT = 'DIVERSION1' OR GRM.COMPONENT = 'MORTALITY1') THEN
                       CASE
                        WHEN TRE_BEGIN.TRE_CN IS NOT NULL THEN
                         - (TRE_BEGIN.VOLCFNET / PLOT.REMPER)
                        ELSE
                         - (PTREE.VOLCFNET / PLOT.REMPER)
                       END -- for time 1, set the beginning estimate negative; ingrowth
                            -- contributes 0; divide by remper to annualize; use time 1
                            -- estimate from TREE_GRM_BEGIN when available
                                 ELSE
                       (0)
                     END)
                   END)) * POP_STRATUM.EXPNS) AS ESTIMATED_VALUE
                 -- join clause
                 FROM &FIADB_SCHEMA.BEGINEND BE, &FIADB_SCHEMA.POP_EVAL_GRP PEG
                 JOIN &FIADB_SCHEMA.POP_EVAL_TYP PET
                   ON (PET.EVAL_GRP_CN = PEG.CN)
                 JOIN &FIADB_SCHEMA.POP_EVAL PEV
                   ON (PEV.CN = PET.EVAL_CN)
                 JOIN &FIADB_SCHEMA.POP_ESTN_UNIT PEU
                   ON (PEV.CN = PEU.EVAL_CN)
                 JOIN &FIADB_SCHEMA.POP_STRATUM POP_STRATUM
                   ON (PEU.CN = POP_STRATUM.ESTN_UNIT_CN)
                 JOIN &FIADB_SCHEMA.POP_PLOT_STRATUM_ASSGN POP_PLOT_STRATUM_ASSGN
                   ON (POP_STRATUM.CN = POP_PLOT_STRATUM_ASSGN.STRATUM_CN)
                 JOIN &FIADB_SCHEMA.PLOT PLOT
                   ON (POP_PLOT_STRATUM_ASSGN.PLT_CN = PLOT.CN)
                 JOIN &FIADB_SCHEMA.PLOTGEOM PLOTGEOM
                   ON (PLOT.CN = PLOTGEOM.CN)
                 JOIN &FIADB_SCHEMA.PLOT PPLOT
                   ON (PLOT.PREV_PLT_CN = PPLOT.CN) -- join plot to previous plot, limits query to
                 -- annual-to-annual remeasurement
                 JOIN &FIADB_SCHEMA.COND PCOND
                   ON (PLOT.PREV_PLT_CN = PCOND.PLT_CN) -- join plot to previous cond, limits
```

```
-- query to annual-to-annual remeasurement
  JOIN &FIADB_SCHEMA.COND COND
    ON (PLOT.CN = COND.PLT_CN)
  JOIN &FIADB_SCHEMA.TREE TREE
    ON (TREE.CONDID = COND.CONDID AND TREE.PLT_CN = PLOT.CN AND
      TREE.PREVCOND = PCOND.CONDID) -- join tree to previous cond, limits query to
-- annual-to-annual remeasurement
  LEFT OUTER JOIN &FIADB_SCHEMA.TREE PTREE
    ON (TREE.PREV_TRE_CN = PTREE.CN) -- join tree to previous tree; outer joins run
-- even if no previous attributes available
  LEFT OUTER JOIN &FIADB_SCHEMA.TREE_GRM_BEGIN TRE_BEGIN
    ON (TREE.CN = TRE_BEGIN.TRE_CN) -- join to time 1 recalculated tree measurements;
-- needed in curcumstances when diameter
-- measurement point moves on tree or species id -- changes
  LEFT OUTER JOIN &FIADB_SCHEMA.TREE_GRM_MIDPT TRE_MIDPT
    ON (TREE.CN = TRE_MIDPT.TRE_CN) -- join to midpoint tree measurements;
-- needed if a mortality, removal, diversion or
-- reversion
  LEFT OUTER JOIN (SELECT TRE_CN,
                  DIA_BEGIN,
                  DIA_MIDPT,
                  DIA_END,
                  SUBP_COMPONENT_GS_TIMBER     AS COMPONENT,
                  SUBP_SUBPTYP_GRM_GS_TIMBER   AS SUBPTYP_GRM,
                  SUBP_TPAGROW_UNADJ_GS_TIMBER AS TPAGROW_UNADJ
                FROM &FIADB_SCHEMA.TREE_GRM_COMPONENT) GRM
    ON (TREE.CN = GRM.TRE_CN)
-- acquire begin (time 1), midpoint and end (time 2) diameters; acquire appropriate
-- change component classifications and nonsampled area adjustment factor

-- where  clause
  WHERE 1 = 1
    AND PET.EVAL_TYP = 'EXPGROW'
    AND PEG.EVAL_GRP = &EVAL_GRP
    AND 1 = 1
  GROUP BY pcond.stdszcd past_stdszcd,
       cond.stdszcd current_stdszcd, -- current and past stand-size class
  ORDER BY pcond.stdszcd past_stdszcd,
       cond.stdszcd current_stdszcd, -- current and past stand-size class
```

The example above produces the following estimates by previous and current stand-size class for Minnesota 2017.

PAST_STDSZCD	CURRENT_STDSZCD	ESTIMATE
1	1	95,255,809
1	2	2,340,250
1	3	-2,104,598
1	5	-548,355
1	-	-158,356
2	1	21,540,866
2	2	166,753,014
2	3	-5,836,962
2	5	400,011
2	-	374,872
3	1	2,732,652
3	2	53,750,593
3	3	53,067,135
3	5	123,288
3	-	35,594
5	1	36,400
5	2	272,292
5	3	122,540
5	5	-4.527
5	-	1,809
-	1	11,019,443
-	2	9,661,899,675
-	3	1,392,579
-	5	404,360

To know how much annual net growth occurred within a certain stand-size class between time 1 and time 2, accounting for volume movement both into and out of that stand-size class, then employ the accounting method script (example 7-3).

If the value of the attribute of interest should not change over time (e.g., State, county, species), then it is not necessary to use the accounting method.

Special cases for removal and mortality trees (midpoint attribute is available)

At this point, we have only identified two exceptions when the midpoint attribute value is used in the accounting script. First, when a midpoint value has been determined and is stored in the database (estimated midpoint tree diameter on cut, diversion, and mortality trees stored in TREE_GRM_COMPONENT.DIA_MIDPT) and when it is relatively easy and acceptable to calculate the midpoint attribute value "on-the-fly" (e.g., stand age). The midpoint stand age is derived by starting with the previous stand age and adding one-half of the remeasurement period between time 1 and time 2. Both of these attributes are

usually assigned to broader classes such as a 2-inch diameter class and 5-, 10-, or 20-year age classes.

Example 7-5: Average annual net growth of merchantable bole volume of trees (at least 5 inches d.b.h./d.r.c.), in cubic feet, on forest land by diameter class using the accounting method (ATTRIBUTE_NBR 201 modified), Minnesota 2017 (&EVAL_GRP = 272017).

```
SELECT CASE BE.ONEORTWO
        WHEN 1 THEN
         ((trunc(GRM.DIA_BEGIN / 2 + .5)) * 2)
        WHEN 2 THEN
         CASE GRM.COMPONENT
           WHEN 'SURVIVOR' THEN
            ((trunc(GRM.DIA_END / 2 + .5)) * 2)
           WHEN 'INGROWTH' THEN
            ((trunc(GRM.DIA_END / 2 + .5)) * 2)
           WHEN 'REVERSION1' THEN
            ((trunc(GRM.DIA_END / 2 + .5)) * 2)
           WHEN 'REVERSION2' THEN
            ((trunc(GRM.DIA_END / 2 + .5)) * 2)
           ELSE
            ((trunc(GRM.DIA_MIDPT / 2 + .5)) * 2)
            -- for cut, diversion and mortality assign midpoint diameter class
         END
        END AS DIACLASS,
        SUM((GRM.TPAGROW_UNADJ * (CASE
           WHEN COALESCE(GRM.SUBPTYP_GRM, 0) = 0 THEN
            (0)
           WHEN GRM.SUBPTYP_GRM = 1 THEN
            POP_STRATUM.ADJ_FACTOR_SUBP
           WHEN GRM.SUBPTYP_GRM = 2 THEN
            POP_STRATUM.ADJ_FACTOR_MICR
           WHEN GRM.SUBPTYP_GRM = 3 THEN
            POP_STRATUM.ADJ_FACTOR_MACR
           ELSE
            (0)
          END) * (CASE
           WHEN BE.ONEORTWO = 2 THEN
            (CASE
              WHEN (GRM.COMPONENT = 'SURVIVOR' OR GRM.COMPONENT = 'INGROWTH' OR
                  GRM.COMPONENT LIKE 'REVERSION%') THEN
               (TREE.VOLCFSND / PLOT.REMPER)
              WHEN (GRM.COMPONENT LIKE 'CUT%' OR GRM.COMPONENT LIKE 'DIVERSION%') THEN
               (TRE_MIDPT.VOLCFSND / PLOT.REMPER)
              ELSE
               (0)
            END)
            ELSE
            (CASE
              WHEN (GRM.COMPONENT = 'SURVIVOR' OR GRM.COMPONENT = 'CUT1' OR
                  GRM.COMPONENT = 'DIVERSION1' OR GRM.COMPONENT = 'MORTALITY1') THEN
               CASE
```

```
                          WHEN TRE_BEGIN.TRE_CN IS NOT NULL THEN
                           - (TRE_BEGIN.VOLCFSND / PLOT.REMPER)
                          ELSE
                           - (PTREE.VOLCFSND / PLOT.REMPER)
                        END
                      ELSE
                       (0)
                     END)
                 END)) * POP_STRATUM.EXPNS) AS ESTIMATE_ACCOUNTING
            FROM &FIADB_SCHEMA.BEGINEND BE, &FIADB_SCHEMA.POP_EVAL_GRP PEG
            JOIN &FIADB_SCHEMA.POP_EVAL_TYP PET
              ON (PET.EVAL_GRP_CN = PEG.CN)
            JOIN &FIADB_SCHEMA.POP_EVAL PEV
              ON (PEV.CN = PET.EVAL_CN)
            JOIN &FIADB_SCHEMA.POP_ESTN_UNIT PEU
              ON (PEV.CN = PEU.EVAL_CN)
            JOIN &FIADB_SCHEMA.POP_STRATUM POP_STRATUM
              ON (PEU.CN = POP_STRATUM.ESTN_UNIT_CN)
            JOIN &FIADB_SCHEMA.POP_PLOT_STRATUM_ASSGN POP_PLOT_STRATUM_ASSGN
              ON (POP_STRATUM.CN = POP_PLOT_STRATUM_ASSGN.STRATUM_CN)
            JOIN &FIADB_SCHEMA.PLOT PLOT
              ON (POP_PLOT_STRATUM_ASSGN.PLT_CN = PLOT.CN)
            JOIN &FIADB_SCHEMA.PLOTGEOM PLOTGEOM
              ON (PLOT.CN = PLOTGEOM.CN)
            JOIN &FIADB_SCHEMA.PLOT PPLOT
              ON (PLOT.PREV_PLT_CN = PPLOT.CN)
            JOIN &FIADB_SCHEMA.COND PCOND
              ON (PLOT.PREV_PLT_CN = PCOND.PLT_CN)
            JOIN &FIADB_SCHEMA.COND COND
              ON (PLOT.CN = COND.PLT_CN)
            JOIN &FIADB_SCHEMA.TREE TREE
              ON (TREE.CONDID = COND.CONDID AND TREE.PLT_CN = PLOT.CN AND
                TREE.PREVCOND = PCOND.CONDID)
            LEFT OUTER JOIN &FIADB_SCHEMA.TREE PTREE
              ON (TREE.PREV_TRE_CN = PTREE.CN)
            LEFT OUTER JOIN &FIADB_SCHEMA.TREE_GRM_BEGIN TRE_BEGIN
              ON (TREE.CN = TRE_BEGIN.TRE_CN)
            LEFT OUTER JOIN &FIADB_SCHEMA.TREE_GRM_MIDPT TRE_MIDPT
              ON (TREE.CN = TRE_MIDPT.TRE_CN)
            LEFT OUTER JOIN (SELECT TRE_CN,
                          DIA_BEGIN,
                          DIA_MIDPT,
                          DIA_END,
                          SUBP_COMPONENT_AL_FOREST     AS COMPONENT,
                          SUBP_SUBPTYP_GRM_AL_FOREST   AS SUBPTYP_GRM,
                          SUBP_TPAGROW_UNADJ_AL_FOREST AS TPAGROW_UNADJ
                       FROM &FIADB_SCHEMA.TREE_GRM_COMPONENT) GRM
              ON (TREE.CN = GRM.TRE_CN)
            WHERE 1 = 1
              AND PET.EVAL_TYP = 'EXPGROW'
              AND PEG.EVAL_GRP = &EVAL_GRP
```

```
       AND 1 = 1
     GROUP BY CASE BE.ONEORTWO
          WHEN 1 THEN
           ((trunc(GRM.DIA_BEGIN / 2 + .5)) * 2)
          WHEN 2 THEN
           CASE GRM.COMPONENT
             WHEN 'SURVIVOR' THEN
              ((trunc(GRM.DIA_END / 2 + .5)) * 2)
             WHEN 'INGROWTH' THEN
              ((trunc(GRM.DIA_END / 2 + .5)) * 2)
             WHEN 'REVERSION1' THEN
              ((trunc(GRM.DIA_END / 2 + .5)) * 2)
             WHEN 'REVERSION2' THEN
              ((trunc(GRM.DIA_END / 2 + .5)) * 2)
             ELSE
             ((trunc(GRM.DIA_MIDPT / 2 + .5)) * 2)
  -- for cut, diversion and mortality assign midpoint diameter class
           END
         END
     ORDER BY CASE BE.ONEORTWO
          WHEN 1 THEN
           ((trunc(GRM.DIA_BEGIN / 2 + .5)) * 2)
          WHEN 2 THEN
           CASE GRM.COMPONENT
             WHEN 'SURVIVOR' THEN
              ((trunc(GRM.DIA_END / 2 + .5)) * 2)
             WHEN 'INGROWTH' THEN
              ((trunc(GRM.DIA_END / 2 + .5)) * 2)
             WHEN 'REVERSION1' THEN
              ((trunc(GRM.DIA_END / 2 + .5)) * 2)
             WHEN 'REVERSION2' THEN
              ((trunc(GRM.DIA_END / 2 + .5)) * 2)
             ELSE
             ((trunc(GRM.DIA_MIDPT / 2 + .5)) * 2)
  -- for cut, diversion and mortality assign midpoint diameter class
           END
         END
```

The above example produces estimates of annual net growth of live trees on forest land by diameter class using the accounting method.

DIACLASS	ESTIMATE_ACCOUNTING
NULL	0
6	76,720,277
8	66,342,121
10	51,031,186
12	53,411,212

DIACLASS	ESTIMATE_ACCOUNTING
14	48,287,696
16	33,732,048
18	46,438,095
20	19,140,379
22	7,224,447
24	24,009,696
26	10,845,437
28	1,075,201
30	3,815,330
32	1,007,443
34	8,070,217
36	1,446,792
38	-416,123
40	1,340,169
42	-964,734
44	1,661,286
46	468,936
52	2,570,269
Sum	**457,257,383**

Example 7-6: Average annual net growth of merchantable bole volume of trees (at least 5 inches d.b.h./d.r.c.), in cubic feet, on forest land by stand age class using the accounting method (ATTRIBUTE_NBR 201 modified), Minnesota 2017 (&EVAL_GRP = 272017).

```
SELECT CASE
        WHEN STAND_AGE IS NULL THEN
        'Unknown'
        WHEN STAND_AGE <= 20 THEN
        '000-020 years'
        WHEN STAND_AGE > 20 AND STAND_AGE <= 40 THEN
        '021-040 years'
        WHEN STAND_AGE > 40 AND STAND_AGE <= 60 THEN
        '041-060 years'
        WHEN STAND_AGE > 60 AND STAND_AGE <= 80 THEN
        '061-080 years'
        WHEN STAND_AGE > 80 AND STAND_AGE <= 100 THEN
        '081-100 years'
        WHEN STAND_AGE > 100 THEN
        '100+ years'
        ELSE
        'Unknown'
    END STAND_AGE_CLASS,
```

```
                    round(SUM(ESTIMATED_VALUE)) AS ESTIMATE_ACCOUNTING
              FROM (SELECT CASE BE.ONEORTWO
                        WHEN 1 THEN
                         PCOND.STDAGE
                        WHEN 2 THEN
                         CASE GRM.COMPONENT
                           WHEN 'SURVIVOR' THEN
                            COND.STDAGE
                           WHEN 'INGROWTH' THEN
                            COND.STDAGE
                           WHEN 'REVERSION1' THEN
                            COND.STDAGE
                           WHEN 'REVERSION2' THEN
                            COND.STDAGE
                           ELSE
                           (PCOND.STDAGE + round(coalesce(PLOT.REMPER, 0) / 2))
                                  -- for cut, diversion and mortality assign midpoint stand age
                         END
                        END AS STAND_AGE,
                        SUM((GRM.TPAGROW_UNADJ * (CASE
                           WHEN COALESCE(GRM.SUBPTYP_GRM, 0) = 0 THEN
                            (0)
                           WHEN GRM.SUBPTYP_GRM = 1 THEN
                            POP_STRATUM.ADJ_FACTOR_SUBP
                           WHEN GRM.SUBPTYP_GRM = 2 THEN
                            POP_STRATUM.ADJ_FACTOR_MICR
                           WHEN GRM.SUBPTYP_GRM = 3 THEN
                            POP_STRATUM.ADJ_FACTOR_MACR
                           ELSE
                            (0)
                          END) * (CASE
                           WHEN BE.ONEORTWO = 2 THEN
                            (CASE
                              WHEN (GRM.COMPONENT = 'SURVIVOR' OR
                                 GRM.COMPONENT = 'INGROWTH' OR
                                 GRM.COMPONENT LIKE 'REVERSION%') THEN
                               (TREE.VOLCFSND / PLOT.REMPER)
                              WHEN (GRM.COMPONENT LIKE 'CUT%' OR
                                 GRM.COMPONENT LIKE 'DIVERSION%') THEN
                               (TRE_MIDPT.VOLCFSND / PLOT.REMPER)
                              ELSE
                               (0)
                             END)
                            ELSE
                             (CASE
                              WHEN (GRM.COMPONENT = 'SURVIVOR' OR GRM.COMPONENT = 'CUT1' OR
                                 GRM.COMPONENT = 'DIVERSION1' OR
                                 GRM.COMPONENT = 'MORTALITY1') THEN
                               CASE
                                 WHEN TRE_BEGIN.TRE_CN IS NOT NULL THEN
                                  - (TRE_BEGIN.VOLCFSND / PLOT.REMPER)
```

```
                          ELSE
                            - (PTREE.VOLCFSND / PLOT.REMPER)
                        END
                      ELSE
                        (0)
                    END)
                END)) * POP_STRATUM.EXPNS) AS ESTIMATED_VALUE
      FROM &FIADB_SCHEMA.BEGINEND BE, &FIADB_SCHEMA.POP_EVAL_GRP PEG
      JOIN &FIADB_SCHEMA.POP_EVAL_TYP PET
        ON (PET.EVAL_GRP_CN = PEG.CN)
      JOIN &FIADB_SCHEMA.POP_EVAL PEV
        ON (PEV.CN = PET.EVAL_CN)
      JOIN &FIADB_SCHEMA.POP_ESTN_UNIT PEU
        ON (PEV.CN = PEU.EVAL_CN)
      JOIN &FIADB_SCHEMA.POP_STRATUM POP_STRATUM
        ON (PEU.CN = POP_STRATUM.ESTN_UNIT_CN)
      JOIN &FIADB_SCHEMA.POP_PLOT_STRATUM_ASSGN POP_PLOT_STRATUM_ASSGN
        ON (POP_STRATUM.CN = POP_PLOT_STRATUM_ASSGN.STRATUM_CN)
      JOIN &FIADB_SCHEMA.PLOT PLOT
        ON (POP_PLOT_STRATUM_ASSGN.PLT_CN = PLOT.CN)
      JOIN &FIADB_SCHEMA.PLOTGEOM PLOTGEOM
        ON (PLOT.CN = PLOTGEOM.CN)
      JOIN &FIADB_SCHEMA.PLOT PPLOT
        ON (PLOT.PREV_PLT_CN = PPLOT.CN)
      JOIN &FIADB_SCHEMA.COND PCOND
        ON (PLOT.PREV_PLT_CN = PCOND.PLT_CN)
      JOIN &FIADB_SCHEMA.COND COND
        ON (PLOT.CN = COND.PLT_CN)
      JOIN &FIADB_SCHEMA.TREE TREE
        ON (TREE.CONDID = COND.CONDID AND TREE.PLT_CN = PLOT.CN AND
          TREE.PREVCOND = PCOND.CONDID)
      LEFT OUTER JOIN &FIADB_SCHEMA.TREE PTREE
        ON (TREE.PREV_TRE_CN = PTREE.CN)
      LEFT OUTER JOIN &FIADB_SCHEMA.TREE_GRM_BEGIN TRE_BEGIN
        ON (TREE.CN = TRE_BEGIN.TRE_CN)
      LEFT OUTER JOIN &FIADB_SCHEMA.TREE_GRM_MIDPT TRE_MIDPT
        ON (TREE.CN = TRE_MIDPT.TRE_CN)
      LEFT OUTER JOIN (SELECT TRE_CN,
                    DIA_BEGIN,
                    DIA_MIDPT,
                    DIA_END,
                    SUBP_COMPONENT_AL_FOREST     AS COMPONENT,
                    SUBP_SUBPTYP_GRM_AL_FOREST   AS SUBPTYP_GRM,
                    SUBP_TPAGROW_UNADJ_AL_FOREST AS TPAGROW_UNADJ
                  FROM &FIADB_SCHEMA.TREE_GRM_COMPONENT) GRM
        ON (TREE.CN = GRM.TRE_CN)
      WHERE 1 = 1
        AND PET.EVAL_TYP = 'EXPGROW'
        AND PEG.EVAL_GRP = &EVAL_GRP
        AND 1 = 1
      GROUP BY CASE BE.ONEORTWO
```

```
                        WHEN 1 THEN
                         PCOND.STDAGE
                        WHEN 2 THEN
                         CASE GRM.COMPONENT
                           WHEN 'SURVIVOR' THEN
                            COND.STDAGE
                           WHEN 'INGROWTH' THEN
                            COND.STDAGE
                           WHEN 'REVERSION1' THEN
                            COND.STDAGE
                           WHEN 'REVERSION2' THEN
                            COND.STDAGE
                           ELSE
                           (PCOND.STDAGE + round(coalesce(PLOT.REMPER, 0) / 2))
                                   -- for cut, diversion and mortality assign midpoint stand age
                         END
                        END) x
                  GROUP BY CASE
                        WHEN STAND_AGE IS NULL THEN
                         'Unknown'
                        WHEN STAND_AGE <= 20 THEN
                         '000-020 years'
                        WHEN STAND_AGE > 20 AND STAND_AGE <= 40 THEN
                         '021-040 years'
                        WHEN STAND_AGE > 40 AND STAND_AGE <= 60 THEN
                         '041-060 years'
                        WHEN STAND_AGE > 60 AND STAND_AGE <= 80 THEN
                         '061-080 years'
                        WHEN STAND_AGE > 80 AND STAND_AGE <= 100 THEN
                         '081-100 years'
                        WHEN STAND_AGE > 100 THEN
                         '100+ years'
                        ELSE
                         'Unknown'
                       END
                  ORDER BY CASE
                        WHEN STAND_AGE IS NULL THEN
                         'Unknown'
                        WHEN STAND_AGE <= 20 THEN
                         '000-020 years'
                        WHEN STAND_AGE > 20 AND STAND_AGE <= 40 THEN
                         '021-040 years'
                        WHEN STAND_AGE > 40 AND STAND_AGE <= 60 THEN
                         '041-060 years'
                        WHEN STAND_AGE > 60 AND STAND_AGE <= 80 THEN
                         '061-080 years'
                        WHEN STAND_AGE > 80 AND STAND_AGE <= 100 THEN
                         '081-100 years'
                        WHEN STAND_AGE > 100 THEN
                         '100+ years'
                        ELSE
```

'Unknown'
END

The above example produces estimates of annual net growth of live trees on forest land by stand-age class using the accounting method

STAND_AGE_CLASS	ESTIMATE_ACCOUNTING
000-020 years	20,550,147
021-040 years	78,227,667
041-060 years	36,844,790
061-080 years	38,645,099
081-100 years	168,995,579
100+ years	113,994,102
Sum	**457,257,384**

7.3   Net growth components

Net growth represents the change in volume of trees between two points in time (e.g., previous 2006 inventory and current 2011 inventory) accounting for gains in growth and losses from mortality but not for removal of volume due to cutting or land-use change. To help understand these changes in volume, net growth is broken down into a number of components.

FIA identifies the following components of net growth associated with forest land:

- Survivor growth - change in volume of live trees between inventories on land identified as forest in both inventories. Identified as SURVIVOR in the table of example 7-7 below.

- Mortality - volume (negative) of live trees from the previous inventory that died before the current inventory. The land was forest in the previous inventory. Identified as MORTALITY1 and MORTALITY2 in the table of example 7-7 below.

- Ingrowth - volume of trees that grew into a merchantable size (e.g., 5-inch diameter) since the previous inventory. The volume is not counted until the current inventory and the land is identified as forest in both inventories. Identified as INGROWTH in the table of example 7-7 below.

- Reversion - volume of live trees on land that is now forest but was previously nonforest. Identified as REVERSION1 and REVERSION2 in the table of example 7-7 below.

- Diversion growth - change in volume of live trees between inventories on land that changed from forest to nonforest. Diversion only counts trees that remained present and living. Identified as DIVERSION1 and DIVERSION2 in the table of example 7-7 below.

- Cut growth - increase in volume of live trees from the previous inventory that were cut before the current inventory. The land was forest in the previous inventory. Identified as CUT1 and CUT2 in the table of example 7-7 below.

In example 7-7, we estimate net growth of growing-stock, and nongrowing-stock trees on forest land by net growth component for Maine, 2011 and Maine, 2006. The total net growth estimate increased from 544.5 to 699.6 million cubic feet. Most of the increase is attributed to a decrease in mortality and increases in reversions and ingrowth. The small increase in survivor growth had less of an effect.

Example 7-7: Average annual net growth of merchantable bole volume of trees (at least 5 inches d.b.h./d.r.c.), in cubic feet, on forest land by net growth component (ATTRIBUTE_NBR 201 modified), Maine 2006 and 2011 (&EVAL_GRP in [232006, 232011]).

```
SELECT PEG.EVAL_GRP,
    COMPONENT, -- select by tree components
    SUM((GRM.TPAGROW_UNADJ * (CASE
        WHEN COALESCE(GRM.SUBPTYP_GRM, 0) = 0 THEN
         (0)
        WHEN GRM.SUBPTYP_GRM = 1 THEN
         POP_STRATUM.ADJ_FACTOR_SUBP
        WHEN GRM.SUBPTYP_GRM = 2 THEN
```

```
                    POP_STRATUM.ADJ_FACTOR_MICR
                 WHEN GRM.SUBPTYP_GRM = 3 THEN
                    POP_STRATUM.ADJ_FACTOR_MACR
                 ELSE
                  (0)
               END) * (CASE
                 WHEN BE.ONEORTWO = 2 THEN
                  (CASE
                    WHEN (GRM.COMPONENT = 'SURVIVOR' OR GRM.COMPONENT = 'INGROWTH' OR
                       GRM.COMPONENT LIKE 'REVERSION%') THEN
                     (TREE.VOLCFSND / PLOT.REMPER)
                    WHEN (GRM.COMPONENT LIKE 'CUT%' OR GRM.COMPONENT LIKE 'DIVERSION%') THEN
                     (TRE_MIDPT.VOLCFSND / PLOT.REMPER)
                    ELSE
                     (0)
                  END)
                 ELSE
                  (CASE
                    WHEN (GRM.COMPONENT = 'SURVIVOR' OR GRM.COMPONENT = 'CUT1' OR
                       GRM.COMPONENT = 'DIVERSION1' OR GRM.COMPONENT = 'MORTALITY1') THEN
                     CASE
                       WHEN TRE_BEGIN.TRE_CN IS NOT NULL THEN
                        - (TRE_BEGIN.VOLCFSND / PLOT.REMPER)
                       ELSE
                        - (PTREE.VOLCFSND / PLOT.REMPER)
                     END
                    ELSE
                     (0)
                  END)
               END)) * POP_STRATUM.EXPNS) AS ESTIMATE
           FROM &FIADB_SCHEMA.BEGINEND BE, &FIADB_SCHEMA.POP_EVAL_GRP PEG
           JOIN &FIADB_SCHEMA.POP_EVAL_TYP PET
             ON (PET.EVAL_GRP_CN = PEG.CN)
           JOIN &FIADB_SCHEMA.POP_EVAL PEV
             ON (PEV.CN = PET.EVAL_CN)
           JOIN &FIADB_SCHEMA.POP_ESTN_UNIT PEU
             ON (PEV.CN = PEU.EVAL_CN)
           JOIN &FIADB_SCHEMA.POP_STRATUM POP_STRATUM
             ON (PEU.CN = POP_STRATUM.ESTN_UNIT_CN)
           JOIN &FIADB_SCHEMA.POP_PLOT_STRATUM_ASSGN POP_PLOT_STRATUM_ASSGN
             ON (POP_STRATUM.CN = POP_PLOT_STRATUM_ASSGN.STRATUM_CN)
           JOIN &FIADB_SCHEMA.PLOT PLOT
             ON (POP_PLOT_STRATUM_ASSGN.PLT_CN = PLOT.CN)
           JOIN &FIADB_SCHEMA.PLOTGEOM PLOTGEOM
             ON (PLOT.CN = PLOTGEOM.CN)
           JOIN &FIADB_SCHEMA.PLOT PPLOT
             ON (PLOT.PREV_PLT_CN = PPLOT.CN)
           JOIN &FIADB_SCHEMA.COND PCOND
             ON (PLOT.PREV_PLT_CN = PCOND.PLT_CN)
           JOIN &FIADB_SCHEMA.COND COND
             ON (PLOT.CN = COND.PLT_CN)
```

```sql
        JOIN &FIADB_SCHEMA.TREE TREE
          ON (TREE.CONDID = COND.CONDID AND TREE.PLT_CN = PLOT.CN AND
            TREE.PREVCOND = PCOND.CONDID)
        LEFT OUTER JOIN &FIADB_SCHEMA.TREE PTREE
          ON (TREE.PREV_TRE_CN = PTREE.CN)
        LEFT OUTER JOIN &FIADB_SCHEMA.TREE_GRM_BEGIN TRE_BEGIN
          ON (TREE.CN = TRE_BEGIN.TRE_CN)
        LEFT OUTER JOIN &FIADB_SCHEMA.TREE_GRM_MIDPT TRE_MIDPT
          ON (TREE.CN = TRE_MIDPT.TRE_CN)
        LEFT OUTER JOIN (SELECT TRE_CN,
                    DIA_BEGIN,
                    DIA_MIDPT,
                    DIA_END,
                    SUBP_COMPONENT_AL_FOREST    AS COMPONENT,
                    SUBP_SUBPTYP_GRM_AL_FOREST   AS SUBPTYP_GRM,
                    SUBP_TPAGROW_UNADJ_AL_FOREST AS TPAGROW_UNADJ
                FROM &FIADB_SCHEMA.TREE_GRM_COMPONENT) GRM
          ON (TREE.CN = GRM.TRE_CN)
        WHERE 1 = 1
          AND PET.EVAL_TYP = 'EXPGROW'
          AND PEG.EVAL_GRP in (&EVAL_GRP)
          AND 1 = 1
        GROUP BY PEG.EVAL_GRP, GRM.COMPONENT
        ORDER BY PEG.EVAL_GRP, GRM.COMPONENT
        -- group and order by evaluation group and tree components
```

The example above produces the following:

EVAL_GRP	COMPONENT	ESTIMATE
232006	CUT1	33,919,875
232006	CUT2	1,643,007
232006	DIVERSION1	184,131
232006	INGROWTH	155,351,725
232006	MORTALITY1	-361,426,921
232006	MORTALITY2	0
232006	REVERSION1	7,798,281
232006	REVERSION2	36,662
232006	SURVIVOR	706,998,619
232011	CUT1	40,012,272
232011	CUT2	2,015,425
232011	DIVERSION1	326,866
232011	INGROWTH	194,629,689
232011	MORTALITY1	-304,764,329
232011	MORTALITY2	0
232011	REVERSION1	52,167,940

EVAL_GRP	COMPONENT	ESTIMATE
232011	REVERSION2	353,506
232011	SURVIVOR	714,829,723

Some of the component types are identified with a '1' or '2' (e.g., CUT1 and CUT2). The 1 denotes trees that met the minimum quality and/or size requirements in the previous inventory. The 2 denotes trees that did not meet minimum requirements in the previous inventory but meet the requirements in the current inventory. In the previous example using Maine, the current inventory is 2011 and the previous inventory is 2006 based on a five-year cycle of samples.

Diversion differs from the diversion component. When the land basis is forest land, as opposed to timberland, diversion is the volume of trees on land diverted from forest to nonforest between the previous and current inventory and is based on the midpoint in time between inventories. Tree size at the midpoint is modeled from the tree size at the previous inventory. When the land basis is timberland, diversions also include land diverted to reserved forest land (removed from timber production by statute or administrative designation) and less productive forest land (incapable of producing at least 20 cubic feet of growing stock per acre annually). The component is the change in volume of live trees between inventories on land that diverted and uses the modeled midpoint from the tree size at the previous inventory. This net growth component is equivalent to diversion growth in Bechtold and Patterson (2005).

When the land basis is forest land, reversion is the volume of trees on land that reverts from nonforest to forest between the previous and current inventory and is based on the modeled midpoint in time between inventories using the tree size in the current inventory. Unlike the diversion component of net growth, the reversion component, which is simply reversion, counts the total tree volume at the modeled midpoint between inventories. Thus, reversion can have substantially more impact on net growth estimates as compared to the impacts from diversion, given equal total tree volumes.

Cut or harvest removals differ from the cut component. Cut or harvest removals are the volume of trees cut or killed in conjunction with a harvest or silvicultural operation between the previous and current inventory and is based on the midpoint in time between inventories. Tree size at the midpoint is modeled from the tree size at the previous inventory. The cut component is only the increase in volume associated with these trees from the previous inventory to the modeled midpoint between inventories based on the tree size at the previous inventory. This net growth component is equivalent to cut growth in Bechtold and Patterson (2005).

Ingrowth differs from the ingrowth component. Ingrowth is the volume of trees at the time they grow across a minimum quality and/or size threshold between inventories. Minimum size thresholds vary by live, growing-stock, and sawtimber trees. Minimum quality thresholds apply to growing-stock and sawtimber trees. The growth on ingrowth is the volume the trees grew since crossing the minimum thresholds until the current inventory. The ingrowth component includes ingrowth plus growth on ingrowth.

Mortality is not equivalent to the mortality component (see example 7-8). Mortality is the volume of trees that die from natural causes between the previous and current inventory and is based on the midpoint in time between inventories. Tree size at the midpoint is modeled from the tree size at the previous inventory. The mortality component equals the

volume of the tree at the previous inventory. Thus, the mortality component of net growth is always smaller than mortality volume. Examples 7-7 and 7-8 focus on the same mortality component of net growth but example 7-7 represents the volume as negative.

Example 7-8:

M_{ng} = Mortality component of net growth

V_{mid} = Volume of tree at modeled midpoint between inventories or mortality volume

V_{t1} = Volume of tree at previous inventory

$M_{ng} = V_{mid} - (V_{mid} - V_{t1})$ or $M_{ng} = V_{t1}$

Bechtold and Patterson (2005) also cover the components presented here but present them in the context of net change. Presented in the context of net growth and as implemented in the FIA database, some component names differ in meaning as previously described.

7.4   Annual removals estimation summarized by previous attributes

According to Bechtold and Patterson (2005), the event that caused the removal is deemed to occur at the midpoint of the remeasurement period. Currently, FIA does not compute and store values for every attribute at the midpoint of the remeasurement period. In most cases, only the time 1 and time 2 values are available. Because the event that results in a removal or mortality tree can also significantly change the condition, it is generally acceptable to consider that the removal or mortality occurred while that attribute held its time 1 value.

For example, consider a forest condition that was a large stand-size class (sawlog size, COND.STDSZCD = 1) at time 1, then was harvested prior to time 2, where it was recorded as a small stand-size class (seedling/sapling, COND.STDSZCD = 3)) after the harvest. In such a scenario it is logical that the removals were from the large class recorded at time 1, and not from the small class as recorded at time 2.

Example 7-9: Average annual removals of sound bole volume of trees (at least 5 inches d.b.h./d.r.c.), in cubic feet, on forest land by past stand-size class (ATTRIBUTE_NBR 225 modified), Minnesota 2017 (&EVAL_GRP = 272017).

```
SELECT PCOND.STDSZCD PAST_STDSZCD, -- select by past stand-size class
    SUM((GRM.TPAREMV_UNADJ * (CASE
        WHEN COALESCE(GRM.SUBPTYP_GRM, 0) = 0 THEN
         (0)
        WHEN GRM.SUBPTYP_GRM = 1 THEN
         POP_STRATUM.ADJ_FACTOR_SUBP
        WHEN GRM.SUBPTYP_GRM = 2 THEN
         POP_STRATUM.ADJ_FACTOR_MICR
        WHEN GRM.SUBPTYP_GRM = 3 THEN
         POP_STRATUM.ADJ_FACTOR_MACR
        ELSE
         (0)
        END) * (CASE
         WHEN (GRM.COMPONENT LIKE 'CUT%' OR GRM.COMPONENT LIKE 'DIVERSION%') THEN
          TRE_MIDPT.VOLCFSND
         ELSE
          (0)
        END)) * POP_STRATUM.EXPNS) AS ESTIMATE
    FROM &FIADB_SCHEMA.POP_EVAL_GRP PEG
    JOIN &FIADB_SCHEMA.POP_EVAL_TYP PET
     ON (PET.EVAL_GRP_CN = PEG.CN)
    JOIN &FIADB_SCHEMA.POP_EVAL PEV
     ON (PEV.CN = PET.EVAL_CN)
    JOIN &FIADB_SCHEMA.POP_ESTN_UNIT PEU
     ON (PEV.CN = PEU.EVAL_CN)
    JOIN &FIADB_SCHEMA.POP_STRATUM POP_STRATUM
     ON (PEU.CN = POP_STRATUM.ESTN_UNIT_CN)
    JOIN &FIADB_SCHEMA.POP_PLOT_STRATUM_ASSGN POP_PLOT_STRATUM_ASSGN
     ON (POP_STRATUM.CN = POP_PLOT_STRATUM_ASSGN.STRATUM_CN)
    JOIN &FIADB_SCHEMA.PLOT PLOT
     ON (POP_PLOT_STRATUM_ASSGN.PLT_CN = PLOT.CN)
```

```
        JOIN &FIADB_SCHEMA.PLOTGEOM PLOTGEOM
          ON (PLOT.CN = PLOTGEOM.CN)
        JOIN &FIADB_SCHEMA.PLOT PPLOT
          ON (PLOT.PREV_PLT_CN = PPLOT.CN)
        JOIN &FIADB_SCHEMA.COND PCOND
          ON (PLOT.PREV_PLT_CN = PCOND.PLT_CN)
        JOIN &FIADB_SCHEMA.COND COND
          ON (PLOT.CN = COND.PLT_CN)
        JOIN &FIADB_SCHEMA.TREE TREE
          ON (TREE.CONDID = COND.CONDID AND TREE.PLT_CN = PLOT.CN AND
            TREE.PREVCOND = PCOND.CONDID)
        LEFT OUTER JOIN &FIADB_SCHEMA.TREE PTREE
          ON (TREE.PREV_TRE_CN = PTREE.CN)
        LEFT OUTER JOIN &FIADB_SCHEMA.TREE_GRM_BEGIN TRE_BEGIN
          ON (TREE.CN = TRE_BEGIN.TRE_CN)
        LEFT OUTER JOIN &FIADB_SCHEMA.TREE_GRM_MIDPT TRE_MIDPT
          ON (TREE.CN = TRE_MIDPT.TRE_CN)
        LEFT OUTER JOIN (SELECT TRE_CN,
                    DIA_BEGIN,
                    DIA_MIDPT,
                    DIA_END,
                    SUBP_COMPONENT_AL_FOREST     AS COMPONENT,
                    SUBP_SUBPTYP_GRM_AL_FOREST   AS SUBPTYP_GRM,
                    SUBP_TPAREMV_UNADJ_AL_FOREST AS TPAREMV_UNADJ
                  FROM &FIADB_SCHEMA.TREE_GRM_COMPONENT) GRM
          ON (TREE.CN = GRM.TRE_CN)
        WHERE 1 = 1
          AND PET.EVAL_TYP = 'EXPREMV'
          AND PEG.EVAL_GRP = &EVAL_GRP
          AND 1 = 1
        GROUP BY ROLLUP(PCOND.STDSZCD)
        ORDER BY PCOND.STDSZCD
        -- group and order by previous stand-size class
```

Example 7-9 produces the following estimate of annual removals of live trees on forest land by past stand-size class (cubic feet per year, description of code added for clarity):

PAST_STDSZCD	DESCRIPTION	ESTIMATE
NULL	Nonforest	0
1	Large diameter stands	123,894,514
2	Medium diameter stands	106,767,684
3	Small diameter stands	6,097,913
5	Nonstocked stands	36,498
-	**Sum**	**236,796,608**

The above results indicate that most removals took place on stands in the large and medium size classes. The results below show removal estimates by current stand-size class, which is the size of the stand after the removals took place (some stands diverted to nonforest). In contrast to the summary by previous stand size, most removals are associated with the small stand-size class.

CURRENT_STDSZCD	DESCRIPTION	ESTIMATE
NULL	Nonforest	22,140,738
1	Large diameter stands	38,079,632
2	Medium diameter stands	26,968,279
3	Small diameter stands	138,306,182
5	Nonstocked stands	11,301,777
-	**Sum**	**236,796,608**

7.5   Estimation summarized by midpoint attributes

As discussed in the annual net growth accounting section 7.2, only two attributes are available to summarize by at the midpoint (diameter and stand age). The midpoint diameters are stored in TREE_GRM_COMPONENT.DIA_MIDPT. The midpoint stand age is derived by starting with the previous stand age and adding one-half of the remeasurement period between time 1 and time 2. Both of these attributes are usually assigned to broader classes such as a 2-inch diameter class and 5-, 10-, or 20-year age classes.

As in annual net growth accounting, the midpoint diameter may only be available for remeasured annual-to-annual inventory plots. In periodic inventories, the diameter may be the diameter at the estimated time of death/removal instead of the midpoint of the remeasurement period. For some periodic-to-periodic and periodic-to-annual inventories, the estimated midpoint diameter for removals may be stored in TREE.DIA or TREE.DIACALC. If this is the case, the script below still can be modified by replacing 'grm.dia_midpt' with 't.dia' or 't.diacalc' as appropriate.

Example 7-10: Average annual removals of sound bole volume of trees (at least 5 inches d.b.h./d.r.c.), in cubic feet, on forest land by estimated midpoint diameter class (ATTRIBUTE_NBR 225 modified), Minnesota 2017 (&EVAL_GRP = 272017).

```sql
SELECT((trunc(GRM.DIA_MIDPT / 2 + .5)) * 2) AS DIA_CLASS,
--added to summarize mortality or removals by the estimated midpoint diameter
    SUM((GRM.TPAREMV_UNADJ * (CASE
        WHEN COALESCE(GRM.SUBPTYP_GRM, 0) = 0 THEN
         (0)
        WHEN GRM.SUBPTYP_GRM = 1 THEN
         POP_STRATUM.ADJ_FACTOR_SUBP
        WHEN GRM.SUBPTYP_GRM = 2 THEN
         POP_STRATUM.ADJ_FACTOR_MICR
        WHEN GRM.SUBPTYP_GRM = 3 THEN
         POP_STRATUM.ADJ_FACTOR_MACR
        ELSE
         (0)
        END) * (CASE
         WHEN (GRM.COMPONENT LIKE 'CUT%' OR GRM.COMPONENT LIKE 'DIVERSION%') THEN
         TRE_MIDPT.VOLCFSND
         ELSE
         (0)
        END)) * POP_STRATUM.EXPNS) AS ESTIMATE
  FROM &FIADB_SCHEMA.POP_EVAL_GRP PEG
  JOIN &FIADB_SCHEMA.POP_EVAL_TYP PET
   ON (PET.EVAL_GRP_CN = PEG.CN)
  JOIN &FIADB_SCHEMA.POP_EVAL PEV
   ON (PEV.CN = PET.EVAL_CN)
  JOIN &FIADB_SCHEMA.POP_ESTN_UNIT PEU
   ON (PEV.CN = PEU.EVAL_CN)
  JOIN &FIADB_SCHEMA.POP_STRATUM POP_STRATUM
   ON (PEU.CN = POP_STRATUM.ESTN_UNIT_CN)
  JOIN &FIADB_SCHEMA.POP_PLOT_STRATUM_ASSGN POP_PLOT_STRATUM_ASSGN
   ON (POP_STRATUM.CN = POP_PLOT_STRATUM_ASSGN.STRATUM_CN)
```

```
        JOIN &FIADB_SCHEMA.PLOT PLOT
          ON (POP_PLOT_STRATUM_ASSGN.PLT_CN = PLOT.CN)
        JOIN &FIADB_SCHEMA.PLOTGEOM PLOTGEOM
          ON (PLOT.CN = PLOTGEOM.CN)
        JOIN &FIADB_SCHEMA.PLOT PPLOT
          ON (PLOT.PREV_PLT_CN = PPLOT.CN)
        JOIN &FIADB_SCHEMA.COND PCOND
          ON (PLOT.PREV_PLT_CN = PCOND.PLT_CN)
        JOIN &FIADB_SCHEMA.COND COND
          ON (PLOT.CN = COND.PLT_CN)
        JOIN &FIADB_SCHEMA.TREE TREE
          ON (TREE.CONDID = COND.CONDID AND TREE.PLT_CN = PLOT.CN AND
            TREE.PREVCOND = PCOND.CONDID)
        LEFT OUTER JOIN &FIADB_SCHEMA.TREE PTREE
          ON (TREE.PREV_TRE_CN = PTREE.CN)
        LEFT OUTER JOIN &FIADB_SCHEMA.TREE_GRM_BEGIN TRE_BEGIN
          ON (TREE.CN = TRE_BEGIN.TRE_CN)
        LEFT OUTER JOIN &FIADB_SCHEMA.TREE_GRM_MIDPT TRE_MIDPT
          ON (TREE.CN = TRE_MIDPT.TRE_CN)
        LEFT OUTER JOIN (SELECT TRE_CN,
                        DIA_BEGIN,
                        DIA_MIDPT,
                        DIA_END,
                        SUBP_COMPONENT_AL_FOREST     AS COMPONENT,
                        SUBP_SUBPTYP_GRM_AL_FOREST   AS SUBPTYP_GRM,
                        SUBP_TPAREMV_UNADJ_AL_FOREST AS TPAREMV_UNADJ
                   FROM &FIADB_SCHEMA.TREE_GRM_COMPONENT) GRM
          ON (TREE.CN = GRM.TRE_CN)
       WHERE 1 = 1
         AND PET.EVAL_TYP = 'EXPREMV'
         AND PEG.EVAL_GRP = &EVAL_GRP
         AND 1 = 1
      GROUP BY ROLLUP((trunc(GRM.DIA_MIDPT / 2 + .5)) * 2)
      ORDER BY ((trunc(GRM.DIA_MIDPT / 2 + .5)) * 2)
```

-- added to summarize annual mortality or removals by the estimated midpoint diameter

Example 7-10 produces the following estimate of annual removals of live trees on forest land by current stand-size class (cubic feet per year):

DIACLASS	ESTIMATE
6	25,794,034
8	39,931,786
10	47,556,620
12	38,355,824
14	32,234,910
16	20,623,693
18	13,912,360

| DIACLASS	ESTIMATE
20	8,447,444
22	3,173,386
24	2,689,507
26	1,259,658
28	1,404,854
30	1,412,532
Sum	**236,796,608**

7.6 Annual mortality estimation

Annual mortality estimation mirrors annual removals estimation in all respects. Modify example 7-10 to obtain mortality estimates by replacing the following:

- GRM.TPAMORT_UNADJ for GRM.TPAREMV_UNADJ

- WHEN GRM.COMPONENT LIKE 'MORTALITY%' THEN for WHEN (GRM.COMPONENT LIKE 'CUT%' OR GRM.COMPONENT LIKE 'DIVERSION%') THEN

- SUBP_TPAMORT_UNADJ_AL_FOREST AS TPAMORT_UNADJ for SUBP_TPAREMV_UNADJ_AL_FOREST AS TPAREMV_UNADJ

- EXPMORT' for 'EXPREMV'

7.7   The SUBP_COND_CHNG_MTRX (SCCM) table

The SUBP_COND_CHNG_MTRX (SCCM) table was added in the FIADB version 4.0 to facilitate the tracking of area change for the annual inventory. Under this design, a plot measures area change by tracking the movement in condition boundaries within the area of the four subplots. Figure 7-1 shows what can happen on a plot when a condition boundary (in this case the edge of a beaver pond) moves over time. Beaver activity raised the level of the pond, increasing the pond area and converting some of the forest land to water. The same kind of changes can occur from any number of human-caused events such as timber harvesting, land clearing or road construction, or natural events such as fire, storms, or insect attacks.
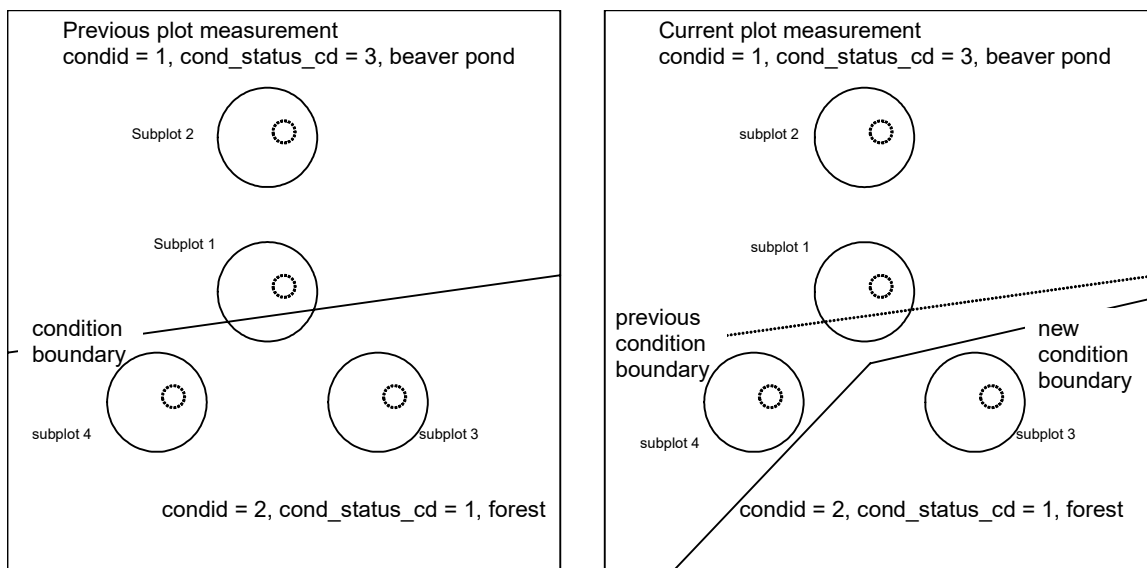
Figure 7-1: Example plot layout where condition boundaries changed between previous (left panel) and current plot measurements (right panel). The solid circles are the subplots and the smaller dashed circles are the microplots.

It is important to remember that condition boundaries are not just defined along changes in condition status code, but also may occur within forest land. The following tabulation shows how the area change information in figure 7-1 would be recorded in the SCCM table.

SCCM table data for figure 7-1:

SUBP	SUBPTYP	CONDID	PREVCOND	SUBPTYP_PROP_CHNG
1	1	1	1	.8000
1	1	1	2	.2000
1	2	1	1	1.000
2	1	1	1	1.000
2	2	1	1	1.000
3	1	2	2	1.000
3	2	2	2	1.000
4	1	1	2	1.000
4	2	1	2	1.000

The SCCM table tracks the change in condition areas for each of the four subplots (SUBPTYP = 1) and each of the four microplots (SUBPTYP = 2) on this plot. In inventories where the macroplot is used, there would also be entries for each macroplot (SUBPTYP = 3). The attribute PROP_BASIS in the COND table identifies how area estimation was conducted for each plot, on the basis of either the macroplot or the subplot. In this example, area estimation (and thus area change estimation) is based on the subplot information, not the macroplot. Area estimation is typically based on the largest area sampled (macroplot in States where it is measured, otherwise the subplot) and not on the microplot. Area and area change estimation based on the microplot is only appropriate with another estimate solely collected on the microplot such as number of trees or biomass in trees <5 inches diameter at breast height. The examples of change presented here are based on the subplot, but could easily be modified to obtain estimates based on the microplots.

In the example shown in , the SCCM table has two entries where SUBPTYP = 1 and SUBP = 1. The first entry indicates that 80 percent of the subplot area was in condition 1 (water) at both measurements, and the second entry indicates 20 percent of the subplot area changed from forest to water. For the other three subplots and all four microplots, only one record exists, indicating that the entire subplot or microplot either stayed in the same condition (subplots and microplots 2 and 3) or the entire area changed from one condition to another (subplot and microplot 4). For this remeasured plot, change based on the four subplots is water to water 45 percent, forest to water 30 percent, and forest to forest 25 percent; change based on the four microplots is water to water 50 percent, forest to water 25 percent, and forest to forest 25 percent. The following section presents SQL script that produces these estimates.

7.8   Using the SCCM table to estimate area change between two measurements

The estimation of area change over time requires linking current and past (most previous) conditions through the SCCM (SUBP_COND_CHNG_MTRX) table to determine the portion of plot area that transitioned from conditions observed at time 1 (past) to those observed at time 2 (current). These methods are applicable only between two measurements in the annual inventory, annual-to-annual observations. There are no means available for linking past to current conditions in periodic-to-periodic or periodic-to-annual observations.

We begin by modifying the script that produces the estimate of area of forest land so that it uses the area change evaluation EXPCHNG rather than the current area evaluation EXPCURR that is standard for area estimations. Example 7-11 shows this modification in bold.

Example 7-11: Area of forest land, in acres, based on the area change evaluation (ATTRIBUTE_NBR 2 modified, Minnesota 2007 (&EVAL_GRP = 272007).

```
SELECT SUM((COND.CONDPROP_UNADJ * CASE COND.PROP_BASIS
        WHEN 'MACR' THEN
          POP_STRATUM.ADJ_FACTOR_MACR
        ELSE
          POP_STRATUM.ADJ_FACTOR_SUBP
        END) * POP_STRATUM.EXPNS) AS ESTIMATED_VALUE
  FROM &FIADB_SCHEMA.POP_EVAL_GRP PEG
  JOIN &FIADB_SCHEMA.POP_EVAL_TYP PET
    ON (PET.EVAL_GRP_CN = PEG.CN)
  JOIN &FIADB_SCHEMA.POP_EVAL PEV
    ON (PEV.CN = PET.EVAL_CN)
  JOIN &FIADB_SCHEMA.POP_ESTN_UNIT PEU
    ON (PEV.CN = PEU.EVAL_CN)
  JOIN &FIADB_SCHEMA.POP_STRATUM POP_STRATUM
    ON (PEU.CN = POP_STRATUM.ESTN_UNIT_CN)
  JOIN &FIADB_SCHEMA.POP_PLOT_STRATUM_ASSGN
    ON (POP_PLOT_STRATUM_ASSGN.STRATUM_CN = POP_STRATUM.CN)
  JOIN &FIADB_SCHEMA.PLOT
    ON (POP_PLOT_STRATUM_ASSGN.PLT_CN = PLOT.CN)
  JOIN &FIADB_SCHEMA.PLOTGEOM
    ON (PLOT.CN = PLOTGEOM.CN)
  JOIN &FIADB_SCHEMA.COND
    ON (COND.PLT_CN = PLOT.CN)
  WHERE COND.COND_STATUS_CD = 1
    AND COND.CONDPROP_UNADJ IS NOT NULL
    AND PET.EVAL_TYP = 'EXPCHNG'
        -- modified to use change evaluation type expchng versus current area evaluation
        -- type expcurr
    AND PEG.EVAL_GRP = &EVAL_GRP
  AND 1 = 1
```

The remeasured plots (12,273 plots) associated with EXPCHNG produce an area estimate of 16,961,345.3 acres of forest land versus 16,722,924.7 provided by EXPCURR using all plots (17,855 plots). The estimate based on EXPCURR is valid. In this case, the estimate provided by the remeasurement sample EXPCHNG may not be valid if areas that are currently forest were not sampled in the past measurement. Using EXPCHNG, estimates should only include areas that are sampled in both the current and past measurement.The adjustment factors, POP_STRATUM.ADJ_FACTOR_MACR and POP_STRATUM.ADJ_FACTOR_SUBP, compensate for nonsampled areas in either the current or past measurement, including nonsampled areas results in an erroneous over-estimation of acreage.

To estimate area change over time, the script has been further modified to link past and current condition records. The modified script correctly restricts the remeasurement sample to areas sampled at both points in time. Past and current conditions are linked in the SCCM table. This table has entries for every subplot on a remeasured plot and stores the proportion of the area of each subplot by the two points in time in the attribute SCCM.SUBTYP_PROP_CHNG. Again, changes and additions from example 7-11 are shown in bold. Line numbers are for reference purposes.

Example 7-12: Estimate area change, in acres, by condition status and stand size (area forest land either measurement from remeasured plots; ATTRIBUTE 128 modified; Minnesota, time 1 from 1999-2002 and time 2 from 2003-2007, &EVAL_GRP = 272007).

Line	Script
1	SELECT **PCOND.COND_STATUS_CD PAST_COND_STATUS_CD,**
2	**PCOND.STDSZCD PAST_STDSZCD,**
3	**COND.COND_STATUS_CD CURRENT_COND_STATUS_CD,**
4	**COND.STDSZCD CURRENT_STDSZCD,**
5	SUM((COALESCE(**SCCM.SUBPTYP_PROP_CHNG / 4** * CASE COND.PROP_BASIS
6	WHEN 'MACR' THEN
7	POP_STRATUM.ADJ_FACTOR_MACR
8	ELSE
9	POP_STRATUM.ADJ_FACTOR_SUBP
10	END,
11	0)) * POP_STRATUM.EXPNS) AS ESTIMATED_VALUE,
12	**COUNT(*) COUNT,**
13	**SUM(SCCM.SUBPTYP_PROP_CHNG / 4) PLOT_AREA**
14	FROM &FIADB_SCHEMA.POP_EVAL_GRP PEG
15	JOIN &FIADB_SCHEMA.POP_EVAL_TYP PET
16	ON (PET.EVAL_GRP_CN = PEG.CN)
17	JOIN &FIADB_SCHEMA.POP_EVAL PEV
18	ON (PEV.CN = PET.EVAL_CN)
19	JOIN &FIADB_SCHEMA.POP_ESTN_UNIT PEU
20	ON (PEV.CN = PEU.EVAL_CN)

Line	Script
21	JOIN &FIADB_SCHEMA.POP_STRATUM POP_STRATUM
22	ON (PEU.CN = POP_STRATUM.ESTN_UNIT_CN)
23	JOIN &FIADB_SCHEMA.POP_PLOT_STRATUM_ASSGN POP_PLOT_STRATUM_ASSGN
24	ON (POP_PLOT_STRATUM_ASSGN.STRATUM_CN = POP_STRATUM.CN)
25	JOIN &FIADB_SCHEMA.PLOT PLOT
26	ON (POP_PLOT_STRATUM_ASSGN.PLT_CN = PLOT.CN)
27	JOIN &FIADB_SCHEMA.PLOTGEOM PLOTGEOM
28	ON (PLOT.CN = PLOTGEOM.CN)
29	JOIN &FIADB_SCHEMA.COND COND
30	ON (COND.PLT_CN = PLOT.CN)
31	**JOIN &FIADB_SCHEMA.COND PCOND**
32	**ON (PCOND.PLT_CN = PLOT.PREV_PLT_CN)**
33	**JOIN &FIADB_SCHEMA.SUBP_COND_CHNG_MTRX SCCM**
34	**ON (SCCM.PLT_CN = COND.PLT_CN AND SCCM.PREV_PLT_CN = PCOND.PLT_CN AND**
35	**SCCM.CONDID = COND.CONDID AND SCCM.PREVCOND = PCOND.CONDID)**
36	WHERE COND.CONDPROP_UNADJ IS NOT NULL
37	**AND ((SCCM.SUBPTYP = 3 AND COND.PROP_BASIS = 'MACR') OR**
38	**(SCCM.SUBPTYP = 1 AND COND.PROP_BASIS = 'SUBP'))**
39	**AND COALESCE(COND.COND_NONSAMPLE_REASN_CD, 0) = 0**
40	**AND COALESCE(PCOND.COND_NONSAMPLE_REASN_CD, 0) = 0**
41	**AND (COND.COND_STATUS_CD = 1 OR PCOND.COND_STATUS_CD = 1)**
42	AND PET.EVAL_TYP = 'EXPCHNG'
43	AND PEG.EVAL_GRP = &EVAL_GRP
44	AND 1 = 1
45	**GROUP BY PCOND.COND_STATUS_CD,**
46	**PCOND.STDSZCD,**
47	**COND.COND_STATUS_CD,**
48	**COND.STDSZCD**
49	**ORDER BY PCOND.COND_STATUS_CD,**
50	**PCOND.STDSZCD,**
51	**COND.COND_STATUS_CD,**
52	**COND.STDSZCD**

Example 7-12 can be used as a template to create almost any cross tabulation of past and current area estimates based on a remeasured set of plots. The following changes (bold sections) were made to example 7-11 to facilitate the estimation of area change:

- Line 31 - The table **COND** with the alias **PCOND** was added to the list of tables to be joined. This provides the condition-level attributes for the past (time 1) measurement of the plot.

- Line 33 - The table S**UBP_COND_CHG_MTRX** with the alias **SCCM** was added to the list of tables to be joined. This table provides the link between past (time 1) and current (time 2) conditions at the subplot level. Each entry in this table defines the portion (0-1) of the subplot, microplot or macroplot that was observed in a condition at time 2 and observed in a condition at time 1. For a subplot that was entirely in a single condition at both times, there will only be one entry for the subplot, with SCCM.SUBPTYP_PROP_CHNG = 1.0. For a subplot that was mapped to be 40 percent in one condition and 60 percent in another condition at both times with no change in boundary, there will be two entries for the subplot, one with SCCM.SUBPTYP_PROP_CHNG = 0.4 and the other with SCCM.SUBPTYP_PROP_CHNG = 0.6. For subplots where boundaries have changed, there will be entries that account for all the pieces of the subplot area with the total value of SCCM.SUBPTYP_PROP_CHNG adding to 1.0.

- Lines 1-4 and 45-52 - Past and current condition status and stand-size class codes **(group by PCOND.COND_STATUS_CD, PCOND.STDSZCD, COND.COND_STATUS_CD, COND.STDSZCD)** were grouped to obtain estimate breakdowns by these attributes.

- Line 5 - **COND.CONDPROP_UNADJ** (the total plot condition proportions that are within a specific condition) was replaced with **SCCM.SUBPTYP_PROP_CHNG / 4** (the subplot condition proportion divided by the number of subplots in the plot). The division by 4 is required because the SCCM table tracks area at the subplot level (4 subplots per plot).

- Lines 12 and 13 - **COUNT(*) COUNT and SUM(SCCM.SUBPTYP_PROP_CHNG / 4) PLOT_AREA** provide two additional summary attributes along with the area estimates. **COUNT** is the total number of subplot pieces that is tracked in the estimation. **PLOT_AREA** is the total portion of plots that is tracked in the estimation.

- Lines 31-35 - These additions to the join clause provide the proper links to the **PCOND** and **SCCM** tables that were added to the table list. Lines 31-32 match the past and current condition records to the same plot, and lines 33-35 provide the other restrictions that link the appropriate conditions at the two measurements through the **SCCM** table.

- Lines 37-38 - These ensure that in inventories where area estimates are based on the macroplot observations, the area change estimates are based on the macroplot observations, and in all other cases the estimates are based on the subplot observations.

- Lines 39-40 - These additions limit observations to areas sampled in both the current and most previous measurement. The **SCCM** table accounts for all combinations of current and previous observations, even nonsampled areas. The script estimates change based on sampled areas.

- Line 41 - The restrictions were changed in the where clause from **AND COND.COND_STATUS_CD = 1** to **AND (COND.COND_STATUS_CD = 1 or PCOND.COND_STATUS_CD = 1)**, to select conditions that were forest in at least one of the measurements, not just the current measurement. This query tracks the area of land that moves in and out of forest, as well as changes in stand-size class on land that remains forest.

Example 7-12 produces the following estimates of total area (ESTIMATED_VALUE), total number of subplots (COUNT), and total portion of plots (PLOT_AREA) broken down by past and current COND_STATUS_CD and STDSZCD values, for land that was forest at time 1, time 2, or both (&EVAL_GRP = 272007

PAST_COND_ STATUS_CD	PAST_ STDSZCD	CURRENT_ STATUS_CD	CURRENT_ STDSZCD	ESTIMATED_ VALUE	COUNT	PLOT_AREA
1	1	1	1	3,631,160.4	3208	767.8
1	1	1	2	291,277.3	274	63.1
1	1	1	3	390,763.5	360	83.0
1	1	1	5	58,700.4	53	12.0
1	1	2	-	70,387.0	117	15.2
1	1	3	-	3,961.3	10	0.8
1	1	4	-	2,892.6	9	0.6
1	2	1	1	786,401.0	709	167.1
1	2	1	2	4,648,293.5	4160	996.0
1	2	1	3	620,036.7	571	132.4
1	2	1	5	46,356.9	46	10.2
1	2	2	-	84,928.1	133	18.8
1	2	3	-	1,990.6	6	0.4
1	2	4	-	895.2	1	0.2
1	3	1	1	158,110.2	151	32.5
1	3	1	2	648,108.5	604	138.3
1	3	1	3	4,243,065.9	3884	934.6
1	3	1	5	61,623.3	56	13.1
1	3	2	-	98,616.9	126	21.4
1	3	3	-	12,348.1	11	2.1
1	3	4	-	4,707.5	4	1.0
1	5	1	1	16,820.1	18	3.7
1	5	1	2	18,273.1	20	4.2
1	5	1	3	95,244.4	94	21.5
1	5	1	5	61,597.5	59	14.2
1	5	2	-	55,411.0	53	11.9
1	5	3	-	549.8	1	0.1
2	-	1	1	233,189.9	288	50.4
2	-	1	2	267,173.3	326	59.6
2	-	1	3	556,373.0	564	126.3
2	-	1	5	48,463.7	51	11.0
3	-	1	1	14,427.4	19	3.1
3	-	1	2	9,767.2	13	2.3
3	-	1	3	21,966.0	21	4.3

PAST_COND_ STATUS_CD	PAST_ STDSZCD	CURRENT_ STATUS_CD	CURRENT_ STDSZCD	ESTIMATED_ VALUE	COUNT	PLOT_AREA
3	-	1	5	1,225.5	2	0.3
4	-	1	1	17,585.0	19	4.0
4	-	1	2	4,149.1	10	0.9
4	-	1	3	8,858.1	9	2.0

These results are used to produce the following tabulation of estimated change in forest area by condition status code and stand-size class at two points in time.

Table 7-2: Estimated forest land broken down by past and current condition status code and stand-size class, Minnesota, 2007 (acres).

PAST_ COND_ STATUS_CD	PAST_ STDSZCD	CURRENT_COND_STATUS_CD								
		1 Forest land CURRENT_STDSZCD								
		1 Large diameter	2 Medium diameter	3 Small diameter	5 Non-stocked	Total on forest land	2 Nonforest land	3 Noncensus water	4 Census water	Total
1 Forest land	1 Large diameter	3,631,160.4	291,277.3	390,763.5	58,700.4	4,371,901.6	70,387.0	3,961.3	2,892.6	4,449,142.5
	2 Medium diameter	786,401.0	4,648,293.5	620,036.7	46,356.9	6,101,088.1	84,928.1	1,990.6	895.2	6,188,902.0
	3 Small diameter	158,110.2	648,108.5	4,243,065.9	61,623.3	5,110,907.8	98,616.9	12,348.1	4,707.5	5,226,580.4
	5 Non-stocked	16,820.1	18,273.1	95,244.4	61,597.5	191,935.1	55,411.0	549.8	-	247,895.9
Total on forest land		4,592,491.7	5,605,952.3	5,349,110.6	228,278.0	15,775,832.6	309,343.1	18,849.8	8,495.3	16,112,520.8
2 Nonforest land		233,189.9	267,173.3	556,373.0	48,463.7	1,105,199.9	-	-	-	1,105,199.8
3 Noncensus water		14,427.4	9,767.2	21,966.0	1,225.5	47,386.1	-	-	-	47,386.1
4 Census water		17,585.0	4,149.1	8,858.1	-	30,592.1	-	-	-	30,592.1
Total		4,857,693.9	5,887,041.9	5,936,307.6	277,967.2	16,959,010.7	309,343.1	18,849.8	8,495.3	17,295,698.8

Note: Includes lands classified as forest at either or both measurements. Based on plots first measured in 1999-2002 and remeasured in 2003-2007

The total current forest land area in the table above (16,959,010.7 acres) is close to the results we obtained in example 7-11 (16,961,345.3 acres). The preponderance of the difference between these two estimates is 2,339.8 acres that were nonsampled at time 1 and are now forest. The remaining difference is due to rounding error introduced by storing and computing condition proportions for each of the individual subplot sections in **SCCM.SUBPTYP_PROP_CHNG** versus the total condition proportion in **COND.CONDPROP_UNADJ.** The total past forest land area in the tabulation above (16,112,520.8 acres) is based on the same remeasured plots and comes close, but does not match the 2003 estimate of forest land area (16,230,326.1 acres) one obtains when using example 7-11 and setting pet.eval_typ='EXPCURR' and pop_eval_grp.eval_grp = 272003.

The COUNT and PLOT_AREA values provide data users with the number of measurements associated with each estimate, giving users some information about the reliability of the estimates. For example, conditions that remained as large diameter (COND.STDSZCD equals 1) from time 1 to time 2 had an area estimate of 3,631,160.4 acres at time 2. From time 1 to time 2, there were 3,208 subplots or portions of subplots that maintained their large diameter condition. These subplots or portions of subplots represent an area equivalent to 767.8 total plots. The estimates are based on a considerable number of observations. In contrast, if one is interested in tracking area of water (either census or noncensus water) that converts to or from forest land over time, estimates are based on far fewer observed changes. The estimated area that changed from water (COND.COND_STATUS_CD equals 3 or 4) to forest (COND.COND_STATUS_CD equals 1) is 77,978.2 acres, and the estimated change from forest to water is 27,345.1 acres. The water to forest change is based on observations from 93 subplots where at least a portion of the subplot was observed to change from water to forest. The total area of this observed change is equal to 16.8 plots. The change from forest to water estimate (27,345.1 acres) is based on 42 subplot observations over an area equivalent to 5.2 plots.

Example 7-13 presents sampling errors for Minnesota 2007 area change estimates where conditions were sampled at both inventories from remeasured plots (ATTRIBUTE_NBR = 126). Results for three different scenarios are presented in the tabulation that follows example 7-13 (filters specified with &FILTER, &GRP_BY_ATTRIB = plot.statecd, &EVAL_GRP=272007). Refer to Chapter 4: Producing Estimates with Sampling Errors for further information on input and output of sampling error scripts. Users will note that the sampling errors for the estimates of forest to water and water to forest area change are quite high (29.2 percent and 18.4 percent, respectively) and the sampling error on conditions remaining large diameter is fairly low (2.9 percent).

Example 7-13: Estimate area change, in acres (sampled at both inventories by remeasured plots; ATTRIBUTE 126; Minnesota, time 1 from 1999-2002 and time 2 from 2003-2007, &EVAL_GRP = 272007, &GRP_BY_ATTRIB = plot.statcd)

```
select eval_grp,
  eval_grp_descr,
  126 attribute_nbr,
  'Area change - sampled at both inventories by remeasured plots' attribute_descr,
  coalesce(cast(grp_by_attrib as varchar(4000)), 'Not available') group_by_field,
  '&filter' filter,
  sum(estimate_by_estn_unit.estimate) estimate,
```

```
            case
              when sum(estimate_by_estn_unit.estimate) <> 0 then
                abs(sqrt(sum(estimate_by_estn_unit.var_of_estimate)) /
                    sum(estimate_by_estn_unit.estimate) * 100)
              else
                0
            end as se_of_estimate_pct,
            sqrt(sum(estimate_by_estn_unit.var_of_estimate)) se_of_estimate,
            sum(estimate_by_estn_unit.var_of_estimate) var_of_estimate,
            sum(estimate_by_estn_unit.total_plots) total_plots,
            sum(estimate_by_estn_unit.non_zero_plots) non_zero_plots,
            sum(estimate_by_estn_unit.tot_pop_area_acres) tot_pop_ac
        from (select pop_eval_grp_cn,
                     eval_grp,
                     eval_grp_descr,
                     SUM(coalesce(ysum_hd, 0) * phase_1_summary.expns) estimate,
                     phase_1_summary.n total_plots,
                     SUM(phase_summary.number_plots_in_domain) domain_plots,
                     SUM(phase_summary.non_zero_plots) non_zero_plots,
                     total_area * total_area / phase_1_summary.n *
                     ((SUM(w_h * phase_1_summary.n_h *
                          (((coalesce(ysum_hd_sqr, 0) / phase_1_summary.n_h) -
                          ((coalesce(ysum_hd, 0) / phase_1_summary.n_h) *
                          (coalesce(ysum_hd, 0) / phase_1_summary.n_h))) /
                          (phase_1_summary.n_h - 1)))) +
                     1 / phase_1_summary.n *
                     (SUM((1 - w_h) * phase_1_summary.n_h *
                          (((coalesce(ysum_hd_sqr, 0) / phase_1_summary.n_h) -
                          ((coalesce(ysum_hd, 0) / phase_1_summary.n_h) *
                          (coalesce(ysum_hd, 0) / phase_1_summary.n_h))) /
                          (phase_1_summary.n_h - 1))))) var_of_estimate,
                     total_area tot_pop_area_acres,
                     grp_by_attrib
              from (select PEV.cn eval_cn,
                           PEG.eval_grp,
                           PEG.eval_grp_descr,
                           PEG.cn pop_eval_grp_cn,
                           POP_STRATUM.estn_unit_cn,
                           POP_STRATUM.expns,
                           POP_STRATUM.cn pop_stratum_cn,
                           p1pointcnt /
                           (select sum(str.p1pointcnt)
                              from &FIADB_SCHEMA.pop_stratum str
                             where str.estn_unit_cn = pop_stratum.estn_unit_cn) w_h,
                           (select sum(str.p1pointcnt)
                              from &FIADB_SCHEMA.pop_stratum str
                             where str.estn_unit_cn = pop_stratum.estn_unit_cn) n_prime,
                           p1pointcnt n_prime_h,
                           (select sum(eu_s.area_used)
                              from &FIADB_SCHEMA.pop_estn_unit eu_s
                             where eu_s.cn = pop_stratum.estn_unit_cn) total_area,
```

```
                              (select sum(str.p2pointcnt)
                                 from &FIADB_SCHEMA.pop_stratum str
                                where str.estn_unit_cn = pop_stratum.estn_unit_cn) n,
                              POP_STRATUM.p2pointcnt n_h
                       FROM &FIADB_SCHEMA.POP_EVAL_GRP PEG
                       JOIN &FIADB_SCHEMA.POP_EVAL_TYP PET
                        ON (PET.EVAL_GRP_CN = PEG.CN)
                       JOIN &FIADB_SCHEMA.POP_EVAL PEV
                        ON (PEV.CN = PET.EVAL_CN)
                       JOIN &FIADB_SCHEMA.POP_ESTN_UNIT PEU
                        ON (PEV.CN = PEU.EVAL_CN)
                       JOIN &FIADB_SCHEMA.POP_STRATUM POP_STRATUM
                        ON (PEU.CN = POP_STRATUM.ESTN_UNIT_CN)
                      where PEG.eval_grp in (&eval_grp)
                       and PET.eval_typ = 'EXPCHNG') phase_1_summary
                  left outer join (select pop_stratum_cn,
                               estn_unit_cn,
                               eval_cn,
                               sum(y_hid_adjusted) ysum_hd,
                               sum(y_hid_adjusted * y_hid_adjusted) ysum_hd_sqr,
                               count(*) number_plots_in_domain,
                               SUM(case y_hid_adjusted
                                   when 0 then
                                     0
                                   when NULL then
                                     0
                                   else
                                     1
                                   end) non_zero_plots,
                                grp_by_attrib
                               from (SELECT SUM((COALESCE(SCCM.SUBPTYP_PROP_CHNG / 4 *
                                              CASE COND.PROP_BASIS
                                              WHEN 'MACR' THEN
                                               POP_STRATUM.ADJ_FACTOR_MACR
                                              ELSE
                                               POP_STRATUM.ADJ_FACTOR_SUBP
                                              END, 0))) AS y_hid_adjusted, -- edit to
                                                            -- ref_pop_attribute.sql_query
                                   peu.cn estn_unit_cn, -- addition to ref_pop_attribute.sql_query
                                   pev.cn eval_cn, -- addition to ref_pop_attribute.sql_query
                                   pop_stratum.cn pop_stratum_cn, -- addition to
                                                            -- ref_pop_attribute.sql_query
                                   plot.cn plt_cn, -- addition to ref_pop_attribute.sql_query
                                  &grp_by_attrib grp_by_attrib -- addition to ref_pop_attribute.sql_query
                                    FROM &FIADB_SCHEMA.POP_EVAL_GRP PEG
                                   JOIN &FIADB_SCHEMA.POP_EVAL_TYP PET
                                    ON (PET.EVAL_GRP_CN = PEG.CN)
                                   JOIN &FIADB_SCHEMA.POP_EVAL PEV
                                    ON (PEV.CN = PET.EVAL_CN)
                                   JOIN &FIADB_SCHEMA.POP_ESTN_UNIT PEU
                                    ON (PEV.CN = PEU.EVAL_CN)
```

```
                            JOIN &FIADB_SCHEMA.POP_STRATUM POP_STRATUM
                              ON (PEU.CN = POP_STRATUM.ESTN_UNIT_CN)
                              JOIN
                      &FIADB_SCHEMA.POP_PLOT_STRATUM_ASSGN POP_PLOT_STRATUM_ASSGN
                                ON (POP_PLOT_STRATUM_ASSGN.STRATUM_CN =
                                 POP_STRATUM.CN)
                              JOIN &FIADB_SCHEMA.PLOT PLOT
                               ON (POP_PLOT_STRATUM_ASSGN.PLT_CN =PLOT.CN)
                              JOIN &FIADB_SCHEMA.PLOTGEOM PLOTGEOM
                               ON (PLOT.CN = PLOTGEOM.CN)
                              JOIN &FIADB_SCHEMA.COND COND
                               ON (COND.PLT_CN = PLOT.CN)
                              JOIN &FIADB_SCHEMA.COND PCOND
                               ON (PCOND.PLT_CN = PLOT.PREV_PLT_CN)
                              JOIN &FIADB_SCHEMA.SUBP_COND_CHNG_MTRX SCCM
                               ON (SCCM.PLT_CN = COND.PLT_CN AND
                                SCCM.PREV_PLT_CN = PCOND.PLT_CN AND
                                SCCM.CONDID = COND.CONDID AND
                                SCCM.PREVCOND = PCOND.CONDID)
                             WHERE COND.CONDPROP_UNADJ IS NOT NULL
                              AND ((SCCM.SUBPTYP = 3 AND
                              COND.PROP_BASIS = 'MACR') OR
                              (SCCM.SUBPTYP = 1 AND
                              COND.PROP_BASIS = 'SUBP'))
                              AND COALESCE(COND.COND_NONSAMPLE_REASN_CD, 0) = 0
                              AND COALESCE(PCOND.COND_NONSAMPLE_REASN_CD, 0) = 0
                              AND PET.EVAL_TYP = 'EXPCHNG'
                              AND PEG.EVAL_GRP in (&EVAL_GRP)
                              AND 1 = 1-- edit to ref_pop_attribute.sql_query
                               &filter
                              group by peu.cn,
                                   pev.cn,
                                   pop_stratum.cn,
                                   plot.cn,
                                   &grp_by_attrib) plot_summary
                        group by pop_stratum_cn,
                              estn_unit_cn,
                              eval_cn,
                              grp_by_attrib) phase_summary
                  on (phase_1_summary.pop_stratum_cn =
                     phase_summary.pop_stratum_cn and
                     phase_1_summary.eval_cn = phase_summary.eval_cn and
                     phase_1_summary.estn_unit_cn = phase_summary.estn_unit_cn)
                  group by phase_1_summary.pop_eval_grp_cn,
                       phase_1_summary.eval_grp,
                       phase_1_summary.eval_grp_descr,
                       phase_1_summary.estn_unit_cn,
                       phase_1_summary.total_area,
                       phase_1_summary.n,
                       grp_by_attrib) estimate_by_estn_unit
               where non_zero_plots is not null
```

```
group by pop_eval_grp_cn,
       eval_grp,
       eval_grp_descr,
       coalesce(cast(grp_by_attrib as varchar(4000)), 'Not available')
```

Using Example 7-13, area change estimates and sampling errors for three different scenarios specified by filters using &FILTER.

Output field	Forest to water	Water to forest	Large diameter forest at both measurements
EVAL_GRP	272007	272007	272007
ATTRIBUTE_NBR	126	126	126
ATTRIBUTE_DESCR	Area change - sampled at both inventories by remeasured plots	Area change - sampled at both inventories by remeasured plots	Area change - sampled at both inventories by remeasured plots
GROUP_BY_FIELD	27	27	27
FILTER	and pcond.cond_status_cd = 1 and cond.cond_status_cd in (3,4)	and pcond.cond_status_cd in (3,4) and cond.cond_status_cd = 1	and (pcond.cond_status_cd = 1 and pcond.stdszcd = 1) and (cond.cond_status_cd = 1 and cond.stdszcd = 1)
ESTIMATE	27,345	77,978	3,631,160
SE_OF_ESTIMATE_PCT	29.2	18.4	2.9
SE_OF_ESTIMATE	7,987.3	14,366.3	106,899.5
VAR_OF_ESTIMATE	63,796,853.4	206,390,711.8	11,427,498,038.9
TOTAL_PLOTS	11,557	12,022	12,047
NON_ZERO_PLOTS	32	57	1,007
TOT_POP_AC	50,891,423	52,855,557	52,988,426

Chapter 8: Using Population-by-Evaluation Type Views

Population-by-evaluation-type views are available to users who query the FIADB within the Forest Service firewall. The views allow users to select the appropriate population with only two joins, rather than the seven used in standard queries.

View Name	Description
POP_EXPALL_VW	All plots: sampled and nonsampled.
POP_EXPCHNG_VW	Sampled plots used for area change estimates.
POP_EXPCURR_VW	Sampled plots used for current area and condition-level estimates.
POP_EXPDWM_VW	Sampled plots used for down woody material estimates.
POP_EXPGROW_VW	Sampled plots used for tree growth estimates.
POP_EXPMORT_VW	Sampled plots used for tree mortality estimates.
POP_EXPREGEN_VW	Sampled plots used for tree regeneration estimates.
POP_EXPREMV_VW	Sampled plots used for tree removal estimates.
POP_EXPVOL_VW	Sampled plots used for tree inventory estimates.

Postgres users can create their own POP_EXPCURR_VW with the following script. The other views can be similarly constructed by replacing 'EXPCURR' with the appropriate EVAL_TYP.

Example 8-1: Script to create Postgres view (POP_EXPCURR_VW)

```
CREATE or REPLACE VIEW pop_expcurr_vw AS -- modify view name for the desired eval_type
SELECT peg.eval_grp,
       peg.eval_grp_descr,
       peg.statecd,
       peg.rscd,
       pet.eval_typ,
       pev.evalid,
       pet.eval_cn,
       psm.adj_factor_subp,
       psm.adj_factor_macr,
       psm.adj_factor_micr,
       peu.area_used,
       peu.p1pntcnt_eu,
       psm.p1pointcnt,
       psm.p2pointcnt,
       psm.expns,
       ppsa.plt_cn
  FROM fs_fiadb.pop_eval_grp peg
  JOIN fs_fiadb.pop_eval_typ pet
    ON (pet.eval_grp_cn = peg.cn)
  JOIN fs_fiadb.pop_eval pev
    ON (pev.cn = pet.eval_cn)
```

```
          JOIN fs_fiadb.pop_estn_unit peu
            ON (pev.cn = peu.eval_cn)
          JOIN fs_fiadb.pop_stratum psm
            ON (peu.cn = psm.estn_unit_cn)
          JOIN fs_fiadb.pop_plot_stratum_assgn ppsa
            ON (ppsa.stratum_cn = psm.cn)
        WHERE pet.eval_typ = 'EXPCURR' -- modify for the appropriate eval_typ
```

Example 3-2, which estimates area of timberland in acres
(REF_POP_ATTRIBUTE.ATTRIBUTE_NBR = 3), selects the EVAL_TYP and uses the POP
tables to select the appropriate population.

```
  -- select clause
 SELECT SUM((COND.CONDPROP_UNADJ * CASE COND.PROP_BASIS
          WHEN 'MACR' THEN
           POP_STRATUM.ADJ_FACTOR_MACR
          ELSE
           POP_STRATUM.ADJ_FACTOR_SUBP
        END) * POP_STRATUM.EXPNS) AS ESTIMATED_VALUE
  -- join clause
   FROM &FIADB_SCHEMA.POP_EVAL_GRP PEG
   JOIN &FIADB_SCHEMA.POP_EVAL_TYP PET
    ON (PET.EVAL_GRP_CN = PEG.CN)
   JOIN &FIADB_SCHEMA.POP_EVAL PEV
    ON (PEV.CN = PET.EVAL_CN)
   JOIN &FIADB_SCHEMA.POP_ESTN_UNIT PEU
    ON (PEV.CN = PEU.EVAL_CN)
   JOIN &FIADB_SCHEMA.POP_STRATUM POP_STRATUM
    ON (PEU.CN = POP_STRATUM.ESTN_UNIT_CN)
   JOIN &FIADB_SCHEMA.POP_PLOT_STRATUM_ASSGN
    ON (POP_PLOT_STRATUM_ASSGN.STRATUM_CN = POP_STRATUM.CN)
   -- view will handle the population estimate table joins
   JOIN &FIADB_SCHEMA.PLOT
    ON (POP_PLOT_STRATUM_ASSGN.PLT_CN = PLOT.CN)
   JOIN &FIADB_SCHEMA.PLOTGEOM
    ON (PLOT.CN = PLOTGEOM.CN)
   JOIN &FIADB_SCHEMA.COND
    ON (COND.PLT_CN = PLOT.CN)
  -- where clause
  WHERE COND.RESERVCD = 0
   AND COND.SITECLCD IN (1, 2, 3, 4, 5, 6)
   AND COND.COND_STATUS_CD = 1
   AND COND.CONDPROP_UNADJ IS NOT NULL
   AND PET.EVAL_TYP = 'EXPCURR' -- view will be specific to eval_typ
   AND PEG.EVAL_GRP = &EVAL_GRP
   AND 1 = 1
```

Using the POP_EXPCURR_VW shortens the joins as shown below.

Example 8-2: Estimate area of timberland, in acres, using POP_EXPCURR_VW.

```sql
-- select clause
SELECT SUM(PVW.EXPNS * COND.CONDPROP_UNADJ * CASE COND.PROP_BASIS
        WHEN 'MACR' THEN
          PVW.ADJ_FACTOR_MACR
        ELSE
          PVW.ADJ_FACTOR_SUBP
        END) AS ESTIMATED_VALUE -- view has expansion and adjustment factors
-- join clause
 FROM &FIADB_SCHEMA.POP_EXPCURR_VW PVW
 JOIN &FIADB_SCHEMA.PLOT
  ON (PVW.PLT_CN = PLOT.CN)
  -- view handles the population estimate table joins specific to eval_typ
 JOIN &FIADB_SCHEMA.PLOTGEOM
  ON (PLOT.CN = PLOTGEOM.CN)
 JOIN &FIADB_SCHEMA.COND
  ON (COND.PLT_CN = PLOT.CN)
-- where clause
 WHERE COND.RESERVCD = 0
  AND COND.SITECLCD IN (1, 2, 3, 4, 5, 6)
  AND COND.COND_STATUS_CD = 1
  AND COND.CONDPROP_UNADJ IS NOT NULL
  AND PVW.EVAL_GRP = &EVAL_GRP
  AND 1 = 1
```

Literature Cited

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Miles, P.D.; Jacobson, K.; Brand, G.J. [and others]. 2007. Minnesota's forests 1999-2003 (Part A). Reourc. Bull. NRS-12A. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station. 92 p.

Burrill, E.A.; Wilson, A.M.; Turner, J.A. [and others]. 2018. The Forest Inventory and Analysis Database: Database description and user guide for Phase 2 (version 8.0). U.S. Department of Agriculture, Forest Service. 946p. [Online]. Available at web address: http://www.fia.fs.fed.us/library/database-documentation/.

Appendix A:Values and Descriptions in REF_POP_ATTRIBUTE

Attribute Number (ATTRIBUTE_NBR)	Attribute Description (ATTRIBUTE_DESCR)	Evaluation Type (EVAL_TYP)
1	Area of sampled and nonsampled land and water, in acres, within U.S. boundary.	EXPALL
2	Area of forest land, in acres.	EXPCURR
3	Area of timberland, in acres.	EXPCURR
4	Number of live trees (at least 1 inch d.b.h./d.r.c.), in trees, on forest land.	EXPVOL
5	Number of growing-stock trees (at least 5 inches d.b.h.), in trees, on forest land.	EXPVOL
6	Number of standing dead trees (at least 5 inches d.b.h./d.r.c.), in trees, on forest land.	EXPVOL
7	Number of live trees (at least 1 inch d.b.h./d.r.c.), in trees, on timberland.	EXPVOL
8	Number of growing-stock trees (at least 5 inches d.b.h.), in trees, on timberland.	EXPVOL
9	Number of standing dead trees (at least 5 inches d.b.h./d.r.c.), in trees, on timberland.	EXPVOL
10	Aboveground biomass of live trees (at least 1 inch d.b.h./d.r.c.), in dry short tons, on forest land.	EXPVOL
11	Merchantable bole biomass of live trees (timber species at least 5 inches d.b.h.), in dry short tons, on forest land.	EXPVOL
12	Merchantable bole biomass of live trees (timber species at least 5 inches d.b.h.), in dry short tons, on timberland.	EXPVOL
13	Aboveground biomass of live trees (at least 1 inch d.b.h./d.r.c.), in dry short tons, on timberland.	EXPVOL
14	Net merchantable bole volume of live trees (at least 5 inches d.b.h./d.r.c.), in cubic feet, on forest land.	EXPVOL
15	Net merchantable bole volume of growing-stock trees (at least 5 inches d.b.h.), in cubic feet, on forest land.	EXPVOL
16	Net sawlog volume of sawtimber trees, in cubic feet, on forest land.	EXPVOL
17	Net merchantable bole volume of live trees (at least 5 inches d.b.h./d.r.c.), in cubic feet, on timberland.	EXPVOL

Attribute Number (ATTRIBUTE_NBR)	Attribute Description (ATTRIBUTE_DESCR)	Evaluation Type (EVAL_TYP)
18	Net merchantable bole volume of growing-stock trees (at least 5 inches d.b.h.), in cubic feet, on timberland.	EXPVOL
19	Net sawlog volume of sawtimber trees, in cubic feet, on timberland.	EXPVOL
20	Net sawlog volume of sawtimber trees, in board feet (International 1/4-inch rule), on forest land.	EXPVOL
21	Net sawlog volume of sawtimber trees, in board feet (International 1/4-inch rule), on timberland.	EXPVOL
22	Gross sawlog volume of sawtimber trees, in board feet (International 1/4-inch rule), on forest land.	EXPVOL
23	Gross bole volume of live trees (at least 5 inches d.b.h./d.r.c.), in cubic feet, on forest land.	EXPVOL
24	Sound bole volume of live trees (at least 5 inches d.b.h./d.r.c.), in cubic feet, on forest land.	EXPVOL
25	Average annual net growth of live trees (at least 5 inches d.b.h./d.r.c.), in cubic feet, on forest land.	EXPGROW
26	Average annual net growth of growing-stock trees (at least 5 inches d.b.h.), in cubic feet, on forest land.	EXPGROW
27	Average annual net growth of sawtimber trees, in board feet (International 1/4-inch rule), on forest land.	EXPGROW
28	Average annual net growth of live trees (at least 5 inches d.b.h./d.r.c.), in cubic feet, on timberland.	EXPGROW
29	Average annual net growth of growing-stock trees (at least 5 inches d.b.h.), in cubic feet, on timberland.	EXPGROW
30	Average annual net growth of sawtimber trees, in board feet (International 1/4-inch rule), on timberland.	EXPGROW
31	Average annual mortality of trees (at least 5 inches d.b.h./d.r.c.), in cubic feet, on forest land.	EXPMORT
32	Average annual mortality of trees (at least 5 inches d.b.h./d.r.c.), in trees, on forest land.	EXPMORT

Attribute Number (ATTRIBUTE_NBR)	Attribute Description (ATTRIBUTE_DESCR)	Evaluation Type (EVAL_TYP)
33	Average annual mortality of growing-stock trees (at least 5 inches d.b.h.), in cubic feet, on forest land.	EXPMORT
34	Average annual mortality of sawtimber trees, in board feet (International 1/4-inch rule), on forest land.	EXPMORT
35	Average annual mortality of trees (at least 5 inches d.b.h./d.r.c.), in cubic feet, on timberland.	EXPMORT
36	Average annual mortality of trees (at least 5 inches d.b.h./d.r.c.), in trees, on timberland.	EXPMORT
37	Average annual mortality of growing-stock trees (at least 5 inches d.b.h.), in cubic feet, on timberland.	EXPMORT
38	Average annual mortality of sawtimber trees, in board feet (International 1/4-inch rule), on timberland.	EXPMORT
39	Average annual removals of live trees (at least 5 inches d.b.h./d.r.c.), in cubic feet, on forest land.	EXPREMV
40	Average annual removals of growing-stock trees (at least 5 inches d.b.h.), in cubic feet, on forest land.	EXPREMV
41	Average annual removals of sawtimber trees, in board feet (International 1/4-inch rule), on forest land.	EXPREMV
42	Average annual removals of live trees (at least 5 inches d.b.h./d.r.c.), in cubic feet, on timberland.	EXPREMV
43	Average annual removals of growing-stock trees (at least 5 inches d.b.h.), in cubic feet, on timberland.	EXPREMV
44	Average annual removals of sawtimber trees, in board feet (International 1/4-inch rule), on timberland.	EXPREMV
45	Number of live seedlings (less than 1 inch d.b.h./d.r.c.), in seedlings, on forest land.	EXPVOL
46	Number of live seedlings (less than 1 inch d.b.h./d.r.c.), in seedlings, on timberland.	EXPVOL
47	Aboveground and belowground carbon in standing dead trees (at least 1 inch d.b.h./d.r.c.), in short tons, on forest land.	EXPCURR
48	Aboveground carbon in live seedlings, shrubs, and bushes, in short tons, on forest land.	EXPCURR

Attribute Number (ATTRIBUTE_NBR)	Attribute Description (ATTRIBUTE_DESCR)	Evaluation Type (EVAL_TYP)
49	Belowground carbon in live seedlings, shrubs, and bushes, in short tons, on forest land.	EXPCURR
50	Carbon in stumps, coarse roots, and coarse woody debris, in short tons, on forest land.	EXPCURR
51	Carbon in litter, in short tons, on forest land.	EXPCURR
52	Carbon in organic soil, in short tons, on forest land.	EXPCURR
53	Aboveground carbon in live trees (at least 1 inch d.b.h./d.r.c.), in short tons, on forest land.	EXPVOL
54	Belowground carbon in live trees (at least 1 inch d.b.h./d.r.c.) in short tons on forest land.	EXPVOL
55	Aboveground and belowground carbon in live trees (at least 1 inch d.b.h./d.r.c.), in short tons, on forest land.	EXPVOL
56	Top and limb biomass of live trees (timber species at least 5 inches d.b.h.), in dry short tons, on forest land.	EXPVOL
57	Aboveground biomass of live saplings (timber species at least 1 and less than 5 inches d.b.h.), in dry short tons, on forest land.	EXPVOL
58	Stump biomass of live trees (timber species at least 5 inches d.b.h.), in dry short tons, on forest land.	EXPVOL
59	Belowground biomass of live trees (at least 1 inch d.b.h./d.r.c.), in dry short tons, on forest land.	EXPVOL
60	Aboveground biomass of live trees (woodland species at least 1 inch d.r.c.), in dry short tons, on forest land.	EXPVOL
61	Aboveground and belowground carbon in standing dead trees (at least 1 inch d.b.h./d.r.c.), in short tons, on timberland.	EXPCURR
62	Aboveground carbon in live seedlings, shrubs, and bushes, in short tons, on timberland.	EXPCURR
63	Belowground carbon in live seedlings, shrubs, and bushes, in short tons, on timberland.	EXPCURR
64	Carbon in stumps, coarse roots, and coarse woody debris, in short tons, on timberland.	EXPCURR
65	Carbon in litter, in short tons, on timberland.	EXPCURR

Attribute Number (ATTRIBUTE_NBR)	Attribute Description (ATTRIBUTE_DESCR)	Evaluation Type (EVAL_TYP)
66	Carbon in organic soil, in short tons, on timberland.	EXPCURR
67	Aboveground carbon in live trees (at least 1 inch d.b.h./d.r.c.), in short tons, on timberland.	EXPVOL
68	Belowground carbon in live trees (at least 1 inch d.b.h./d.r.c.), in short tons, on timberland.	EXPVOL
69	Aboveground and belowground carbon in live trees (at least 1 inch d.b.h./d.r.c.) in short tons on timberland.	EXPVOL
70	Top and limb biomass of live trees (timber species at least 5 inches d.b.h.), in dry short tons, on timberland.	EXPVOL
71	Aboveground biomass of live saplings (timber species at least 1 and less than 5 inches d.b.h.), in dry short tons, on timberland.	EXPVOL
72	Stump biomass of live trees (timber species at least 5 inches d.b.h.), in dry short tons, on timberland.	EXPVOL
73	Belowground biomass of live trees (at least 1 inch d.b.h./d.r.c.), in dry short tons, on timberland.	EXPVOL
74	Aboveground biomass of live trees (woodland species at least 1 inch d.r.c.), in dry short tons, on timberland.	EXPVOL
75	Aboveground biomass of live trees (at least 1 inch d.b.h./d.r.c.), in dry short tons, on forest land calculated with retired regional methods.	EXPVOL
76	Merchantable bole biomass of live trees (at least 5 inches d.b.h./d.r.c.), in dry short tons, on forest land calculated with retired regional methods.	EXPVOL
77	Merchantable bole biomass of live trees (at least 5 inches d.b.h./d.r.c.), in dry short tons, on timberland calculated with retired regional methods.	EXPVOL
78	Aboveground biomass of live trees (at least 1 inch d.b.h./d.r.c.), in dry short tons, on timberland calculated with retired regional methods.	EXPVOL
79	Area of sampled land and water, in acres.	EXPCURR

Attribute Number (ATTRIBUTE_NBR)	Attribute Description (ATTRIBUTE_DESCR)	Evaluation Type (EVAL_TYP)
80	Average annual harvest removals of live trees (at least 5 inches d.b.h./d.r.c.), in cubic feet, on forest land.	EXPREMV
81	Average annual harvest removals of growing-stock trees (at least 5 inches d.b.h.), in cubic feet, on forest land.	EXPREMV
82	Average annual harvest removals of sawtimber trees, in board feet (International 1/4-inch rule), on forest land.	EXPREMV
83	Average annual harvest removals of live trees (at least 5 inches d.b.h./d.r.c.), in cubic feet, on timberland.	EXPREMV
84	Average annual harvest removals of growing-stock trees (at least 5 inches d.b.h.), in cubic feet, on timberland.	EXPREMV
85	Average annual harvest removals of sawtimber trees, in board feet (International 1/4-inch rule), on timberland.	EXPREMV
86	Average annual other removals of live trees (at least 5 inches d.b.h./d.r.c.), in cubic feet, on forest land.	EXPREMV
87	Average annual other removals of growing-stock trees (at least 5 inches d.b.h.), in cubic feet, on forest land.	EXPREMV
88	Average annual other removals of sawtimber trees, in board feet (International 1/4-inch rule), on forest land.	EXPREMV
89	Average annual other removals of live trees (at least 5 inches d.b.h./d.r.c.), in cubic feet, on timberland.	EXPREMV
90	Average annual other removals of growing-stock trees (at least 5 inches d.b.h.), in cubic feet, on timberland.	EXPREMV
91	Average annual other removals of sawtimber trees, in board feet (International 1/4-inch rule), on timberland.	EXPREMV
92	Net merchantable bole volume of standing dead trees (at least 5 inches d.b.h./d.r.c.) in cubic feet on forest land.	EXPVOL
93	Net merchantable bole volume of standing dead trees (at least 5 inches d.b.h./d.r.c.), in cubic feet, on timberland.	EXPVOL
94	Bark biomass of live trees (at least 1 inch d.b.h./d.r.c.), in dry short tons, on forest land.	EXPVOL

Attribute Number (ATTRIBUTE_NBR)	Attribute Description (ATTRIBUTE_DESCR)	Evaluation Type (EVAL_TYP)
96	Aboveground biomass of standing dead trees (at least 5 inches d.b.h./d.r.c.), in dry short tons, on forest land.	EXPVOL
97	Total carbon, in short tons, on forest land.	EXPCURR
98	Forest carbon pool 1: live aboveground, in metric tonnes, on forest land.	EXPCURR
99	Forest carbon pool 2: live belowground, in metric tonnes, on forest land.	EXPCURR
100	Forest carbon pool 3: dead wood, in metric tonnes, on forest land.	EXPCURR
101	Forest carbon pool 4: litter, in metric tonnes, on forest land.	EXPCURR
102	Forest carbon pool 5: soil organic, in metric tonnes, on forest land.	EXPCURR
103	Forest carbon total: all 5 pools, in metric tonnes, on forest land.	EXPCURR
104	Total volume of FWD (small) pieces, in cubic feet, on forest land.	EXPDWM
105	Dry weight of FWD (small) pieces, in short tons, on forest land.	EXPDWM
106	Carbon in FWD (small) pieces, in short tons, on forest land.	EXPDWM
107	Total volume of FWD (medium) pieces, in cubic feet, on forest land.	EXPDWM
108	Dry weight of FWD (medium) pieces, in short tons, on forest land.	EXPDWM
109	Carbon in FWD (medium) pieces, in short tons, on forest land.	EXPDWM
110	Total volume of FWD (large) pieces, in cubic feet, on forest land.	EXPDWM
111	Dry weight of FWD (large) pieces, in short tons, on forest land.	EXPDWM
112	Carbon in FWD (large) pieces, in short tons, on forest land.	EXPDWM
113	Number of CWD pieces, in pieces, on forest land.	EXPDWM
114	Total volume of CWD, in cubic feet, on forest land.	EXPDWM
115	Dry weight of CWD, in short tons, on forest land.	EXPDWM
116	Carbon in CWD, in short tons, on forest land.	EXPDWM

Attribute Number (ATTRIBUTE_NBR)	Attribute Description (ATTRIBUTE_DESCR)	Evaluation Type (EVAL_TYP)
117	Total volume of DWM piles, in cubic feet, on forest land.	EXPDWM
118	Dry weight of DWM piles, in short tons, on forest land.	EXPDWM
119	Carbon in DWM piles, in short tons, on forest land.	EXPDWM
120	Total volume of FWD (all sizes) pieces, in cubic feet, on forest land.	EXPDWM
121	Dry weight of FWD (all sizes) pieces, in short tons, on forest land.	EXPDWM
122	Carbon in FWD (all sizes) pieces, in short tons, on forest land.	EXPDWM
123	Total volume of DWM (FWD, CWD and piles), in cubic feet, on forest land.	EXPDWM
124	Total dry weight of DWM (FWD, CWD and piles), in short tons, on forest land.	EXPDWM
125	Total carbon in DWM (FWD, CWD and piles), in short tons, on forest land.	EXPDWM
126	Area change - sampled at both inventories by remeasured plots.	EXPCHNG
127	Area change - area forest land both measurements from remeasured plots.	EXPCHNG
128	Area change - area forest land either measurement from remeasured plots.	EXPCHNG
129	Area change - area timberland both measurements from remeasured plots.	EXPCHNG
130	Area change - area timberland either measurement from remeasured plots.	EXPCHNG
131	Sound sawlog volume sawtimber trees, in cubic feet, on forest land.	EXPVOL
132	Sound sawlog volume of sawtimber trees, in cubic feet, on timberland.	EXPVOL
133	Sawlog biomass of sawtimber trees, in dry short tons, on forest land.	EXPVOL
134	Sawlog biomass of sawtimber trees, in dry short tons, on timberland.	EXPVOL
135	Area change annual - sampled at both inventories by remeasured plots.	EXPCHNG
136	Area change annual - area forest land both measurements from remeasured plots.	EXPCHNG
137	Area change annual - area forest land either measurement from remeasured plots.	EXPCHNG

Attribute Number (ATTRIBUTE_NBR)	Attribute Description (ATTRIBUTE_DESCR)	Evaluation Type (EVAL_TYP)
138	Area change annual - area timberland both measurements from remeasured plots.	EXPCHNG
139	Area change annual - area timberland either measurement from remeasured plots.	EXPCHNG
201	Average annual net growth of sound bole volume of trees (at least 5 inches d.b.h./d.r.c.), in cubic feet, on forest land.	EXPGROW
202	Average annual net growth of merchantable bole volume of growing-stock trees (at least 5 inches d.b.h.), in cubic feet, on forest land.	EXPGROW
203	Average annual net growth of sawlog volume of sawtimber trees, in board feet (International 1/4-inch rule), on forest land.	EXPGROW
204	Average annual net growth of sawlog volume of sawtimber trees, in cubic feet, on forest land.	EXPGROW
205	Average annual net growth of merchantable bole volume above the sawlog of sawtimber trees, in cubic feet, on forest land.	EXPGROW
206	Average annual net growth of merchantable bole volume of sawtimber trees, in cubic feet, on forest land.	EXPGROW
207	Average annual net growth of sound bole volume of trees (at least 5 inches d.b.h./d.r.c.), in cubic feet, on timberland.	EXPGROW
208	Average annual net growth of merchantable bole volume of growing-stock trees (at least 5 inches d.b.h.), in cubic feet, on timberland.	EXPGROW
209	Average annual net growth of sawlog volume of sawtimber trees, in board feet (International 1/4-inch rule), on timberland.	EXPGROW
210	Average annual net growth of sawlog volume of sawtimber trees, in cubic feet, on timberland.	EXPGROW
211	Average annual net growth of merchantable bole volume above the sawlog of sawtimber trees, in cubic feet, on timberland.	EXPGROW
212	Average annual net growth of merchantable bole volume of sawtimber trees, in cubic feet, on timberland.	EXPGROW
213	Average annual mortality of sound bole volume of trees (at least 5 inches d.b.h./d.r.c.), in cubic feet, on forest land.	EXPMORT

Attribute Number (ATTRIBUTE_NBR)	Attribute Description (ATTRIBUTE_DESCR)	Evaluation Type (EVAL_TYP)
214	Average annual mortality of merchantable bole volume of growing-stock trees (at least 5 inches d.b.h.), in cubic feet, on forest land.	EXPMORT
215	Average annual mortality of sawlog volume of sawtimber trees, in board feet (International 1/4-inch rule), on forest land.	EXPMORT
216	Average annual mortality of sawlog volume of sawtimber trees, in cubic feet, on forest land.	EXPMORT
217	Average annual mortality of merchantable bole volume above the sawlog of sawtimber trees, in cubic feet, on forest land.	EXPMORT
218	Average annual mortality of merchantable bole volume of sawtimber trees, in cubic feet, on forest land.	EXPMORT
219	Average annual mortality of sound bole volume of trees (at least 5 inches d.b.h./d.r.c.), in cubic feet, on timberland.	EXPMORT
220	Average annual mortality of merchantable bole volume of growing-stock trees (at least 5 inches d.b.h.), in cubic feet, on timberland.	EXPMORT
221	Average annual mortality of sawlog volume of sawtimber trees, in board feet (International 1/4-inch rule), on timberland.	EXPMORT
222	Average annual mortality of sawlog volume of sawtimber trees, in cubic feet, on timberland.	EXPMORT
223	Average annual mortality of merchantable bole volume above the sawlog of sawtimber trees, in cubic feet, on timberland.	EXPMORT
224	Average annual mortality of merchantable bole volume of sawtimber trees, in cubic feet, on timberland.	EXPMORT
225	Average annual removals of sound bole volume of trees (at least 5 inches d.b.h./d.r.c.), in cubic feet, on forest land.	EXPREMV
226	Average annual removals of merchantable bole volume of growing-stock trees (at least 5 inches d.b.h.), in cubic feet, on forest land.	EXPREMV
227	Average annual removals of sawlog volume of sawtimber trees, in board feet (International 1/4-inch rule), on forest land.	EXPREMV

Attribute Number (ATTRIBUTE_NBR)	Attribute Description (ATTRIBUTE_DESCR)	Evaluation Type (EVAL_TYP)
228	Average annual removals of sawlog volume of sawtimber trees, in cubic feet, on forest land.	EXPREMV
229	Average annual removals of merchantable bole volume above the sawlog of sawtimber trees, in cubic feet, on forest land.	EXPREMV
230	Average annual removals of merchantable bole volume of sawtimber trees, in cubic feet, on forest land.	EXPREMV
231	Average annual removals of sound bole volume of trees (at least 5 inches d.b.h./d.r.c.), in cubic feet, on timberland.	EXPREMV
232	Average annual removals of merchantable bole volume of growing-stock trees (at least 5 inches d.b.h.), in cubic feet, on timberland.	EXPREMV
233	Average annual removals of sawlog volume of sawtimber trees, in board feet (International 1/4-inch rule), on timberland.	EXPREMV
234	Average annual removals of sawlog volume of sawtimber trees, in cubic feet, on timberland.	EXPREMV
235	Average annual removals of merchantable bole volume above the sawlog of sawtimber trees, in cubic feet, on timberland.	EXPREMV
236	Average annual removals of merchantable bole volume of sawtimber trees, in cubic feet, on timberland.	EXPREMV
237	Average annual harvest removals of sound bole volume of trees (at least 5 inches d.b.h./d.r.c.), in cubic feet, on forest land.	EXPREMV
238	Average annual harvest removals of merchantable bole volume of growing-stock trees (at least 5 inches d.b.h.), in cubic feet, on forest land.	EXPREMV
239	Average annual harvest removals of sawlog volume of sawtimber trees, in board feet (International 1/4-inch rule), on forest land.	EXPREMV
240	Average annual harvest removals of sawlog volume of sawtimber trees, in cubic feet, on forest land.	EXPREMV
241	Average annual harvest removals of merchantable bole volume above the sawlog of sawtimber trees, in cubic feet, on forest land.	EXPREMV

Attribute Number (ATTRIBUTE_NBR)	Attribute Description (ATTRIBUTE_DESCR)	Evaluation Type (EVAL_TYP)
242	Average annual harvest removals of merchantable bole volume of sawtimber trees, in cubic feet, on forest land.	EXPREMV
243	Average annual harvest removals of sound bole volume of trees (at least 5 inches d.b.h./d.r.c.), in cubic feet, on timberland.	EXPREMV
244	Average annual harvest removals of merchantable bole volume of growing-stock trees (at least 5 inches d.b.h.), in cubic feet, on timberland.	EXPREMV
245	Average annual harvest removals of sawlog volume of sawtimber trees, in board feet (International 1/4-inch rule), on timberland.	EXPREMV
246	Average annual harvest removals of sawlog volume of sawtimber trees, in cubic feet, on timberland.	EXPREMV
247	Average annual harvest removals of merchantable bole volume above the sawlog of sawtimber trees, in cubic feet, on timberland.	EXPREMV
248	Average annual harvest removals of merchantable bole volume of sawtimber trees, in cubic feet, on timberland.	EXPREMV
249	Average annual other removals of sound bole volume of trees (at least 5 inches d.b.h./d.r.c.), in cubic feet, on forest land.	EXPREMV
250	Average annual other removals of merchantable bole volume of growing-stock trees (at least 5 inches d.b.h.), in cubic feet, on forest land.	EXPREMV
251	Average annual other removals of sawlog volume of sawtimber trees, in board feet (International 1/4-inch rule), on forest land.	EXPREMV
252	Average annual other removals of sawlog volume of sawtimber trees, in cubic feet, on forest land.	EXPREMV
253	Average annual other removals of merchantable bole volume above the sawlog of sawtimber trees, in cubic feet, on forest land.	EXPREMV
254	Average annual other removals of merchantable bole volume of sawtimber trees, in cubic feet, on forest land.	EXPREMV
255	Average annual other removals of sound bole volume of trees (at least 5 inches d.b.h./d.r.c.), in cubic feet, on timberland.	EXPREMV

Attribute Number (ATTRIBUTE_NBR)	Attribute Description (ATTRIBUTE_DESCR)	Evaluation Type (EVAL_TYP)
256	Average annual other removals of merchantable bole volume of growing-stock trees (at least 5 inches d.b.h.), in cubic feet, on timberland.	EXPREMV
257	Average annual other removals of sawlog volume of sawtimber trees, in board feet (International 1/4-inch rule), on timberland.	EXPREMV
258	Average annual other removals of sawlog volume of sawtimber trees, in cubic feet, on timberland.	EXPREMV
259	Average annual other removals of merchantable bole volume above the sawlog of sawtimber trees, in cubic feet, on timberland.	EXPREMV
260	Average annual other removals of merchantable bole volume of sawtimber trees, in cubic feet, on timberland.	EXPREMV
301	Average annual net growth of merchantable bole biomass of trees (at least 5 inches d.b.h./d.r.c.), in dry short tons, on forest land.	EXPGROW
302	Average annual net growth of merchantable bole biomass of growing-stock trees (at least 5 inches d.b.h.), in dry short tons, on forest land.	EXPGROW
303	Average annual net growth of sawlog biomass of sawtimber trees, in dry short tons, on forest land.	EXPGROW
304	Average annual net growth of merchantable bole biomass above the sawlog of sawtimber trees, in dry short tons, on forest land.	EXPGROW
305	Average annual net growth of merchantable bole biomass of sawtimber trees, in dry short tons, on forest land.	EXPGROW
306	Average annual net growth of merchantable bole biomass of trees (at least 5 inches d.b.h./d.r.c.), in dry short tons, on timberland.	EXPGROW
307	Average annual net growth of merchantable bole biomass of growing-stock trees (at least 5 inches d.b.h.), in dry short tons, on timberland.	EXPGROW
308	Average annual net growth of sawlog biomass of sawtimber trees, in dry short tons, on timberland.	EXPGROW

Attribute Number (ATTRIBUTE_NBR)	Attribute Description (ATTRIBUTE_DESCR)	Evaluation Type (EVAL_TYP)
309	Average annual net growth of merchantable bole biomass above the sawlog of sawtimber trees, in dry short tons, on timberland.	EXPGROW
310	Average annual net growth of merchantable bole biomass of sawtimber trees, in dry short tons, on timberland.	EXPGROW
311	Average annual net growth of aboveground biomass of trees (at least 1 inches d.b.h./d.r.c.), in dry short tons, on forest land.	EXPGROW
312	Average annual net growth of aboveground biomass of growing-stock trees (at least 5 inches d.b.h./d.r.c.), in dry short tons, on forest land.	EXPGROW
313	Average annual net growth of aboveground biomass of sawtimber trees, in dry short tons, on forest land.	EXPGROW
314	Average annual net growth of aboveground biomass of trees (at least 1 inches d.b.h./d.r.c.), in dry short tons, on timberland.	EXPGROW
315	Average annual net growth of aboveground biomass of growing-stock trees (at least 5 inches d.b.h.), in dry short tons, on timberland.	EXPGROW
316	Average annual net growth of aboveground biomass of sawtimber trees, in dry short tons, on timberland.	EXPGROW
317	Average annual net growth of belowground biomass of trees (at least 1 inches d.b.h./d.r.c.), in dry short tons, on forest land.	EXPGROW
318	Average annual net growth of belowground biomass of growing-stock trees (at least 5 inches d.b.h.), in dry short tons, on forest land.	EXPGROW
319	Average annual net growth of belowground biomass of sawtimber trees, in dry short tons, on forest land.	EXPGROW
320	Average annual net growth of belowground biomass of trees (at least 1 inches d.b.h./d.r.c.), in dry short tons, on timberland.	EXPGROW

Attribute Number (ATTRIBUTE_NBR)	Attribute Description (ATTRIBUTE_DESCR)	Evaluation Type (EVAL_TYP)
321	Average annual net growth of belowground biomass of growing-stock trees (at least 5 inches d.b.h.), in dry short tons, on timberland.	EXPGROW
322	Average annual net growth of belowground biomass of sawtimber trees, in dry short tons, on timberland.	EXPGROW
323	Average annual net growth of stump biomass of trees (at least 5 inches d.b.h./d.r.c.), in dry short tons, on forest land.	EXPGROW
324	Average annual net growth of stump biomass of growing-stock trees (at least 5 inches d.b.h.), in dry short tons, on forest land.	EXPGROW
325	Average annual net growth of stump biomass of sawtimber trees, in dry short tons, on forest land.	EXPGROW
326	Average annual net growth of stump biomass of trees (at least 5 inches d.b.h./d.r.c.), in dry short tons, on timberland.	EXPGROW
327	Average annual net growth of stump biomass of growing-stock trees (at least 5 inches d.b.h.), in dry short tons, on timberland.	EXPGROW
328	Average annual net growth of stump biomass of sawtimber trees, in dry short tons, on timberland.	EXPGROW
329	Average annual net growth of top and limb biomass of trees (at least 5 inches d.b.h./d.r.c.), in dry short tons, on forest land.	EXPGROW
330	Average annual net growth of top and limb biomass of growing-stock trees (at least 5 inches d.b.h.), in dry short tons, on forest land.	EXPGROW
331	Average annual net growth of top and limb biomass of sawtimber trees, in dry short tons, on forest land.	EXPGROW
332	Average annual net growth of top and limb biomass of trees (at least 5 inches d.b.h./d.r.c.), in dry short tons, on timberland.	EXPGROW

Attribute Number (ATTRIBUTE_NBR)	Attribute Description (ATTRIBUTE_DESCR)	Evaluation Type (EVAL_TYP)
333	Average annual net growth of top and limb biomass of growing-stock trees (at least 5 inches d.b.h.), in dry short tons, on timberland.	EXPGROW
334	Average annual net growth of top and limb biomass of sawtimber trees, in dry short tons, on timberland.	EXPGROW
335	Average annual mortality of aboveground biomass of trees (at least 1 inches d.b.h./d.r.c.), in dry short tons, on forest land.	EXPMORT
336	Average annual mortality of aboveground biomass of growing-stock trees (at least 5 inches d.b.h.), in dry short tons, on forest land.	EXPMORT
337	Average annual mortality of aboveground biomass of sawtimber trees, in dry short tons, on forest land.	EXPMORT
338	Average annual mortality of aboveground biomass of trees (at least 1 inches d.b.h./d.r.c.), in dry short tons, on timberland.	EXPMORT
339	Average annual mortality of aboveground biomass of growing-stock trees (at least 5 inches d.b.h.), in dry short tons, on timberland.	EXPMORT
340	Average annual mortality of aboveground biomass of sawtimber trees, in dry short tons, on timberland.	EXPMORT
341	Average annual mortality of belowground biomass of trees (at least 1 inches d.b.h./d.r.c.), in dry short tons, on forest land.	EXPMORT
342	Average annual mortality of belowground biomass of growing-stock trees (at least 5 inches d.b.h.), in dry short tons, on forest land.	EXPMORT
343	Average annual mortality of belowground biomass of sawtimber trees, in dry short tons, on forest land.	EXPMORT
344	Average annual mortality of belowground biomass of trees (at least 1 inches d.b.h./d.r.c.), in dry short tons, on timberland.	EXPMORT

Attribute Number (ATTRIBUTE_NBR)	Attribute Description (ATTRIBUTE_DESCR)	Evaluation Type (EVAL_TYP)
345	Average annual mortality of belowground biomass of growing-stock trees (at least 5 inches d.b.h.), in dry short tons, on timberland.	EXPMORT
346	Average annual mortality of belowground biomass of sawtimber trees, in dry short tons, on timberland.	EXPMORT
347	Average annual mortality of merchantable bole biomass of trees (at least 5 inches d.b.h./d.r.c.), in dry short tons, on forest land.	EXPMORT
348	Average annual mortality of merchantable bole biomass of growing-stock trees (at least 5 inches d.b.h.), in dry short tons, on forest land.	EXPMORT
349	Average annual mortality of merchantable bole biomass of sawtimber trees, in dry short tons, on forest land.	EXPMORT
350	Average annual mortality of merchantable bole biomass of trees (at least 5 inches d.b.h./d.r.c.), in dry short tons, on timberland.	EXPMORT
351	Average annual mortality of merchantable bole biomass of growing-stock trees (at least 5 inches d.b.h.), in dry short tons, on timberland.	EXPMORT
352	Average annual mortality of merchantable bole biomass of sawtimber trees, in dry short tons, on timberland.	EXPMORT
353	Average annual mortality of sawlog biomass of sawtimber trees, in dry short tons, on forest land.	EXPMORT
354	Average annual mortality of sawlog biomass of sawtimber trees, in dry short tons, on timberland.	EXPMORT
355	Average annual mortality of merchantable bole biomass above the sawlog of sawtimber trees, in dry short tons, on forest land.	EXPMORT
356	Average annual mortality of merchantable bole biomass above the sawlog of sawtimber trees, in dry short tons, on timberland.	EXPMORT
357	Average annual mortality of stump biomass of trees (at least 5 inches d.b.h./d.r.c.), in dry short tons, on forest land.	EXPMORT

Attribute Number (ATTRIBUTE_NBR)	Attribute Description (ATTRIBUTE_DESCR)	Evaluation Type (EVAL_TYP)
358	Average annual mortality of stump biomass of growing-stock trees (at least 5 inches d.b.h.), in dry short tons, on forest land.	EXPMORT
359	Average annual mortality of stump biomass of sawtimber trees, in dry short tons, on forest land.	EXPMORT
360	Average annual mortality of stump biomass of trees (at least 5 inches d.b.h./d.r.c.), in dry short tons, on timberland.	EXPMORT
361	Average annual mortality of stump biomass of growing-stock trees (at least 5 inches d.b.h.), in dry short tons, on timberland.	EXPMORT
362	Average annual mortality of stump biomass sawtimber trees, in dry short tons, on timberland.	EXPMORT
363	Average annual mortality of top and limb biomass of trees (at least 5 inches d.b.h./d.r.c.), in dry short tons, on forest land.	EXPMORT
364	Average annual mortality of top and limb biomass of growing-stock trees (at least 5 inches d.b.h.), in dry short tons, on forest land.	EXPMORT
365	Average annual mortality of top and limb biomass of sawtimber trees, in dry short tons, on forest land.	EXPMORT
366	Average annual mortality of top and limb biomass of trees (at least 5 inches d.b.h./d.r.c.), in dry short tons, on timberland.	EXPMORT
367	Average annual mortality of top and limb biomass of growing-stock trees (at least 5 inches d.b.h.), in dry short tons, on timberland.	EXPMORT
368	Average annual mortality of top and limb biomass of sawtimber trees, in dry short tons, on timberland.	EXPMORT
369	Average annual removals of aboveground biomass of trees (at least 1 inches d.b.h./d.r.c.), in dry short tons, on forest land.	EXPREMV
370	Average annual removals of aboveground biomass of growing-stock trees (at least 5 inches d.b.h.), in dry short tons, on forest land.	EXPREMV

Attribute Number (ATTRIBUTE_NBR)	Attribute Description (ATTRIBUTE_DESCR)	Evaluation Type (EVAL_TYP)
371	Average annual removals of aboveground biomass of sawtimber trees, in dry short tons, on forest land.	EXPREMV
372	Average annual removals of aboveground biomass of trees (at least 1 inches d.b.h./d.r.c.), in dry short tons, on timberland.	EXPREMV
373	Average annual removals of aboveground biomass of growing-stock trees (at least 5 inches d.b.h.), in dry short tons, on timberland.	EXPREMV
374	Average annual removals of aboveground biomass of sawtimber trees, in dry short tons, on timberland.	EXPREMV
375	Average annual removals of belowground biomass of trees (at least 1 inches d.b.h./d.r.c.), in dry short tons, on forest land.	EXPREMV
376	Average annual removals of belowground biomass of growing-stock trees (at least 5 inches d.b.h.), in dry short tons, on forest land.	EXPREMV
377	Average annual removals of belowground biomass of sawtimber trees, in dry short tons, on forest land.	EXPREMV
378	Average annual removals of belowground biomass of trees (at least 1 inches d.b.h./d.r.c.), in dry short tons, on timberland.	EXPREMV
379	Average annual removals of belowground biomass of growing-stock trees (at least 5 inches d.b.h.), in dry short tons, on timberland.	EXPREMV
380	Average annual removals of belowground biomass of sawtimber trees, in dry short tons, on timberland.	EXPREMV
381	Average annual removals of merchantable bole biomass of trees (at least 5 inches d.b.h./d.r.c.), in dry short tons, on forest land.	EXPREMV
382	Average annual removals of merchantable bole biomass of growing-stock trees (at least 5 inches d.b.h.), in dry short tons, on forest land.	EXPREMV
383	Average annual removals of merchantable bole biomass of sawtimber trees, in dry short tons, on forest land.	EXPREMV

Attribute Number (ATTRIBUTE_NBR)	Attribute Description (ATTRIBUTE_DESCR)	Evaluation Type (EVAL_TYP)
384	Average annual removals of merchantable bole biomass of trees (at least 5 inches d.b.h./d.r.c.), in dry short tons, on timberland.	EXPREMV
385	Average annual removals of merchantable bole biomass of growing-stock trees (at least 5 inches d.b.h.), in dry short tons, on timberland.	EXPREMV
386	Average annual removals of merchantable bole biomass of sawtimber trees, in dry short tons, on timberland.	EXPREMV
387	Average annual removals of sawlog biomass of sawtimber trees, in dry short tons, on forest land.	EXPREMV
388	Average annual removals of sawlog biomass of sawtimber trees, in dry short tons, on timberland.	EXPREMV
389	Average annual removals of merchantable bole biomass above the sawlog of sawtimber trees, in dry short tons, on forest land.	EXPREMV
390	Average annual removals of merchantable bole biomass above the sawlog of sawtimber trees, in dry short tons, on timberland.	EXPREMV
391	Average annual removals of stump biomass of trees (at least 5 inches d.b.h./d.r.c.), in dry short tons, on forest land.	EXPREMV
392	Average annual removals of stump biomass of growing-stock trees (at least 5 inches d.b.h.), in dry short tons, on forest land.	EXPREMV
393	Average annual removals of stump biomass of sawtimber trees, in dry short tons, on forest land.	EXPREMV
394	Average annual removals of stump biomass of trees (at least 5 inches d.b.h./d.r.c.), in dry short tons, on timberland.	EXPREMV
395	Average annual removals of stump biomass of growing-stock trees (at least 5 inches d.b.h.), in dry short tons, on timberland.	EXPREMV
396	Average annual removals of stump biomass of sawtimber trees, in dry short tons, on timberland.	EXPREMV

Attribute Number (ATTRIBUTE_NBR)	Attribute Description (ATTRIBUTE_DESCR)	Evaluation Type (EVAL_TYP)
397	Average annual removals of top and limb biomass of trees (at least 5 inches d.b.h./d.r.c.), in dry short tons, on forest land.	EXPREMV
398	Average annual removals of top and limb biomass of growing-stock trees (at least 5 inches d.b.h.), in dry short tons, on forest land.	EXPREMV
399	Average annual removals of top and limb biomass of sawtimber trees, in dry short tons, on forest land.	EXPREMV
400	Average annual removals of top and limb biomass of trees (at least 5 inches d.b.h./d.r.c.), in dry short tons, on timberland.	EXPREMV
401	Average annual removals of top and limb biomass of growing-stock trees (at least 5 inches d.b.h.), in dry short tons, on timberland.	EXPREMV
402	Average annual removals of top and limb biomass of sawtimber trees, in dry short tons, on timberland.	EXPREMV
403	Average annual harvest removals of aboveground biomass of trees (at least 1 inches d.b.h./d.r.c.), in dry short tons, on forest land.	EXPREMV
404	Average annual harvest removals of aboveground biomass of growing-stock trees (at least 5 inches d.b.h.), in dry short tons, on forest land.	EXPREMV
405	Average annual harvest removals of aboveground biomass of sawtimber trees, in dry short tons, on forest land.	EXPREMV
406	Average annual harvest removals of aboveground biomass of trees (at least 1 inches d.b.h./d.r.c.), in dry short tons, on timberland.	EXPREMV
407	Average annual harvest removals of aboveground biomass of growing-stock trees (at least 5 inches d.b.h.), in dry short tons, on timberland.	EXPREMV
408	Average annual harvest removals of aboveground biomass of sawtimber trees, in dry short tons, on timberland.	EXPREMV

Attribute Number (ATTRIBUTE_NBR)	Attribute Description (ATTRIBUTE_DESCR)	Evaluation Type (EVAL_TYP)
409	Average annual harvest removals of belowground biomass of trees (at least 1 inches d.b.h./d.r.c.), in dry short tons, on forest land.	EXPREMV
410	Average annual harvest removals of belowground biomass of growing-stock trees (at least 5 inches d.b.h.), in dry short tons, on forest land.	EXPREMV
411	Average annual harvest removals of belowground biomass of sawtimber trees, in dry short tons, on forest land.	EXPREMV
412	Average annual harvest removals of belowground biomass of trees (at least 1 inches d.b.h./d.r.c.), in dry short tons, on timberland.	EXPREMV
413	Average annual harvest removals of belowground biomass of growing-stock trees (at least 5 inches d.b.h.), in dry short tons, on timberland.	EXPREMV
414	Average annual harvest removals of belowground biomass of sawtimber trees, in dry short tons, on timberland.	EXPREMV
415	Average annual harvest removals of merchantable bole biomass of trees (at least 5 inches d.b.h./d.r.c.), in dry short tons, on forest land.	EXPREMV
416	Average annual harvest removals of merchantable bole biomass of growing-stock trees (at least 5 inches d.b.h.), in dry short tons, on forest land.	EXPREMV
417	Average annual harvest removals of merchantable bole biomass of sawtimber trees, in dry short tons, on forest land.	EXPREMV
418	Average annual harvest removals of merchantable bole biomass of trees (at least 5 inches d.b.h./d.r.c.), in dry short tons, on timberland.	EXPREMV
419	Average annual harvest removals of merchantable bole biomass of growing-stock trees (at least 5 inches d.b.h.), in dry short tons, on timberland.	EXPREMV
420	Average annual harvest removals of merchantable bole biomass of sawtimber trees, in dry short tons, on timberland.	EXPREMV
421	Average annual harvest removals of sawlog biomass of sawtimber trees, in dry short tons, on forest land.	EXPREMV

Attribute Number (ATTRIBUTE_NBR)	Attribute Description (ATTRIBUTE_DESCR)	Evaluation Type (EVAL_TYP)
422	Average annual harvest removals of sawlog biomass of sawtimber trees, in dry short tons, on timberland.	EXPREMV
423	Average annual harvest removals of merchantable bole biomass above the sawlog of sawtimber trees, in dry short tons, on forest land.	EXPREMV
424	Average annual harvest removals of merchantable bole biomass above the sawlog of sawtimber trees, in dry short tons, on timberland.	EXPREMV
425	Average annual harvest removals of stump biomass of trees (at least 5 inches d.b.h./d.r.c.), in dry short tons, on forest land.	EXPREMV
426	Average annual harvest removals of stump biomass of growing-stock trees (at least 5 inches d.b.h.), in dry short tons, on forest land.	EXPREMV
427	Average annual harvest removals of stump biomass of sawtimber trees, in dry short tons, on forest land.	EXPREMV
428	Average annual harvest removals of stump biomass of trees (at least 5 inches d.b.h./d.r.c.), in dry short tons, on timberland.	EXPREMV
429	Average annual harvest removals of stump biomass of growing-stock trees (at least 5 inches d.b.h.), in dry short tons, on timberland.	EXPREMV
430	Average annual harvest removals of stump biomass of sawtimber trees, in dry short tons, on timberland.	EXPREMV
431	Average annual harvest removals of top and limb biomass of trees (at least 5 inches d.b.h./d.r.c.), in dry short tons, on forest land.	EXPREMV
432	Average annual harvest removals of top and limb biomass of growing-stock trees (at least 5 inches d.b.h.), in dry short tons, on forest land.	EXPREMV
433	Average annual harvest removals of top and limb biomass of sawtimber trees, in dry short tons, on forest land.	EXPREMV

Attribute Number (ATTRIBUTE_NBR)	Attribute Description (ATTRIBUTE_DESCR)	Evaluation Type (EVAL_TYP)
434	Average annual harvest removals of top and limb biomass of trees (at least 5 inches d.b.h./d.r.c.), in dry short tons, on timberland.	EXPREMV
435	Average annual harvest removals of top and limb biomass of growing-stock trees (at least 5 inches d.b.h.), in dry short tons, on timberland.	EXPREMV
436	Average annual harvest removals of top and limb biomass of sawtimber trees, in dry short tons, on timberland.	EXPREMV
437	Average annual other removals of aboveground biomass of trees (at least 1 inches d.b.h./d.r.c.), in dry short tons, on forest land.	EXPREMV
438	Average annual other removals of aboveground biomass of growing-stock trees (at least 5 inches d.b.h.), in dry short tons, on forest land.	EXPREMV
439	Average annual other removals of aboveground biomass of sawtimber trees, in dry short tons, on forest land.	EXPREMV
440	Average annual other removals of aboveground biomass of trees (at least 1 inches d.b.h./d.r.c.), in dry short tons, on timberland.	EXPREMV
441	Average annual other removals of aboveground biomass of growing-stock trees (at least 5 inches d.b.h.), in dry short tons, on timberland.	EXPREMV
442	Average annual other removals of aboveground biomass of sawtimber trees, in dry short tons, on timberland.	EXPREMV
443	Average annual other removals of belowground biomass of trees (at least 1 inches d.b.h./d.r.c.), in dry short tons, on forest land.	EXPREMV
444	Average annual other removals of belowground biomass of growing-stock trees (at least 5 inches d.b.h.), in dry short tons, on forest land.	EXPREMV
445	Average annual other removals of belowground biomass of sawtimber trees, in dry short tons, on forest land.	EXPREMV

Attribute Number (ATTRIBUTE_NBR)	Attribute Description (ATTRIBUTE_DESCR)	Evaluation Type (EVAL_TYP)
446	Average annual other removals of belowground biomass of trees (at least 1 inches d.b.h./d.r.c.), in dry short tons, on timberland.	EXPREMV
447	Average annual other removals of belowground biomass of growing-stock trees (at least 5 inches d.b.h.), in dry short tons, on timberland.	EXPREMV
448	Average annual other removals of belowground biomass of sawtimber trees, in dry short tons, on timberland.	EXPREMV
449	Average annual other removals of merchantable bole biomass of trees (at least 5 inches d.b.h./d.r.c.), in dry short tons, on forest land.	EXPREMV
450	Average annual other removals of merchantable bole biomass of growing-stock trees (at least 5 inches d.b.h.), in dry short tons, on forest land.	EXPREMV
451	Average annual other removals of merchantable bole biomass of sawtimber trees, in dry short tons, on forest land.	EXPREMV
452	Average annual other removals of merchantable bole biomass of trees (at least 5 inches d.b.h./d.r.c.), in dry short tons, on timberland.	EXPREMV
453	Average annual other removals of merchantable bole biomass of growing-stock trees (at least 5 inches d.b.h.), in dry short tons, on timberland.	EXPREMV
454	Average annual other removals of merchantable bole biomass of sawtimber trees, in dry short tons, on timberland.	EXPREMV
455	Average annual other removals of sawlog biomass of sawtimber trees, in dry short tons, on forest land.	EXPREMV
456	Average annual other removals of sawlog biomass of sawtimber trees, in dry short tons, on timberland.	EXPREMV
457	Average annual other removals of merchantable bole biomass above the sawlog of sawtimber trees, in dry short tons, on forest land.	EXPREMV
458	Average annual other removals of merchantable bole biomass above the sawlog of sawtimber trees, in dry short tons, on timberland.	EXPREMV

Attribute Number (ATTRIBUTE_NBR)	Attribute Description (ATTRIBUTE_DESCR)	Evaluation Type (EVAL_TYP)
459	Average annual other removals of stump biomass of trees (at least 5 inches d.b.h./d.r.c.), in dry short tons, on forest land.	EXPREMV
460	Average annual other removals of stump biomass of growing-stock trees (at least 5 inches d.b.h.), in dry short tons, on forest land.	EXPREMV
461	Average annual other removals of stump biomass of sawtimber trees, in dry short tons, on forest land.	EXPREMV
462	Average annual other removals of stump biomass of trees (at least 5 inches d.b.h./d.r.c.), in dry short tons, on timberland.	EXPREMV
463	Average annual other removals of stump biomass of growing-stock trees (at least 5 inches d.b.h.), in dry short tons, on timberland.	EXPREMV
464	Average annual other removals of stump biomass of sawtimber trees, in dry short tons, on timberland.	EXPREMV
465	Average annual other removals of top and limb biomass of trees (at least 5 inches d.b.h./d.r.c.), in dry short tons, on forest land.	EXPREMV
466	Average annual other removals of top and limb biomass of growing-stock trees (at least 5 inches d.b.h.), in dry short tons, on forest land.	EXPREMV
467	Average annual other removals of top and limb biomass of sawtimber trees, in dry short tons, on forest land.	EXPREMV
468	Average annual other removals of top and limb biomass of trees (at least 5 inches d.b.h./d.r.c.), in dry short tons, on timberland.	EXPREMV
469	Average annual other removals of top and limb biomass of growing-stock trees (at least 5 inches d.b.h.), in dry short tons, on timberland.	EXPREMV
470	Average annual other removals of top and limb biomass of sawtimber trees, in dry short tons, on timberland.	EXPREMV
510	Aboveground biomass of live trees (at least 1 inch d.b.h./d.r.c.), in green short tons, on forest land.	EXPVOL

Attribute Number (ATTRIBUTE_NBR)	Attribute Description (ATTRIBUTE_DESCR)	Evaluation Type (EVAL_TYP)
511	Merchantable bole biomass of live trees (timber species at least 5 inches d.b.h.), in green short tons, on forest land.	EXPVOL
512	Merchantable bole biomass of live trees (timber species at least 5 inches d.b.h.), in green short tons, on timberland.	EXPVOL
513	Aboveground biomass of live trees (at least 1 inch d.b.h./d.r.c.), in green short tons, on timberland.	EXPVOL
533	Sawlog biomass of sawtimber trees, in green short tons, on forest land.	EXPVOL
534	Sawlog biomass of sawtimber trees, in green short tons, on timberland.	EXPVOL
556	Top and limb biomass of live trees (timber species at least 5 inches d.b.h.), in green short tons, on forest land.	EXPVOL
557	Aboveground biomass of live saplings (timber species at least 1 and less than 5 inches d.b.h.), in green short tons, on forest land.	EXPVOL
558	Stump biomass of live trees (timber species at least 5 inches d.b.h.), in green short tons, on forest land.	EXPVOL
560	Aboveground biomass of live trees (woodland species at least 1 inch d.r.c.), in green short tons, on forest land.	EXPVOL
570	Top and limb biomass of live trees (timber species at least 5 inches d.b.h.), in green short tons, on timberland.	EXPVOL
571	Aboveground biomass of live saplings (timber species at least 1 and less than 5 inches d.b.h.), in green short tons, on timberland.	EXPVOL
572	Stump biomass of live trees (timber species at least 5 inches d.b.h.), in green short tons, on timberland.	EXPVOL
574	Aboveground biomass of live trees (woodland species at least 1 inch d.r.c.), in green short tons, on timberland.	EXPVOL
575	Aboveground biomass of live trees (at least 1 inch d.b.h./d.r.c.), in green short tons, on forest land calculated with retired regional methods.	EXPVOL

Attribute Number (ATTRIBUTE_NBR)	Attribute Description (ATTRIBUTE_DESCR)	Evaluation Type (EVAL_TYP)
576	Merchantable bole biomass of live trees (at least 5 inches d.b.h./d.r.c.), in green short tons, on forest land calculated with retired regional methods.	EXPVOL
577	Merchantable bole biomass of live trees (at least 5 inches d.b.h./d.r.c.), in green short tons, on timberland calculated with retired regional methods.	EXPVOL
578	Aboveground biomass of live trees (at least 1 inch d.b.h./d.r.c.), in green short tons, on timberland calculated with retired regional methods.	EXPVOL
594	Bark biomass of live trees (at least 1 inch d.b.h./d.r.c.), in green short tons, on forest land.	EXPVOL
601	Average annual net growth of merchantable bole carbon in trees (at least 5 inches d.b.h./d.r.c.), in short tons, on forest land.	EXPGROW
602	Average annual net growth of merchantable bole carbon in growing-stock trees (at least 5 inches d.b.h.), in short tons, on forest land.	EXPGROW
603	Average annual net growth of sawlog carbon in sawtimber trees, in short tons, on forest land.	EXPGROW
604	Average annual net growth of merchantable bole carbon above the sawlog in sawtimber trees, in short tons, on forest land.	EXPGROW
605	Average annual net growth of merchantable bole carbon in sawtimber trees, in short tons, on forest land.	EXPGROW
606	Average annual net growth of merchantable bole carbon in trees (at least 5 inches d.b.h./d.r.c.), in short tons, on timberland.	EXPGROW
607	Average annual net growth of merchantable bole carbon in growing-stock trees (at least 5 inches d.b.h.), in short tons, on timberland.	EXPGROW
608	Average annual net growth of sawlog carbon in sawtimber trees, in short tons, on timberland.	EXPGROW
609	Average annual net growth of merchantable bole carbon above the sawlog of sawtimber trees, in short tons, on timberland.	EXPGROW

Attribute Number (ATTRIBUTE_NBR)	Attribute Description (ATTRIBUTE_DESCR)	Evaluation Type (EVAL_TYP)
610	Average annual net growth of merchantable bole carbon in sawtimber trees, in short tons, on timberland.	EXPGROW
611	Average annual net growth of aboveground carbon in trees (at least 1 inches d.b.h./d.r.c.), in short tons, on forest land.	EXPGROW
612	Average annual net growth of aboveground carbon in growing-stock trees (at least 5 inches d.b.h.), in short tons, on forest land.	EXPGROW
613	Average annual net growth of aboveground carbon in sawtimber trees, in short tons, on forest land.	EXPGROW
614	Average annual net growth of aboveground carbon in trees (at least 1 inches d.b.h./d.r.c.), in short tons, on timberland.	EXPGROW
615	Average annual net growth of aboveground carbon in growing-stock trees (at least 5 inches d.b.h.), in short tons, on timberland.	EXPGROW
616	Average annual net growth of aboveground carbon in sawtimber trees, in short tons, on timberland.	EXPGROW
617	Average annual net growth of belowground carbon in trees (at least 1 inch d.b.h./d.r.c.), in short tons, on forest land.	EXPGROW
618	Average annual net growth of belowground carbon in growing-stock trees (at least 5 inches d.b.h.), in short tons, on forest land.	EXPGROW
619	Average annual net growth of belowground carbon in sawtimber trees, in short tons, on forest land.	EXPGROW
620	Average annual net growth of belowground carbon in trees (at least 1 inches d.b.h./d.r.c.), in short tons, on timberland.	EXPGROW
621	Average annual net growth of belowground carbon in growing-stock trees (at least 5 inches d.b.h.), in short tons, on timberland.	EXPGROW
622	Average annual net growth of belowground carbon in sawtimber trees, in short tons, on timberland.	EXPGROW
623	Average annual net growth of stump carbon in trees (at least 5 inches d.b.h./d.r.c.), in short tons, on forest land.	EXPGROW
624	Average annual net growth of stump carbon in growing-stock trees (at least 5 inches d.b.h.), in short tons, on forest land.	EXPGROW

Attribute Number (ATTRIBUTE_NBR)	Attribute Description (ATTRIBUTE_DESCR)	Evaluation Type (EVAL_TYP)
625	Average annual net growth of stump carbon in sawtimber trees, in short tons, on forest land.	EXPGROW
626	Average annual net growth of stump carbon in trees (at least 5 inches d.b.h./d.r.c.), in short tons, on timberland.	EXPGROW
627	Average annual net growth of stump carbon in growing-stock trees (at least 5 inches d.b.h.), in short tons, on timberland.	EXPGROW
628	Average annual net growth of stump carbon in sawtimber trees, in short tons, on timberland.	EXPGROW
629	Average annual net growth of top and limb carbon in trees (at least 5 inches d.b.h./d.r.c.), in short tons, on forest land.	EXPGROW
630	Average annual net growth of top and limb carbon in growing-stock trees (at least 5 inches d.b.h.), in short tons, on forest land.	EXPGROW
631	Average annual net growth of top and limb carbon in sawtimber trees, in short tons, on forest land.	EXPGROW
632	Average annual net growth of top and limb carbon in trees (at least 5 inches d.b.h./d.r.c.), in short tons, on timberland.	EXPGROW
633	Average annual net growth of top and limb carbon in growing-stock trees (at least 5 inches d.b.h.), in short tons, on timberland.	EXPGROW
634	Average annual net growth of top and limb carbon in sawtimber trees, in short tons, on timberland.	EXPGROW
635	Average annual mortality of aboveground carbon in trees (at least 1 inches d.b.h./d.r.c.), in short tons, on forest land.	EXPMORT
636	Average annual mortality of aboveground carbon in growing-stock trees (at least 5 inches d.b.h.), in short tons, on forest land.	EXPMORT
637	Average annual mortality aboveground carbon in sawtimber trees, in short tons, on forest land.	EXPMORT
638	Average annual mortality of aboveground carbon in trees (at least 1 inches d.b.h./d.r.c.), in short tons, on timberland.	EXPMORT
639	Average annual mortality of aboveground carbon in growing-stock trees (at least 5 inches d.b.h.), in short tons, on timberland.	EXPMORT

Attribute Number (ATTRIBUTE_NBR)	Attribute Description (ATTRIBUTE_DESCR)	Evaluation Type (EVAL_TYP)
640	Average annual mortality of aboveground carbon in sawtimber trees, in short tons, on timberland.	EXPMORT
641	Average annual mortality of belowground carbon in trees (at least 1 inches d.b.h./d.r.c.), in short tons, on forest land.	EXPMORT
642	Average annual mortality of belowground carbon in growing-stock trees (at least 5 inches d.b.h.), in short tons, on forest land.	EXPMORT
643	Average annual mortality of belowground carbon in sawtimber trees, in short tons, on forest land.	EXPMORT
644	Average annual mortality of belowground carbon in trees (at least 1 inches d.b.h./d.r.c.), in short tons, on timberland.	EXPMORT
645	Average annual mortality of belowground carbon in growing-stock trees (at least 5 inches d.b.h.), in short tons, on timberland.	EXPMORT
646	Average annual mortality of belowground carbon in sawtimber trees, in short tons, on timberland.	EXPMORT
647	Average annual mortality of merchantable bole carbon in trees (at least 5 inches d.b.h./d.r.c.), in short tons, on forest land.	EXPMORT
648	Average annual mortality of merchantable bole carbon in growing-stock trees (at least 5 inches d.b.h.), in short tons, on forest land.	EXPMORT
649	Average annual mortality of merchantable bole carbon in sawtimber trees, in short tons, on forest land.	EXPMORT
650	Average annual mortality of merchantable bole carbon in trees (at least 5 inches d.b.h./d.r.c.), in short tons, on timberland.	EXPMORT
651	Average annual mortality of merchantable bole carbon in growing-stock trees (at least 5 inches d.b.h.), in short tons, on timberland.	EXPMORT
652	Average annual mortality of merchantable bole carbon in sawtimber trees, in short tons, on timberland.	EXPMORT
653	Average annual mortality of sawlog carbon in sawtimber trees, in short tons, on forest land.	EXPMORT

Attribute Number (ATTRIBUTE_NBR)	Attribute Description (ATTRIBUTE_DESCR)	Evaluation Type (EVAL_TYP)
654	Average annual mortality of sawlog carbon in sawtimber trees, in short tons, on timberland.	EXPMORT
655	Average annual mortality of merchantable bole carbon above the sawlog of sawtimber trees, in short tons, on forest land.	EXPMORT
656	Average annual mortality of merchantable bole carbon above the sawlog of sawtimber trees, in short tons, on timberland.	EXPMORT
657	Average annual mortality of stump carbon in trees (at least 5 inches d.b.h./d.r.c.), in short tons, on forest land.	EXPMORT
658	Average annual mortality of stump carbon in growing-stock trees (at least 5 inches d.b.h.), in short tons, on forest land.	EXPMORT
659	Average annual mortality of stump carbon in sawtimber trees, in short tons, on forest land.	EXPMORT
660	Average annual mortality of stump carbon in trees (at least 5 inches d.b.h./d.r.c.), in short tons, on timberland.	EXPMORT
661	Average annual mortality of stump carbon in growing-stock trees (at least 5 inches d.b.h.), in short tons, on timberland.	EXPMORT
662	Average annual mortality of stump carbon in sawtimber trees, in short tons, on timberland.	EXPMORT
663	Average annual mortality of top and limb carbon in trees (at least 5 inches d.b.h./d.r.c.), in short tons, on forest land.	EXPMORT
664	Average annual mortality of top and limb carbon in growing-stock trees (at least 5 inches d.b.h.), in short tons, on forest land.	EXPMORT
665	Average annual mortality of top and limb carbon in sawtimber trees, in short tons, on forest land.	EXPMORT
666	Average annual mortality of top and limb carbon in trees (at least 5 inches d.b.h./d.r.c.), in short tons, on timberland.	EXPMORT
667	Average annual mortality of top and limb carbon in growing-stock trees (at least 5 inches d.b.h.), in short tons, on timberland.	EXPMORT
668	Average annual mortality of top and limb carbon in sawtimber trees, in short tons, on timberland.	EXPMORT

Attribute Number (ATTRIBUTE_NBR)	Attribute Description (ATTRIBUTE_DESCR)	Evaluation Type (EVAL_TYP)
669	Average annual removals of aboveground carbon in trees (at least 1 inches d.b.h./d.r.c.), in short tons, on forest land.	EXPREMV
670	Average annual removals of aboveground carbon in growing-stock trees (at least 5 inches d.b.h.), in short tons, on forest land.	EXPREMV
671	Average annual removals of aboveground carbon in sawtimber trees, in short tons, on forest land.	EXPREMV
672	Average annual removals of aboveground carbon in trees (at least 1 inches d.b.h./d.r.c.), in short tons, on timberland.	EXPREMV
673	Average annual removals of aboveground carbon in growing-stock trees (at least 5 inches d.b.h.), in short tons, on timberland.	EXPREMV
674	Average annual removals of aboveground carbon in sawtimber trees, in short tons, on timberland.	EXPREMV
675	Average annual removals of belowground carbon in trees (at least 1 inches d.b.h./d.r.c.), in short tons, on forest land.	EXPREMV
676	Average annual removals of belowground carbon in growing-stock trees (at least 5 inches d.b.h.), in short tons, on forest land.	EXPREMV
677	Average annual removals of belowground carbon in sawtimber trees, in short tons, on forest land.	EXPREMV
678	Average annual removals of belowground carbon in trees (at least 1 inches d.b.h./d.r.c.), in short tons, on timberland.	EXPREMV
679	Average annual removals of belowground carbon in growing-stock trees (at least 5 inches d.b.h.), in short tons, on timberland.	EXPREMV
680	Average annual removals of belowground carbon in sawtimber trees, in short tons, on timberland.	EXPREMV
681	Average annual removals of merchantable bole carbon in trees (at least 5 inches d.b.h./d.r.c.), in short tons, on forest land.	EXPREMV
682	Average annual removals of merchantable bole carbon in growing-stock trees (at least 5 inches d.b.h.), in short tons, on forest land.	EXPREMV
683	Average annual removals of merchantable bole carbon in sawtimber trees, in short tons, on forest land.	EXPREMV

Attribute Number (ATTRIBUTE_NBR)	Attribute Description (ATTRIBUTE_DESCR)	Evaluation Type (EVAL_TYP)
684	Average annual removals of merchantable bole carbon in trees (at least 5 inches d.b.h./d.r.c.), in short tons, on timberland.	EXPREMV
685	Average annual removals of merchantable bole carbon in growing-stock trees (at least 5 inches d.b.h.), in short tons, on timberland.	EXPREMV
686	Average annual removals of merchantable bole carbon in sawtimber trees, in short tons, on timberland.	EXPREMV
687	Average annual removals of sawlog carbon in sawtimber trees, in short tons, on forest land.	EXPREMV
688	Average annual removals of sawlog carbon in sawtimber trees, in short tons, on timberland.	EXPREMV
689	Average annual removals of merchantable bole carbon above the sawlog of sawtimber trees, in short tons, on forest land.	EXPREMV
690	Average annual removals of merchantable bole carbon above the sawlog of sawtimber trees, in short tons, on timberland.	EXPREMV
691	Average annual removals of stump carbon in trees (at least 5 inches d.b.h./d.r.c.), in short tons, on forest land.	EXPREMV
692	Average annual removals of stump carbon in growing-stock trees (at least 5 inches d.b.h.), in short tons, on forest land.	EXPREMV
693	Average annual removals of stump carbon in sawtimber trees, in short tons, on forest land.	EXPREMV
694	Average annual removals of stump carbon in trees (at least 5 inches d.b.h./d.r.c.), in short tons, on timberland.	EXPREMV
695	Average annual removals of stump carbon in growing-stock trees (at least 5 inches d.b.h.), in short tons, on timberland.	EXPREMV
696	Average annual removals of stump carbon in sawtimber trees, in short tons, on timberland.	EXPREMV
697	Average annual removals of top and limb carbon in trees (at least 5 inches d.b.h./d.r.c.), in short tons, on forest land.	EXPREMV
698	Average annual removals of top and limb carbon in growing-stock trees (at least 5 inches d.b.h.), in short tons, on forest land.	EXPREMV

Attribute Number (ATTRIBUTE_NBR)	Attribute Description (ATTRIBUTE_DESCR)	Evaluation Type (EVAL_TYP)
699	Average annual removals of top and limb carbon in sawtimber trees, in short tons, on forest land.	EXPREMV
700	Average annual removals of top and limb carbon in trees (at least 5 inches d.b.h./d.r.c.), in short tons, on timberland.	EXPREMV
701	Average annual removals of top and limb carbon in growing-stock trees (at least 5 inches d.b.h.), in short tons, on timberland.	EXPREMV
702	Average annual removals of top and limb carbon in sawtimber trees, in short tons, on timberland.	EXPREMV
703	Average annual harvest removals of aboveground carbon in trees (at least 1 inches d.b.h./d.r.c.), in short tons, on forest land.	EXPREMV
704	Average annual harvest removals of aboveground carbon in growing-stock trees (at least 5 inches d.b.h.), in short tons, on forest land.	EXPREMV
705	Average annual harvest removals of aboveground carbon in sawtimber trees, in short tons, on forest land.	EXPREMV
706	Average annual harvest removals of aboveground carbon in trees (at least 1 inches d.b.h./d.r.c.), in short tons, on timberland.	EXPREMV
707	Average annual harvest removals of aboveground carbon in growing-stock trees (at least 5 inches d.b.h.), in short tons, on timberland.	EXPREMV
708	Average annual harvest removals of aboveground carbon in sawtimber trees , in short tons, on timberland.	EXPREMV
709	Average annual harvest removals of belowground carbon in trees (at least 1 inches d.b.h./d.r.c.), in short tons, on forest land.	EXPREMV
710	Average annual harvest removals of belowground carbon in growing-stock trees (at least 5 inches d.b.h.), in short tons, on forest land.	EXPREMV
711	Average annual harvest removals of belowground carbon in sawtimber trees, in short tons, on forest land.	EXPREMV

Attribute Number (ATTRIBUTE_NBR)	Attribute Description (ATTRIBUTE_DESCR)	Evaluation Type (EVAL_TYP)
712	Average annual harvest removals of belowground carbon in trees (at least 1 inches d.b.h./d.r.c.), in short tons, on timberland.	EXPREMV
713	Average annual harvest removals of belowground carbon in growing-stock trees (at least 5 inches d.b.h.), in short tons, on timberland.	EXPREMV
714	Average annual harvest removals of belowground carbon in sawtimber trees, in short tons, on timberland.	EXPREMV
715	Average annual harvest removals of merchantable bole carbon in trees (at least 5 inches d.b.h./d.r.c.), in short tons, on forest land.	EXPREMV
716	Average annual harvest removals of merchantable bole carbon in growing-stock trees (at least 5 inches d.b.h.), in short tons, on forest land.	EXPREMV
717	Average annual harvest removals of merchantable bole carbon in trees (at least 5 inches d.b.h./d.r.c.), in short tons, on timberland.	EXPREMV
718	Average annual harvest removals of merchantable bole carbon in growing-stock trees (at least 5 inches d.b.h.), in short tons, on timberland.	EXPREMV
719	Average annual harvest removals of merchantable bole carbon in sawtimber trees, in short tons, on timberland.	EXPREMV
720	Average annual harvest removals of sawlog carbon in sawtimber trees, in short tons, on forest land.	EXPREMV
721	Average annual harvest removals of sawlog carbon in sawtimber trees, in short tons, on timberland.	EXPREMV
722	Average annual harvest removals of merchantable bole carbon in sawtimber trees, in short tons, on forest land.	EXPREMV
723	Average annual harvest removals of merchantable bole carbon above the sawlog of sawtimber trees, in short tons, on forest land.	EXPREMV
724	Average annual harvest removals of merchantable bole carbon above the sawlog of sawtimber trees, in short tons, on timberland.	EXPREMV

Attribute Number (ATTRIBUTE_NBR)	Attribute Description (ATTRIBUTE_DESCR)	Evaluation Type (EVAL_TYP)
725	Average annual harvest removals of stump carbon in trees (at least 5 inches d.b.h./d.r.c.), in short tons, on forest land.	EXPREMV
726	Average annual harvest removals of stump carbon in growing-stock trees (at least 5 inches d.b.h.), in short tons, on forest land.	EXPREMV
727	Average annual harvest removals of stump carbon in sawtimber trees, in short tons, on forest land.	EXPREMV
728	Average annual harvest removals of stump carbon in trees (at least 5 inches d.b.h./d.r.c.), in short tons, on timberland.	EXPREMV
729	Average annual harvest removals of stump carbon in growing-stock trees (at least 5 inches d.b.h.), in short tons, on timberland.	EXPREMV
730	Average annual harvest removals of stump carbon in sawtimber trees, in short tons, on timberland.	EXPREMV
731	Average annual harvest removals of top and limb carbon in trees (at least 5 inches d.b.h./d.r.c.), in short tons, on forest land.	EXPREMV
732	Average annual harvest removals of top and limb carbon in growing-stock trees (at least 5 inches d.b.h.), in short tons, on forest land.	EXPREMV
733	Average annual harvest removals of top and limb carbon in sawtimber trees, in short tons, on forest land.	EXPREMV
734	Average annual harvest removals of top and limb carbon in trees (at least 5 inches d.b.h./d.r.c.), in short tons, on timberland.	EXPREMV
735	Average annual harvest removals of top and limb carbon in growing-stock trees (at least 5 inches d.b.h.), in short tons, on timberland.	EXPREMV
736	Average annual harvest removals of top and limb carbon in sawtimber trees, in short tons, on timberland.	EXPREMV
737	Average annual other removals of aboveground carbon in trees (at least 1 inches d.b.h./d.r.c.), in short tons, on forest land.	EXPREMV
738	Average annual other removals of aboveground carbon in growing-stock trees (at least 5 inches d.b.h.), in short tons, on forest land.	EXPREMV

Attribute Number (ATTRIBUTE_NBR)	Attribute Description (ATTRIBUTE_DESCR)	Evaluation Type (EVAL_TYP)
739	Average annual other removals of aboveground carbon in sawtimber trees, in short tons, on forest land.	EXPREMV
740	Average annual other removals of aboveground carbon in trees (at least 1 inches d.b.h./d.r.c.), in short tons, on timberland.	EXPREMV
741	Average annual other removals of aboveground carbon in growing-stock trees (at least 5 inches d.b.h.), in short tons, on timberland.	EXPREMV
742	Average annual other removals of aboveground carbon in sawtimber trees, in short tons, on timberland.	EXPREMV
743	Average annual other removals of belowground carbon in trees (at least 1 inches d.b.h./d.r.c.), in short tons, on forest land.	EXPREMV
744	Average annual other removals of belowground carbon in growing-stock trees (at least 5 inches d.b.h.), in short tons, on forest land.	EXPREMV
745	Average annual other removals of belowground carbon in sawtimber trees, in short tons, on forest land.	EXPREMV
746	Average annual other removals of belowground carbon in trees (at least 1 inches d.b.h./d.r.c.), in short tons, on timberland.	EXPREMV
747	Average annual other removals of belowground carbon in growing-stock trees (at least 5 inches d.b.h.), in short tons, on timberland.	EXPREMV
748	Average annual other removals of belowground carbon in sawtimber trees, in short tons, on timberland.	EXPREMV
749	Average annual other removals of merchantable bole carbon in trees (at least 5 inches d.b.h./d.r.c.), in short tons, on forest land.	EXPREMV
750	Average annual other removals of merchantable bole carbon in growing-stock trees (at least 5 inches d.b.h.), in short tons, on forest land.	EXPREMV

Attribute Number (ATTRIBUTE_NBR)	Attribute Description (ATTRIBUTE_DESCR)	Evaluation Type (EVAL_TYP)
751	Average annual other removals of merchantable bole carbon in trees (at least 5 inches d.b.h./d.r.c.), in short tons, on timberland.	EXPREMV
752	Average annual other removals of merchantable bole carbon in growing-stock trees (at least 5 inches d.b.h.), in short tons, on timberland.	EXPREMV
753	Average annual other removals of merchantable bole carbon in sawtimber trees, in short tons, on forest land.	EXPREMV
754	Average annual other removals of merchantable bole carbon in sawtimber trees, in short tons, on timberland.	EXPREMV
755	Average annual other removals of sawlog carbon in sawtimber trees, in short tons, on forest land.	EXPREMV
756	Average annual other removals of sawlog carbon in sawtimber trees, in short tons, on timberland.	EXPREMV
757	Average annual other removals of merchantable bole carbon above the sawlog of sawtimber trees, in short tons, on forest land.	EXPREMV
758	Average annual other removals of merchantable bole carbon above the sawlog of sawtimber trees, in short tons, on timberland.	EXPREMV
759	Average annual other removals of stump carbon in trees (at least 5 inches d.b.h./d.r.c.), in short tons, on forest land.	EXPREMV
760	Average annual other removals of stump carbon in growing-stock trees (at least 5 inches d.b.h.), in short tons, on forest land.	EXPREMV
761	Average annual other removals of stump carbon in sawtimber trees, in short tons, on forest land.	EXPREMV
762	Average annual other removals of stump carbon in trees (at least 5 inches d.b.h./d.r.c.), in short tons, on timberland.	EXPREMV
763	Average annual other removals of stump carbon in growing-stock trees (at least 5 inches d.b.h.), in short tons, on timberland.	EXPREMV
764	Average annual other removals of stump carbon in sawtimber trees, in short tons, on timberland.	EXPREMV

Attribute Number (ATTRIBUTE_NBR)	Attribute Description (ATTRIBUTE_DESCR)	Evaluation Type (EVAL_TYP)
765	Average annual other removals of top and limb carbon in trees (at least 5 inches d.b.h./d.r.c.), in short tons, on forest land.	EXPREMV
766	Average annual other removals of top and limb carbon in growing-stock trees (at least 5 inches d.b.h.), in short tons, on forest land.	EXPREMV
767	Average annual other removals of top and limb carbon in sawtimber trees, in short tons, on forest land.	EXPREMV
768	Average annual other removals of top and limb carbon in trees (at least 5 inches d.b.h./d.r.c.), in short tons, on timberland.	EXPREMV
769	Average annual other removals of top and limb carbon in growing-stock trees (at least 5 inches d.b.h.), in short tons, on timberland.	EXPREMV
770	Average annual other removals of top and limb carbon in sawtimber trees, in short tons, on timberland.	EXPREMV
901	Average annual mortality of trees (at least 5 inches d.b.h./d.r.c.), in trees, on forest land.	EXPMORT
902	Average annual mortality of growing-stock trees (at least 5 inches d.b.h.), in trees, on forest land.	EXPMORT
903	Average annual mortality of sawtimber trees, in trees, on forest land.	EXPMORT
904	Average annual mortality of trees (at least 5 inches d.b.h./d.r.c.), in trees, on timberland.	EXPMORT
905	Average annual mortality of growing-stock trees (at least 5 inches d.b.h.), in trees, on timberland.	EXPMORT
906	Average annual mortality of sawtimber trees, in trees, on timberland.	EXPMORT
907	Average annual removals of trees (at least 5 inches d.b.h./d.r.c.), in trees, on forest land.	EXPREMV
908	Average annual removals of growing-stock trees (at least 5 inches d.b.h.), in trees, on forest land.	EXPREMV
909	Average annual removals of sawtimber trees, in trees, on forest land.	EXPREMV
910	Average annual removals of trees (at least 5 inches d.b.h./d.r.c.), in trees, on timberland.	EXPREMV

Attribute Number (ATTRIBUTE_NBR)	Attribute Description (ATTRIBUTE_DESCR)	Evaluation Type (EVAL_TYP)
911	Average annual removals of growing-stock trees (at least 5 inches d.b.h.), in trees, on timberland.	EXPREMV
912	Average annual removals of sawtimber trees, in trees, on timberland.	EXPREMV
913	Average annual harvest removals of trees (at least 5 inches d.b.h./d.r.c.), in trees, on forest land.	EXPREMV
914	Average annual harvest removals of growing-stock trees (at least 5 inches d.b.h.), in trees, on forest land.	EXPREMV
915	Average annual harvest removals of sawtimber trees, in trees, on forest land.	EXPREMV
916	Average annual harvest removals of trees (at least 5 inches d.b.h./d.r.c.), in trees, on timberland.	EXPREMV
917	Average annual harvest removals of growing-stock trees (at least 5 inches d.b.h.), in trees, on timberland.	EXPREMV
918	Average annual harvest removals of sawtimber trees, in trees, on timberland.	EXPREMV
919	Average annual other removals of trees (at least 5 inches d.b.h./d.r.c.), in trees, on forest land.	EXPREMV
920	Average annual other removals of growing-stock trees (at least 5 inches d.b.h.), in trees, on forest land.	EXPREMV
921	Average annual other removals of sawtimber trees, in trees, on forest land.	EXPREMV
922	Average annual other removals of trees (at least 5 inches d.b.h./d.r.c.), in trees, on timberland.	EXPREMV
923	Average annual other removals of growing-stock trees (at least 5 inches d.b.h.), in trees, on timberland.	EXPREMV
924	Average annual other removals of sawtimber trees, in trees, on timberland.	EXPREMV
1004	Basal area of live trees (at least 1 inch d.b.h./d.r.c.), in square feet, on forest land.	EXPVOL
1005	Basal area of growing-stock trees (at least 5 inches d.b.h.), in square feet, on forest land.	EXPVOL
1007	Basal area of live trees (at least 1 inch d.b.h./d.r.c.), in square feet, on timberland.	EXPVOL
1008	Basal area of growing-stock trees (at least 5 inches d.b.h.), in square feet, on timberland.	EXPVOL

Attribute Number (ATTRIBUTE_NBR)	Attribute Description (ATTRIBUTE_DESCR)	Evaluation Type (EVAL_TYP)
1201	Average annual gross growth of sound bole volume of trees (at least 5 inches d.b.h./d.r.c.), in cubic feet, on forest land.	EXPGROW
1202	Average annual gross growth of merchantable bole volume of growing-stock trees (at least 5 inches d.b.h.), in cubic feet, on forest land.	EXPGROW
1203	Average annual gross growth of sawlog volume of sawtimber trees, in board feet (International 1/4-inch rule), on forest land.	EXPGROW
1204	Average annual gross growth of sawlog volume of sawtimber trees, in cubic feet, on forest land.	EXPGROW
1205	Average annual gross growth of merchantable bole volume above the sawlog of sawtimber trees, in cubic feet, on forest land.	EXPGROW
1206	Average annual gross growth of merchantable bole volume of sawtimber trees, in cubic feet, on forest land.	EXPGROW
1207	Average annual gross growth of sound bole volume of trees (at least 5 inches d.b.h./d.r.c.), in cubic feet, on timberland.	EXPGROW
1208	Average annual gross growth of merchantable bole volume of growing-stock trees (at least 5 inches d.b.h.), in cubic feet, on timberland.	EXPGROW
1209	Average annual gross growth of sawlog volume of sawtimber trees, in board feet (International 1/4-inch rule), on timberland.	EXPGROW
1210	Average annual gross growth of sawlog volume of sawtimber trees, in cubic feet, on timberland.	EXPGROW
1211	Average annual gross growth of merchantable bole volume above the sawlog of sawtimber trees, in cubic feet, on timberland.	EXPGROW
1212	Average annual gross growth of merchantable bole volume of sawtimber trees, in cubic feet, on timberland.	EXPGROW
1301	Average annual gross growth of merchantable bole biomass of trees (at least 5 inches d.b.h./d.r.c.), in dry short tons, on forest land.	EXPGROW

Attribute Number (ATTRIBUTE_NBR)	Attribute Description (ATTRIBUTE_DESCR)	Evaluation Type (EVAL_TYP)
1302	Average annual gross growth of merchantable bole biomass of growing-stock trees (at least 5 inches d.b.h.), in dry short tons, on forest land.	EXPGROW
1303	Average annual gross growth of sawlog biomass of sawtimber trees, in dry short tons, on forest land.	EXPGROW
1304	Average annual gross growth of merchantable bole biomass above the sawlog of sawtimber trees, in dry short tons, on forest land.	EXPGROW
1305	Average annual gross growth of merchantable bole biomass of sawtimber trees, in dry short tons, on forest land.	EXPGROW
1306	Average annual gross growth of merchantable bole biomass of trees (at least 5 inches d.b.h./d.r.c.), in dry short tons, on timberland.	EXPGROW
1307	Average annual gross growth of merchantable bole biomass of growing-stock trees (at least 5 inches d.b.h.), in dry short tons, on timberland.	EXPGROW
1308	Average annual gross growth of sawlog biomass of sawtimber trees, in dry short tons, on timberland.	EXPGROW
1309	Average annual gross growth of merchantable bole biomass above the sawlog of sawtimber trees, in dry short tons, on timberland.	EXPGROW
1310	Average annual gross growth of merchantable bole biomass of sawtimber trees, in dry short tons, on timberland.	EXPGROW
1311	Average annual gross growth of aboveground biomass of trees (at least 1 inches d.b.h./d.r.c.), in dry short tons, on forest land.	EXPGROW
1312	Average annual gross growth of aboveground biomass of growing-stock trees (at least 5 inches d.b.h.), in dry short tons, on forest land.	EXPGROW
1313	Average annual gross growth of aboveground biomass of sawtimber trees, in dry short tons, on forest land.	EXPGROW
1314	Average annual gross growth of aboveground biomass of trees (at least 1 inches d.b.h./d.r.c.), in dry short tons, on timberland.	EXPGROW

Attribute Number (ATTRIBUTE_NBR)	Attribute Description (ATTRIBUTE_DESCR)	Evaluation Type (EVAL_TYP)
1315	Average annual gross growth of aboveground biomass of growing-stock trees (at least 5 inches d.b.h.), in dry short tons, on timberland.	EXPGROW
1316	Average annual gross growth of aboveground biomass of sawtimber trees, in dry short tons, on timberland.	EXPGROW
1317	Average annual gross growth of belowground biomass of trees (at least 1 inches d.b.h./d.r.c.), in dry short tons, on forest land.	EXPGROW
1318	Average annual gross growth of belowground biomass of growing-stock trees (at least 5 inches d.b.h.), in dry short tons, on forest land.	EXPGROW
1319	Average annual gross growth of belowground biomass of sawtimber trees, in dry short tons, on forest land.	EXPGROW
1320	Average annual gross growth of belowground biomass of trees (at least 1 inches d.b.h./d.r.c.), in dry short tons, on timberland.	EXPGROW
1321	Average annual gross growth of belowground biomass of growing-stock trees (at least 5 inches d.b.h.), in dry short tons, on timberland.	EXPGROW
1322	Average annual gross growth of belowground biomass of sawtimber trees, in dry short tons, on timberland.	EXPGROW
1323	Average annual gross growth of stump biomass of trees (at least 5 inches d.b.h./d.r.c.), in dry short tons, on forest land.	EXPGROW
1324	Average annual gross growth of stump biomass of growing-stock trees (at least 5 inches d.b.h.), in dry short tons, on forest land.	EXPGROW
1325	Average annual gross growth of stump biomass of sawtimber trees, in dry short tons, on forest land.	EXPGROW
1326	Average annual gross growth of stump biomass of trees (at least 5 inches d.b.h./d.r.c.), in dry short tons, on timberland.	EXPGROW

Attribute Number (ATTRIBUTE_NBR)	Attribute Description (ATTRIBUTE_DESCR)	Evaluation Type (EVAL_TYP)
1327	Average annual gross growth of stump biomass of growing-stock trees (at least 5 inches d.b.h.), in dry short tons, on timberland.	EXPGROW
1328	Average annual gross growth of stump biomass of sawtimber trees, in dry short tons, on timberland.	EXPGROW
1329	Average annual gross growth of top and limb biomass of trees (at least 5 inches d.b.h./d.r.c.), in dry short tons, on forest land.	EXPGROW
1330	Average annual gross growth of top and limb biomass of growing-stock trees (at least 5 inches d.b.h.), in dry short tons, on forest land.	EXPGROW
1331	Average annual gross growth of top and limb biomass of sawtimber trees, in dry short tons, on forest land.	EXPGROW
1332	Average annual gross growth of top and limb biomass of trees (at least 5 inches d.b.h./d.r.c.), in dry short tons, on timberland.	EXPGROW
1333	Average annual gross growth of top and limb biomass of growing-stock trees (at least 5 inches d.b.h.), in dry short tons, on timberland.	EXPGROW
1334	Average annual gross growth of top and limb biomass of sawtimber trees, in dry short tons, on timberland.	EXPGROW
1601	Average annual gross growth of merchantable bole carbon in trees (at least 5 inches d.b.h./d.r.c.), in short tons, on forest land.	EXPGROW
1602	Average annual gross growth of merchantable bole carbon in growing-stock trees (at least 5 inches d.b.h.), in short tons, on forest land.	EXPGROW
1603	Average annual gross growth of sawlog carbon in sawtimber trees, in short tons, on forest land.	EXPGROW
1604	Average annual gross growth of merchantable bole carbon above the sawlog of sawtimber trees, in short tons, on forest land.	EXPGROW
1605	Average annual gross growth of merchantable bole carbon in sawtimber trees, in short tons, on forest land.	EXPGROW

Attribute Number (ATTRIBUTE_NBR)	Attribute Description (ATTRIBUTE_DESCR)	Evaluation Type (EVAL_TYP)
1606	Average annual gross growth of merchantable bole carbon in trees (at least 5 inches d.b.h./d.r.c.), in short tons, on timberland.	EXPGROW
1607	Average annual gross growth of merchantable bole carbon in growing-stock trees (at least 5 inches d.b.h.), in short tons, on timberland.	EXPGROW
1608	Average annual gross growth of sawlog carbon in sawtimber trees, in short tons, on timberland.	EXPGROW
1609	Average annual gross growth of merchantable bole carbon above the sawlog of sawtimber trees, in short tons, on timberland.	EXPGROW
1610	Average annual gross growth of merchantable bole carbon in sawtimber trees, in short tons, on timberland.	EXPGROW
1611	Average annual gross growth of aboveground carbon in trees (at least 1 inches d.b.h./d.r.c.), in short tons, on forest land.	EXPGROW
1612	Average annual gross growth of aboveground carbon in growing-stock trees (at least 5 inches d.b.h.), in short tons, on forest land.	EXPGROW
1613	Average annual gross growth of aboveground carbon in sawtimber trees, in short tons, on forest land.	EXPGROW
1614	Average annual gross growth of aboveground carbon in trees (at least 1 inches d.b.h./d.r.c.), in short tons, on timberland.	EXPGROW
1615	Average annual gross growth of aboveground carbon in growing-stock trees (at least 5 inches d.b.h.), in short tons, on timberland.	EXPGROW
1616	Average annual gross growth of aboveground carbon in sawtimber trees, in short tons, on timberland.	EXPGROW
1617	Average annual gross growth of belowground carbon in trees (at least 1 inches d.b.h./d.r.c.), in short tons, on forest land.	EXPGROW

Attribute Number (ATTRIBUTE_NBR)	Attribute Description (ATTRIBUTE_DESCR)	Evaluation Type (EVAL_TYP)
1618	Average annual gross growth of belowground carbon in growing-stock trees (at least 5 inches d.b.h.), in short tons, on forest land.	EXPGROW
1619	Average annual gross growth of belowground carbon in sawtimber trees, in short tons, on forest land.	EXPGROW
1620	Average annual gross growth of belowground carbon in trees (at least 1 inch d.b.h./d.r.c.), in short tons, on timberland.	EXPGROW
1621	Average annual gross growth of belowground carbon in growing-stock trees (at least 5 inches d.b.h.), in short tons, on timberland.	EXPGROW
1622	Average annual gross growth of belowground carbon of sawtimber trees, in short tons, on timberland.	EXPGROW
1623	Average annual gross growth of stump carbon in trees (at least 5 inches d.b.h./d.r.c.), in short tons, on forest land.	EXPGROW
1624	Average annual gross growth of stump carbon in growing-stock trees (at least 5 inches d.b.h.), in short tons, on forest land.	EXPGROW
1625	Average annual gross growth of stump carbon in sawtimber trees, in short tons, on forest land.	EXPGROW
1626	Average annual gross growth of stump carbon in trees (at least 5 inches d.b.h./d.r.c.), in short tons, on timberland.	EXPGROW
1627	Average annual gross growth of stump carbon in growing-stock trees (at least 5 inches d.b.h.), in short tons, on timberland.	EXPGROW
1628	Average annual gross growth of stump carbon in sawtimber trees, in short tons, on timberland.	EXPGROW
1629	Average annual gross growth of top and limb carbon in trees (at least 5 inches d.b.h./d.r.c.), in short tons, on forest land.	EXPGROW
1630	Average annual gross growth of top and limb carbon in growing-stock trees (at least 5 inches d.b.h.), in short tons, on forest land.	EXPGROW
1631	Average annual gross growth of top and limb carbon in sawtimber trees, in short tons, on forest land.	EXPGROW

Attribute Number (ATTRIBUTE_NBR)	Attribute Description (ATTRIBUTE_DESCR)	Evaluation Type (EVAL_TYP)
1632	Average annual gross growth of top and limb carbon in trees (at least 5 inches d.b.h./d.r.c.), in short tons, on timberland.	EXPGROW
1633	Average annual gross growth of top and limb carbon in growing-stock trees (at least 5 inches d.b.h.), in short tons, on timberland.	EXPGROW
1634	Average annual gross growth of top and limb carbon in sawtimber trees, in short tons, on timberland.	EXPGROW
2201	Average annual net change of sound bole volume of trees (at least 5 inches d.b.h./d.r.c.), in cubic feet, on forest land.	EXPGROW
2202	Average annual net change of merchantable bole volume of growing-stock trees (at least 5 inches d.b.h.), in cubic feet, on forest land.	EXPGROW
2203	Average annual net change of sawlog volume of sawtimber trees, in board feet (International 1/4-inch rule), on forest land.	EXPGROW
2204	Average annual net change of sawlog volume of sawtimber trees, in cubic feet, on forest land.	EXPGROW
2205	Average annual net change of merchantable bole volume above the sawlog of sawtimber trees, in cubic feet, on forest land.	EXPGROW
2206	Average annual net change of merchantable bole volume of sawtimber trees, in cubic feet, on forest land.	EXPGROW
2207	Average annual net change of sound bole volume of trees (at least 5 inches d.b.h./d.r.c.), in cubic feet, on timberland.	EXPGROW
2208	Average annual net change of merchantable bole volume of growing-stock trees (at least 5 inches d.b.h.), in cubic feet, on timberland.	EXPGROW
2209	Average annual net change of sawlog volume of sawtimber trees, in board feet (International 1/4-inch rule), on timberland.	EXPGROW
2210	Average annual net change of sawlog volume of sawtimber trees, in cubic feet, on timberland.	EXPGROW
2211	Average annual net change of merchantable bole volume above the sawlog of sawtimber trees, in cubic feet, on timberland.	EXPGROW

Attribute Number (ATTRIBUTE_NBR)	Attribute Description (ATTRIBUTE_DESCR)	Evaluation Type (EVAL_TYP)
2212	Average annual net change of merchantable bole volume of sawtimber trees, in cubic feet, on timberland.	EXPGROW
2301	Average annual net change of merchantable bole biomass of trees (at least 5 inches d.b.h./d.r.c.), in dry short tons, on forest land.	EXPGROW
2302	Average annual net change of merchantable bole biomass of growing-stock trees (at least 5 inches d.b.h.), in dry short tons, on forest land.	EXPGROW
2303	Average annual net change of sawlog biomass of sawtimber trees, in dry short tons, on forest land.	EXPGROW
2304	Average annual net change of merchantable bole biomass above the sawlog of sawtimber trees, in dry short tons, on forest land.	EXPGROW
2305	Average annual net change of merchantable bole biomass of sawtimber trees, in dry short tons, on forest land.	EXPGROW
2306	Average annual net change of merchantable bole biomass of trees (at least 5 inches d.b.h./d.r.c.), in dry short tons, on timberland.	EXPGROW
2307	Average annual net change of merchantable bole biomass of growing-stock trees (at least 5 inches d.b.h.), in dry short tons, on timberland.	EXPGROW
2308	Average annual net change of sawlog biomass of sawtimber trees, in dry short tons, on timberland.	EXPGROW
2309	Average annual net change of merchantable bole biomass above the sawlog of sawtimber trees, in dry short tons, on timberland.	EXPGROW
2310	Average annual net change of merchantable bole biomass of sawtimber trees, in dry short tons, on timberland.	EXPGROW
2311	Average annual net change of aboveground biomass of trees (at least 1 inches d.b.h./d.r.c.), in dry short tons, on forest land.	EXPGROW
2312	Average annual net change of aboveground biomass of growing-stock trees (at least 5 inches d.b.h.), in dry short tons, on forest land.	EXPGROW

Attribute Number (ATTRIBUTE_NBR)	Attribute Description (ATTRIBUTE_DESCR)	Evaluation Type (EVAL_TYP)
2313	Average annual net change of aboveground biomass of sawtimber trees, in dry short tons, on forest land.	EXPGROW
2314	Average annual net change of aboveground biomass of trees (at least 1 inches d.b.h./d.r.c.), in dry short tons, on timberland.	EXPGROW
2315	Average annual net change of aboveground biomass of growing-stock trees (at least 5 inches d.b.h.), in dry short tons, on timberland.	EXPGROW
2316	Average annual net change of aboveground biomass of sawtimber trees, in dry short tons, on timberland.	EXPGROW
2317	Average annual net change of belowground biomass of trees (at least 1 inches d.b.h./d.r.c.), in dry short tons, on forest land.	EXPGROW
2318	Average annual net change of belowground biomass of growing-stock trees (at least 5 inches d.b.h.), in dry short tons, on forest land.	EXPGROW
2319	Average annual net change of belowground biomass of sawtimber trees, in dry short tons, on forest land.	EXPGROW
2320	Average annual net change of belowground biomass of trees (at least 1 inches d.b.h./d.r.c.), in dry short tons, on timberland.	EXPGROW
2321	Average annual net change of belowground biomass of growing-stock trees (at least 5 inches d.b.h.), in dry short tons, on timberland.	EXPGROW
2322	Average annual net change of belowground biomass of sawtimber trees, in dry short tons, on timberland.	EXPGROW
2323	Average annual net change of stump biomass of trees (at least 5 inches d.b.h./d.r.c.), in dry short tons, on forest land.	EXPGROW
2324	Average annual net change of stump biomass of growing-stock trees (at least 5 inches d.b.h.), in dry short tons, on forest land.	EXPGROW
2325	Average annual net change of stump biomass of sawtimber trees, in dry short tons, on forest land.	EXPGROW

Attribute Number (ATTRIBUTE_NBR)	Attribute Description (ATTRIBUTE_DESCR)	Evaluation Type (EVAL_TYP)
2326	Average annual net change of stump biomass of trees (at least 5 inches d.b.h./d.r.c.), in dry short tons, on timberland.	EXPGROW
2327	Average annual net change of stump biomass of growing-stock trees (at least 5 inches d.b.h.), in dry short tons, on timberland.	EXPGROW
2328	Average annual net change of stump biomass of sawtimber trees, in dry short tons, on timberland.	EXPGROW
2329	Average annual net change of top and limb biomass of trees (at least 5 inches d.b.h./d.r.c.), in dry short tons, on forest land.	EXPGROW
2330	Average annual net change of top and limb biomass of growing-stock trees (at least 5 inches d.b.h.), in dry short tons, on forest land.	EXPGROW
2331	Average annual net change of top and limb biomass of sawtimber trees, in dry short tons, on forest land.	EXPGROW
2332	Average annual net change of top and limb biomass of trees (at least 5 inches d.b.h./d.r.c.), in dry short tons, on timberland.	EXPGROW
2333	Average annual net change of top and limb biomass of growing-stock trees (at least 5 inches d.b.h.), in dry short tons, on timberland.	EXPGROW
2334	Average annual net change of top and limb biomass of sawtimber trees, in dry short tons, on timberland.	EXPGROW
2601	Average annual net change of merchantable bole carbon in trees (at least 5 inches d.b.h./d.r.c.), in short tons, on forest land.	EXPGROW
2602	Average annual net change of merchantable bole carbon in growing-stock trees (at least 5 inches d.b.h.), in short tons, on forest land.	EXPGROW
2603	Average annual net change of sawlog carbon in sawtimber trees, in short tons, on forest land.	EXPGROW
2604	Average annual net change of merchantable bole carbon above the sawlog of sawtimber trees, in short tons, on forest land.	EXPGROW

Attribute Number (ATTRIBUTE_NBR)	Attribute Description (ATTRIBUTE_DESCR)	Evaluation Type (EVAL_TYP)
2605	Average annual net change of merchantable bole carbon in sawtimber trees, in short tons, on forest land.	EXPGROW
2606	Average annual net change of merchantable bole carbon in trees (at least 5 inches d.b.h./d.r.c.), in short tons, on timberland.	EXPGROW
2607	Average annual net change of merchantable bole carbon in growing-stock trees (at least 5 inches d.b.h.), in short tons, on timberland.	EXPGROW
2608	Average annual net change of sawlog carbon in sawtimber trees, in short tons, on timberland.	EXPGROW
2609	Average annual net change of merchantable bole carbon above the sawlog of sawtimber trees, in short tons, on timberland.	EXPGROW
2610	Average annual net change of merchantable bole carbon in sawtimber trees, in short tons, on timberland.	EXPGROW
2611	Average annual net change of aboveground carbon in trees (at least 1 inches d.b.h./d.r.c.), in short tons, on forest land.	EXPGROW
2612	Average annual net change of aboveground carbon in growing-stock trees (at least 5 inches d.b.h.), in short tons, on forest land.	EXPGROW
2613	Average annual net change of aboveground carbon in sawtimber trees, in short tons, on forest land.	EXPGROW
2614	Average annual net change of aboveground carbon in trees (at least 1 inches d.b.h./d.r.c.), in short tons, on timberland.	EXPGROW
2615	Average annual net change of aboveground carbon in growing-stock trees (at least 5 inches d.b.h.), in short tons, on timberland.	EXPGROW
2616	Average annual net change of aboveground carbon in sawtimber trees, in short tons, on timberland.	EXPGROW
2617	Average annual net change of belowground carbon in trees (at least 1 inches d.b.h./d.r.c.), in short tons, on forest land.	EXPGROW
2618	Average annual net change of belowground carbon in growing-stock trees (at least 5 inches d.b.h.), in short tons, on forest land.	EXPGROW
2619	Average annual net change of belowground carbon in sawtimber trees, in short tons, on forest land.	EXPGROW

Attribute Number (ATTRIBUTE_NBR)	Attribute Description (ATTRIBUTE_DESCR)	Evaluation Type (EVAL_TYP)
2620	Average annual net change of belowground carbon in trees (at least 1 inches d.b.h./d.r.c.), in short tons, on timberland.	EXPGROW
2621	Average annual net change of belowground carbon in growing-stock trees (at least 5 inches d.b.h.), in short tons, on timberland.	EXPGROW
2622	Average annual net change of belowground carbon in sawtimber trees, in short tons, on timberland.	EXPGROW
2623	Average annual net change of stump carbon in trees (at least 5 inches d.b.h./d.r.c.), in short tons, on forest land.	EXPGROW
2624	Average annual net change of stump carbon in growing-stock trees (at least 5 inches d.b.h.), in short tons, on forest land.	EXPGROW
2625	Average annual net change of stump carbon in sawtimber trees, in short tons, on forest land.	EXPGROW
2626	Average annual net change of stump carbon in trees (at least 5 inches d.b.h./d.r.c.), in short tons, on timberland.	EXPGROW
2627	Average annual net change of stump carbon in growing-stock trees (at least 5 inches d.b.h.), in short tons, on timberland.	EXPGROW
2628	Average annual net change of stump carbon in sawtimber trees, in short tons, on timberland.	EXPGROW
2629	Average annual net change of top and limb carbon in trees (at least 5 inches d.b.h./d.r.c.), in short tons, on forest land.	EXPGROW
2630	Average annual net change of top and limb carbon in growing-stock trees (at least 5 inches d.b.h.), in short tons, on forest land.	EXPGROW
2631	Average annual net change of top and limb carbon in sawtimber trees, in short tons, on forest land.	EXPGROW
2632	Average annual net change of top and limb carbon in trees (at least 5 inches d.b.h./d.r.c.), in short tons, on timberland.	EXPGROW
2633	Average annual net change of top and limb carbon in growing-stock trees (at least 5 inches d.b.h.), in short tons, on timberland.	EXPGROW
2634	Average annual net change of top and limb carbon in sawtimber trees, in short tons, on timberland.	EXPGROW

Attribute Number (ATTRIBUTE_NBR)	Attribute Description (ATTRIBUTE_DESCR)	Evaluation Type (EVAL_TYP)
2635	Average annual net growth of aboveground biomass of trees (at least 5 inches d.b.h./d.r.c.), in dry short tons, on forest land.	EXPGROW
2636	Average annual net growth of aboveground biomass of trees (at least 5 inches d.b.h./d.r.c.), in dry short tons, on timberland.	EXPGROW
2637	Average annual mortality of aboveground biomass of trees (at least 5 inches d.b.h./d.r.c.), in dry short tons, on forest land.	EXPMORT
2638	Average annual mortality of aboveground biomass of trees (at least 5 inches d.b.h./d.r.c.), in dry short tons, on timberland.	EXPMORT
2639	Average annual net growth of belowground biomass of trees (at least 5 inches d.b.h./d.r.c.), in dry short tons, on forest land.	EXPGROW
2640	Average annual net growth of belowground biomass of trees (at least 5 inches d.b.h./d.r.c.), in dry short tons, on timberland.	EXPGROW
2641	Average annual mortality of belowground biomass of trees (at least 5 inches d.b.h./d.r.c.), in dry short tons, on forest land.	EXPMORT
2642	Average annual mortality of belowground biomass of trees (at least 5 inches d.b.h./d.r.c.), in dry short tons, on timberland.	EXPMORT
2643	Average annual net growth of aboveground carbon in trees (at least 5 inches d.b.h./d.r.c.), in short tons, on forest land.	EXPGROW
2644	Average annual harvest removals of belowground carbon in trees (at least 5 inches d.b.h./d.r.c.), in short tons, on forest land.	EXPREMV
2645	Average annual harvest removals of belowground carbon in trees (at least 5 inches d.b.h./d.r.c.), in short tons, on timberland.	EXPREMV
2646	Average annual net growth of aboveground carbon in trees (at least 5 inches d.b.h./d.r.c.), in short tons, on timberland.	EXPGROW

Attribute Number (ATTRIBUTE_NBR)	Attribute Description (ATTRIBUTE_DESCR)	Evaluation Type (EVAL_TYP)
2647	Average annual net growth of belowground carbon in trees (at least 5 inches d.b.h./d.r.c.), in short tons, on forest land.	EXPGROW
2648	Average annual net growth of belowground carbon in trees (at least 5 inches d.b.h./d.r.c.), in short tons, on timberland	EXPGROW
2649	Average annual harvest removals of aboveground biomass of trees (at least 5 inches d.b.h./d.r.c.), in dry short tons, on forest land.	EXPREMV
2650	Average annual harvest removals of aboveground biomass of trees (at least 5 inches d.b.h./d.r.c.), in dry short tons, on timberland.	EXPREMV
2651	Average annual harvest removals of belowground biomass of trees (at least 5 inches d.b.h./d.r.c.), in dry short tons, on forest land.	EXPREMV
2652	Average annual gross growth of aboveground biomass of trees (at least 5 inches d.b.h./d.r.c.), in dry short tons, on forest land.	EXPGROW
2653	Average annual gross growth of aboveground biomass of trees (at least 5 inches d.b.h./d.r.c.), in dry short tons, on timberland.	EXPGROW
2654	Average annual harvest removals of belowground biomass of trees (at least 5 inches d.b.h./d.r.c.), in dry short tons, on timberland.	EXPREMV
2655	Average annual other removals of aboveground carbon in trees (at least 5 inches d.b.h./d.r.c.), in short tons, on forest land.	EXPREMV
2656	Average annual other removals of aboveground carbon in trees (at least 5 inches d.b.h./d.r.c.), in short tons, on timberland.	EXPREMV
2657	Average annual other removals of belowground carbon in trees (at least 5 inches d.b.h./d.r.c.), in short tons, on forest land.	EXPREMV
2658	Average annual mortality of aboveground carbon in trees (at least 5 inches d.b.h./d.r.c.), in short tons, on forest land.	EXPMORT

Attribute Number (ATTRIBUTE_NBR)	Attribute Description (ATTRIBUTE_DESCR)	Evaluation Type (EVAL_TYP)
2659	Average annual mortality of aboveground carbon in trees (at least 5 inches d.b.h./d.r.c.), in short tons, on timberland.	EXPMORT
2660	Average annual other removals of belowground carbon in trees (at least 5 inches d.b.h./d.r.c.), in short tons, on timberland	EXPREMV
2661	Average annual gross growth of belowground biomass of trees (at least 5 inches d.b.h./d.r.c.), in dry short tons, on forest land.	EXPGROW
2662	Average annual gross growth of belowground biomass of trees (at least 5 inches d.b.h./d.r.c.), in dry short tons, on timberland.	EXPGROW
2663	Average annual mortality of belowground carbon in trees (at least 5 inches d.b.h./d.r.c.), in short tons, on forest land.	EXPMORT
2664	Average annual mortality in belowground carbon in trees (at least 5 inches d.b.h./d.r.c.), in short tons, on timberland.	EXPMORT
2665	Average annual other removals of aboveground biomass of trees (at least 5 inches d.b.h./d.r.c.), in dry short tons, on forest land.	EXPREMV
2666	Average annual gross growth of aboveground carbon in trees (at least 5 inches d.b.h./d.r.c.), in short tons, on forest land.	EXPGROW
2667	Average annual other removals of aboveground biomass of trees (at least 5 inches d.b.h./d.r.c.), in dry short tons, on timberland	EXPREMV
2668	Average annual other removals of belowground biomass of trees (at least 5 inches d.b.h./d.r.c.), in dry short tons, on forest land.	EXPREMV
2669	Average annual other removals of belowground biomass of trees (at least 5 inches d.b.h./d.r.c.), in dry short tons, on timberland.	EXPREMV
2670	Average annual removals of aboveground carbon in trees (at least 5 inches d.b.h./d.r.c.), in short tons, on forest land	EXPREMV
2671	Average annual removals aboveground carbon in trees (at least 5 inches d.b.h./d.r.c.), in short tons, on timberland.	EXPREMV

Attribute Number (ATTRIBUTE_NBR)	Attribute Description (ATTRIBUTE_DESCR)	Evaluation Type (EVAL_TYP)
2672	Average annual removals of belowground carbon in trees (at least 5 inches d.b.h./d.r.c.), in short tons, on forest land.	EXPREMV
2673	Average annual removals of belowground carbon in trees (at least 5 inches d.b.h./d.r.c.), in short tons, on timberland.	EXPREMV
2674	Average annual removals of aboveground biomass of trees (at least 5 inches d.b.h./d.r.c.), in dry short tons, on forest land.	EXPREMV
2675	Average annual removals of aboveground biomass of trees (at least 5 inches d.b.h./d.r.c.), in dry short tons, on timberland	EXPREMV
2676	Average annual removals of belowground biomass of trees (at least 5 inches d.b.h./d.r.c.), in dry short tons, on forest land	EXPREMV
2677	Average annual removals of belowground biomass of trees (at least 5 inches d.b.h./d.r.c.), in dry short tons, on timberland.	EXPREMV
2678	Average annual harvest removals of aboveground carbon in trees (at least 5 inches d.b.h./d.r.c.), in short tons, on forest land.	EXPREMV
2679	Average annual harvest removals of aboveground carbon in trees (at least 5 inches d.b.h./d.r.c.), in short tons, on timberland.	EXPREMV
2680	Average annual net change of aboveground biomass of trees (at least 5 inches d.b.h./d.r.c.), in dry short tons, on forest land.	EXPGROW
2681	Average annual net change of aboveground biomass of trees (at least 5 inches d.b.h./d.r.c.), in dry short tons, on timberland.	EXPGROW
2682	Average annual net change of belowground biomass of trees (at least 5 inches d.b.h./d.r.c.), in dry short tons, on forest land.	EXPGROW
2683	Average annual net change of belowground biomass of trees (at least 5 inches d.b.h./d.r.c.), in dry short tons, on timberland.	EXPGROW

Attribute Number (ATTRIBUTE_NBR)	Attribute Description (ATTRIBUTE_DESCR)	Evaluation Type (EVAL_TYP)
2684	Average annual net change of aboveground carbon in trees (at least 5 inches d.b.h./d.r.c.), in short tons, on forest land.	EXPGROW
2685	Average annual gross growth of aboveground carbon in trees (at least 5 inches d.b.h./d.r.c.), in short tons, on timberland.	EXPGROW
2686	Average annual net change of aboveground carbon in trees (at least 5 inches d.b.h./d.r.c.), in short tons, on timberland.	EXPGROW
2687	Average annual gross growth of belowground carbon in trees (at least 5 inches d.b.h./d.r.c.), in short tons, on forest land.	EXPGROW
2688	Average annual gross growth of belowground carbon in trees (at least 5 inches d.b.h./d.r.c.), in short tons, on timberland.	EXPGROW
2689	Average annual net change of belowground carbon in trees (at least 5 inches d.b.h./d.r.c.), in short tons, on forest land.	EXPGROW
2690	Average annual net change of belowground carbon in trees (at least 5 inches d.b.h./d.r.c.), in short tons, on timberland.	EXPGROW