The Forest Inventory and Analysis Database: Database Description and User Guide for Urban Data

Abstract:

This document describes the initial data structure for storing urban forest inventory data. Codes and definitions are provided as well as a guide for producing population-level estimates. The data structure documented within represents the first draft of an Urban Forest Inventory and Analysis Database (UFIADB) produced as a collaboration between the Forest Inventory and Analysis (FIA) and Urban Forest, Human Health, and Environmental Quality research units. This initial structure is likely to change in subsequent releases. The currently available data contained in the Urban FIADB are from the first cities to implement the new urban protocol of FIA. Additional urban areas will be made available as they are implemented. All data contained in the data structure are public.

Users familiar with the traditional Forest Inventory and Analysis Database (FIADB) for Phase 2 data will find many familiar elements in this database. But, there are some important differences. Such users are urged to review this document carefully.

Keywords – Urban, Forest Inventory and Analysis, inventory database, user manual, user guide, monitoring

Preface

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. During the first decade of the new annual inventory several pilot studies were conducted looking at the feasibility of an FIA urban forest inventory. In 2014 the FIA program launched the first production urban inventory. Urban areas will be phased into the FIA Urban inventory program as resources allow. USDA Forest Service regional research stations are responsible for conducting these inventories and publishing summary reports for individual urban areas.

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 Urban Forest Inventory and Analysis Database (UFIADB) structure, was developed to provide users with as much data as possible in a consistent manner among urban areas. Annual urban inventories use a common plot design and common data collection procedures nationwide, resulting in consistent data for all targeted urban areas.

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Chapter 1 -- Overview

1.1 Introduction

1.1.1 Purpose of This Guide

In 2014 the Forest Inventory and Analysis (FIA) and the Urban Forests, Human Health, and Environmental Quality (UFHHEQ) research units of the USDA Forest Service began a partnership to conduct and deliver an annualized inventory of urban forests. Both of these units have experience in conducting forest inventories and delivering results to their constituents. They both, however, bring a different tradition and perspective to the effort. The combined urban inventory effort is an opportunity to bring the strengths of each unit to bear on an important component of our Nation's forests; urban forests. For more information about the annual forest inventory see the FIA national web site (http://www.fia.fs.fed.us). For more information about the UFHHEQ urban forest inventory product (known as iTree [http://www.nrs.fs.fed.us/units/urban/.])

This document describes the initial outcome of the annualized urban forest inventory. It describes the structure and organization of inventory data including Sample Organization data, Inventory data, Population Estimation data, and Reference data. There are notable differences between this structure and the traditional data structures of both FIA and UFHHEQ (see the following paragraph). There is a guide on estimation of population attributes using this data structure located in chapter 8 of this document, including a discussion and examples of the main concepts involved in population estimation.

The process of integrating two different forest inventory traditions is difficult. Both FIA and UFHHEQ have developed complex compilation systems that accept raw field data and compute additional values, such as tree biomass. The integration of these two systems (NIMS and iTree respectively) requires careful analysis of both the mechanisms and the science; a process that will take time. The decision was made to perform the initial compilation using the iTree system because it was developed specifically for urban forests. This effort is referred to as Stage 1 of the annualized urban forest inventory. Therefore, the resulting data structure is more similar to the iTree program than to the structure used by FIA. The goal of Stage 1 is to deliver the initial reports as well as the supporting data to the public in a downloadable format as quickly as possible. This will be accomplished by establishing an independent database with its own DataMart.

Once Stage 1 of the annualized urban forest inventory is completed, Stage 2 will launch. Stage 2 of the FIA Urban inventory will begin a more formal integration of the two inventory traditions into a combined program that will include the strengths of both. This integration will likely alter the data structure of Stage 1. For example, the iTree compilation system does not incorporate the traditional FIA concept of *condition*, and therefore it is excluded from the Stage 1 structure. The Stage 2 combined data structure will include *condition*. Stage 2 will involve several iterations as a unified compilation system evolves. Subsequent documentation will describe the additions to each iteration. Advanced users are cautioned against developing complex applications dependent upon the Stage 1 structure because it is expected to change in the next major release.

This guide is the definitive guide to the Stage 1 Urban Forest Inventory and Analysis Database (UFIADB). Although it is used widely by internal analysts, a substantial part, if not the majority, of the intended audience includes those outside FIA and UFHHEQ who are interested in using these data for their own analyses. Awareness of the potential uses of Urban-FIA data by users outside the FIA community is expected to grow, and the data will become increasingly useful as additional attributes are collected across more urban areas. As is the case with any data source, however, it is incumbent upon the user to understand not only the data definitions and acquisition methods, but also the context in which the data were collected. This guide is intended to help current and potential users understand the necessary details of the UFIADB.

This guide has eight chapters. The remainder of chapter 1 includes general introductions to the Urban-FIA program and the Urban-FIA database, including brief histories of both. It provides a convenient overview for those who have an interest in using Urban-FIA data, but have not yet become familiar with the Urban-FIA program. Chapter 1 also provides descriptions of FIA sampling methods, including plot location and design, data measurement and computation, and general estimation procedures. Chapters 2-7 describe the tables that comprise the database, the attributes stored in each table, and the linkages between tables. Descriptions of the attributes, their data format, valid values, and other important details are given, but the appropriate field guides should be consulted for exact specifications regarding data collection methods. Users with a good understanding of chapters 2-7 and fundamental database management skills should be able to conduct a wide range of analyses. Chapter 8 explains the standard methods used to compile population-level estimates from UFIADB, and applies the estimation procedures documented by Bechtold and Patterson (2005). These procedures are based on adoption of the urban annual inventory system and the mapped plot design. Note that the plot footprint used for the urban annual inventory system differs from the footprint used in the FIA Phase 2 forestland inventory. See below for details.

There are several conventions used in this guide. The names of attributes (i.e., columns within tables) and table names appear in capital letters (e.g., PLOT table). Some attribute names appear in two or more tables. In most cases, such as in the table descriptions in chapters 2-7, the attribute name will be used alone and the affiliation with a particular table is implied by the context.

1.1.2 The FIA Program

The mission of FIA is to determine the extent, condition, volume, growth, and use of trees of timber on the Nation's forest land. FIA is the only program that collects, publishes, and analyzes data from all ownerships of forest land in the United States (Smith 2002). Throughout the 87-year history of the program, inventories have been conducted by a number of geographically dispersed FIA work units. Currently, the national FIA program is implemented by four regionally distributed work units that are coordinated by a National Office in Washington, DC (see figure 1). The four FIA work units are named by the Research Station in which they reside. Station abbreviations are used within this document and they are defined as Pacific Northwest Research Station (PNWRS), Northern Research Station (NRS), Rocky Mountain Research Station (RMRS), and Southern Research Station (SRS). NRS was formed from the merger of North Central Research Station (NCRS) and Northeastern Research Station (NERS). Some data items still retain these designations.

Figure 1. Boundaries of the four regionally distributed FIA work units and locations of program offices.

Starting in 1929, FIA accomplished its mission by conducting periodic forest inventories on a State-by-State basis. With the completion of Arizona, New Mexico, and Nevada in 1962, all 48 coterminous States had at least one periodic inventory (Van Hooser and others 1993). Repeat intervals for inventorying individual States have varied widely. By the late 1990s, most States had been inventoried more than once under the periodic inventory system; however, not all periodic data are available in electronic form (appendix L in The Forest Inventory and Analysis Database: Database Description and User Guide for Phase 2 [http://www.fia.fs.fed.us/library/database-documentation/index.php] lists all periodic data available in the FIADB and the year in which annual inventory began).

With the passage of the 1998 Farm Bill, the FIA program was required to move from a periodic inventory to an annualized system, with a portion of all plots within a State measured each year (Gillespie 1999). Starting in 1999, States were phased into the annual inventory system (see appendix L in The Forest Inventory and Analysis Database: Database Description and User Guide for Phase 2 [http://www.fia.fs.fed.us/library/database-documentation/index.php]). At the time of publication of this document, annual inventory has not yet been started in Interior Alaska. Although the 1998 Farm Bill specified that 20 percent of the plots within each State would be visited annually, funding limitations have resulted in the actual portion of plots measured annually ranging between 10 and 20 percent, depending on the State.

During the first ten years of the annualized inventory system several pilot studies were performed to examine the feasibility of conducting urban inventories. These studies produced valuable knowledge and experience that were applied in the implementation of the annualized urban inventory system in 2014. As with the annualized forest land inventory, the annualized urban inventory system will be phased in beginning with the largest and most iconic cities. The proportion of plots measured annually will be commensurate with the larger State population. Some exceptions may occur to this as some cities have opted to accelerate the initial establishment of the urban sample.

Annual urban data are analyzed to produce reports at a city level. Reports covering State, regional, and possibly national levels will be possible when the annualized urban inventory system is fully implemented. In addition to published reports, data are made available to the public for those who are interested in conducting their own analyses. Downloadable data, available online on the national Forest Inventory and Analysis website (http://fia.fs.fed.us/tools-data/), follow the format described in this document.

1.1.3 The Urban FIA Database

The Urban Forest Inventory and Analysis Database (UFIADB) was developed to provide users with data in a consistent format, spanning all targeted urban areas and inventories. This is the first version of UFIADB. A national plot design (see figure 2) is implemented on all data across all targeted urban areas. The UFIADB table structure is currently derived from the iTree Urban Forest Analysis toolset (www.fs.usda.gov/ccrc/tools/i-tree), which was designed to process urban inventory data. Future releases of the UFIADB will change the data structure to be a hybrid of the iTree and Stage 2 FIADB data structures.

Annual urban forest inventories use a nationally standardized plot design and common data collection procedures. A National Urban Field Guide (www.nrs.fs.fed.us/fia/urban/) has been implemented governing all data collection. The database contains an attribute labeled URBAN_MANUAL that stores the version number of the field guide under which the data were collected. Some attributes in the field guide are defined as being "core" while others are allowed to be "core optional." Core attributes must be collected by every FIA work unit, using the same definition and set of codes. In contrast, collection of core optional attributes are decided upon by the individual FIA work units, using the same national protocol, predefined definition, and set of codes. Many attributes, regardless of whether or not they are core or core optional, are only populated under certain conditions, such as on forestland or non-forestland. Attributes described in chapter 3 are noted if they are core optional.

Users who wish to analyze data using aggregations of multiple urban inventories or multiple inventories within an urban area should become familiar with changes in methodology and attribute definitions (see chapters 2-7). For each attribute in the current version of UFIADB, an effort has been made to provide the current definition of the attribute, as well as any variations in definition that may have been used among various FIA work units. In other words, although inventory data have been made available in a common data format, users should be aware of differences that might affect their analyses.

1.2 FIA Sampling and Estimation Procedures

To use the UFIADB effectively, users should acquire a basic understanding of the FIA sample design. This sample design is comprised of a sampling strategy and a statistical estimator. FIA establishes a permanent network of ground plots drawn from a hexagonal sampling frame that covers all States and territories of the United States. The base sampling intensity of this sampling frame is approximately one plot per 6,000 acres. Intensification of this sampling frame, however, is possible, and has been done for several areas. The resulting sample is a quasi-systematic sample that distributes sampling points across large populations. This is FIA's sampling strategy. Additional measurement protocols known as "indicators" targeting specific domains of the population are possible. For example, a protocol targeting herbaceous invasive species would be considered an indicator. Indicators typically require additional time on the plot and potentially special training and certification, which can make them more expensive and time-consuming to collect. To compensate, such indicators may be collected on a sub-sample of the plot network to reduce cost. Such sub-samples can be identified in UFIADB by SERIES in the Sample Organization table group. The sample is combined with a stratified estimator (sometimes known as post-stratification), which incorporates remotely sensed data covering the population to produce statistical estimates of population attributes with acceptable error. This combination of the hexagonal sampling frame and resulting sample combined with the stratified estimator constitutes the FIA sample design.

The FIA hexagonal sampling frame was designed to distribute a sample evenly across both space and time. By constraining each sampling point to fall within a hexagon, the sample has a quasi-systematic distribution across the landscape. It has also been described as being systematic with a random component. This provides good spatial distribution for targeting large populations at the strategic level. Each hexagon is also assigned a temporal address known as a subpanel. There are 70 such subpanels, which allow the complete sample to be divided by 7, 10, and 14 corresponding to cycle lengths 10-year, 7-year, and 5-year. These are the three most common cycle lengths employed by the FIA annualized inventory system. The combined effect of constraining sampling point locations both spatially and temporally is to avoid clumping of the sample in either dimension (space and time), which makes the sampling frame effective at sampling any large area that falls within it.

1.2.1 Sampling and Stratification Methodology

Remote Sensing

Remotely sensed data are used to stratify the population for estimation. Candidate remote-sensing data must completely cover the population with no gaps. Stratification divides the population into one or more classes of known area. The proportion of the area in each stratum is the stratum weight. Classes are developed such that they represent homogeneous areas of the population in some respect. Typically, homogeneity is assessed in some type of land cover metric such as tree canopy cover. But it can also represent other aspects such as land use. Sampling points are assigned to strata using spatial intersection. If the classes developed for stratification are effective, then the plots assigned to a given stratum will be homogeneous relative to the overall sample. When stratum-level estimates are expanded up to the population level, the variance of the population-level estimate is reduced due to the lower variability within each stratum. The remote-sensing products available that cover a given target population can change. Efforts are made to use the most recent and effective data possible in the formation of stratifications. This method of estimation assumes that the area of each stratum and the total area of the population are known.

The stratified estimator works by computing the mean of the plot-level attribute of interest within each stratum and multiplying that mean by the product of the total population area and the stratum weight. The variance is similarly computed. The expansion factor for each stratum is computed as the product of the known total area and the stratum weight divided by the number of sampling points assigned to the stratum. This value is known as the stratum expansion factor and is typically in units of acres per plot. For details on FIA's stratified estimation methodology see Bechtold and Patterson (2005).

The specific stratification developed for a given population at a given point in time can vary depending on what remote sensing data are available and what variables are most effective for the population of interest. Users should contact the appropriate FIA unit for further details if needed.

1.2.2 Plot Location

The UFIADB includes coordinates for every plot location in the database, whether it is forested or not, but these are not the precise locations of the plot centers. In an amendment to the Food Security Act of 1985 (reference 7 USC 2276 § 1770), Congress directed FIA to ensure the privacy of private landowners. Exact plot coordinates could be used in conjunction with other publicly available data to link plot data to specific landowners, which would be in violation of the requirements set by Congress. In addition to the issue of private landowner privacy, the FIA program had concerns about plot integrity and vandalism of plot locations on public lands. A revised policy has been implemented and methods for making approximate coordinates available for all plots have been developed. These methods are collectively known as "fuzzing and swapping" (Lister and others 2005). "Fuzzing" refers to an obfuscation of the true coordinate such that it falls within 1.0 miles of the true coordinate. Most plots fall within 0.5 miles of the true coordinate. The "swapping" element of the policy is applied to about 20 percent of privately owned plots, whereby fuzzed coordinates are swapped with similar plots within the same county. This creates a level of uncertainty about the true location and thus ownership of any sampling point to comply with the congressional directive. It also ensures that county-level aggregations of data using fuzzed and swapped coordinates will match aggregations using the true coordinates.

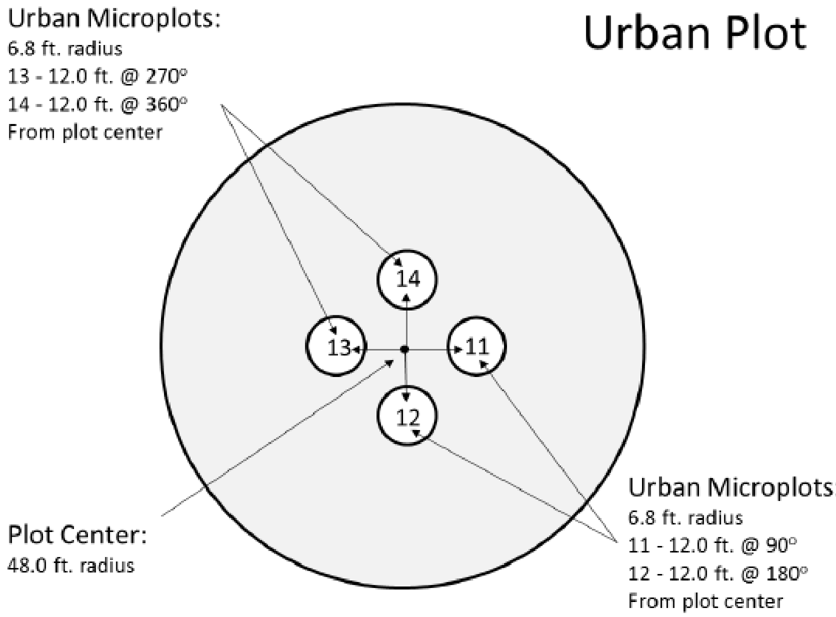


Figure 2. The FIA mapped urban plot design. The plot consists of one subplot (shaded area) and four microplots.

For most user applications, such as woodbasket analyses and estimates of other large areas, fuzzed and swapped coordinates provide a sufficient level of accuracy. Some FIA customers, however, require more precision of plot locations in order to perform analyses by user-defined polygons and for relating FIA plot data to other map-based information, such as soils maps and satellite imagery. To accommodate this need, FIA provides spatial data services that allow most of the desired analyses while meeting privacy requirements. The possibilities and limitations for these types of analyses are case-specific, so interested users should contact their local FIA work unit for more information.

1.2.3 Plot Design and Types of Data Attributes

Plot Designs

The purpose of the PLOT table is to organize information about the primary sampling point; a plot. The Urban field plot consists of one subplot approximately 1/6 acre in size with a radius of 48.0 feet. The subplot is used to collect data on trees with a diameter (at breast height, DBH, or at root collar, DRC) of 5.0 inches or greater. The subplot contains four microplots; each is approximately 1/300 acre in size, with a radius of 6.8 feet. The centers of the microplots are offset 12.0 feet horizontal in each cardinal direction from the subplot center. Microplots are numbered 11-14 in a clockwise fashion starting at 90 degrees from subplot center. Microplots are used to select and collect data on saplings (DBH/DRC of 1.0 inch through 4.9 inches).

1.2.4 Types of Attributes

Measured, Assigned, and Computed Attributes
In addition to attributes that are collected in the field, UFIADB includes attributes that are populated in the office. Examples of field attributes include tree diameter and height, and slope and aspect of the subplot. Attributes that are populated in the office include assigned attributes, such as county and owner group codes, or computed attributes, such as tree and area expansion factors, and tree biomass.

For measured attributes, this document provides only basic information on the methodology used in the field. The authoritative source for methodology is the Forest Inventory and Analysis National Urban Core Field Guide used during the inventory in which the data were collected (see National Urban Field Guide [www.nrs.fs.fed.us/fia/urban/]). The URBAN_MANUAL attribute in the PLOT table documents the version number where data collection protocols can be found.

Values of attributes that are assigned in the office are determined in several ways, depending on the attribute. For example, ownership may be determined using geographic data or local government records. Other attributes, such as owner group, are assigned values based on other attributes collected by the field crew.

Some computed attributes in the database are derived using other attributes in the database. Ordinarily, such attributes would not be included in a database table because they could be computed using the supplied attributes. Some data compilation routines, however, are complex or vary within or among FIA work units, so these computed attributes are populated for the convenience of database users.

In most cases computed attributes should be sufficient for users' needs, because the equations and algorithms used to compute them have been determined by the FIA program to be the best available for the plot location. For most computed attributes, however, the relevant tree- and plot-level attributes used to compute them are included in the database, so users may do their own calculations if desired. More information on attribute types is included in each chapter.

1.2.5 Expansion Factors

Tree Expansion Factors
The expansion factor(s) used to scale each tree on a plot to a per-acre basis is dependent on the plot design. The examples here are for fixed-radius plots. For fixed-plot designs, scaling is straightforward, with the number of trees per acre (TPA) represented by one tree equal to the inverse of the plot area in acres. The general formula is shown by equation [1]:

[1] TPA = 1/(N*A)
Where N is the number of subplots, and
A is the area of each subplot.

For example, the TPA expansion factor of each tree ≥5.0 inches in diameter occurring on the current plot design would be calculated using equation [2.1]:

TPA expansion factors for standard subplot, microplot and macroplot designs

[2.1] TPA per 48-foot fixed-radius subplot

Radius of a subplot = 48 feet
Area of subplot = pi*radius^2
Area of subplot = 3.141592654*48^2
Area of subplot = 7238.229 square feet

Acres in a subplot = area of subplot in square feet / (43560 square feet /acre)
Acres in a subplot = 7238.229 square feet / (43560 square feet /acre)
Acres in a subplot = 0.166167 acres per subplot
Acres in a plot = 1 subplots per plot
Acres per plot = 1* 0.166167
= 0.166167 acres per plot

TPA = 1 / (0.166166884) = 6.018046

The TPA expansion factor of each sapling 1.0 to 5.0 inches in diameter occurring on the current microplot design would be calculated using equation [2.2]:

[2.2] TPA per 6.8-foot fixed-radius microplot

Radius of a microplot = 6.8 feet
Area of microplot = pi*radius^2
Area of microplot = 3.141592654*6.8^2
Area of microplot = 145.2672443 square feet

Acres in a microplot = area of microplot in square feet / (43560 square feet /acre)
Acres in a microplot = 145.2672443 square feet / (43560 square feet /acre)
Acres in a microplot = 0.003334877 acres per subplot

Acres in a plot = 4 microplots per plot
Acres per plot = 4* 0.003334877
= 0.013339508 acres per plot

TPA = 1 / (0.013339508) = 74.965282

This expansion factor can be found in the TPA_UNADJ attribute in the TREE table (see chapter 3) for plots measured with the annual urban plot design.

Plot Area Expansion Factors
The plot area expansion factors (acres per plot) are computed during the stratification process. It is computed as the product of the total area of the population (considered known) and the stratum weight divided by the number of plots in the stratum. This value is stored on the POP_STRATUM table. In addition, an adjustment factor is computed for each of the fixed-radius plot sizes used in

the Urban inventory; subplots and microplots. The adjustment factors compensate for non-response in the sample within the stratum. The adjustment factors are also stored on the POP_STRATUM table. Note that the plot area expansion factors and adjustment factors are a function of both the particular sample used as well as the stratification. Thus, they change over time.

FIA has chosen the term ‘evaluation’ to describe the unique combination of a sample and a stratification for a given target population and reporting year. Evaluations target a specific set of population attributes for estimation. For example, one evaluation may target estimates of urban forest area while another evaluation targets estimates of net growth for the same population and reporting year. Evaluations provide a mechanism to package the data required to use the FIA stratified estimator to make estimates of population attributes. Evaluations are defined in the POP_EVAL table and are identified by a unique value stored in the EVALID column. More information about evaluations and their use is covered in the estimation section.

1.3 Database Structure

This section provides information about the database tables, including detailed descriptions of all attributes within the tables. Each column or attribute in a table is listed with its unabbreviated name, followed by a description of the attribute. Attributes that are coded include a list of the codes and their meanings. Appendix A is an index of the attributes, sorted alphabetically by column name, showing the table where the column is found including the attribute number in the table. Some overview information is presented below, followed by a section with complete information about all tables and attributes.

1.3.1 Table Descriptions

- PLOT table – Provides information relevant to the entire field plot. This table links to most other tables, and the linkage is made using PLOT.CN = *TABLE_NAME*.PLT_CN (*TABLE_NAME* is the name of any table containing the column name PLT_CN). Below are some examples of linking PLOT to other tables.
    - PLOT.CN = SUBPLOT.PLT_CN links the unique plot record to the subplot records.
    - PLOT.CN = TREE.PLT_CN links the unique plot record to the tree records.
- SUBPLOT table – Describes the features of a single subplot.
    - PLOT.CN = SUBPLOT.PLT_CN links the unique plot record to the subplot records.
- TREE table – Provides information for each tree 1 inch in diameter and larger found on a microplot or subplot.
    - PLOT.CN = TREE.PLT_CN links the tree records to the unique plot record.
- POP_ESTN_UNIT table – An estimation unit is a geographic area that can be drawn on a map. It has a known area, and the sampling intensity must be the same within a stratum within an estimation unit. Generally, estimation units are contiguous areas, but exceptions are made when certain ownerships, usually National Forests, are sampled at different intensities. One record in the POP_ESTN_UNIT table corresponds to a single estimation unit.

  - POP_ESTN_UNIT.CN = POP_STRATUM.ESTN_UNIT_CN links the unique stratified geographical area (ESTN_UNIT) to the strata (STRATUMCD) that are assigned to each ESTN_UNIT.
- POP_EVAL table – An evaluation is the combination of a set of plots (the sample) and a stratification that can be used to produce population estimates for a population at a given point in time. A record in the POP_EVAL table identifies one evaluation and provides some descriptive information about how the evaluation may be used.
  - POP_ESTN_UNIT.EVAL_CN = POP_EVAL.CN links the unique evaluation identifier (EVALID) in the POP_EVAL table to the unique geographical areas (ESTN_UNIT) that are stratified. Within a population evaluation (EVALID) there can be multiple population estimation units, or geographic areas across which there are a number of values being estimated (e.g., estimation of biomass across counties for a given population).
- POP_STRATUM table – The area within an estimation unit is divided into strata. The area for each stratum can be calculated by determining the proportion of Phase 1 pixels/plots in each stratum and multiplying that proportion by the total area in the estimation unit. Information for a single stratum is stored in a single record of the POP_STRATUM table.
- REF_POP_ATTRIBUTE table – Identifies all of the population attributes that are currently supported, and links to information useful to the estimation procedure, such as how to calculate forest area.
- REF_SPECIES table – A reference table containing the species code, descriptive common name, scientific name, and other attributes for each species. For example, data users who want to convert the species code to the associated common name should link codes as shown below and then obtain the information stored in COMMON_NAME.
  - REF_SPECIES.SPCD = TREE.SPCD links the species reference table record to the tree species code.
- REF_SPECIES_GROUP table – A reference table containing the species group code, descriptive name, and several other attributes for each species group. Data users should link codes as shown below and then obtain the information stored in NAME to convert the code to a descriptive name.
  - REF_SPECIES_GROUP.SPGRPCD = TREE.SPGRPCD links the species group reference table to the tree species group code.

1.3.2 Keys Presented with the Tables

Each summarized table in chapters 2-7 has a list of keys just below the bottom of the table. These keys are used to join data from different tables. The following provides a general definition of each kind of key.

Primary key

A single column in a table whose values uniquely identify each row in an Oracle[1] table. The primary key in each Urban FIADB 1.0 table is the CN column.

The name of the primary key for each table is listed in the table description. It follows the nomenclature of 'TABLEABBREVIATION'_PK. The table abbreviations are:

Table name	Table abbreviation
POPULATION	POPN
PROJECT_POPN_ASSGN	PROJPOPNASGN
PROJECT	PROJ
SERIES	SER
FIELD_SAMPLE	FLDSAMP
TIME_PERIOD	TIMEPER
SAMPLE_RULE	SAMPRL
POPULATION_STRUCTURE	POPNSTRUC
GEOAREA	GEOAREA
PLOT_FLDSAMP_ASSGN	PLTFLDSAMPASGN
PLOT	PLT
SUBPLOT	SBP
FIELD_LANDUSE	FLU
COVER	CVR
TREE	TRE
BUILDING_INTERACTION	BINTA
POP_EVAL	PE
POP_ESTN_UNIT	PEU
POP_STRATUM	PS
POP_STAT_SAMP	PSS
POP_STAT_SAMP_CONSTR_ASSGN	PSSCA
POP_EVAL_TYPE_ASSGN	PETA
PLOT_STRAT_ASSGN	PLTSTRATASGN
PLOT_STATSAMP_ASSGN	PLTSTATSAMPASGN
MOD_ENERGY_EFFECTS	MEE
MOD_POLLUTION_HEALTH_FACTOR	MPHF
MOD_POLLUTION_REMOVAL	MPR
MOD_RAINFALL	MR
MOD_VOC_EMISSIONS	MVOCE
REF_BOLE_STUMP_REMOVED	RBSR
REF_CAUSE_OF_DEATH	RCOD
REF_COUNTY	RCTY
REF_CROWN_CLASS	RCC
REF_CROWN_LIGHT_EXPOSURE	RCLE
REF_DAMAGE_AGENT	RDMGA
REF_DAMAGE_AGENT_GROUP	RDMGAG

[1] The use of trade or firm names in this publication is for reader information only and does not imply endorsement by the U.S. Department of Agriculture of any product or service.

REF_DIAHT	RDHT
REF_ENERGY_EFFECT	REGYE
REF_ENERGY_USE	REGYU
REF_SAMPLKIND	RSKD
REF_LANDUSE	RLU
REF_NONFOREST_LANDUSE	RNFLU
REF_OWNER	ROWN
REF_OWNER_GROUP	ROWNG
REF_PLANTED	RPTD
REF_SPECIES	RSPC
REF_SPECIES_GROUP	RSPCGP
REF_STANDING_DEAD	RSD
REF_STATE	RST
REF_TREE_STATUS	RTS
REF_UNIT	RUNT
REF_URBAN-PLOT-NONSAMPLE-REASN	RUPNR
REF_URBAN_PLOT_STATUS	RUPS
REF_URBAN_SUBP_NONSAMPLE_REASN	RUSNR
REF_URBAN_SUBP_STATUS	RUSS
REF_DB_VERSION	RDBVER
REF_POP_ATTRIBUTE	RPA
REF_POP_DOMAIN	RPD
REF_POP_EVAL_TYPE	RPET
REF_CALCULATION	RC
REF_SAMPLE_CONSTRAINT	RSC

Unique key

Multiple columns in a table whose values uniquely identify the entity (such as a tree) stored in each row in an Oracle table. There can be one and only one row for each unique key value.

The unique key varies for each UFIADB 1.0 table. The unique key for the PLOT table is PLOTID and VISIT_NBR.

The name of the unique key for each table is listed in the table description. It follows the nomenclature of ‘TABLEABBREVIATION’_UK.

Foreign key

A column in a table that is used as a link to a matching column in another Oracle table.

A foreign key connects a record in one table to one and only one record in another table. Foreign keys are used both to link records between data tables and as a check (or constraint) to prevent “unrepresented data.” For example, if there are rows of data in the TREE table for a specific plot, there needs to be a corresponding data row for that same plot in the PLOT table. The foreign key in the TREE table is the attribute PLT_CN, which links specific rows in the TREE table to one record in the PLOT table using the plot attribute CN.

The name of the foreign key for each table is listed in the table description. It follows the nomenclature of
‘SOURCETABLEABBREVIATION’_‘MATCHINGTABLEABBREVIATION’_FK,

where the source table is the table containing the foreign key and the matching table is the table the foreign key matches. The foreign key usually matches the CN column of the matching table. Most tables in UFIADB 1.0 have only one foreign key, but tables can have multiple foreign keys.

1.3.3 Oracle Data Types

Oracle data type	**Definition**
DATE	A data type that stores the date in the format of DD-MON-YYYY. For example, 29-AUG-2012.
NUMBER	A data type that contains only numbers, positive or negative, with a floating decimal point.
NUMBER(SIZE, D)	A data type that contains only numbers up to a specified maximum size. The maximum size (*and optional fixed decimal point*) is specified by the value(s) listed in the parentheses. For example, an attribute with a data type specified as “NUMBER(2)” indicates that the attribute may contain a maximum of two digits (*for example*, “11” or “5”), however, none of the digits are decimals. An attribute with a data type specified as “NUMBER(3,1)” may contain a maximum of three digits, however, the last digit is a fixed decimal (*for example*, “4.0” or “12.7”). Likewise, “NUMBER(6,4)” would indicate that an attribute may contain a maximum of six digits, however, the last four digits are part of a fixed decimal (*for example,* “18.7200”). **Note:** When needed, digits to the right of a fixed decimal point are filled in with zero(s).
VARCHAR2(SIZE)	A data type that contains alphanumeric data (numbers and/or characters) up to a specified maximum size. For example, an attribute with a data type specified as “VARCHAR2(8)” indicates that the attribute may contain a maximum of eight alphanumeric characters.

1.4 Data Structure of Stage 1 of Urban Data Collection

This section of the document will describe the data structure of Urban Stage 1. The description will cover the table names, columns and data types. It will also cover the information organized in each table and how that information can be combined with other information to answer questions. Example queries are provided using standard Oracle SQL.

The Urban Stage 1 data structure can be organized into five distinct table groups; Sample Organization, Population Estimation, Inventory Data, Population Model, and Reference Data. These five groups are intended to work together to allow the user to identify the population they are interested in, extract the inventory data for that population, use the population estimation data to estimate the population attributes of interest, and describe the resulting estimates with the aid of reference data. The Population Model table group stores the output of large and complex models describing the entire population. This is unique to UFIADB and has no analog in FIADB. These same generic groups (excepting the Population Model table group) also exist in FIADB, but have been modified to function better in the context of urban forest inventory. The following chapters discuss each table group.

In addition to changing the data structure to account for iTree output, the Urban Stage 1 data structure will also introduce some new concepts relating to defining populations of interest and allowing populations to change over time. This is something the traditional FIA inventory program is interested in and that the UFHHEQ unit has experience with. This makes the data structure of Urban Stage 1 somewhat experimental. Implementing Urban Stage 1 in an independent database allows these new concepts to be tested without affecting the traditional FIADB database and the various applications that are built on its current data structure.

1.5 User Guide Updates

The following updates were made in the October, 2015 revision of this document:

- Revised text throughout the document for clarity.

- Whenever it occurred, pssa.stat_samp_cn was changed to pssa.pss_cn – pp. 93, 94, 95, 96, 234, 254, 260, 268, 278, 287, 296, 304.

- Whenever it occurred, sampassgn.stat_samp_cn was changed to sampassgn.pss_cn – pp. 232, 241, 242, 243, 255, 261, 269, 270, 271, 279, 280, 288, 290, 297, 298, 305, 306, 307, 308.

Chapter 2 – Sample Organization Table Group

One of the most significant differences between the Urban Stage 1 data structure and the traditional FIADB data structure (used by FIA) is the loss of STATECD as the identifier of the population of interest. The traditional FIADB data structure is designed to deliver annual forest inventory data for States. But the urban inventory data must be organized at a finer scale than just State. In addition, the boundaries used to define urban areas for inventory are a function of population densities and are expected to change over time. This dynamic quality to urban populations must be accounted for in the data structure.

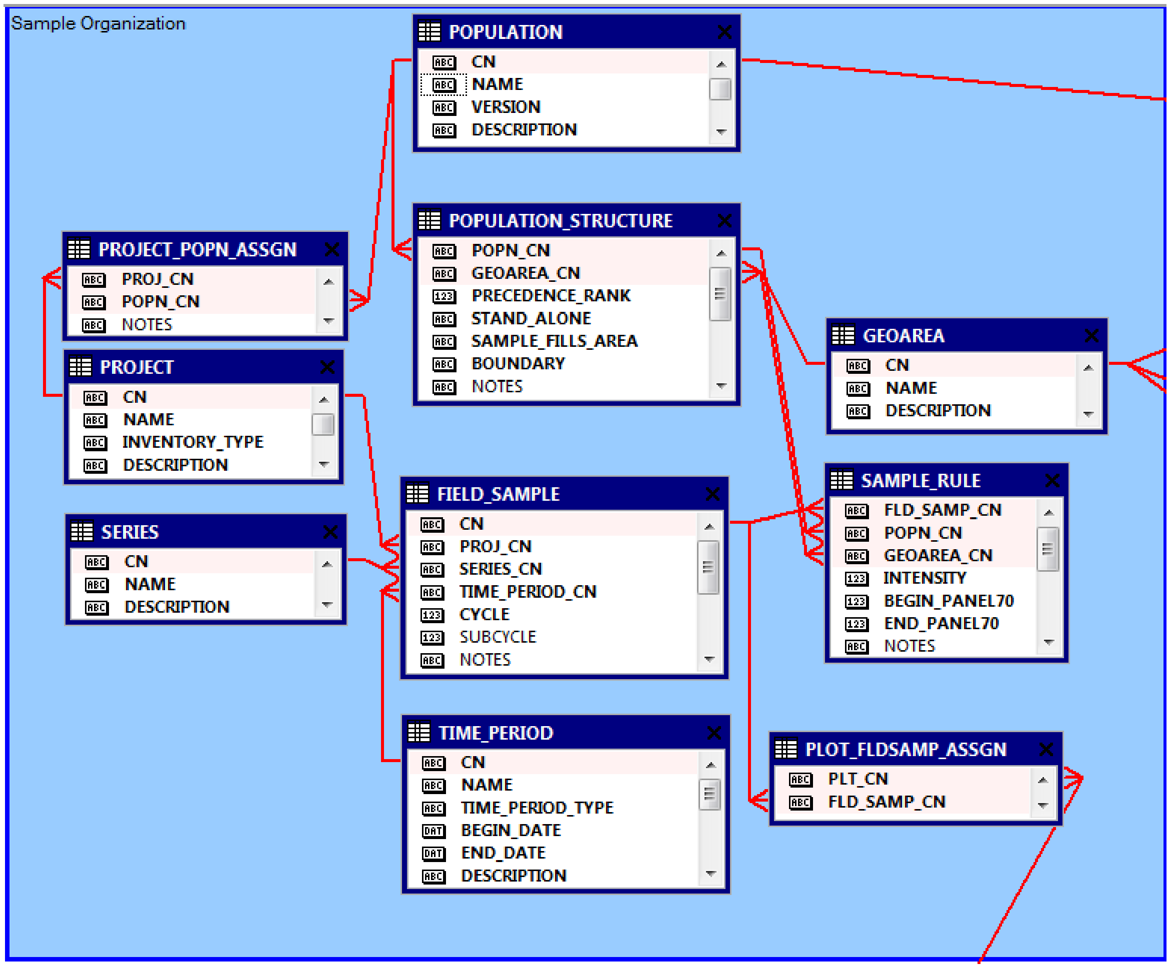


Figure 3. Sample Organization Table Group

2.1 Population Table (Oracle table name is POPULATION)

The purpose of the Population table is to define the population under study in a generic and flexible way. Populations can be defined as whatever they need to be, including traditional State inventories as well as inventories that focus on cities and urban areas. The definition of a population can be versioned to account for significant changes over time.

	Column name	**Descriptive name**	**Oracle data type**
1	CN	Population Sequence Number	VARCHAR2(34)
2	NAME	Population Name	VARCHAR2(50)
3	VERSION	Population Version	VARCHAR2(30)
4	DESCRIPTION	Population Description	VARCHAR2(2000)
5	CREATED_BY	Created by	VARCHAR2(30)
6	CREATED_DATE	Created date	DATE
7	CREATED_IN_INSTANCE	Created in instance	VARCHAR2(6)
8	MODIFIED_BY	Modified by	VARCHAR2(30)
9	MODIFIED_DATE	Modified date	DATE
10	MODIFIED_IN_INSTANCE	Modified in instance	VARCHAR2(6)

Type of Key	**Column(s) order**	**Tables to link**	**Abbreviated notation**
Primary	CN	N/A	POPN_PK
Unique	NAME, VERSION	N/A	POPN_UK

1. CN Population sequence number. A unique sequence number used to identify a population record.

2. NAME Population name. The name assigned to the population under study.

3. VERSION Population version. A version value assigned to a population. This permits a given population to be assigned a version to account for major changes to the population during long-term inventory projects.

4. DESCRIPTION

   Population description. A brief summary description of the population intended to eliminate ambiguity of the exact definition of the population under study.

5. CREATED_BY Created by. The employee who created the record. This attribute is intentionally left blank in download files.

6. CREATED_DATE

Created date. The date the record was created. Date will be in the form DD-MON-YYYY.

7. CREATED_IN_INSTANCE

Created in instance. The database instance in which the record was created. Each computer system has a unique database instance code and this attribute stores that information to determine on which computer the record was created.

8. MODIFIED_BY

Modified by. The employee who modified the record. This field will be blank (null) if the data have not been modified since initial creation. This attribute is intentionally left blank in download files.

9. MODIFIED_DATE

Modified date. The date the record was last modified. This field will be blank (null) if the data have not been modified since initial creation. Date will be in the form DD-MON-YYYY.

10. MODIFIED_IN_INSTANCE

Modified in instance. The database instance in which the record was modified. This field will be blank (null) if the data have not been modified since initial creation.

2.2 Project Population Assignment Table (Oracle table name is PROJECT_POPN_ASSGN)

The purpose of the PROJECT_POPN_ASSGN table is to store the relationship between a given population and an inventory project (see PROJECT table). This relationship is modeled to be a many-to-many relationship; meaning any population can be studied by many projects and any project can study many populations. Allowing a given project to study multiple populations allows a given population to be versioned over time, with each version creating a new record in the POPULATION table.

	Column name	**Descriptive name**	**Oracle data type**
1	PROJ_CN	Project sequence number	VARCHAR2(34)
2	POPN_CN	Population sequence number	VARCHAR2(34)
3	NOTES	Notes	VARCHAR2(2000)
4	CREATED_BY	Created by	VARCHAR2(30)
5	CREATED_DATE	Created date	DATE
6	CREATED_IN_INSTANCE	Created in instance	VARCHAR2(6)
7	MODIFIED_BY	Modified by	VARCHAR2(30)
8	MODIFIED_IN_INSTANCE	Modified in instance	VARCHAR2(6)
9	MODIFIED_DATE	Modified date	DATE

Type of key	**Column(s) order**	**Tables to link**	**Abbreviated notation**
Primary	PROJ_CN, POPN_CN	N/A	PROJPOPNASGN_PK
Foreign	POPN_CN	PROJECT_POPN_ASSGN to POPULATION	PROJPOPNASGN_POPN_FK
Foreign	PROJ_CN	PROJECT_POPN_ASSGN to PROJECT	PROJPOPNASGN_PROJ_FK

1. PROJ_CN Project sequence number. A unique sequence number used to identify a project record.

2. POPN_CN Population sequence number. A unique sequence number used to identify a population record.

3. NOTES Notes. Any pertinent notes pertaining to the assignment of projects to populations.

4. CREATED_BY Created by. See POPULATION.CREATED_BY description for definition.

5. CREATED_DATE

   Created date. See POPULATION.CREATED_DATE description for definition.

6. CREATED_IN_INSTANCE

Created in instance. See POPULATION.CREATED_IN_INSTANCE description for definition.

7. MODIFIED_BY

Modified by. See POPULATION.MODIFIED_BY description for definition.

8. MODIFIED_IN_INSTANCE

Modified in instance. See POPULATION.MODIFIED_IN_INSTANCE description for definition.

9. MODIFIED_DATE

Modified date. See POPULATION.MODIFIED_DATE description for definition.

2.3 Project Table (Oracle table name is PROJECT)

The purpose of the PROJECT table is to identify distinct inventory efforts. Projects are well-defined inventories that target a defined population and have a dedicated set of resources, such as field staff and data processing staff. Projects are defined in a way that represents the operational reality of the project. For example, the FIA program inventories the forest land of the United States. But operationally, it is implemented as State-level inventories. Similarly, urban inventories are operationally organized by the urban area they target, and thus a project is declared for each such inventory. This allows users to easily identify the project they are interested it.

	Column name	**Descriptive name**	**Oracle data type**
1	CN	Project sequence number	VARCHAR2(34)
2	NAME	Project name	VARCHAR2(50)
3	INVENTORY_TYPE	Inventory type	VARCHAR2(30)
4	DESCRIPTION	Description	VARCHAR2(2000)
5	CREATED_BY	Created by	VARCHAR2(30)
6	CREATED_DATE	Created date	DATE
7	CREATED_IN_INSTANCE	Created in instance	VARCHAR2(6)
8	MODIFIED_BY	Modified by	VARCHAR2(30)
9	MODIFIED_DATE	Modified date	DATE
10	MODIFIED_IN_INSTANCE	Modified in instance	VARCHAR2(6)

Type of Key	**Column(s) order**	**Tables to link**	**Abbreviated notation**
Primary	CN	N/A	PROJ_PK
Unique	NAME	N/A	PROJ_UK

1. CN — Project sequence number. A unique sequence number used to identify a project record.

2. NAME — Project name. A unique name for the project.

3. INVENTORY_TYPE

   Inventory type. A phrase-code used to describe the type of inventory project. Legal phrases include: Annualized, One-time, Periodic.

4. DESCRIPTION

   Project description. A brief summary description of the inventory project.

5. CREATED_BY — Created by. See POPULATION.CREATED_BY description for definition.

6. CREATED_DATE

   Created date. See POPULATION.CREATED_DATE description for definition.

7. CREATED_IN_INSTANCE

   Created in instance. See POPULATION.CREATED_IN_INSTANCE description for definition.

8. MODIFIED_BY

   Modified by. See POPULATION.MODIFIED_BY description for definition.

9. MODIFIED_DATE

   Modified date. See POPULATION.MODIFIED_DATE description for definition.

10. MODIFIED_IN_INSTANCE

    Modified in instance. See POPULATION.MODIFIED_IN_INSTANCE description for definition.

2.4 Series Table (Oracle table name is SERIES)

The purpose of the SERIES table is to store a list of available data series that can be used by any given project. A series is a distinct cohort of data within a project that share the same sampling methodology, field protocol, and targets a specific set of population attributes. For example, the traditional FIA inventory includes a P2 series that targets standing trees on forest land. There are also other series within FIA that target population attributes such as down and dead wood, or herbaceous vegetation. These distinct series of data can be identified within the Sample Organization module and associated with particular field samples (see FIELD_SAMPLE table) such that the user can quickly see what series of data are included in which field samples.

	Column name	**Descriptive name**	**Oracle data type**
1	CN	Sequence number	VARCHAR2(34)
2	NAME	Series name	VARCHAR2(50)
3	DESCRIPTION	Series description	NUMBER(2000)
4	CREATED_BY	Created by	VARCHAR2(30)
5	CREATED_DATE	Created date	DATE
6	CREATED_IN_INSTANCE	Created in instance	VARCHAR2(6)
7	MODIFIED_BY	Modified by	VARCHAR2(30)
8	MODIFIED_DATE	Modified date	DATE
9	MODIFIED_IN_INSTANCE	Modified in instance	VARCHAR2(6)

Type of key	**Column(s) order**	**Tables to link**	**Abbreviated notation**
Primary	CN	N/A	SER_PK
Unique	NAME	N/A	SER_UK

1. CN Series sequence number. A unique sequence number used to identify the series record.

2. NAME Series name. A unique name for the series.

3. DESCRIPTION

   Series description. A brief summary description of the series.

4. CREATED_BY Created by. See POPULATION.CREATED_BY description for definition.

5. CREATED_DATE

   Created date. See POPULATION.CREATED_DATE description for definition.

6. CREATED_IN_INSTANCE

Created in instance. See POPULATION.CREATED_IN_INSTANCE description for definition.

7. MODIFIED_BY

Modified by. See POPULATION.MODIFIED_BY description for definition.

8. MODIFIED_DATE

Modified date. See POPULATION.MODIFIED_DATE description for definition.

9. MODIFIED_IN_INSTANCE

Modified in instance. See POPULATION.MODIFIED_IN_INSTANCE description for definition.

2.5 Field Sample Table (Oracle table name is FIELD_SAMPLE)

The purpose of the FIELD_SAMPLE table is to define the field samples selected for each series of a project that are implemented in a given time period (see TIME_PERIOD table). Each field sample is defined by the unique combination of a parent project (PROJECT table), a data series (SERIES table), and a time period in which the field work is conducted (TIME_PERIOD table). Users familiar with the traditional FIADB data structure will note similarities between this and the SURVEY table of FIADB, except that this structure allows a different record for each series (such as P2 and P3 series). This finer granularity of information allows the different series of data to have different cycle lengths, if appropriate. A different time period can also be associated with each series, which can be useful when a particular series should be constrained to the leaf-on portion of a field season.

The concept of a field sample is different from a statistical sample (see Population Estimation table group). In an annualized inventory, a field sample typically includes only a portion of the full number of plots in the full sample. A statistical sample includes the most recent visit to sampling points falling in the population regardless of the field season in which it was collected.

	Column name	Descriptive name	Oracle data type
1	CN	Field sample sequence number	VARCHAR2(34)
2	PROJ_CN	Project sequence number	VARCHAR2(34)
3	SERIES_CN	Series sequence number	VARCHAR2(34)
4	TIME_PERIOD_CN	Time period sequence number	VARCHAR2(34)
5	CYCLE	Inventory cycle number	NUMBER(2,0)
6	SUBCYCLE	Inventory subcycle number	NUMBER(2,0)
7	NOTES	Field sample notes	VARCHAR2(2000)
8	CREATED_BY	Created by	VARCHAR2(30)
9	CREATED_DATE	Created date	DATE
10	CREATED_IN_INSTANCE	Created in instance	VARCHAR2(6)
11	MODIFIED_BY	Modified by	VARCHAR2(30)
12	MODIFIED_IN_INSTANCE	Modified in instance	VARCHAR2(6)
13	MODIFIED_DATE	Modified date	DATE

Type of key	Column(s) order	Tables to link	Abbreviated notation
Primary	CN	N/A	FLDSAMP_PK
Unique	PROJ_CN, SERIES_CN, TIME_PERIOD_CN, CYCLE	N/A	FLDSAMP_UK
Foreign	PROJ_CN	FIELD_SAMPLE to PROJECT	FLDSAMP_PROJ_FK
Foreign	SERIES_CN	FIELD_SAMPLE to SERIES	FLDSAMP_SER_FK
Foreign	TIME_PERIOD_CN	FIELD_SAMPLE to TIME_PERIOD	FLDSAMP_TIMEPER_FK

1. CN Field sample sequence number. A unique sequence number used to identify the field sample record.

2. PROJ_CN — Project sequence number. Foreign key linking the field sample record to the project record.

3. SERIES_CN — Series sequence number. Foreign key linking the field sample record to the series record.

4. TIME_PERIOD_CN

   Time period sequence number. Foreign key linking the field sample record to the time period record.

5. CYCLE — Inventory cycle number. An iterating number counting the number of times a complete sample has been collected for the related project and targeted population. Periodic and one-time inventory projects are assumed to have CYCLE = 1.

6. SUBCYCLE — Inventory subcycle number. An iterating number counting the number of subsamples conducted to complete the full sample. Annualized inventory projects spread data collection over n number of years where n is the number of subcycles. This value is set to 0 for periodic or one-time projects.

7. NOTES — Field sample notes. Any relevant comments regarding the field sample not captured in a more formal column.

8. CREATED_BY — Created by. See POPULATION.CREATED_BY description for definition.

9. CREATED_DATE

   Created date. See POPULATION.CREATED_DATE description for definition.

10. CREATED_IN_INSTANCE

    Created in instance. See POPULATION.CREATED_IN_INSTANCE description for definition.

11. MODIFIED_BY

    Modified by. See POPULATION.MODIFIED_BY description for definition.

12. MODIFIED_IN_INSTANCE

    Modified in instance. See POPULATION.MODIFIED_IN_INSTANCE description for definition.

13. MODIFIED_DATE

    Modified date. See POPULATION.MODIFIED_DATE description for definition.

2.6 Time Period Table (Oracle table name is TIME_PERIOD)

The purpose of the TIME_PERIOD table is to define a period of time in which field data collection is targeted. For some series, field data can be collected year-round without loss in data integrity or repeatability of measurement protocol. But other series, such as those that target herbaceous vegetation, can only be reliably collected within a particular window of time. The particular window of time might be wider or narrower given the latitude of the target population. Allowing this window of time to vary from population to population allows some additional flexibility when planning field operations.

	Column name	Descriptive name	Oracle data type
1	CN	Time period sequence number	VARCHAR2(34)
2	NAME	Time period name	VARCHAR2(50)
3	TIME_PERIOD_TYPE	Time period type	VARCHAR2(34)
4	BEGIN_DATE	Time period begin date	DATE
5	END_DATE	Time period end date	DATE
6	DESCRIPTION	Time period description	VARCHAR2(2000)
7	CREATED_BY	Created by	VARCHAR2(30)
8	CREATED_DATE	Created date	DATE
9	CREATED_IN_INSTANCE	Created in instance	VARCHAR2(6)
10	MODIFIED_BY	Modified by	VARCHAR2(30)
11	MODIFIED_DATE	Modified date	DATE
12	MODIFIED_IN_INSTANCE	Modified in instance	VARCHAR2(6)
13	INVYR	Time period inventory year	NUMBER(4,0)

Type of key	Column(s) order	Tables to link	Abbreviated notation
Primary	CN	N/A	TIMEPER_PK
Unique	NAME	N/A	TIMEPER_UK
Unique	BEGIN_DATE, END_DATE	N/A	TIMEPER_UK2

1. CN Time period sequence number. A unique sequence number used to identify the time period record.

2. NAME Time period name. A unique name for the time period.

3. TIME_PERIOD_TYPE

   Time period type. An attribute indicating the type of time period.

Value	Description
FISCAL YEAR	Defines a time period based on the federal fiscal year, which begins October 1st and end on September 30th.
SUMMER WINDOW	Defines a time period as a summer window falling between two dates.

Value	Description
CALENDAR YEAR	Defines a time period based on a standard calendar year, which begins January 1st and ends on December 31st.

4. BEGIN_DATE Time period begin date. The date designating the start of the time period.

5. END_DATE Time period end date. The date designating the end of the time period.

6. DESCRIPTION

   Time period description. A brief summary description of the time period.

7. CREATED_BY Created by. See POPULATION.CREATED_BY description for definition.

8. CREATED_DATE

   Created date. See POPULATION.CREATED_DATE description for definition.

9. CREATED_IN_INSTANCE

   Created in instance. See POPULATION.CREATED_IN_INSTANCE description for definition.

10. MODIFIED_BY

    Modified by. See POPULATION.MODIFIED_BY description for definition.

11. MODIFIED_DATE

    Modified date. See POPULATION.MODIFIED_DATE description for definition.

12. MODIFIED_IN_INSTANCE

    Modified in instance. See POPULATION.MODIFIED_IN_INSTANCE description for definition.

13. INVYR Time period inventory year. This convention is carried over from the traditional FIADB for compatibility. It is the year that best represents the year a set of plots was selected for inclusion in the sample. Plots assigned to a given inventory year are considered representative of the target population at that point in time. Plot assignment to an inventory year does not necessarily imply that it was collected in the corresponding calendar year. Rather, it is a mechanism to group plots together temporally that were selected, measured, and processed as a group.

2.7 Sample Rule Table (Oracle table name is SAMPLE_RULE)

The purpose of the SAMPLE_RULE table is to document supporting metadata relating to exactly how each field sample was selected. The FIA hexagonal sampling frame is assumed by this design. This metadata defines the spatial intensity as well as the temporal panels of the field sample selected. In addition, this table links to the particular population structure (see POPULATION_STRUCTURE table) used during the selection of the field sample. This can be important when a population of interest changes over time (such as an urban boundary expanding). Most users will not need the information in this table in order to produce population-attribute estimates.

	Column name	Descriptive name	Oracle data type
1	FLDSAMP_CN	Field sample sequence number	VARCHAR2(34)
2	POPN_CN	Population sequence number	VARCHAR2(34)
3	GEOAREA_CN	Geographic area sequence number	VARCHAR2(34)
4	INTENSITY	Sample intensity	NUMBER(3,0)
5	BEGIN_PANEL70	Beginning panel70	NUMBER(2,0)
6	END_PANEL70	End panel70	NUMBER(2,0)
7	NOTES	Sample rule notes	VARCHAR2(2000)
8	CREATED_BY	Created by	VARCHAR2(30)
9	CREATED_DATE	Created date	DATE
10	CREATED_IN_INSTANCE	Created in instance	VARCHAR2(6)
11	MODIFIED_BY	Modified by	VARCHAR2(30)
12	MODIFIED_IN_INSTANCE	Modified in instance	VARCHAR2(6)
13	MODIFIED_DATE	Modified date	DATE

Type of key	Column(s) order	Tables to link	Abbreviated notation
Primary	FLDSAMP_CN, POPN_CD, GEOAREA_CN, INTENSITY	N/A	SAMPRL_PK
Foreign	POPN_CN, GEOAREA_CN	SAMPLE_RULE to POPULATION_STRUCTURE	SAMPRL_POPNSTRUC_FK
Foreign	FLDSAMP_CN	SAMPLE_RULE to FIELD_SAMPLE	SAMPRL_FLDSAMP_FK

1. FLDSAMP_CN

   Field sample sequence number. A unique sequence number used to identify the field sample record.

2. POPN_CN — Population sequence number. Foreign key linking the field sample record to the population record.

3. GEOAREA_CN

Geographic area sequence number. Foreign key linking the field sample record to the geographic area record.

4. INTENSITY

Sample intensity. The spatial intensity of the sampling frame represented by the record. The FIA hexagonal sampling frame defines sampling intensity in terms of the number of plots located within a parent hexagon. The base federal sample includes a single plot per parent hexagon and is referred to as 1X where X is interpreted as the number of plots per hexagon. Therefore, a record with an INTENSITY = 3 would represent a third plot per hexagon and therefore a 3X sampling intensity.

5. BEGIN_PANEL70

Beginning panel70. The FIA hexagonal sampling frame is temporally divided into five national panels according to a repeating spatial pattern. Each of the five national panels is further divided into 14 subpanels governed by a different spatial pattern. The combination of the two spatial patterns produces 70 unique combinations that are spatially distributed. The result is a flexible sampling frame that can distribute a sample across both space and time. Samples are selected by determining the number of subpanel values that can be collected in a field season and these panels are selected sequentially. Therefore, the temporal position of the sample within the sampling frame can be described by the beginning and ending panel 70 values. The BEGIN_PANEL70 column indicates the beginning value of the field sample within the 70 possible temporal panels.

6. END_PANEL70

End panel70. The FIA hexagonal sampling frame is temporally divided into five national panels according to a repeating spatial pattern. Each of the five national panels is further divided into 14 subpanels governed by a different spatial pattern. The combination of the two spatial patterns produces 70 unique combinations that are spatially distributed. The result is a flexible sampling frame that can distribute a sample across both space and time. Samples are selected by determining the number of subpanel values that can be collected in a field season and these panels are selected sequentially. Therefore, the temporal position of the sample within the sampling frame can be described by the beginning and ending panel 70 values. The END_PANEL70 column indicates the ending value of the field sample within the 70 possible temporal panels.

7. NOTES

Sample rule notes. Any relevant notes or comments regarding an individual sample rule.

8. CREATED_BY

Created by. See POPULATION.CREATED_BY description for definition.

9. CREATED_DATE

   Created date. See POPULATION.CREATED_DATE description for definition.

10. CREATED_IN_INSTANCE

    Created in instance. See POPULATION.CREATED_IN_INSTANCE description for definition.

11. MODIFIED_BY

    Modified by. See POPULATION.MODIFIED_BY description for definition.

12. MODIFIED_IN_INSTANCE

    Modified in instance. See POPULATION.MODIFIED_IN_INSTANCE description for definition.

13. MODIFIED_DATE

    Modified date. See POPULATION.MODIFIED_DATE description for definition.

2.8 Population Structure Table (Oracle table name is POPULATION_STRUCTURE)

The purpose of the POPULATION_STRUCTURE table is to define the general structure of a particular version of a given population. This information is not meant to identify every possible subpopulation. It allows inventory planners to define the boundary used for the overall population as well as important subpopulations that might have special significance either during sample selection or estimation. For example, if a particular subpopulation receives an increased sampling intensity, then it should be included in the structure. Or if any particular subpopulation will serve as an estimation unit during the estimation procedure, it should be defined. The elements of the population structure are ordered by PRECEDENCE_RANK, where the lower the rank value the higher the rank. So an element with PRECEDENCE_RANK = 1 is the top element in the stack. Elements in the population structure can be either sampled (SAMPLE_FILLS_AREA = ‘Y’) or they can serve a different purpose, such as population boundary. Some elements are considered independent of other elements (STAND_ALONE = ‘Y’). For these elements, any intersections with other population elements are ignored except for the population boundary. For example, a National Forest is commonly considered an independent subpopulation regardless of any counties it may intersect.

	Column name	Descriptive name	Oracle data type
1	POPN_CN	Population sequence number	VARCHAR2(34)
2	GEOAREA_CN	Geographic area sequence number	VARCHAR2(34)
3	PRECEDENCE_RANK	Precedence rank	NUMBER(3,0)
4	STAND_ALONE	Stand-alone indicator	CHAR(1)
5	SAMPLE_FILLS_AREA	Sample-fills-area indicator	CHAR(1)
6	BOUNDARY	Boundary indicator	CHAR(1)
7	NOTES	Population structure notes	VARCHAR2(2000)
8	CREATED_BY	Created by	VARCHAR2(30)
9	CREATED_DATE	Created date	DATE
10	CREATED_IN_INSTANCE	Created in instance	VARCHAR2(6)
11	MODIFIED_BY	Modified by	VARCHAR2(30)
12	MODIFIED_IN_INSTANCE	Modified in instance	VARCHAR2(6)
13	MODIFIED_DATE	Modified date	DATE

Type of key	Column(s) order	Tables to link	Abbreviated notation
Primary	POPN_CN, GEOAREA_CN	N/A	POPNSTRUC_PK
Foreign	GEOAREA_CN	POPULATION_STRUCTURE to GEOAREA	POPNSTRUC_GEOAREA_FK
Foreign	POPN_CN	POPULATION_STRUCTURE to POPULATION	POPNSTRUC_POPN_FK

1. POPN_CN Population sequence number. Foreign key linking the population structure record to the population record.

2. GEOAREA_CN

Geographic area sequence number. Foreign key linking the population structure record to the geographic area record.

3. PRECEDENCE_RANK

Precedence rank. A numeric value representing the rank of a given geographic area within the structure of a given population. Precedence rank represents a relative position within a “stack” of geographic areas. So a geographic area representing precedence rank 1 within a population is the top layer on the stack. And another geographic area with a precedence rank of 2 within the same population occupies the second slot in the stack.

4. STAND_ALONE

Stand-alone indicator. A code indicating whether or not the geographic area is considered to stand alone. There are two main reasons to declare a geographic area within a population structure to be stand-alone. First, some subpopulations receive spatially or temporally intensified samples. The increased precision of these samples is constrained only to the targeted subpopulation as indicated in the population structure. Second, some subpopulations will require the ability to produce independent estimates during estimation regardless of sampling intensity.

Code	Description
Y	A geographic area that is considered to stand-alone; an independent subpopulation that will ignore intersections with other geographic areas in the population structure except for ones designated as the population boundary.
N	A geographic area not considered to be stand-alone; recognizes intersections with other geographic areas.

5. SAMPLE_FILLS_AREA

Sample-fills-area indicator. A code indicating whether or not the geographic area within the population structure was sampled. Some areas within a population under study are specifically excluded from the sample. SAMPLE_FILLS_AREA allows inventory planners to define such areas.

Code	Description
Y	Yes, the geographic area within the population structure was sampled.
N	No, the geographic area within the population structure was not sampled.

6. BOUNDARY Boundary indicator. A code indicating whether or not the geographic area represents the boundary of the population under study.

Code	Description
Y	Yes, the geographic area represents the boundary of the population under study.
N	No, the geographic area does not represent the boundary of the population under study.

7. NOTES Population structure notes. Any relevant notes or comments regarding the population structure record.

8. CREATED_BY Created by. See POPULATION.CREATED_BY description for definition.

9. CREATED_DATE

   Created date. See POPULATION.CREATED_DATE description for definition.

10. CREATED_IN_INSTANCE

    Created in instance. See POPULATION.CREATED_IN_INSTANCE description for definition.

11. MODIFIED_BY

    Modified by. See POPULATION.MODIFIED_BY description for definition.

12. MODIFIED_IN_INSTANCE

    Modified in instance. See POPULATION.MODIFIED_IN_INSTANCE description for definition

13. MODIFIED_DATE

    Modified date. See POPULATION.MODIFIED_DATE description for definition.

2.9 Geographic Area Table (Oracle table name is GEOAREA)

The purpose of the GEOAREA table is to store the list of available places used to construct a population. They can be thought of as defined polygons on the landscape. Examples include familiar places, such as States and counties, as well as urban boundaries or even the boundary of a fire or other disturbance event that might be of interest for study. It is important to note that the GEOAREA table stores the identity of the places and not the actual geometry. As the data structure develops, the actual geometry used will be stored in another location and linked to these identities. That will be included in Urban Stage 2 of development.

	Column name	**Descriptive name**	**Oracle data type**
1	CN	Geographic area sequence number	VARCHAR2(34)
2	NAME	Geographic area name	VARCHAR2(50)
3	DESCRIPTION	Geographic area description	VARCHAR2(2000)
4	CREATED_BY	Created by	VARCHAR2(30)
5	CREATED_DATE	Created date	DATE
6	CREATED_IN_INSTANCE	Created in instance	VARCHAR2(6)
7	MODIFIED_BY	Modified by	VARCHAR2(30)
8	MODIFIED_DATE	Modified date	DATE
9	MODIFIED_IN_INSTANCE	Modified in instance	VARCHAR2(6)

Type of key	**Column(s)**	**Tables to link**	**Abbreviated notation**
Primary	CN	N/A	GEOAREA_PK
Unique	NAME	N/A	GEOAREA_UK

1. CN — Geographic area sequence number. A unique sequence number used to identify a geographic area record.

2. NAME — Geographic area name. A unique name for the geographic area.

3. DESCRIPTION

   Geographic area description. A brief summary description of the geographic area.

4. CREATED_BY — Created by. See POPULATION.CREATED_BY description for definition.

5. CREATED_DATE

   Created date. See POPULATION.CREATED_DATE description for definition.

6. CREATED_IN_INSTANCE

Created in instance. See POPULATION.CREATED_IN_INSTANCE description for definition.

7. MODIFIED_BY

Modified by. See POPULATION.MODIFIED_BY description for definition.

8. MODIFIED_DATE

Modified date. See POPULATION.MODIFIED_DATE description for definition.

9. MODIFIED_IN_INSTANCE

Modified in instance. See POPULATION.MODIFIED_IN_INSTANCE description for definition.

2.10 Plot Field Sample Assignment Table (Oracle table name is PLOT_FLDSAMP_ASSGN)

The purpose of the PLOT_FLDSAMP_ASSGN table is to store the linkage between plots (see PLOT table) and field samples. This relationship is modeled as many-to-many. This means a given field sample can be associated with many plots and a given plot can be associated with many field samples. Allowing a given plot to be associated with many field samples allows a plot to fulfill multiple purposes for a single visit. For example, a single plot visit may collect data for the traditional FIA forest land inventory as well as urban data for a particular urban area. A plot might be both an FIA forest plot and a fire study plot. By modeling this relationship the user can easily identify the particular series of data they are interested in and then link to the plots that are included in that sample without repeating plot data.

	Column name	**Descriptive name**	**Oracle data type**
1	PLT_CN	Plot sequence number	VARCHAR2(34)
2	FLDSAMP_CN	Field sample sequence number	VARCHAR2(34)
3	CREATED_BY	Created by	VARCHAR2(30)
4	CREATED_DATE	Created date	DATE
5	CREATED_IN_INSTANCE	Created in instance	VARCHAR2(6)
6	MODIFIED_BY	Modified by	VARCHAR2(30)
7	MODIFIED_IN_INSTANCE	Modified in instance	VARCHAR2(6)
8	MODIFIED_DATE	Modified date	Date

Type of key	**Column(s)**	**Tables to link**	**Abbreviated notation**
Primary	PLT_CN, FLDSAMP_CN	N/A	PLTFLDSAMPASGN_PK
Foreign	FLDSAMP_CN	PLOT_FLDSAMP_ASSGN to FIELD_SAMPLE	PLTFLDSAMPASGN _FLDSAMP_FK
Foreign	PLT_CN	PLOT_FLDSAMP_ASSGN to PLOT	PLTFLDSAMPASGN _PLT_FK

1. PLT_CN Plot sequence number. Foreign key linking the plot field sample assignment record to the plot record.

2. FLDSAMP_CN

   Field sample sequence number. Foreign key linking the plot field sample assignment record to the field sample record.

3. CREATED_BY Created by. See POPULATION.CREATED_BY description for definition.

4. CREATED_DATE

   Created date. See POPULATION.CREATED_DATE description for definition.

5. CREATED_IN_INSTANCE

   Created in instance. See POPULATION.CREATED_IN_INSTANCE description for definition.

6. MODIFIED_BY

   Modified by. See POPULATION.MODIFIED_BY description for definition.

7. MODIFIED_IN_INSTANCE

   Modified in instance. See POPULATION.MODIFIED_IN_INSTANCE description for definition.

8. MODIFIED_DATE

   Modified date. See POPULATION.MODIFIED_DATE description for definition.

2.11 Sample Organization Examples

There is a lot of information available in the Sample Organization table group. This section provides some examples of how to make use of this information to answer questions. This section is organized by question. A brief explanation, along with a SQL script, is provided for each question. SQL scripts are written in standard Oracle SQL language.

<u>What populations are available for estimation?</u>

The list of defined populations is stored in a single table called POPULATION. No joins are required to access this list. Note that this table allows multiple versions of a population to be defined, which reflects the potential for populations to change over time. Using an ORDER BY clause makes it easy to organize output and show versions of populations in order.

```
SELECT * FROM population ORDER BY NAME, version;
```

<u>What inventory projects are available for a population of interest?</u>

The Urban Stage 1 data structure models the relationship between a population of interest and an inventory project as many-to-many. This allows a given inventory project to target multiple versions of a population. To query this from the database, the user must include the list of populations, the list of inventory projects, and the link between these lists. This is accomplished by including the POPULATION, PROJECT, and PROJECT_POPN_ASSGN tables in the FROM clause. There are two joins required. First, the PROJECT table must be joined to the PROJECT_POPN_ASSGN table through the CN value of the PROJECT. Second, the POPULATION table must be joined to the PROJECT_POPN_ASSGN table through the CN value of the POPULATION.

```
SELECT pop.name              popn_name,
       pop.version           popn_version,
       proj.name,
       proj.inventory_type,
       proj.description
  FROM project proj, population pop, project_popn_assgn ppa
 WHERE ppa.proj_cn = proj.cn
   AND ppa.popn_cn = pop.cn
 ORDER BY pop.name, pop.version, proj.name;
```

<u>What field samples are available for a project of interest?</u>

Field samples are defined for every series within a project. To identify field samples, one must join together all the constituent components. To illustrate this, reference figure 2. Note the number of connections between the FIELD_SAMPLE table and other tables. In this example, the desired output is one record per field sample for a given project. The required tables for this are the PROJECT, SERIES, TIME_PERIOD and FIELD_SAMPLE tables. It is useful to include the POPULATION table so that the targeted population is clearly stated. Note that the SAMPLE_RULE table is not required. That table stores metadata describing how the sample was selected, which is not necessary for the current example.

Once the tables are included in the FROM clause they must be correctly joined. This is accomplished by joining the FIELD_SAMPLE table to the PROJECT, SERIES, and TIME_PERIOD tables through the associated CN values. Then, join the PROJECT table to the POPULATION table through the PROJECT_POPN_ASSGN table (as shown in the example above). The results can be constrained by specifying the project of interest by name.

```
SELECT popn.name     targeted_popn,
       popn.version  popn_version,
       proj.name     project_name,
       ser.name      series_name,
       tp.name       time_period,
       samp.cycle,
       samp.subcycle,
       tp.begin_date,
       tp.end_date,
       samp.notes
  FROM project            proj,
       series             ser,
       time_period        tp,
       field_sample       samp,
       population         popn,
       project_popn_assgn ppa
 WHERE samp.proj_cn = proj.cn
   AND samp.series_cn = ser.cn
   AND samp.time_period_cn = tp.cn
   AND proj.cn = ppa.proj_cn
   AND ppa.popn_cn = popn.cn
   AND proj.name = 'User-provided name'
 ORDER BY targeted_popn, popn_version, project_name, cycle, subcycle;
```

<u>What is the structure of a given version of a given population of interest?</u>

The sample organization table group allows users to query the defined structure of a given version of a population. The design feature reflects the reality that populations are not static over time. Things like county lines may change over long periods of time. Urban population boundaries are expected to change regularly as population concentrations change across the landscape. Annualized inventories that target such populations over a long period of time must be able to account for changes in the structure of the population. The POPULATION_STRUCTURE table provides this ability.

The user can query the structural elements of any population by querying the POPULATION, POPULATION_STRUCTURE, and GOEAREA tables. The POPULATION_STRUCTURE table is joined to the POPULATION table through the CN value of the population of interest. This can be identified by the query from the first example. The POPULATION_STRUCTURE table is also joined to the GEOAREA table through the CN value for the geographical area (GEOAREA_CN). Once these tables are joined, the user has access to the complete structure.

```
SELECT popn.name,
       popn.version,
       popstruc.precedence_rank,
       popstruc.boundary,
       popstruc.stand_alone,
```

```
             popstruc.sample_fills_area,
             ga.name area_name,
             popstruc.notes
        FROM population popn, population_structure popstruc, geoarea ga
       WHERE popn.cn = popstruc.popn_cn
         AND popstruc.geoarea_cn = ga.cn
         AND popn.name = 'User-provided name'
         AND popn.version = 'User-provided version
      ORDER BY popn.name, popn.version, popstruc.precedence_rank, ga.name;
```

What rules were used to select a field sample of interest?

Advanced users may want to know what rules were used to generate a particular sample of interest. This information is stored in the SAMPLE_RULE table. The information in this table relates a given FIELD_SAMPLE record to a particular set of POPULATION_STRUCTURE records, and by doing so, completes a circuit of information that starts and ends with POPULATION (reference figure 3). This connection reveals which version of a population was sampled by which field sample of a project. Each rule targets a specific element of the population structure and represents an intensification level and the temporal panels implemented for that element.

This query builds on the previous field sample example by adding two additional tables; SAMPLE_RULE and POPULATION_STRUCTURE. The SAMPLE_RULE table must be joined to the FIELD_SAMPLE table through the CN value for the field sample. The SAMPLE_RULE table must also be joined to the POPULATION_STRUCTURE table through both the population CN value (POPN_CN) and the geographic area CN value (GEOAREA_CN). This second connection explicitly joins to the structure of a defined version of a population. The final join is to join the POPULATION_STRUCTURE table to the POPULATION table through the population CN value (POPN_CN). An ORDER BY clause can be specified to order the results in a logical way for easy interpretation.

```
      SELECT samp.cn          fld_samp_cn,
             popn.name        targeted_popn,
             popn.version     popn_version,
             proj.name        project_name,
             ser.name         series_name,
             tp.name          time_period,
             ga.name          targeted_geoarea,
             sr.intensity,
             samp.cycle,
             samp.subcycle,
             tp.begin_date,
             tp.end_date,
             sr.begin_panel70,
             sr.end_panel70,
             samp.notes
        FROM project              proj,
             series               ser,
             time_period          tp,
             field_sample         samp,
             sample_rule          sr,
             population_structure ps,
             population           popn,
             project_popn_assgn   ppa,
```

```
      geoarea               ga
WHERE samp.proj_cn = proj.cn
  AND samp.series_cn = ser.cn
  AND samp.time_period_cn = tp.cn
  AND sr.fld_samp_cn = samp.cn
  AND sr.popn_cn = ps.popn_cn
  AND sr.geoarea_cn = ps.geoarea_cn
  AND sr.geoarea_cn = ga.cn
  AND ps.geoarea_cn = ga.cn
  AND ps.popn_cn = popn.cn
  AND proj.cn = ppa.proj_cn
  AND ppa.popn_cn = popn.cn
ORDER BY project_name, cycle, subcycle, targeted_geoarea, intensity;
```

Chapter 3 – Inventory Data Table Group

The structure of the inventory data for Urban Stage 1 of the annualized urban forest inventory is designed to accept the output from the iTree compilation engine of UFHHEQ. This data structure is different than that implemented in the traditional FIADB database that some users might be familiar with. The central element is the PLOT table, which stores information describing the primary sampling unit; a plot. The other tables are child tables (directly or indirectly) of the plot table. Users are cautioned that this data structure implemented for Urban Stage 1 of the annualized urban inventory is expected to change significantly during Urban Stage 2 of the project. Building large and complex applications that depend on this structure is not recommended.

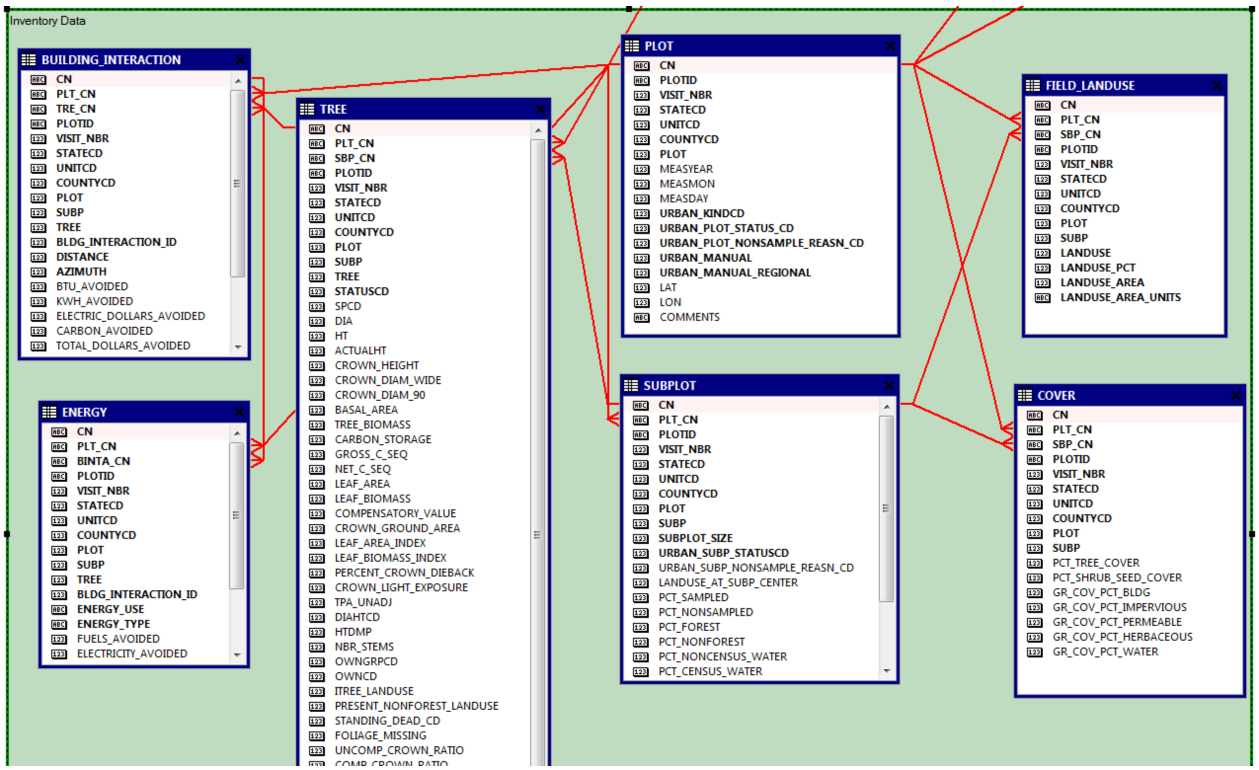


Figure 4. Inventory Data Table Group.

3.1 Plot Table (Oracle table name is PLOT)

The purpose of the PLOT table is to organize information about the primary sampling point; a plot. A plot is a dimensionless point that exists at a specific place at a specific point in time. Information describing the primary sampling unit includes the identity of the plot, the measurement date, the sampling status achieved at the visit, and the location of the plot. Note that a single plot visit might result in information for multiple purposes. For example, a given plot visit might constitute an FIA P2 plot, as well as an Urban plot visit. In this example, there are two purposes or contexts in which the plot visit can be interpreted. From the perspective of the FIA P2 CORE (forestland) inventory program, it represents a standard plot visit targeting a State as the population of interest. From the perspective of the Urban inventory, it represents a plot visit targeting a particular urban area. The CYCLE and SUBCYCLE iterators may be different under each context representing the number of times that given population has been fully inventoried using the FIA hexagonal sampling frame. The relationship between a plot visit (a record in the PLOT table) and the contexts it supports is stored in the PLOT_FLDSAMP_ASSGN table of the Sample Organization table group.

	Column name	**Descriptive name**	**Oracle data type**
1	CN	Sequence number	VARCHAR2(34)
2	PLOTID	Plot identifier	VARCHAR2(20)
3	VISIT_NBR	Visit number	NUMBER(3,0)
4	STATECD	State code	NUMBER(4,0)
5	UNITCD	Unit code	NUMBER(2,0)
6	COUNTYCD	County code	NUMBER(3,0)
7	PLOT	Plot number	NUMBER(6,0)
8	MEASYEAR	Measurement year	NUMBER(4,0)
9	MEASMON	Measurement month	NUMBER(2,0)
10	MEASDAY	Measurement day	NUMBER(2,0)
11	URBAN_KINDCD	Urban sample kind code	NUMBER(2,0)
12	URBAN_PLOT_STATUS_CD	Urban plot status code	NUMBER(1,0)
13	URBAN_PLOT_NONSAMPLE_REASN_CD	Urban plot nonsampled reason code	NUMBER(2,0)
14	URBAN_MANUAL	Urban manual version	NUMBER(3,1)
15	URBAN_MANUAL_REGIONAL	Urban regional manual version	NUMBER(4,2)
16	LAT	Latitude	NUMBER(8,6)
17	LON	Longitude	NUMBER(9,6)
18	NOTES	Plot notes	VARCHAR2(2000)
19	CREATED_BY	Created by	VARCHAR2(30)
20	CREATED_DATE	Created date	DATE
21	CREATED_IN_INSTANCE	Created in instance	VARCHAR2(6)
22	MODIFIED_BY	Modified by	VARCHAR2(30)
23	MODIFIED_IN_INSTANCE	Modified in instance	VARCHAR2(6)
24	MODIFIED_DATE	Modified date	DATE

Type of key	Column(s)	Tables to link	Abbreviated notation
Primary	CN	N/A	PLT_PK
Unique	PLOTID, VISIT_NBR	N/A	PLT_UK
Unique	STATECD, COUNTYCD, PLOT, VISIT_NBR	N/A	PLT_UK2

1. CN — Sequence number. A unique sequence number identifying the plot record.

2. PLOTID — Plot identifier. A concatenated string that uniquely identifies the sampling point used for the plot record.

3. VISIT_NBR — Visit number. An iterating counter recording the number of times the sampling point has been visited.

4. STATECD — State code. A numeric code indicating the State. The code is taken from the Federal Information Processing Standards (FIPS) code set maintained by the Bureau of the Census. Refer to appendix B. Each State is also defined as a geographic area in the GEOAREA table.

5. UNITCD — Survey unit number. Forest Inventory and Analysis survey unit identification number. Survey units are groups of counties within States used to organize the population into logical groups for field logistics as well as for estimation purposes. Refer to appendix B for codes.

6. COUNTYCD — County code. The identification number for a county, parish, watershed, borough, or similar governmental unit in a State. FIPS codes from the Bureau of the Census are used. Each county (or other governmental unit) is also defined in the GEOAREA table. Refer to appendix B for codes.

7. PLOT — Plot number. A number that, in combination with STATECD and COUNTYCD, uniquely identifies a sample location; and with STATECD, COUNTYCD, and INVYR uniquely identifies a plot visit.

8. MEASYEAR — Measurement year. The calendar year in which the plot measurement occurred.

9. MEASMON — Measurement month. The calendar month in which the plot measurement occurred.

Code	Description
01	January
02	February
03	March
04	April
05	May
06	June
07	July
08	August
09	September

Code	Description
10	October
11	November
12	December

10. MEASDAY Measurement day. The day on which the plot measurement occurred.

11. URBAN_KINDCD

Urban sample kind code. The sample kind code under the urban protocol. A sample kind is a code indicating the type of plot installation that occurred at the current visit.

Code	Description
1	Initial installation of a National design plot.
2	Remeasurement of previously installed National design plot.
3	Replacement of previously installed National design plot.

12. URBAN_PLOT_STATUS_CD

Urban plot status code. The plot status code under the urban protocol. A code describing the sampling status of an urban plot visit.

Code	Description
1	Sampled – at least one accessible forest land condition present on plot.
2	Sampled- no accessible forest or non forest land condition present on plot, i.e. Plot is either census and / or noncensus water.
3	Nonsampled.

13. URBAN_PLOT_NONSAMPLE_REASN_CD

Urban plot nonsampled reason code. A code describing the reason an urban plot was entirely nonsampled.

Code	Description
01	Outside U.S. boundary – Entire plot is outside of the U.S. border.
02	Denied access – Access to the entire plot is denied by the legal owner, or by the owner of the only reasonable route to the plot.
03	Hazardous – Entire plot cannot be accessed because of a hazard or danger, for example cliffs, quarries, strip mines, illegal substance plantations, high water, etc.
05	Lost data – Plot data file was discovered to be corrupt after a panel was completed and submitted for processing. This code is applied at the time of processing after notification to the units. This code is for office use only.
06	Lost plot – Entire plot cannot be found. Whenever this code is assigned, a replacement plot is required.
07	Wrong location – Previous plot can be found, but its placement is beyond the tolerance limits for plot location. Whenever this code is assigned, a replacement plot is required.
08	Skipped visit – Entire plot skipped. Used for plots that are not completed prior to the time a panel is finished and submitted for processing. This code is for office use only.

Code	Description
09	Dropped intensified plot - Intensified plot dropped due to a change in grid density. This code used only by units engaged in intensification. This code is for office use only.
10	Other – Entire plot not sampled due to a reason other than one of the specific reasons already listed.
11	Ocean – Plot falls in ocean water below mean high tide line.

14. URBAN_MANUAL

Urban manual version. The version of the national urban field guide used to make measurements for the current plot visit. This value is used when cross-referencing legal code values in code definition reference tables to assure the codes returned are the codes the crews used for data collection.

15. URBAN_MANUAL REGIONAL

Urban regional manual version. The version of the regional urban field guide used to make measurements for the current plot visit. Note that each region makes regional modifications to the national field guide. Changes streamline data collection for the targeted region as well as append additional measurements that are only of interest in the given region.

16. LAT — Latitude. The approximate latitude of the plot in decimal degrees using the NAD 83 datum. Actual plot coordinates cannot be released because of a Privacy provision enacted by Congress in the Food Security Act of 1985. Therefore, this attribute is approximately +/- 1 mile and, for annual inventory data, most plots are within +/- ½ mile. Annual data have additional uncertainty for private plots caused by swapping plot coordinates for up to 20 percent of the plots.

17. LON — Longitude. The approximate longitude of the plot in decimal degrees using NAD 83 datum. Actual plot coordinates cannot be released because of a Privacy provision enacted by Congress in the Food Security Act of 1985. Therefore, this attribute is approximately +/- 1 mile and, for annual inventory data, most plots are within +/- ½ mile. Annual data have additional uncertainty for private plots caused by swapping plot coordinates for up to 20 percent of the plots.

18. NOTES — Plot notes. Any relevant notes about the plot.

19. CREATED_BY — Created by. See POPULATION.CREATED_BY description for definition.

20. CREATED_DATE

Created date. See POPULATION.CREATED_DATE description for definition.

21. CREATED_IN_INSTANCE

Created in instance. See POPULATION.CREATED_IN_INSTANCE description for definition.

22. MODIFIED_BY

Modified by. See POPULATION.MODIFIED_BY description for definition.

23. MODIFIED_IN_INSTANCE

Modified in instance. POPULATION.MODIFIED_IN_INSTANCE description for definition.

24. MODIFIED_DATE

Modified date. See POPULATION.MODIFIED_DATE description for definition.

3.2 Subplot Table (Oracle table name is SUBPLOT)

The purpose of the SUBPLOT table is to organize information describing the fixed-area footprint components of the plot. Each plot can be thought of as a dimensionless point on the landscape on which one or more footprints are installed. For example, the FIA CORE program installs a fixed-area footprint composed of four 24-foot subplots (each with a single nested microplot) arranged in a cluster pattern. The annualized urban inventory installs a footprint composed of a single 48-foot subplot with four nested microplots. Information describing each footprint element includes its identity, the size, the sampling status, as well as some descriptive values describing the percentage of the footprint element that falls in a given category (e.g., SAMPLED).

There is an important difference between the SUBPLOT table of the Stage 1 Urban FIADB data structure and the SUBPLOT table of the traditional FIADB data structure. In the traditional FIADB, each subplot is assumed to have one nested microplot. Therefore, information relating to the microplot is stored on the record of the corresponding subplot resulting in four records (one for each subplot) for every plot in the traditional FIA forest land inventory. In the Urban Stage 1 Urban FIADB data structure, each footprint element has its own record. Therefore, each plot collected under the urban protocol has five records; one for the 48-foot subplot and one for each of the four microplots nested within the subplot.

	Column name	**Descriptive name**	**Oracle data type**
1	CN	Subplot sequence number	VARCHAR2(34)
2	PLT_CN	Plot sequence number	VARCHAR2(34)
3	PLOTID	Plot identifier	VARCHAR2(20)
4	VISIT_NBR	Visit number	NUMBER(3,0)
5	STATECD	State code	NUMBER(4,0)
6	UNITCD	Survey unit code	NUMBER(2,0)
7	COUNTYCD	County code	NUMBER(3,0)
8	PLOT	Plot number	NUMBER(6,0)
9	SUBP	Subplot number	NUMBER(3,0)
10	SUBPLOT_SIZE	Subplot Size	NUMBER(6,2)
11	URBAN_SUBP_STATUSCD	Urban subplot status code	NUMBER(1,0)
12	URBAN_SUBP_NONSAMPLE_REASN_CD	Urban subplot nonsampled reason code	NUMBER(2,0)
13	LANDUSE_AT_SUBP_CENTER	Land use at subplot center	NUMBER(3,0)
14	PCT_SAMPLED	Percent sampled	NUMBER(3,0)
15	PCT_NONSAMPLED	Percent nonsampled	NUMBER(3,0)
16	PCT_FOREST	Percent forest	NUMBER(3,0)
17	PCT_NONFOREST	Percent nonforest	NUMBER(3,0)
18	PCT_NONCENSUS_WATER	Percent noncensus water	NUMBER(3,0)
19	PCT_CENSUS_WATER	Percent census water	NUMBER(3,0)
20	CREATED_BY	Created by	VARCHAR2(30)
21	CREATED_DATE	Created date	DATE

	Column name	Descriptive name	Oracle data type
22	CREATED_IN_INSTANCE	Created in instance	VARCHAR2(6)
23	MODIFIED_BY	Modified by	VARCHAR2(30)
24	MODIFIED_IN_INSTANCE	Modified in instance	VARCHAR2(6)
25	MODIFIED_DATE	Modified date	DATE

Type of key	Column(s) order	Tables to link	Abbreviated notation
Primary	CN	N/A	SBP_PK
Unique	PLOTID, VISIT_NBR, SUBP	N/A	SBP_UK
Unique	STATECD, COUNTYCD, PLOT, VISIT_NBR, SUBP	N/A	SBP_UK2
Foreign	PLT_CN	SUBPLOT to PLOT	SBP_PLT_FK

1. CN — Subplot sequence number. A unique sequence number identifying the subplot record.

2. PLT_CN — Plot sequence number. Foreign key linking the subplot record to the plot record.

3. PLOTID — Plot identifier. A concatenated string that uniquely identifies the sampling point used for the plot record.

4. VISIT_NBR — Visit number. An iterating counter recording the number of times the sampling point has been visited.

5. STATECD — State code. A numeric code indicating the State. The code is taken from the Federal Information Processing Standards (FIPS) code set maintained by the Bureau of the Census. Refer to appendix B. Each State is defined as a geographic area in the GEOAREA table.

6. UNITCD — Survey unit code. Forest Inventory and Analysis survey unit identification number. Survey units are groups of counties within States used to organize the population into logical groups for field logistics as well as for estimation purposes. Refer to appendix B for codes.

7. COUNTYCD — County code. The identification number for a county, parish, watershed, borough, or similar governmental unit in a State. FIPS codes from the Bureau of the Census are used. Each county (or other governmental unit) is also defined in the GEOAREA table. Refer to appendix B for codes.

8. PLOT — Plot number. A number that, in combination with STATECD and COUNTYCD, uniquely identifies a sample location. And with STATECD, COUNTYCD, and INVYR uniquely identifies a plot visit.

9. SUBP — Subplot number. The identity of the subplot. The national urban protocol includes five subplot elements listed below.

Code	Description
1	48.0-foot subplot centered on Plot Center (PC).
11	6.8-foot microplot located 12 feet from PC 90°.
12	6.8-foot microplot located 12 feet from PC 180°.
13	6.8-foot microplot located 12 feet from PC 270°.
14	6.8-foot microplot located 12 feet from PC 360°.

10. SUBPLOT_SIZE

Subplot size. The radius in feet of the subplot element.

11. URBAN_SUBP_STATUSCD

Urban subplot status code. The subplot status under the urban protocol. A status code describes the sampling status of the subplot. Urban subplot status codes can be referenced in REF_URBAN_SUBP_STATUS.

Code	Description
1	Sampled – at least one accessible forest land condition present on subplot.
2	Sampled – no accessible forest or accessible nonforest land condition present on subplot, i.e., Subplot is either census and/or noncensus water.
3	Nonsampled.

12. URBAN_SUBP_NONSAMPLE_REASN_CD

Urban subplot nonsampled reason code. The subplot nonsampled reason code under the urban protocol. A nonsampled reason code describes why a subplot was not sampled. The urban subplot nonsampled reason codes can be referenced in REF_URBAN_SUBP_NONSAMPLE_REASN.

Code	Description
1	Outside U.S. boundary – Assign this code to condition classes beyond the U.S. border.
2	Denied access area – Any area within the sampled area of a plot to which access is denied by the legal owner, or to which an owner of the only reasonable route to the plot denies access. There are no minimum area or width requirements for a condition class delineated by denied access.
3	Hazardous situation – Any area within the sampled area on plot that cannot be accessed because of a hazard or danger, for example cliffs, quarries, strip mines, illegal substance plantations, temporary high water, etc. There are no minimum size or width requirements for a condition class delineated by a hazardous condition.
4	Time limitation – This code applies to full subplots that cannot be sampled due to a time restriction. This code is reserved for areas with limited access and in situations where it is imperative for the crew to leave before the plot can be completed (e.g., scheduled helicopter rendezvous).
5	Lost data – The plot data file was discovered to be corrupt after a panel was completed and submitted for processing. This code is assigned to entire plots or full subplots that could not be processed, and is applied at the time of processing after notification to the region. Note: This code is for office use only.

Code	Description
6	Lost plot – Entire plot cannot be found. Used for the subplots that are required for this plot.
7	Wrong location – Previous plot can be found, but its placement is beyond the tolerance limits for plot location.
8	Skipped visit – Entire plot skipped. Used for plots that are not completed prior to the time a panel is finished and submitted for processing.
9	Dropped intensified plot - Intensified plot dropped due to a change in grid density. Used only by units engaged in intensification.
10	Other – This code is used whenever a plot or condition class is not sampled due to a reason other than one of the specific reasons already listed.
11	Ocean – Subplot falls in ocean water below mean high tide line.

13. LANDUSE_AT_SUBP_CENTER

Land use at subplot center. The land use assigned to the center of the subplot element. Land uses are determined by the field crew. Land use codes can be referenced in REF_LANDUSE. This code set used was developed by the iTree program and is not the nonforest land use codes traditionally used by FIA.

Code	Description
10	Agriculture: Is defined as cropland, pasture, idle farmland, orchards, vineyards, nurseries, maintained wildlife openings, farmsteads and related buildings, feed lots, rangeland, and includes windbreaks and shelterbelts that do not meet the definition for forest land. Wooded areas /plantations that are managed for a specific crop such as nuts or Christmas trees or forest land that shows obvious evidence of management activity related specifically to wood production are also included.
20	Residential: Freestanding, and related green space, structures serving one to four families each.
21	Multi-family residential: Structures containing more than four residential units. [Note: A block of attached one- to four-family structures would be considered multi-family residential. A residential complex consisting of many separate one- to four-family structures and related green-space would be also considered multi-family residential].
22	Institutional: Schools, hospitals/medical complexes, colleges, religious buildings, government buildings, etc., and related green spaces.
23	Commercial/Industrial: In addition to standard commercial and industrial land uses, this category includes outdoor storage/staging areas as well as parking lots in downtown areas that are not connected with an institutional or residential use.
24	Vacant: This category includes land with no clear intended use. Abandoned buildings, vacant structures, and their associated infrastructure and green space should be classified based on their original intended use. For example, an overgrown parking lot and playground associated with an abandoned apartment complex would be classified as Multi-family Residential, not Vacant. Idle farmland should be classified as Agriculture. Forest land that is not clearly actively managed for timber production and is not contained within the boundaries of a Park, Golf course, or Cemetery land use would be coded as Vacant. For example forest land in the form of a woodlot in the middle of a corn field would be considered Vacant, as the land is not associated with a particular land use. Forest land contained

Code	Description
	within the boundaries of a Park, Golf Course, or Cemetery would be coded respectively.
25	Cemetery: Includes associated access roads, buildings, green space (maintained & unmaintained), and forest land within the cemetery boundary.
30	Transportation: Includes limited access roadways and related green-spaces (such as interstate highways with on and off ramps, sometimes fenced); railroad stations, tracks and yards; shipyards; airports; etc. If plot falls on any other type of road, or associated median strip, classify according to nearest adjacent land use.
31	Utility: Power-generating facilities, sewage treatment facilities, covered and uncovered reservoirs, and empty storm-water runoff retention areas, flood control channels, conduits.
40	Park: Parks include associated access roads, buildings, green space (maintained and unmaintained), and forest land within the park boundary.
41	Golf Course: Includes associated access roads, buildings, green space (maintained and unmaintained), and forest land within the golf course boundary.
50	Water/wetland: Streams, rivers, lakes, storm-water retention areas and other water bodies / wetlands (natural or manmade) that meet the definition of URBAN CONDITION CLASS STATUS 3 or 4 or areas meeting the definition of URBAN NONFOREST LAND USE 420. Areas of standing water / wetlands that do not meet minimum size requirements should be classified based on the adjacent land use; such areas may include small pools and fountains.
60	Other: Land uses that are not better described by one of the categories listed above. This designation should be used very sparingly as it provides very little useful information for the model.

14. PCT_SAMPLED

Percent sampled. The percentage of the area of the subplot element that was sampled.

15. PCT_NONSAMPLED

Percent nonsampled. The percentage of the area of the subplot element that was not sampled.

16. PCT_FOREST Percent forest. The percentage of the area of the subplot element that is forested according to the FIA definition of forest land. Accessible forest land is land that is within the population of interest, is accessible, is on a subplot that can be occupied at subplot center, can safely be visited, and meets the following criteria:

(a) Forest Land has at least 10 percent canopy cover of live tally tree species of any size or has had at least 10 percent canopy cover of live tally species in the past, based on the presence of stumps, snags, or other evidence. Additionally, the condition is not subject to nonforest use(s) that prevent normal tree regeneration and succession, such as regular mowing, intensive grazing, or recreation activities.

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

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

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

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

17. PCT_NONFOREST

Percent nonforest. The percentage of the area of the subplot element that is nonforest according to the FIA definition.

18. PCT_NONCENSUS_WATER

Percent noncensus water. The percentage of the area of the subplot element that is non-census water according to the FIA definition.

19. PCT_CENSUS_WATER

Percent census water. The percentage of the area of the subplot element that is census water according to the FIA definition.

20. CREATED_BY Created by. See POPULATION.CREATED_BY description for definition.

21. CREATED_DATE

    Created date. See POPULATION.CREATED_DATE description for definition.

22. CREATED_IN_INSTANCE

    Created in instance. See POPULATION.CREATED_IN_INSTANCE description for definition.

23. MODIFIED_BY

    Modified by. See POPULATION.MODIFIED_BY description for definition.

24. MODIFIED_IN_INSTANCE

    Modified in instance. See POPULATION.MODIFIED_IN_INSTANCE description for definition.

25. MODIFIED_DATE

    Modified date. See POPULATION.MODIFIED_DATE description for definition.

3.3 Field Land Use Table (Oracle table name is FIELD_LANDUSE)

The purpose of the FIELD_LANDUSE table is to store information describing the land uses identified and mapped on each footprint element installed on the plot. The land uses recorded are defined by the iTree land use codes. This was done because iTree land use codes are assigned to all areas sampled on the footprint whereas the land use codes traditionally used by FIA are only assigned to nonforested areas. Information describing the landuse on each footprint element includes the identity of the footprint element being described, the particular land use mapped, the percentage of the footprint area accounted for by the land use and the area of that land use. Note that multiple land uses can be mapped to a single footprint element and that nonsampled areas are not accounted for in this table; meaning there are no records for nonsampled area.

	Column name	**Descriptive name**	**Oracle data type**
1	CN	Field land use sequence number	VARCHAR2(34)
2	PLT_CN	Plot sequence number	VARCHAR2(34)
3	SBP_CN	Subplot sequence number	VARCHR2(34)
4	PLOTID	Plot identifier	VARCHAR2(20)
5	VISIT_NBR	Visit number	NUMBER(3,0)
6	STATECD	State code	NUMBER(4,0)
7	UNITCD	Survey unit code	NUMBER(2,0)
8	COUNTYCD	County code	NUMBER(3,0)
9	PLOT	Plot number	NUMBER(6,0)
10	SUBP	Subplot number	NUMBER(3,0)
11	LANDUSE	Land use	NUMBER(2,0)
12	PCT_LANDUSE	Percent land use	NUMBER(3,0)
13	LANDUSE_AREA	Land use area	NUMBER(5,1)
14	CREATED_BY	Created by	VARCHAR2(30)
15	CREATED_DATE	Created date	DATE
16	CREATED_IN_INSTANCE	Created in instance	VARCHAR2(6)
17	MODIFIED_BY	Modified by	VARCHAR2(30)
18	MODIFIED_IN_INSTANCE	Modified in instance	VARCHAR2(6)
19	MODIFIED_DATE	Modified date	DATE

Type of key	**Column(s) order**	**Tables to link**	**Abbreviated notation**
Primary	CN	N/A	FLU_PK
Unique	PLOTID, VISIT_NBR, SUBP, LANDUSE	N/A	FLU_UK
Unique	STATECD, COUNTYCD, PLOT, VISIT_NBR, SUBP, LANDUSE	N/A	FLU_UK2
Unique	PLT_CN, SUBP, LANDUSE	N/A	FLU_UK3
Foreign	PLT_CN	FIELD_LANDUSE to PLOT	FLU_PLT_FK
Foreign	SBP_CN	FIELD_LANDUSE to SUBPLOT	FLU_SBP_FK

1. CN — Field land use sequence number. A unique sequence number identifying the field land use record.

2. PLT_CN — Plot sequence number. Foreign key linking the field land use record to the plot record.

3. SBP_CN — Subplot sequence number. Foreign key linking the field land use record to the subplot record.

4. PLOTID — Plot identifier. A concatenated string that uniquely identifies the sampling point used for the plot record.

5. VISIT_NBR — Visit number. An iterating counter recording the number of times the sampling point has been visited.

6. STATECD — State code. A numeric code indicating the State. The code is taken from the Federal Information Processing Standards (FIPS) code set maintained by the Bureau of the Census. Refer to appendix B for codes. Each State is also defined as a geographic area in the GEOAREA table.

7. UNITCD — Survey unit code. Forest Inventory and Analysis (FIA) survey unit identification number. Survey units are groups of counties within States used to organize the population into logical groups for field logistics as well as for estimation purposes. Refer to appendix B for codes.

8. COUNTYCD — County code. The identification code used for a county, parish, watershed, borough, or other similar governmental unit in a State. FIPS codes from the Bureau of the Census are used. County reference data are available in the geographic hierarchy tables. Each county (or other governmental unit) is also defined in the GEOAREA table. Refer to appendix B for codes.

9. PLOT — Plot number. A number that, in combination with STATECD and COUNTYCD, uniquely identifies a sample location. And with STATECD, COUNTYCD, and INVYR uniquely identifies a plot visit.

10. SUBP — Subplot number. The identity of the subplot. The national urban protocol includes five subplot elements listed below.

Code	Description
1	48.0-foot subplot centered on Plot Center (PC).
11	6.8-foot microplot located 12 feet from PC 90°.
12	6.8-foot microplot located 12 feet from PC 180°.
13	6.8-foot microplot located 12 feet from PC 270°.
14	6.8-foot microplot located 12 feet from PC 360°.

11. LANDUSE

Land use. The land use as recorded by the field crew. This code set used was developed by the iTree program and is not the nonforest land use codes traditionally used by FIA.

Code	Description
10	Agriculture: Is defined as cropland, pasture, idle farmland, orchards, vineyards, nurseries, maintained wildlife openings, farmsteads and related buildings, feed lots, rangeland, and includes windbreaks and shelterbelts that do not meet the definition for forest land. Wooded areas /plantations that are managed for a specific crop such as nuts or Christmas trees or forest land that shows obvious evidence of management activity related specifically to wood production are also included.
20	Residential: Freestanding, and related green space, structures serving one to four families each.
21	Multi-family residential: Structures containing more than four residential units. [Note: A block of attached one- to four-family structures would be considered multi-family residential. A residential complex consisting of many separate one- to four-family structures and related green-space would be also considered multi-family residential].
22	Institutional: Schools, hospitals/medical complexes, colleges, religious buildings, government buildings, etc., and related green spaces.
23	Commercial/Industrial: In addition to standard commercial and industrial land uses, this category includes outdoor storage/staging areas as well as parking lots in downtown areas that are not connected with an institutional or residential use.
24	Vacant: This category includes land with no clear intended use. Abandoned buildings, vacant structures, and their associated infrastructure and green space should be classified based on their original intended use. For example, an overgrown parking lot and playground associated with an abandoned apartment complex would be classified as Multi-family Residential, not Vacant. Idle farmland should be classified as Agriculture. Forest land that is not clearly actively managed for timber production and is not contained within the boundaries of a Park, Golf course, or Cemetery land use would be coded as Vacant. For example forest land in the form of a woodlot in the middle of a corn field would be considered Vacant, as the land is not associated with a particular land use. Forest land contained within the boundaries of a Park, Golf Course, or Cemetery would be coded respectively.
25	Cemetery: Includes associated access roads, buildings, green space (maintained & unmaintained), and forest land within the cemetery boundary.
30	Transportation: Includes limited access roadways and related green-spaces (such as interstate highways with on and off ramps, sometimes fenced); railroad stations, tracks and yards; shipyards; airports; etc. If plot falls on any other type of road, or associated median strip, classify according to nearest adjacent land use.
31	Utility: Power-generating facilities, sewage treatment facilities, covered and uncovered reservoirs, and empty storm-water runoff retention areas, flood control channels, conduits.
40	Park: Parks include associated access roads, buildings, green space (maintained and unmaintained), and forest land within the park boundary.
41	Golf Course: Includes associated access roads, buildings, green space (maintained and unmaintained), and forest land within the golf course boundary.
50	Water/wetland: Streams, rivers, lakes, storm-water retention areas and other water bodies / wetlands (natural or manmade) that meet the definition of URBAN CONDITION CLASS STATUS 3 or 4 or areas meeting the definition of URBAN NONFOREST LAND USE 420. Areas of standing water / wetlands that do not meet minimum size requirements should be classified based on the adjacent land use; such areas may include small pools and fountains.

Code	Description
60	Other: Land uses that are not better described by one of the categories listed above. This designation should be used very sparingly as it provides very little useful information for the model.

12. PCT_LANDUSE

Percent land use. The percentage of the parent subplot element assigned to the current land use.

13. LANDUSE_AREA

Land use area. The area of the parent subplot element assigned to the current land use.

14. CREATED_BY Created by. See POPULATION.CREATED_BY description for definition.

15. CREATED_DATE

Created date. See POPULATION.CREATED_DATE description for definition.

16. CREATED_IN_INSTANCE

Created in instance. See POPULATION.CREATED_IN_INSTANCE description for definition.

17. MODIFIED_BY

Modified by. See POPULATION.MODIFIED_BY description for definition.

18. MODIFIED_IN_INSTANCE

Modified in instance. See POPULATION.MODIFIED_IN_INSTANCE description for definition.

19. MODIFIED_DATE

Modified date. See POPULATION.MODIFIED_DATE description for definition.

3.4 Cover Table (Oracle table name is COVER)

The purpose of the COVER table is to store information describing the ground cover of the subplot. Unlike the land use data (see the FIELD_LANDUSE table), cover information is only provided for the subplot. Cover information describes the percent of the subplot covered by trees, shrubs and seedlings, and ground cover. The ground cover is divided into five categories: building, impervious surfaces, permeable surfaces, herbaceous vegetation, and water. The ground cover classes must sum to 100 percent except when there is nonsampled area. As with FIELD_LANDUSE, nonsampled area is not accounted for in these data.

	Column name	Descriptive name	Oracle data type
1	CN	Cover sequence number	VARCHAR2(34)
2	PLT_CN	Plot sequence number	VARCHAR2(34)
3	SBP_CN	Subplot sequence number	VARCHAR2(34)
4	PLOTID	Plot Identifier	VARCHAR2(20)
5	VISIT_NBR	Visit number	NUMBER(3,0)
6	STATECD	State code	NUMBER(4,0)
7	UNITCD	Survey unit code	NUMBER(2,0)
8	COUNTYCD	County code	NUMBER(3,0)
9	PLOT	Plot number	NUMBER(6,0)
10	SUBP	Subplot number	NUMBER(3,0)
11	PCT_TREE_COVER	Percent tree cover	NUMBER(3,0)
12	PCT_SHRUB_SEED_COVER	Percent shrub and seedling cover	NUMBER(3,0)
13	GR_COV_PCT_BLDG	Ground cover – percent building	NUMBER(3,0)
14	GR_COV_PCT_IMPERVIOUS	Ground cover – percent impervious	NUMBER(3,0)
15	GR_COV_PCT_PERMEABLE	Ground cover – percent permeable	NUMBER(3,0)
16	GR_COV_PCT_HERBACEOUS	Ground cover – percent herbaceous	NUMBER(3,0)
17	GR_COV_PCT_WATER	Ground cover – percent water	NUMBER(3,0)
18	CREATED_BY	Created by	VARCHAR2(30)
19	CREATED_DATE	Created date	DATE
20	CREATED_IN_INSTANCE	Created in instance	VARCHAR2(6)
21	MODIFIED_BY	Modified by	VARCHAR2(30)
22	MODIFIED_IN_INSTANCE	Modified in instance	VARCHAR2(6)
23	MODIFIED_DATE	Modified date	DATE

Type of key	Column(s) order	Tables to link	Abbreviated notation
Primary	CN	N/A	CVR_PK
Unique	PLOTID, VISIT_NBR, SUBP	N/A	CVR_UK
Unique	STATECD, COUNTYCD, PLOT, VISIT_NBR, SUBP	N/A	CVR_UK2
Unique	PLT_CN, SUBP	N/A	CVR_UK3
Foreign	PLT_CN	COVER to PLOT	CVR_PLT_FK

Type of key	Column(s) order	Tables to link	Abbreviated notation
Foreign	SBP_CN	COVER to SUBPLOT	CVR_SBP_FK

1. CN — Cover sequence number. A unique sequence number identifying the cover record.

2. PLT_CN — Plot sequence number. Foreign key linking the cover record to the plot record.

3. SBP_CN — Subplot sequence number. Foreign key linking the cover record to the subplot record.

4. PLOTID — Plot identifier. A concatenated string that uniquely identifies the sampling point used for the plot record.

5. VISIT_NBR — Visit number. An iterating counter recording the number of times the sampling point has been visited.

6. STATECD — State code. A numeric code indicating the State. The code is taken from the Federal Information Processing Standards (FIPS) code set maintained by the Bureau of the Census. Refer to appendix B. Each State is also defined as a geographic area in the GEOAREA table.

7. UNITCD — Survey unit code. Forest Inventory and Analysis (FIA) survey unit identification number. Survey units are groups of counties within States used to organize the population into logical groups for field logistics as well as for estimation purposes. Refer to appendix B for codes.

8. COUNTYCD — County code. The identification code used for a county, parish, watershed, borough, or other similar governmental unit in a State. FIPS codes from the Bureau of the Census are used. County reference data are available in the geographic hierarchy tables. Each county (or other governmental unit) is also defined in the GEOAREA table. Refer to appendix B for codes.

9. PLOT — Plot number. A number that, in combination with STATECD and COUNTYCD, uniquely identifies a sample location. And with STATECD, COUNTYCD, and INVYR uniquely identifies a plot visit.

10. SUBP — Subplot number. The identity of the subplot. The national urban protocol includes five subplot elements listed below.

Code	Description
1	48.0-foot subplot centered on Plot Center (PC).
11	6.8-foot microplot located 12 feet from PC 90°.
12	6.8-foot microplot located 12 feet from PC 180°.
13	6.8-foot microplot located 12 feet from PC 270°.
14	6.8-foot microplot located 12 feet from PC 360°.

11. PCT_TREE_COVER

Percent tree cover. The percentage of the subplot area covered by trees and saplings.

12. PCT_SHRUB_SEED_COVER

Percent shrub and seedling cover. The percentage of the subplot area covered by shrubs and seedlings.

13. GR_COV_PCT_BLDG

Ground cover – percent building. The percentage of the subplot area covered by building.

14. GR_COV_PCT_IMPERVIOUS

Ground cover – percent impervious. The percentage of the subplot area covered by impervious surface.

15. GR_COV_PCT_PERMEABLE

Ground cover – percent permeable. The percentage of the subplot area covered by permeable surface.

16. GR_COV_PCT_HERBACEOUS

Ground cover – percent herbaceous. The percentage of the subplot area covered by herbaceous vegetation.

17. GR_COV_PCT_WATER

Ground cover – percent water. The percentage of the subplot area covered by water.

18. CREATED_BY Created by. See POPULATION.CREATED_BY description for definition.

19. CREATED_DATE

Created date. See POPULATION.CREATED_DATE description for definition.

20. CREATED_IN_INSTANCE

Created in instance. See POPULATION.CREATED_IN_INSTANCE description for definition.

21. MODIFIED_BY

Modified by. See POPULATION.MODIFIED_BY description for definition.

22. MODIFIED_IN_INSTANCE

Modified in instance. See POPULATION.MODIFIED_IN_INSTANCE description for definition.

23. MODIFIED_DATE

Modified date. See POPULATION.MODIFIED_DATE description for definition.

3.5 Tree Table (Oracle table name is TREE)

The purpose of the TREE table is to store information about all trees tallied on any footprint element. Each tree is considered a child of the footprint element (subplot or microplot) on which it was sampled. A foreign key to the parent plot, however, is also supported. This is the largest table in the Inventory Data table group both in terms of the records and columns. Each tree is uniquely identified by a tree number. There are many descriptive variables populated for each tree. Some of them are field measured or observed values, others were computed values populated by the iTree compilation engine. These computed values form the basis from which all tree-related population attributes will be computed.

	Column name	Descriptive name	Oracle data type
1	CN	Tree sequence number	VARCHAR2(34)
2	PLT_CN	Plot sequence number	VARCHAR2(34)
3	SBP_CN	Subplot sequence number	VARCHAR2(34)
4	PLOTID	Plot identifier	VARCHAR2(20)
5	VISIT_NBR	Visit number	NUMBER(3,0)
6	STATECD	State code	NUMBER(4,0)
7	UNITCD	Survey unit code	NUMBER(2,0)
8	COUNTYCD	County code	NUMBER(3,0)
9	PLOT	Plot number	NUMBER(6,0)
10	SUBP	Subplot number	NUMBER(3,0)
11	TREE	Tree number	NUMBER(3,0)
12	STATUSCD	Tree status code	NUMBER(1,0)
13	SPCD	Species code	NUMBER(4,0)
14	SPGRPCD	Species group code	NUMBER(2,0)
15	DIA	Current diameter	NUMBER(4,1)
16	HT	Total height	NUMBER(4,1)
17	ACTUALHT	Actual height	NUMBER(4,1)
18	CROWN_HEIGHT	Crown height	NUMBER(4,1)
19	CROWN_DIAM_WIDE	Crown diameter at the widest point	NUMBER(4,1)
20	CROWN_DIAM_90	Crown diameter at 90 degrees	NUMBER(4,1)
21	BASAL_AREA	Basal area	NUMBER
22	TREE_BIOMASS	Tree total biomass	NUMBER
23	CARBON_STORAGE	Carbon storage	NUMBER
24	GROSS_C_SEQ	Gross carbon sequestration	NUMBER
25	NET_C_SEQ	Net carbon sequestration	NUMBER
26	LEAF_AREA	Leaf area	NUMBER
27	LEAF_BIOMASS	Leaf biomass	NUMBER
28	COMPENSATORY_VALUE	Compensatory value	NUMBER(7,2)
29	CROWN_GROUND_AREA	Crown ground area	NUMBER

	Column name	Descriptive name	Oracle data type
30	LEAF_AREA_INDEX	Leaf area index	NUMBER
31	LEAF_BIOMASS_INDEX	Leaf biomass index	NUMBER
32	PERCENT_CROWN_DIEBACK	Percent crown dieback	NUMBER(3,0)
33	CROWN_LIGHT_EXPOSURE	Crown light exposure	NUMBER(1,0)
34	TPA_UNADJ	Trees per acre, unadjusted	NUMBER(11,6)
35	DIAHTCD	Diameter height code	NUMBER(1,0)
36	HTDMP	Height to diameter measurement point	NUMBER(3,1)
37	NBR_STEMS	Number of stems	NUMBER(2,0)
38	OWNGRPCD	Owner group code	NUMBER(2,0)
39	OWNCD	Owner code	NUMBER(2,0)
40	LANDUSE	Land use	NUMBER(2,0)
41	PRESENT_NONFOREST_LANDUSE	Present nonforest land use	NUMBER(3,0)
42	STANDING_DEAD_CD	Standing dead code	NUMBER(1,0)
43	FOLIAGE_MISSING	Foliage missing	NUMBER(3,0)
44	UNCOMP_CROWN_RATIO	Uncompacted live crown ratio	NUMBER(2,0)
45	COMP_CROWN_RATIO	Compacted crown ratio	NUMBER(2,0)
46	IS_MAINTAINED_AREA	Is tree in maintained area	VARCHAR2(5)
47	IS_RIPARIAN	Is tree in riparian area	VARCHAR2(5)
48	IS_STREET_TREE	Is tree a street tree	VARCHAR2(5)
49	IS_PLANTED	Is tree planted	VARCHAR2(5)
50	IS_BOLE_STUMP_REMOVED	Is bole/stump removed	VARCHAR2(5)
51	CROWN_CLASS_CD	Crown class code	NUMBER(1,0)
52	DMG_ROOT_STEM_GIRDLING	Root/stem girdling damage	NUMBER(1,0)
53	DMG_TRUNK_BARK_INCLUSION	Trunk/bark inclusion damage	NUMBER(1,0)
54	DMG_TOPPING_PRUNING	Topping/pruning damage	NUMBER(1,0)
55	DMG_EXCESS_MULCH	Excessive mulch damage	NUMBER(1,0)
56	DMG_SIDEWALK_ROOT_CONFLICT	Sidewalk/root conflict damage	NUMBER(1,0)
57	DMG_OVERHEAD_WIRES	Overhead wire conflict damage	NUMBER(1,0)
58	DMG_IMPROPER_PLANTING	Improper planting damage	NUMBER(1,0)
59	DAMAGE_AGENT_CD1	Damage agent 1	NUMBER(5,0)
60	DAMAGE_AGENT_CD2	Damage agent 2	NUMBER(5,0)
61	DAMAGE_AGENT_CD3	Damage agent 3	NUMBER(5,0)
62	CAUSE_OF_DEATH	Cause of death	NUMBER(2,0)
63	CREATED_BY	Created by	VARCHAR2(30)
64	CREATED_DATE	Created date	DATE
65	CREATED_IN_INSTANCE	Created in instance	VARCHAR2(6)
66	MODIFIED_BY	Modified by	VARCHAR2(30)
67	MODIFIED_IN_INSTANCE	Modified in instance	VARCHAR2(6)

	Column name	Descriptive name	Oracle data type
68	MODIFIED_DATE	Modified date	DATE

Type of key	Column(s) order	Tables to link	Abbreviated notation
Primary	CN	N/A	TRE_PK
Unique	PLOTID, VISIT_NBR, SUBP, TREE	N/A	TRE_UK
Unique	STATECD, COUNTYCD, PLOT, VISIT_NBR, SUBP, TREE	N/A	TRE_UK2
Unique	PLT_CN, SUBP, TREE	N/A	TRE_UK3
Foreign	PLT_CN	TREE to PLOT	TRE_PLT_FK
Foreign	SBP_CN	TREE to SUBPLOT	TRE_SBP_FK

1. CN — Tree sequence number. A unique sequence number identifying the tree record.

2. PLT_CN — Plot sequence number. Foreign key linking the tree record to the plot record.

3. SBP_CN — Subplot sequence number. Foreign key linking the tree record to the subplot record.

4. PLOTID — Plot identifier. A concatenated string that uniquely identifies the sampling point used for the plot record.

5. VISIT_NBR — Visit number. An iterating counter recording the number of times the sampling point has been visited.

6. STATECD — State code. A numeric code indicating the State. The code is taken from the Federal Information Processing Standards (FIPS) code set maintained by the Bureau of the Census. Refer to appendix B for codes. Each State is also defined as a geographic area in the GEOAREA table.

7. UNITCD — Survey unit code. Forest Inventory and Analysis (FIA) survey unit identification number. Survey units are groups of counties within States used to organize the population into logical groups for field logistics as well as for estimation purposes. Refer to appendix B for codes.

8. COUNTYCD — County code. The identification code used for a county, parish, watershed, borough, or other similar governmental unit in a State. FIPS codes from the Bureau of the Census are used. Each county (or other governmental unit) is also defined in the GEOAREA table. Refer to appendix B for codes.

9. PLOT — Plot number. A number that, in combination with STATECD and COUNTYCD, uniquely identifies a sample location. And with STATECD, COUNTYCD, and INVYR uniquely identifies a plot visit.

10. SUBP Subplot number. The identity of the subplot. The national urban protocol includes five subplot elements listed below.

Code	Description
1	48.0-foot subplot centered on Plot Center (PC).
11	6.8-foot microplot located 12 feet from PC 90°.
12	6.8-foot microplot located 12 feet from PC 180°.
13	6.8-foot microplot located 12 feet from PC 270°.
14	6.8-foot microplot located 12 feet from PC 360°.

11. TREE Tree number. Unique identifier for the tree. Tree numbers are unique within a subplot and are never reused.

12. STATUSCD Tree status code. The current status of the tree. Tree status codes can be referenced in REF_TREE_STATUS.

Code	Description
0	No status – tree is not presently in the sample (remeasurement plots only). Tree was incorrectly tallied at the previous inventory, currently is not tallied due to definition or procedural change, or is not tallied due to natural causes. Requires RECONCILE code = 5-9.
1	Live tree – any live tree (new, remeasured or ingrowth).
2	Dead tree – any dead tree (new, remeasured, or ingrowth) where the bole of the tree remains on the site, regardless of cause of death. Includes all previously standing dead trees that no longer qualify as standing dead. Does not include trees that are removed from the site.
3	Cut & Utilized – Collected on remeasurement trees only. A tree that occupied a forested condition in the previous inventory only. A tree that has been cut and removed by direct human activity related to harvesting, silviculture or land clearing. The tree is assumed to have been utilized for a commercial purposes, such as timber, chips, or firewood, and noncommercial purposes such as domestic firewood, landscaping, and fence posts.
4	Removed – Collected on remeasurement trees only. A tree that has been removed by direct human activity but not likely utilized for a commercial product, such as timber, chips, or firewood, and noncommercial purposes such as domestic firewood, landscaping, and fence posts.

13. SPCD Species code. An FIA numeric code identifying the species of the tree. Species codes can be referenced in REF_SPECIES.

14. SPGRPCD Species group code. A code assigning each tree species into groups for reporting purposes. Species group codes can be referenced in REF_SPECIES_GROUP. See appendix C.

15. DIA Current diameter (inches). The current diameter in inches of the sample tree at the point of diameter measurement. Refer to DIAHTCD to determine the point of diameter measurement for the tree. Refer to HTDMP to determine the actual point (in feet) of diameter measurement. This column is populated for live and standing dead trees.

16. HT

Total height (feet). This column has long been included in FIA database designs. It was originally intended to store total height of trees. More modern protocols, however, including the annualized Urban inventory, collect total length. The concepts of total height and total length are similar in that they measure the size of the tree from the ground to the tip of the apical meristem, including any missing pieces due to broken tops. In the case of trees with broken tops, the crews will visually estimate what the total height/length would be if it were not broken. But height and length are different measurements and only agree when a tree is perfectly vertical. Leaning trees will have shorter heights than lengths. Field protocols typically measure only height or length, but not both. Rather than create separate columns for these they are stored in this general total height column. For details on which total height/length measurement was taken on the given plot, the field guide version as indicated on the parent PLOT record should be referenced. Most modern FIA protocols measure length not height.

17. ACTUALHT

Actual height (feet). This column has long been included in FIA database designs. It was originally intended to store actual height of trees. More modern protocols, however, including the annualized Urban inventory, collect actual length. The concepts of actual height and actual length are similar in that they measure the size of a tree from the ground to highest portion of the tree still present and attached to the bole. In cases where the tree has a broken top, ACTUALHT will be less than HT. In cases where there is no broken top, ACTUALHT will equal HT. But height and length are different measurements and only agree when a tree is perfectly vertical. Leaning trees have shorter heights than lengths. Field protocols typically measure only height or length, but not both. Rather than create separate columns for these they are stored in this general actual height column. For details on which actual height/length measurements were taken on a given plot, the field guide version as indicated on the parent PLOT record should be referenced. Most modern FIA protocols measure length not height.

18. CROWN_HEIGHT

Crown height (feet). The height at the base of the crown.

19. CROWN_DIAM_WIDE

Crown diameter at the widest point (feet). The width of the live crown at the widest point.

20. CROWN_DIAM_90

Crown diameter at 90 degrees (feet). The width of the crown 90 degrees from (perpendicular to) the widest point of the crown.

21. BASAL_AREA

Basal area (square feet). The basal area of the tree computed as, DIA2*0.005454 where DIA is the current diameter of the tree.

22. TREE_BIOMASS

Tree total biomass (oven-dry pounds). The total above and below ground biomass of the tree as estimated by iTree Eco. Foliage is included for conifer species but excluded for deciduous species.

23. CARBON_STORAGE

Carbon storage (pounds). The carbon stored in the tree including above and below ground. Carbon storage is estimated as tree total biomass * 0.5. Foliage is included for conifer species but not for deciduous species.

24. GROSS_C_SEQ

Gross carbon sequestration (pounds per year). The gross quantity of carbon sequestered by the tree. Gross sequestration does not account for carbon released due to tree morality and decomposition.

25. NET_C_SEQ Net carbon sequestration (pounds per year). The net quantity of carbon sequestered by the tree. Net sequestration accounts for carbon released due to tree mortality and decomposition.

26. LEAF_AREA Leaf area (square feet). The total leaf area of the live crown of the tree.

27. LEAF_BIOMASS

Leaf biomass (oven-dry pounds). Total leaf biomass of the live crown of the tree.

28. COMPENSATORY_VALUE

Compensatory value (dollars). The estimated dollar value of replacement for the tree. Compensatory value represents the monetary compensation that would be paid to owners for the loss of an individual tree and is viewed as the value of the tree as a structural asset.

29. CROWN_GROUND_AREA

Crown ground area (square feet). The area of the tree crown when projected on to the ground.

30. LEAF_AREA_INDEX

Leaf area index. A dimensionless value that describes the relative density of the tree canopy's photosynthetic surface. Leaf Area Index (LAI) is computed as the estimated leaf area divided by the estimated crown ground area.

31. LEAF_BIOMASS_INDEX

Leaf biomass index. An index value that describes the leaf biomass of the tree relative to the size of the crown. It is computed as the estimated leaf biomass divided by the estimated crown ground area. This index value has units of oven-dry pounds per square foot.

32. PERCENT_CROWN_DIEBACK

Crown dieback (percent). The percentage of the live crown area that has died.

33. CROWN_LIGHT_EXPOSURE

Crown light exposure. A code indicating the number of sides (including the top) of the crown that are exposed to direct sunlight. Values for CROWN_LIGHT_EXPOSURE can be found by referencing REF_CROWN_LIGHT_EXPOSURE.

Code	**Description**
0	The tree receives no full light because it is shaded by trees, vines, or other vegetation; the tree has no crown by definition.
1	The tree receives full light from the top or 1 quarter.
2	The tree receives full light from the top and 1 quarter (or 2 quarters without the top).
3	The tree receives full light from the top and 2 quarters (or 3 quarters without the top).
4	The tree receives full light from the top and 3 quarters.
5	The tree receives full light from the top and 4 quarters.

34. TPA_UNADJ — Trees per acre, unadjusted. The unadjusted trees per acre as determined by the fixed-radius subplot element on which the tree was sampled.

35. DIAHTCD — Diameter height code. A code indicating the point of diameter measurement. For species considered to be "timber" species the diameter is taken at 4.5 feet above the ground and is referred to as diameter at breast height (DBH). For species considered to be "woodland" species, the diameter is taken at the root collar (DRC). For woodland species with multiple stems, the diameter is computed as: DRC = SQRT[SUM(stem diameter^2)] where stem diameter is the diameter of each individual stem. DIAHTCD values can be referenced in REF_DIAHT.

Code	**Description**
1	The diameter is taken at 4.5 (Diameter at Breast Height)
2	The diameter is taken at the root collar.

36. HTDMP — Height to diameter measurement point (feet). The length along the tree bole from the ground to the point the crew actually took a diameter measurement. Due to obstructions or tree form anomalies, it is not always possible to take the tree diameter measurement at the intended measurement point and the crew is forced to take a measurement at some other point.

37. NBR_STEMS — Number of stems. The number of stems of an individual tree. This value is only populated for DRC species.

38. OWNGRPCD — Owner group code. A code designating a group of ownership for reporting purposes. Code definitions can be found by referencing REF_OWNER_GROUP.

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

39. OWNCD — Owner code. A code designating the category of ownership of the land on which the tree was measured. Code definitions can be found by referencing REF_OWNER.

Code	Description
11	National Forest.
12	National Grassland.
13	Other national forest.
21	National Park Service.
22	Bureau of Land Management.
23	Fish and Wildlife Service.
24	Departments of Defense or Energy.
25	Other Federal.
31	State.
32	Local (county, municipal, etc.).
33	Other non-federal lands.

The following detailed private owner land codes are not available in this database because of the FIA data confidentiality policy. Users needing this type of information should contact the FIA Spatial Data Services (SDS) group by following the instructions provided at: http://www.fia.fs.fed.us/tools-data/spatial/.

Code	Description
41	Corporate.
42	Nongovernmental conservation.
43	Unincorporated local association or club.
44	Native American.
45	Individual.
46	Undifferentiated private.

40. LANDUSE Land use. The land use of the land on which the tree on was measured. This code set was developed by the iTree program and is not the nonforest land use codes traditionally used by FIA. Land use codes can be referenced in REF_LANDUSE.

Code	Description
10	Agriculture: Is defined as cropland, pasture, idle farmland, orchards, vineyards, nurseries, maintained wildlife openings, farmsteads and related buildings, feed lots, rangeland, and includes windbreaks and shelterbelts that do not meet the definition for forest land. Wooded areas /plantations that are managed for a specific crop such as nuts or Christmas trees or forest land that shows obvious evidence of management activity related specifically to wood production are also included.
20	Residential: Freestanding, and related green space, structures serving one to four families each.
21	Multi-family residential: Structures containing more than four residential units. [Note: A block of attached one- to four-family structures would be considered multi-family residential. A residential complex consisting of many separate one- to four-family structures and related green-space would be also considered multi-family residential].
22	Institutional: Schools, hospitals/medical complexes, colleges, religious buildings, government buildings, etc., and related green spaces.
23	Commercial/Industrial: In addition to standard commercial and industrial land uses, this category includes outdoor storage/staging areas as well as parking lots in downtown areas that are not connected with an institutional or residential use.
24	Vacant: This category includes land with no clear intended use. Abandoned buildings, vacant structures, and their associated infrastructure and green space should be classified based on their original intended use. For example, an overgrown parking lot and playground associated with an abandoned apartment complex would be classified as Multi-family Residential, not Vacant. Idle farmland should be classified as Agriculture. Forest land that is not clearly actively managed for timber production and is not contained within the boundaries of a Park, Golf course, or Cemetery land use would be coded as Vacant. For example forest land in the form of a woodlot in the middle of a corn field would be considered Vacant, as the land is not associated with a particular land use. Forest land contained within the boundaries of a Park, Golf Course, or Cemetery would be coded respectively.
25	Cemetery: Includes associated access roads, buildings, green space (maintained & unmaintained), and forest land within the cemetery boundary.
30	Transportation: Includes limited access roadways and related green-spaces (such as interstate highways with on and off ramps, sometimes fenced); railroad stations, tracks and yards; shipyards; airports; etc. If plot falls on any other type of road, or associated median strip, classify according to nearest adjacent land use.
31	Utility: Power-generating facilities, sewage treatment facilities, covered and uncovered reservoirs, and empty storm-water runoff retention areas, flood control channels, conduits.
40	Park: Parks include associated access roads, buildings, green space (maintained and unmaintained), and forest land within the park boundary.
41	Golf Course: Includes associated access roads, buildings, green space (maintained and unmaintained), and forest land within the golf course boundary.

Code	Description
50	Water/wetland: Streams, rivers, lakes, storm-water retention areas and other water bodies / wetlands (natural or manmade) that meet the definition of URBAN CONDITION CLASS STATUS 3 or 4 or areas meeting the definition of URBAN NONFOREST LAND USE 420. Areas of standing water / wetlands that do not meet minimum size requirements should be classified based on the adjacent land use; such areas may include small pools and fountains.
60	Other: Land uses that are not better described by one of the categories listed above. This designation should be used very sparingly as it provides very little useful information for the model.

41. PRESENT_NONFOREST_LANDUSE

Present nonforest land use. The nonforest land use on which the tree was measured. This code set was developed by the FIA program and has traditionally been used to describe only nonforest land according to the FIA definition. Code definitions can be found by referencing REF_NONFOREST_LANDUSE.

Code	Description
10	Agricultural land - Land managed for crops, pasture, or other agricultural use. The area must be at least 1.0 acre in size and 120.0 feet wide (with the exception of windbreak/shelterbelt, which has no minimum width.) Use the 10 code only for cases not better described by codes 11-17.
11	Cropland.
12	Pasture (improved through cultural practices).
13	Idle farmland.
14	Orchard.
15	Christmas tree planting.
16	Maintained wildlife opening.
17	Windbreak/shelterbelt.
20	Rangeland - Land primarily composed of grasses, forbs, or shrubs. This includes lands vegetated naturally or artificially to provide a plant cover managed like native vegetation and does not meet the definition of pasture. The area must be at least 1.0 acre in size and 120.0 feet wide.
30	Developed - Land used primarily by humans for purposes other than forestry or agriculture. Use the 30 code only for land not better described by codes 31-34.
31	Cultural: business (industrial/commercial), residential, and other places of intense human activity.
32	Rights-of-way: improved roads, railway, power lines, maintained canal.
33	Recreation: parks, skiing, golf courses.
34	Mining.
40	Other - Land parcels greater than 1.0 acre in size and greater than 120.0 feet wide, which do not fall into one of the uses described above. Examples include undeveloped beaches, barren land (rock, sand), marshes, bogs, ice, and snow. Use the 40 code only for cases not better described by codes 41-45.
41	Nonvegetated.
42	Wetland.
43	Beach.
45	Nonforest-Chaparral.

42. STANDING_DEAD_CD

Standing dead code. A code indicating whether a dead tree is standing or not. Stand implies a lean angle of at least 45° from horizontal. Code definitions can be found by referencing REF_STANDING_DEAD.

Code	Description
0	No, tree does not qualify as standing dead.
1	Yes, tree does qualify as standing dead.

43. FOLIAGE_MISSING

Foliage missing. The percentage of foliage absent from the total crown outline. Foliage can be absent due to pruning, dieback, defoliation, or weather/storm damage.

44. UNCOMP_CROWN_RATIO

Uncompacted crown ratio. The ratio of live crown length to actual tree length.

45. COMP_CROWN_RATIO

Compacted crown ratio. The ratio of the visually compacted live crown length to the actual length of the tree. The visually compacted live crown length is determined by the field crew who ocularly fills in gaps in the live canopy with other live areas of the canopy. Compacted crown ratio measures the percentage of the tree bole supporting live, health foliage.

46. IS_MAINTAINED_AREA

Is tree in maintained area. A code indicating whether or not the tree was measured on a maintained area.

Code	Description
0	No, tree is not in a maintained area.
1	Yes, tree is in a maintained area.

47. IS_RIPARIAN Is tree in riparian area. A code indicating whether or not the tree was measured in a riparian zone.

Code	Description
0	No, tree is not a riparian tree.
1	Yes, tree is a riparian tree.

48. IS_STREET_TREE

Is tree a street tree. A code indicating whether or not the tree is classified as a street tree.

Code	Description
0	No, tree is not a street tree.
1	Yes, tree is a street tree.

49. IS_PLANTED Is tree planted. A code indicating the origin of the tree.

Code	Description
1	Planted - Tree appears to have been planted at some point in the past.
2	Natural - Tree appears to be of a natural origin.
3	Not sure - Unable to confidently determine if the tree was planted or not.

50. IS_BOLE_STUMP_REMOVED

Is bole/stump removed. A code applied to trees removed since the previous measurement indicating if the bole or the bole and stump were removed from the site. Code definitions can be referenced in REF_BOLE_STUMP_REMOVED.

Code	Description
1	Bole removed – The bole of the tree was removed but the stump remains on site.
2	Bole & stump removed – The bole and stump were removed from the site. Use this code if the entire surface of the stump has been reduced below ground level or removed completely.

51. CROWN_CLASS_CD

Crown class code. A code indicating the relative crown position of the tree within the stand. Crown class codes are defined in REF_CROWN_CLASS.

Code	Description
1	Open Grown – trees with crowns that received full light from above and from all sides throughout most of its life, particularly during its early developmental period.
2	Dominant – trees with crowns extending above the general level of the crown canopy and receiving full light from above and partly from the sides. These trees are taller than the average trees in the stand and their crowns are well developed, but they could be somewhat crowded on the sides. Also, trees whose crowns have received full light from above and from all sides during early development and most of their life. Their crown form or shape appears to be free of influence from neighboring trees.
3	Co-dominant – trees with crowns at the general level of the crown canopy. Crowns receive full light from above but little direct sunlight penetrates their sides. Usually they have medium-sized crowns and are somewhat crowded from the sides. In stagnated stands, co-dominant trees have small-sized crowns and are crowded on the sides.
4	Intermediate – trees that are shorter than dominants and co-dominant, but their crowns extend into the canopy of co-dominant and dominant trees. They receive little direct light from above and none from the sides. As a result, intermediate trees usually have small crowns and are very crowded from the sides.
5	Overtopped – trees with crowns entirely below the general level of the crown canopy that receive no direct sunlight either from above or the sides.

52. DMG_ROOT_STEM_GIRDLING

Root/stem girdling damage. A code indicating whether or not root/stem girdling damage is present. Root/stem girdling occurs when roots begin to grow around the main stem of the tree and cut off or restrict the movement of water.

Code	Description
0	Damage absent.
1	Damage present.

53. DMG_TRUNK_BARK_INCLUSION

Trunk/bark inclusion damage. A code indicating whether or not there is a trunk or bark inclusion present. An inclusion occurs when branches are not strongly attached to the tree. A weak union occurs when two or more branches grow so closely together that bark grows between the branches and inside the union. The included bark does not have the structural strength of wood and can be very weak.

Code	Description
0	Damage absent.
1	Damage present.

54. DMG_TOPPING_PRUNING

Topping/pruning damage. A code indicating whether or not topping or pruning damage is present. Topping is the cutting of branches down to stubs or reducing the stem height by 25 percent or more. Poor pruning includes leaving stubs outside the branch collar, or cutting into the branch collar. Topping is usually done to reduce the total height of the tree while pruning is done to reduce the over form or volume of the crown.

Code	Description
0	Damage absent.
1	Damage present.

55. DMG_EXCESS_MULCH

Excessive mulch damage. A code indicating whether or not excessive mulching is present. Excessive mulching occurs when mulch is piled high around the steam at a depth greater than 3 inches.

Code	Description
0	Damage absent.
1	Damage present.

56. DMG_SIDEWALK_ROOT_CONFLICT

Sidewalk/root conflict damage. A code indicating whether or not sidewalk/root conflict damage is present. Sidewalk/rood conflict occurs when roots cause direct damage to sidewalk, driveway, road or other hard landscape features.

Code	Description
0	Damage absent.
1	Damage present.

57. DMG_OVERHEAD WIRES

Overhead wire conflict damage. A code indicating whether or not there is conflict between the tree crown and overhead wires. Conflict with overhead wires occurs when tree crowns are within 5 feet of any utility wires.

Code	Description
0	Damage absent.
1	Damage present.

58. DMG_IMPROPER_PLANTING

Improper planting damage. A code indicating whether or not improper planting is observed. Improper planting occurs when burlap, twine or root ball wire was not removed prior to planting.

Code	Description
0	Damage absent.
1	Damage present.

59. DAMAGE_AGENT_CD1

Damage agent 1. A code indicating the first damage agent recorded by the field crew. Crews inspect the tree from bottom to top: roots, bole, branches, foliage (including buds and shoots). They record damage agents as they work their way up the tree. Damage codes can be found by referencing REF_DAMAGE_AGENT. The general agent codes are listed here. See appendix E for the complete list of codes.

Code	General Agent	Damage Threshold*	Descriptions
0	-	No damage.	-
10000	General insects.	Any damage to the terminal leader; damage ≥20% of the roots or boles with >20% of the circumference affected; damage >20% of the multiple-stems (on multi-stemmed woodland species) with >20% of the circumference affected; >20% of the branches affected; damage ≥20% of the foliage with ≥50% of the leaf/needle affected.	Insect damage that cannot be placed in any of the following insect categories.
11000	Bark beetles	Any evidence of a successful attack (successful attacks generally exhibit boring dust, many pitch tubes and/or fading crowns).	Bark beetles (*Dendroctonus*, *Ips*, and other genera) are phloem-feeding insects that bore through the bark and create extensive galleries between the bark and the wood. Symptoms of beetle damage include fading or discolored tree crown (yellow or red), pitch tubes or pitch streaks on the bark, extensive egg galleries in the phloem, boring dust in the bark crevices or at the base of the tree. Bark chipping by woodpeckers may be conspicuous. They inflict damage or destroy all parts of trees at all stages of growth by boring in the bark, inner bark, and phloem. Visible signs of attack include pitch tubes or large pitch masses on the tree, dust and frass on the bark and ground, and resin streaming. Internal tunneling has various patterns. Most have tunnels of uniform width with smaller galleries of variable width radiating from them. Galleries may or may not be packed with fine boring dust.

Code	General Agent	Damage Threshold*	Descriptions
12000	Defoliators	Any damage to the terminal leader; damage ≥20% of the foliage with ≥50% of the leaf/needle affected.	These are foliage-feeding insects that may reduce growth and weaken the tree causing it to be more susceptible to other damaging agents. General symptoms of defoliation damage include large amounts of missing foliage, browning foliage, extensive branch mortality, or dead tree tops.
13000	Chewing insects Note: this is only collected by IW and SRS.	Any damage to the terminal leader; damage ≥20% of the foliage with ≥50% of the leaf/needle affected	Insects, like grasshoppers and cicadas that chew on trees (those insects not covered by defoliators in code 12000).
14000	Sucking insects	Any damage to the terminal leader; damage ≥20% of the foliage with ≥50% of the leaf/needle affected	Adelgids, scales and aphids feed on all parts of the tree. Often they cause galling on branches and trunks. Some appear benign but enable fungi to invade where they otherwise could not (e.g., beech bark disease). The most important ones become conspicuous because of the mass of white, cottony wax that conceals eggs and young nymphs.

Code	General Agent	Damage Threshold*	Descriptions
15000	Boring insects	Any damage to the terminal leader; damage ≥20% of the roots, stems, or branches.	Most wood boring insects attack only severely declining and dead trees. Certain wood boring insects cause significant damage to trees, especially the exotic Asian longhorn beetle, emerald ash borer, and Sirex wood wasp. Bark beetles have both larval and adult galleries in the phloem and adjacent surface of the wood. Wood borers have galleries caused only by larval feeding. Some, such as the genus *Agrilus* (including the emerald ash borer) have galleries only in the phloem and surface of the wood. Other wood borers, such as Asian longhorn beetle bore directly into the phloem and wood. Sirex adults oviposit their eggs through the bark, and developing larvae bore directly into the wood of pines.
19000	General diseases	Any damage to the terminal leader; damage ≥20% of the roots or boles with >20% of the circumference affected; damage >20% of the multiple-stems (on multi-stemmed woodland species) with >20% of the circumference affected; >20% of the branches affected; damage ≥20% of the foliage with ≥50% of the leaf/needle affected.	Diseases that cannot be placed in any of the following disease categories.

Code	General Agent	Damage Threshold*	Descriptions
21000	Root/butt diseases	Any occurrence.	Root disease kills all or a portion of a tree's roots. Quite often, the pathogenic fungus girdles the tree at the root collar. Tree damage includes mortality (often occurring in groups or "centers"), reduced tree growth, and increased susceptibility to other agents (especially bark beetles). General symptoms include resin at the root collar, thin, chlorotic (faded) foliage, and decay of roots. A rot is a wood decay caused by fungi. Rots are characterized by a progression of symptoms in the affected wood. First, the wood stains and discolors, then it begins to lose its structural strength, and finally the wood starts to break down, forming cavities in the stem. Even early stages of wood decay can cause cull due to losses in wood strength and staining of the wood. Rot can lead to mortality, cull, an increased susceptibility to other agents (such as insects), wind throw, and stem breakage.

Code	General Agent	Damage Threshold*	Descriptions
22000	Cankers (non-rust)	Any occurrence.	A canker -- a sunken lesion on the stem caused by the death of cambium -- may cause tree breakage or kill the portion of the tree above the canker. Cankers may be caused by various agents but are most often caused by fungi. A necrotic lesion begins in the bark of branches, trunk or roots, and progresses inward killing the cambium and underlying cells. The causal agent may or may not penetrate the wood. This results in areas of dead tissue that become deeper and wider. There are two types of cankers, annual and perennial. Annual cankers enlarge only once and do so within an interval briefer than the growth cycle of the tree, usually less than one year. Little or no callus is associated with annual cankers, and they may be difficult to distinguish from mechanical injuries. Perennial cankers are usually the more serious of the two, and grow from year to year with callus forming each year on the canker margin, often resulting in a target shape. The most serious non-rust cankers occur on hardwoods, although branch mortality often occurs on conifers.
22500	Stem decays	Any visual evidence (conks; fruiting bodies; rotten wood)	Rot occurring in the bole/stems of trees above the roots and stump.

Code	General Agent	Damage Threshold*	Descriptions
23000	Parasitic / Epiphytic plants	Dwarf mistletoes with Hawksworth rating of ≥3; true mistletoes and vines covering ≥ 50% of crown.	Parasitic and epiphytic plants can cause damage to trees in a variety of ways. The most serious ones are dwarf mistletoes, which reduce growth and can cause severe deformities. Vines may damage trees by strangulation, shading, or physical damage. Benign epiphytes, such as lichens or mosses, are not considered damaging agents.
24000	Decline Complexes/ Dieback/Wilts	Damage ≥ 20% dieback of crown area.	Tree disease which results not from a single causal agent but from an interacting set of factors. Terms that denote the symptom syndrome, such as dieback and wilt, are commonly used to identify these diseases**.**
25000	Foliage diseases	Damage ≥20% of the foliage with ≥50% of the leaf/needle affected.	Foliage diseases are caused by fungi and result in needle shed, growth loss, and, potentially, tree mortality. This category includes needle casts, blights, and needle rusts.

Code	General Agent	Damage Threshold*	Descriptions
26000	Stem rusts	Any occurrence on the bole or stems (on multi-stemmed woodland species), or on branches ≤1 foot from boles or stems; damage to ≥20% of branches.	A stem rust is a disease caused by fungi that kill or deform all or a portion of the stem or branches of a tree. Stem rusts are obligate parasites and host specialization is very common. They infect and develop on fast-growing tissues and cause accelerated growth of infected tissues resulting in galls or cankers. Heavy resinosis is usually associated with infections. Sometimes yellow or reddish-orange spores are present giving a “rusty” appearance. Damage occurs when the disease attacks the cambium of the host, girdling and eventually killing the stem above the attack. Symptoms of rusts include galls (an abnormal and pronounced swelling or deformation of plant tissue that forms on branches or stems) and cankers (a sunken lesion on the stem caused by death of the cambium which often results in the death of tree tops and branches).
27000	Broom rusts	≥50% of crown area affected.	Broom rust is a disease caused by fungi that kill or deform all or a portion of the branches of a tree. Broom rusts are obligate parasites and host specialization is very common. They infect and develop on fast-growing tissues and cause accelerated growth of infected tissues resulting in galls. Symptoms of rusts include galls, an abnormal and pronounced swelling or deformation of plant tissue that forms on branches or stems.

Code	General Agent	Damage Threshold*	Descriptions
30000	Fire	Damage ≥ 20% of bole circumference; >20% of stems on multi-stemmed woodland species affected; ≥20% of crown affected.	Fire damage may be temporary, such as scorched foliage, or may be permanent, such as in cases where cambium is killed around some portion of the bole. The location and amount of fire damage will determine how the damage may affect the growth and survival of the tree. Fire often causes physiological stress, which may predispose the tree to attack by insects of other damaging agents.
41000	Wild animals	Any damage to the terminal leader; damage ≥20% of the roots or boles with> 20% of the circumference affected; damage >20% of the multiple-stems (on multi-stemmed woodland species) with >20% of the circumference affected; >20% of the branches affected; damage ≥20% of the foliage with ≥50% of the leaf/needle affected.	Wild animals from birds to large mammals cause open wounds. Some common types of damage include: sapsucker bird peck, deer rub, bear clawing, porcupine feeding, and beaver gnawing.
42000	Domestic animals	Any damage to the terminal leader; damage ≥20% of the roots or boles with> 20% of the circumference affected; damage >20% of the multiple-stems (on multi-stemmed woodland species) with >20% of the circumference affected; >20% of the branches affected; damage ≥20% of the foliage with ≥50% of the leaf/needle affected.	Open wounds caused by cattle and horses occur on the roots and lower trunk. Soil compaction from the long term presence of these animals in a woodlot can also cause indirect damage.

Code	General Agent	Damage Threshold*	Descriptions
50000	Abiotic	Any damage to the terminal leader; damage ≥20% of the roots or boles with> 20% of the circumference affected; damage >20% of the multiple-stems (on multi-stemmed woodland species) with >20% of the circumference affected; >20% of the branches affected; damage ≥20% of the foliage with ≥50% of the leaf/needle affected.	Abiotic damages are those that are not caused by other organisms. In some cases, the type and severity of damage may be similar for different types of agents (e.g., broken branches from wind, snow, or ice).
60000	Competition	Overtopped shade intolerant trees that are not expected to survive for 5 years or saplings not expected to reach tree size (5.0 inches DBH/DRC).	Suppression of overtopped shade intolerant species. Trees that are not expected to survive for 5 years or saplings not expected to reach tree size (5.0 inches DBH/DRC).
70000	Human activities	Any damage to the terminal leader; damage ≥20% of the roots or boles with> 20% of the circumference affected; damage >20% of the multiple-stems (on multi-stemmed woodland species) with >20% of the circumference affected; >20% of the branches affected; damage ≥20% of the foliage with ≥50% of the leaf/needle affected.	People can injure trees in a variety of ways, from poor pruning, to vandalism, to logging injury. Signs include open wounds or foreign embedded objects.
71000	Harvest	Removal of ≥10% of cubic volume.	Only recorded for woodland species trees that have partial cutting.

Code	General Agent	Damage Threshold*	Descriptions
90000	Other damage	Any damage to the terminal leader; damage ≥20% of the roots or boles with> 20% of the circumference affected; damage >20% of the multiple-stems (on multi-stemmed woodland species) with >20% of the circumference affected; >20% of the branches affected; damage ≥20% of the foliage with ≥50% of the leaf/needle affected.	-
99000	Unknown damage	Any damage to the terminal leader; damage ≥20% of the roots or boles with> 20% of the circumference affected; damage >20% of the multiple-stems (on multi-stemmed woodland species) with >20% of the circumference affected; >20% of the branches affected; damage ≥20% of the foliage with ≥50% of the leaf/needle affected.	Use this code only when observed damage cannot be attributed to a general or specific agent.

* Some Regional specific damage agents within a category may have differing damage thresholds.

60. DAMAGE_AGENT_CD2

Damage agent 2. A code indicating the second damage agent recorded by the field crew. Uses same codes as DAMAGE_AGENT_CD1. If DAMAGE_AGENT_CD1 = 0, then DAMAGE_AGENT_CD2 = blank (null) or 0.

61. DAMAGE_AGENT_CD3

Damage agent 3. A code indicating the third damage agent recorded by the field crew. Uses same codes as DAMAGE_AGENT_CD1. If DAMAGE_AGENT_CD2 = 0, then DAMAGE_AGENT_CD3 = blank (null) or 0.

62. CAUSE_OF_DEATH

Cause of death. A code indicating the likely cause of death as interpreted by the field crew.

Code	Description
10	Insect.
20	Disease.
30	Fire.
40	Animal.
50	Weather.
60	Vegetation (suppression, competition, vines/kudzu).
70	Unknown/not sure/other - includes death from human activity not related to silvicultural or land clearing activity (accidental, random, etc.).
80	Silvicultural or land clearing activity (death caused by harvesting or other silvicultural activity, including girdling, chaining, etc., or to land clearing activity).

63. CREATED_BY Created by. See POPULATION.CREATED_BY description for definition.

64. CREATED_DATE

Created date. See POPULATION.CREATED_DATE description for definition.

65. CREATED_IN_INSTANCE

Created in instance. See POPULATION.CREATED_IN_INSTANCE description for definition.

66. MODIFIED_BY

Modified by. See POPULATION.MODIFIED_BY description for definition.

67. MODIFIED_IN_INSTANCE

Modified in instance. See POPULATION.MODIFIED_IN_INSTANCE description for definition.

68. MODIFIED_DATE

Modified date. See POPULATION.MODIFIED_DATE description for definition.

3.6 Building Interaction (Oracle table name is BUILDING_INTERACTION)

The purpose of the BUILDING_INTERACTION table is to store one or more interactions between a given tree and a building within a short distance of the tree. Each building interaction is identified by a unique number and described by the distance code and azimuth to the building.

	Column Name	**Descriptive Name**	**Oracle data type**
1	CN	Building interaction sequence number	VARCHAR2(34)
2	PLT_CN	Plot sequence number	VARCHAR2(34)
3	TRE_CN	Tree sequence number	VARCHAR2(34)
4	PLOTID	Plot identifier	VARCHAR2(20)
5	VISIT_NBR	Visit number	NUMBER(3,0)
6	STATECD	State code	NUMBER(4,0)
7	UNITCD	Survey unit code	NUMBER(2,0)
8	COUNTYCD	County code	NUMBER(3,0)
9	PLOT	Plot number	NUMBER(6,0)
10	SUBP	Subplot number	NUMBER(3,0)
11	TREE	Tree number	NUMBER(3,0)
12	BLDG_INTERACTION_ID	Building interaction identifier	NUMBER(2,0)
13	DISTANCE	Distance	NUMBER(2,0)
14	AZIMUTH	Azimuth	NUMBER(3,0)
15	CREATED_BY	Created by	VARCHAR2(30)
16	CREATED_DATE	Created date	DATE
17	CREATED_IN_INSTANCE	Created in instance	VARCHAR2(6)
18	MODIFIED_BY	Modified by	VARCHAR2(30)
19	MODIFIED_IN_INSTANCE	Modified in instance	VARCHAR2(6)
20	MODIFIED_DATE	Modified date	DATE

Type of Key	**Column(s) order**	**Tables to link**	**Abbreviated notation**
Primary	CN	N/A	BINTA_PK
Unique	PLOTID, VISIT_NBR, SUBP, TREE, BLDG_INTERACTION_ID	N/A	BINTA_UK
Unique	STATECD, COUNTYCD, PLOT, VISIT_NBR, SUBP, TREE, BLDG_INTERACTION_ID	N/A	BINTA_UK2
Unique	PLT_CN, SUBP, TREE, BLDG_INTERACTION_ID	N/A	BINTA_UK3
Foreign	PLT_CN	BUILDING_INTERACTION to PLOT	BINTA_PLT_FK
Foreign	TRE_CN	BUILDING_INTERACTION to TREE	BINTA_TRE_FK

1. CN — Building interaction sequence number. A unique sequence number identifying the building interaction record.

2. PLT_CN — Plot sequence number. Foreign key linking the building interaction record to the plot record.

3. TRE_CN — Tree sequence number. Foreign key linking the building interaction record to the tree record.

4. PLOTID — Plot identifier. A concatenated string that uniquely identifies the sampling point used for the plot record.

5. VISIT_NBR — Visit number. An iterating counter recording the number of times the sampling point has been visited.

6. STATECD — State code. A numeric code indicating the State. The code is taken from the Federal Information Processing Standards (FIPS) code set maintained by the Bureau of the Census. Each State is also defined as a geographic area in the GEOAREA table. Refer to appendix B.

7. UNITCD — Survey unit code. Forest Inventory and Analysis (FIA) survey unit identification number. Survey units are groups of counties within States used to organize the population into logical groups for field logistics as well as for estimation purposes. Refer to appendix B.

8. COUNTYCD — County code. The identification code used for a county, parish, watershed, borough, or other similar governmental unit in a State. FIPS codes from the Bureau of the Census are used. Each county (or other governmental unit) is also defined in the GEOAREA table. Refer to appendix B.

9. PLOT — Plot number. A number that, in combination with STATECD and COUNTYCD, uniquely identifies a sample location. And with STATECD, COUNTYCD, and INVYR uniquely identifies a plot visit.

10. SUBP — Subplot number. The identity of the subplot. The national urban protocol includes five subplot elements listed below.

Code	Description
1	48.0-foot subplot centered on Plot Center (PC).
11	6.8-foot microplot located 12 feet from PC 90°.
12	6.8-foot microplot located 12 feet from PC 180°.
13	6.8-foot microplot located 12 feet from PC 270°.
14	6.8-foot microplot located 12 feet from PC 360°.

11. TREE — Tree number. Unique identifier for the tree. Tree numbers are unique within a subplot and are never reused.

12. BLDG_INTERACTION_ID

Building interaction identifier. A value that forms a unique identifier for a building interaction when combined with STATECD, COUNTYCD, PLOT, VISIT_NBR, SUBP, and TREE.

13. DISTANCE

Distance. A code indicating the distance category representing the shortest distance between a qualifying tree and a qualifying building. Reference the field guide version indicated on the parent PLOT record for details.

Code	Description
0	No building within 60 feet.
1	Less than 20 feet.
2	21 to 40 feet.
3	41 to 60 feet.

14 . AZIMUTH

Azimuth. The azimuth from the tree to the building.

15. CREATED_BY

Created by. See POPULATION.CREATED_BY description for definition.

16. CREATED_DATE

Created date. See POPULATION.CREATED_DATE description for definition.

17. CREATED_IN_INSTANCE

Created in instance. See POPULATION.CREATED_IN_INSTANCE description for definition.

18. MODIFIED_BY

Modified by. See POPULATION.MODIFIED_BY description for definition.

19. MODIFIED_IN_INSTANCE

Modified in instance. See POPULATION.MODIFIED_IN_INSTANCE description for definition.

20. MODIFIED_DATE

Modified date. See POPULATION.MODIFIED_DATE description for definition.

3.7 Inventory Data Examples

There are significant differences between this data structure implemented for Stage 1 of the annualized urban inventory (Urban Stage 1) and the traditional FIADB data structure many users are familiar with. This section will cover examples of queries that use these tables to answer questions. It is intended to accelerate the user's learning curve while working with the new data structure.

What plots are included in a given field sample?

One of the first steps in working with a new set of data is to understand the composition of those data. It may be of interest to look at the field samples selected to study a particular population. This Stage 1 database design incorporates the concepts of both a field sample and a statistical sample. This example covers extracting plots from a given field sample only.

The query must incorporate information from six sources. First, the project for which the field sample was drawn must be identified using the PROJECT table (from the Sample Organization table group). Second the series of project implemented by the field sample must be identified using the SERIES table (from the Sample Organization table group). Third, the field sample is uniquely defined by the FIELD_SAMPLE table (from the Sample Organization table group). The link between the identified field sample and the plots is made by the PLOT_FLDSAMP_ASSGN table (from the Sample Organization table group). Finally, the individual plots are described by the PLOT table.

There are three user-provided identities required for the query to function. The analyst must provide the name of the project of interest, the series within the project of interest, and the name of the time period of interest. See the 2.11 *Sample Organization Examples* section for more information on these items.

```
SELECT p.plotid, p.urban_plot_status_cd, p.lat, p.lon
  FROM project            proj,
       series             ser,
       time_period        tp,
       field_sample       fs,
       plot_fldsamp_assgn pfsa,
       plot               p
 WHERE fs.cn = pfsa.fld_samp_cn
   AND pfsa.plt_cn = p.cn
   AND proj.cn = fs.proj_cn
   AND fs.series_cn = ser.cn
   AND fs.time_period_cn = tp.cn
   AND proj.name = 'User-provided Project Name'
   AND ser.name = 'User-provided Series Name'
   AND tp.name = 'User-provided Time Period Name';
```

What plots are included in a given statistical sample?

The first step in performing an analysis is to identify the sample to work with. The Urban Stage 1 database design incorporates the concepts of both a field sample and a statistical sample. This example covers extracting plots from a given statistical sample for an analysis only.

This query requires information from three sources. The identity of the sample is acquired from the POP_STAT_SAMP table (from the Population Estimation table group). The linkage between a given statistical sample and the cohort of plots is provided by PLOT_STATSAMP_ASSGN (from the Population Estimation table group). The user must provide the name of the statistical sample for the query to function. For more information on statistical samples reference section 4.9, *Population Estimation Table Examples*.

```
SELECT p.plotid, p.urban_plot_status_cd, p.lat, p.lon
  FROM pop_stat_samp samp, plot_statsamp_assgn pssa, plot p
 WHERE samp.cn = pssa.pss_cn
   AND pssa.plt_cn = p.cn
   AND samp.name = 'User-provided Sample Name';
```

Which plots in my statistical sample are at least 50% sampled?

This example builds upon the previous example by applying an additional filter to the cohort of plots assigned to a given statistical sample. In this case, only plots that are at least 50 percent sampled should be returned.

Using the previous example as a template only one additional table is required. The SUBPLOT table should be added and joined to the PLOT table through the plot CN value. In addition, the results are constrained to look only at the subplot and ignore the microplots. This is approach is a common one for questions like this because the microplots are nested within the subplot, and, therefore, it is easy to get a sense of the overall sampling rate by looking only at the larger plot footprint; the subplot. This constraint is accomplished by limiting the returns to only SUBP = 1. All other subplot records are excluded. To limit the results to only those that were at least 50 percent sample, the subplot attribute of PCT_SAMPLED is used.

```
SELECT p.plotid, p.urban_plot_status_cd, p.lat, p.lon, sp.pct_sampled
  FROM pop_stat_samp samp, plot_statsamp_assgn pssa, plot p, subplot sp
 WHERE samp.cn = pssa.pss_cn
   AND pssa.plt_cn = p.cn
   AND p.cn = sp.plt_cn
   AND sp.subp = 1
   AND sp.pct_sampled >= 50
   AND samp.name = 'User-provided Sample Name'
ORDER BY pct_sampled;
```

For the plots in my statistical sample what proportion of the subplot is accounted for by the land use found at subplot center?

This example builds off of the previous two samples by adding an additional table to the query. This example requires that the land use identified at the subplot center be identified and then the percent coverage of that land use be returned. As with the previous example, this example will constrain the results to only the subplot. Microplot land use coverage will be ignored for the purpose of this example.

Using the previous example as a template only, the FIELD_LANDUSE table must be added. It is joined directly to the SUBPLOT table through the subplot CN value. Note that each subplot (or microplot) can have multiple land uses recorded. This particular example is only interested in the land use assigned to the subplot center, so the constraint SUBP = 1 is used to limit the returning record set to subplots only. The LANDUSE_AT_SUBP_CENTER value from the SUBPLOT record is joined to the LANDUSE value on the FIELD_LANDUSE table. Sometimes the center of the subplot, however, is nonsampled. In these cases there is no land use recorded. This example is written to allow for these cases by returning a NULL value for the land use percentage. This is done by using an outer join to the FIELD_LANDUSE table. The Oracle SQL expression for this is (+), which means that a SUBPLOT record should be returned even if there is no matching FIELD_LANDUSE record. The outer join (+) instruction must be repeated at for each join involving the FIELD_LANDUSE table. Note that a given table can be outer joined to only one other table at a time.

```
SELECT p.plotid,
       p.urban_plot_status_cd,
       p.lat,
       p.lon,
       sp.subp,
       sp.pct_sampled,
       flu.pct_landuse
  FROM pop_stat_samp       samp,
       plot_statsamp_assgn pssa,
       plot                p,
       subplot             sp,
       field_landuse       flu
 WHERE samp.cn = pssa.pss_cn
   AND pssa.plt_cn = p.cn
   AND p.cn = sp.plt_cn
   AND sp.cn = flu.sbp_cn(+)
   AND sp.landuse_at_subp_center = flu.landuse(+)
   AND sp.subp = 1
   AND sp.pct_sampled >= 50
   AND samp.name = 'User-provided Sample Name'
 ORDER BY pct_sampled, pct_landuse;
```

<u>For the plots in my statistical sample what is the ground cover composition?</u>

This example is similar to the previous example except that it looks at ground cover instead of land use. Ground cover is useful for getting a sense of the conditions on the ground at each sampling point.

The structure of this example is very similar to the previous example except that the COVER table is used in place of the FIELD_LANDUSE table. The COVER table is joined to the SUBPLOT table directly through the subplot CN value. Each of the five ground covers is added to the SELECT clause. In addition, the sum of the five ground covers is added as a check. Users will note that the sum of ground covers does not exceed the percent sample value for the subplot. This is because nonsampled areas are not accounted for by the COVER table. Note that the sum of the ground covers is given an alias (total_ground_cover). As an aside; in Oracle SQL, such an alias can be used as part of the ORDER BY clause. This is not true for GROUP BY clauses.

```
SELECT p.plotid,
       p.urban_plot_status_cd,
       p.lat,
       p.lon,
       sp.subp,
       sp.pct_sampled,
       cov.gr_cov_pct_bldg,
       cov.gr_cov_pct_impervious,
       cov.gr_cov_pct_permeable,
       cov.gr_cov_pct_herbaceous,
       cov.gr_cov_pct_water,
       cov.gr_cov_pct_bldg + cov.gr_cov_pct_impervious +
       cov.gr_cov_pct_permeable + cov.gr_cov_pct_herbaceous +
       cov.gr_cov_pct_water total_ground_cover
  FROM pop_stat_samp       samp,
       plot_statsamp_assgn pssa,
       plot                p,
       subplot             sp,
       cover               cov
 WHERE samp.cn = pssa.pss_cn
   AND pssa.plt_cn = p.cn
   AND p.cn = sp.plt_cn
   AND sp.cn = cov.sbp_cn
   AND sp.subp = 1
   AND sp.pct_sampled >= 50
   AND samp.name = 'User-provided Sample Name'
 ORDER BY pct_sampled, total_ground_cover;
```

<u>For the plots in my statistical sample count the number of measured trees by species.</u>

This example explores a different area of the inventory table group; trees. The TREE table is the largest inventory data table both in terms of records and columns. It also contains the information that is of greatest interest to most analyses. There are many types of queries that can be written to make use of tree-level information. This example will cover a simple one for illustration.

This query is similar to previous examples except that the TREE table is included in place of the SUBPLOT or other tables. The TREE table is joined directly to the PLOT table in this example through the plot CN value. This query counts all trees without any filters. If counts of certain trees, such as live trees, were required then these additional requirements should be included in the WHERE clause. Because the COUNT operator is used, the query must specify everything that is not being counted in the GROUP BY clause. As with the other examples, the user must provide the name of the sample of interest. The REF_SPECIES table is included to provide a way of converting species codes to more readable scientific and common names.

```
SELECT p.plotid,
       p.urban_plot_status_cd,
       p.lat,
```

```
       p.lon,
       t.spcd,
       r.genus,
       r.species,
       r.common_name,
       COUNT(t.cn) tree_cnt
  FROM pop_stat_samp       samp,
       plot_statsamp_assgn pssa,
       plot                p,
       tree                t,
       ref_species         r
 WHERE samp.cn = pssa.pss_cn
   AND pssa.plt_cn = p.cn
   AND p.cn = t.plt_cn
   AND t.spcd = r.spcd
   AND p.urban_manual >= r.manual_start
   AND (r.manual_end IS NULL OR p.urban_manual <= r.manual_end)
   AND samp.name = 'User-provided Sample Name'
 GROUP BY p.plotid,
          p.urban_plot_status_cd,
          p.lat,
          p.lon,
          t.spcd,
          r.genus,
          r.species,
          r.common_name
 ORDER BY plotid, spcd;
```

<u>For the plots in my statistical sample count the number of street trees greater than 15 inches in diameter by species.</u>

This example is very similar to the previous example in that it counts trees. This query, however, adds two filters to the WHERE clause. In this case, the analyst is only interested in working with trees that are designated as street trees of at least moderate size (≥15 inches in diameter). To implement these filters, the analyst specifies that all trees must have IS_STREET_TREE = 1 and DIA ≥ 15. The rest of the query remains unchanged.

```
SELECT p.plotid,
       p.urban_plot_status_cd,
       p.lat,
       p.lon,
       t.spcd,
       r.genus,
       r.species,
       r.common_name,
       COUNT(t.cn) tree_cnt
  FROM pop_stat_samp       samp,
       plot_statsamp_assgn pssa,
       plot                p,
       tree                t,
       ref_species         r
 WHERE samp.cn = pssa.pss_cn
   AND pssa.plt_cn = p.cn
   AND p.cn = t.plt_cn
   AND t.spcd = r.spcd
```

```
  AND p.urban_manual >= r.manual_start
  AND (r.manual_end IS NULL OR p.urban_manual <= r.manual_end)
  AND samp.name = 'User-provided Sample Name'
  AND t.dia >= 15
  AND t.is_street_tree = 1
GROUP BY p.plotid,
         p.urban_plot_status_cd,
         p.lat,
         p.lon, t.is_street_tree,
         t.spcd,
         r.genus,
         r.species,
         r.common_name
ORDER BY plotid, spcd;
```

Chapter 4 – Population Estimation Table Group

The population estimation table group (or POP tables for short) organizes information related to the estimation of population attributes. Many of the tables are very similar to the traditional FIADB data structure and use familiar concepts. The concept of an *evaluation* is used to define the unique combination of a sample and a stratification of a given target population for the purpose of producing a certain set of population-attribute estimates. Evaluations are organized into estimation units which define distinct subpopulations for which an independent estimate is made. Each estimation unit is stratified into one or more strata in support of FIA's standard stratified estimation methodology.

There are some differences between the Urban Stage 1 data structure and the traditional FIADB data structure as well. First, the concept of the population of interest has been generalized from a State to a more flexible concept defined by the POPULATION table (see the POPULATION table). Therefore, the familiar EVALID from the traditional FIADB, which is a composite code made from a two-digit State code, two-digit year code, and a two-digit type code, has been abstracted to a short alpha-numeric code intended to convey similar information without dependence on a State. Second, the concept of the statistical sample used for population-attribute estimation has been separated from the concept of the plot-to-stratum assignment. This allows for a statistical sample to be identified and described independently of any estimator, such as the FIA stratified estimator. This will be important for any case where the chosen estimator is not a stratified estimator, or when an analyst would like to use a particular sample for something other than population estimation, such as exporting for map-making.

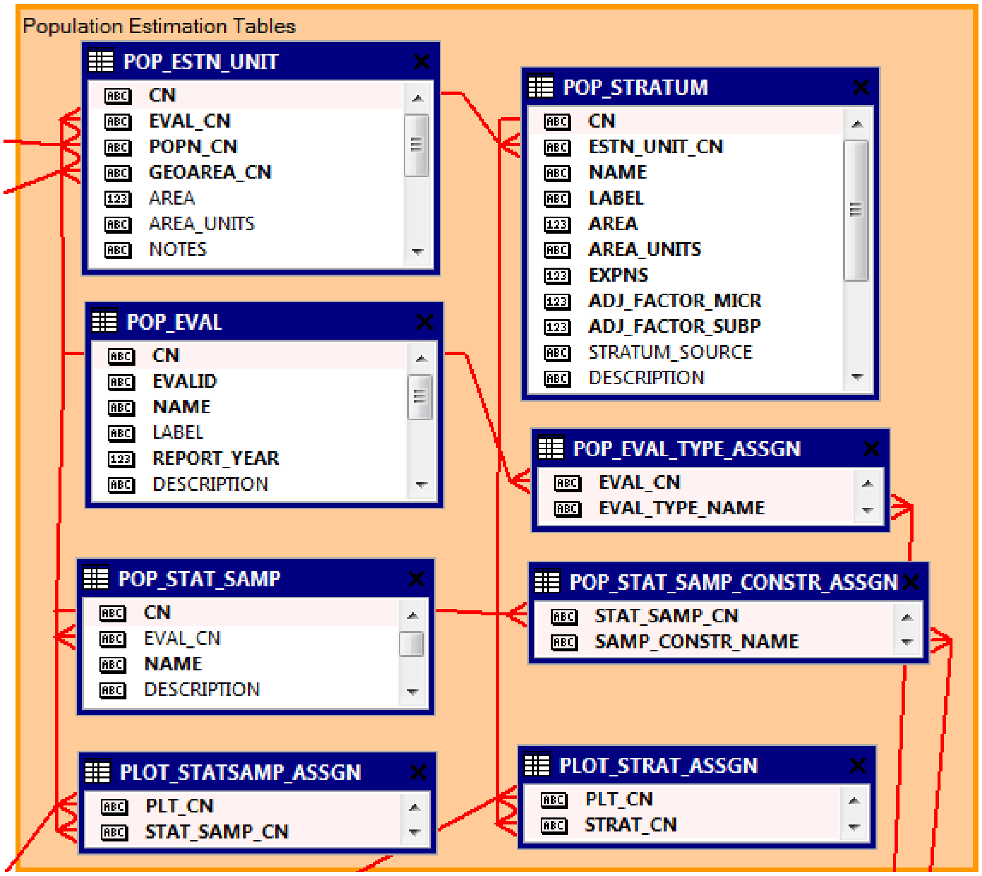


Figure 5. Population Estimation Table Group.

4.1 Population Evaluation Table (Oracle table name is POP_EVAL)

The purpose of the POP_EVAL table is to store the identity of statistical evaluations available for the user. A statistical evaluation (usually referred to as an evaluation) is the unique combination of a statistical sample and a stratification of a defined target population for the purpose of producing a defined set of population attribute estimates. Evaluations are identified uniquely by an EVALID, which is composed of some identifier for the population, the reporting year for the evaluation, and an indication of the purpose of the evaluation.

Each evaluation is not linked directly to a population defined in the POPULATION table. The reason for this is that evaluations may be created for multiple populations, such as for urban areas in a certain region of the country. The linkage between an evaluation and a population is modeled through the POP_ESTN_UNIT table, which is a child of a given evaluation**.**

	Column Name	**Descriptive Name**	**Oracle data type**
1	CN	Evaluation sequence number	VARCHAR2(34)
2	EVALID	Evaluation identifier	VARCHAR2(20)
3	NAME	Evaluation name	VARCHAR2(50)
4	LABEL	Evaluation label	VARCHAR2(20)
5	REPORT_YEAR	Reporting year	NUMBER(4,0)
6	DESCRIPTION	Evaluation description	VARCHAR2(2000)
7	CREATED_BY	Created by	VARCHAR2(30)
8	CREATED_DATE	Created date	DATE
9	CREATED_IN_INSTANCE	Created in instance	VARCHAR2(6)
10	MODIFIED_BY	Modified by	VARCHAR2(30)
11	MODIFIED_DATE	Modified date	DATE
12	MODIFIED_IN_INSTANCE	Modified in instance	VARCHAR2(6)

Type of Key	**Column(s) order**	**Tables to link**	**Abbreviated notation**
Primary	CN	N/A	PE_PK
Unique	EVALID	N/A	PE_UK
Unique	NAME	N/A	PE_UK2

1. CN — Evaluation sequence number. A unique sequence number identifying the evaluation record.

2. EVALID — Evaluation identifier. A short name given to an evaluation that functions as a unique identifier.

   Note: Users familiar with the data structure of the traditional FIADB will notice a difference in EVALIDs. In the traditional FIADB the EVALID is composed of a concatenation of STATECD (2 digits), Reporting year (last 2 digits), and a numeric code indicating the evaluation type (2 digits). Urban inventories, however, do not have 2-digit codes similar to STATECD. Rather than attempt to replicate this, a short and descriptive name is used. The name follows a similar pattern of Population-Reporting year-Evaluation type, but uses a more flexible verbal style.

3. NAME — Evaluation name. A descriptive name used to more precisely describe the evaluation and its purpose.

4. LABEL — Evaluation label. A short label that can be used in reporting outputs. Labels are purely descriptive and contain no information not already present in the other attributes of the evaluation.

5. REPORT_YEAR

   Reporting year. The year to which the estimates generated by the evaluation apply. Annualized inventories collect portions of the overall sample each year and produce updated estimates using the newest data. In these cases, the reporting year indicates the year of the most recent data. Older data, however, collected from the portions of area assigned to previous inventory years are also included, so that the entire sample is involved in making estimates.

6. DESCRIPTION

   Evaluation description. A brief summary description of the evaluation, the population it targets, and the purpose.

7. CREATED_BY — Created by. See POPULATION.CREATED_BY description for definition.

8. CREATED_DATE

   Created date. See POPULATION.CREATED_DATE description for definition.

9. CREATED_IN_INSTANCE

   Created in instance. See POPULATION.CREATED_IN_ INSTANCE description for definition.

10. MODIFIED_BY

   Modified by. See POPULATION.MODIFIED_BY description for definition.

11. MODIFIED_DATE

   Modified date. See POPULATION.MODIFIED_DATE description for definition.

12. MODIFIED_IN_INSTANCE

Modified in instance. See POPULATION.MODIFIED_IN_ INSTANCE description for definition.

4.2 Population Estimation Unit Table (Oracle table name is POP_ESTN_UNIT)

The purpose of the POP_ESTN_UNIT table is to store information about the estimation units defined for a target population for a given evaluation (see POP_EVAL table). An estimation unit is a defined subpopulation within the target population. Estimation units are typically specified for two reasons. First, there is a difference in the sampling intensity that must be constrained to only the target subpopulation. Second, an independent and area-controlled estimate is desired for the subpopulation.

Each estimation unit is a child of one evaluation (POP_EVAL), one target population (POPULATION table), and one geographic area (GEOAREA table). Note that some evaluations may incorporate multiple populations.

	Column Name	Descriptive Name	Oracle data type
1	CN	Estimation unit sequence number	VARCHAR2(34)
2	EVAL_CN	Evaluation sequence number	VARCHAR2(34)
3	POPN_CN	Population sequence number	VARCHAR2(34)
4	GEOAREA_CN	Geographic area sequence number	VARCHAR2(34)
5	AREA	Total area	NUMBER
6	AREA_UNITS	Area units	VARCHAR2(15)
7	NOTES	Estimation unit notes	VARCHAR2(2000)
8	CREATED_BY	Created by	VARCHAR2(30)
9	CREATED_DATE	Created date	DATE
10	CREATED_IN_INSTANCE	Created in instance	VARCHAR2(6)
11	MODIFIED_BY	Modified by	VARCHAR2(30)
12	MODIFIED_IN_INSTANCE	Modified in instance	VARCHAR2(6)
13	MODIFIED_DATE	Modified date	DATE

Type of Key	Column(s) order	Tables to link	Abbreviated notation
Primary	CN	N/A	PEU_PK
Foreign	GEOAREA_CN	POP_ESTN_UNIT to GEOAREA	PEU_GEOAREA_FK
Foreign	POPN_CN	POP_ESTN_UNIT to POPULATION	PEU_POPN_FK
Foreign	EVAL_CN	POP_ESTN-UNIT to POP_EVAL	PEU_PE_FK

1. CN — Estimation unit sequence number. A unique sequence number identifying the estimation unit record.

2. EVAL_CN — Evaluation sequence number. Foreign key linking the estimation unit record to the evaluation record.

3. POPN_CN — Population sequence number. Foreign key linking the estimation unit record to the population record. This linkage reflects the concept that an estimation unit is a subpopulation of a larger population under study.

4. GEOAREA_CN

   Geographic area sequence number. Foreign key linking the estimation unit record to the geographic area record. This linkage reflects the fact that estimation units are polygons representing subpopulations. The geographic area identifies which exact polygon (geographic area) is being used as the estimation unit.

5. AREA Total area. The total area of the estimation unit.

6. AREA_UNITS Area units. The units of the total area of the estimation unit.

7. NOTES Estimation unit notes. Any relevant notes pertaining to the estimation unit.

8. CREATED_BY Created by. See POPULATION.CREATED_BY description for definition.

9. CREATED_DATE

   Created date. See POPULATION.CREATED_DATE description for definition.

10. CREATED_IN_INSTANCE

    Created in instance. See POPULATION.CREATED_IN_ INSTANCE description for definition.

11. MODIFIED_BY

    Modified by. See POPULATION.MODIFIED_BY description for definition.

12. MODIFIED_IN_INSTANCE

    Modified in instance. See POPULATION.MODIFIED_IN_ INSTANCE description for definition.

13. MODIFIED_DATE

    Modified date. See POPULATION.MODIFIED_DATE description for definition.

4.3 Population Stratum Table (Oracle table name is POP_STRATUM)

The purpose of the POP_STRATUM table is to store information describing the stratum or strata for a given estimation unit. Each stratum is a child of one estimation unit (POP_ESTN_UNIT table). Information describing each stratum is required by the stratified estimators used by FIA for population-attribute estimation.

	Column Name	**Descriptive Name**	**Oracle data type**
1	CN	Sequence number	VARCHAR2(34)
2	ESTN_UNIT_CN	Estimation unit sequence number	VARCHAR2(34)
3	NAME	Stratum name	VARCHAR2(50)
4	LABEL	Stratum label	VARCHAR2(15)
5	AREA	Stratum area	NUMBER
6	AREA_UNITS	Stratum area units	VARCHAR2(15)
7	EXPNS	Stratum expansion factor	NUMBER
8	ADJ_FACTOR_MICR	Stratum microplot adjustment factor	NUMBER
9	ADJ_FACTOR_SUBP	Stratum subplot adjustment factor	NUMBER
10	STRATUM_SOURCE	Stratum source	VARCHAR2(100)
11	DESCRIPTION	Stratum description	VARCHAR2(2000)
12	CREATED_BY	Created by	VARCHAR2(30)
13	CREATED_DATE	Created date	DATE
14	CREATED_IN_INSTANCE	Created in instance	VARCHAR2(6)
15	MODIFIED_BY	Modified by	VARCHAR2(30)
16	MODIFIED_DATE	Modified date	DATE
17	MODIFIED_IN_INSTANCE	Modified in instance	VARCHAR2(6)

Type of Key	**Column(s) order**	**Tables to link**	**Abbreviated notation**
Primary	CN	N/A	PS_PK
Unique	ESTN_UNIT_CN, NAME	N/A	PS_UK
Foreign	ESTN_UNIT_CN	POP_STRATUM to POP_ESTN_UNIT	PS_PEU_FK

1. CN — Stratum sequence number. A unique sequence number identifying the stratum record.

2. ESTN_UNIT_CN

   Estimation unit sequence number. Foreign key linking the stratum record to the estimation unit record.

3. NAME — Stratum name. A name given to the stratum functioning as a unique identifier.

4. LABEL Stratum label. A short, descriptive phrase suitable for reporting output.

5. AREA Stratum area. The area of stratum.

6. AREA_UNITS Stratum area units. The units of the stratum area.

7. EXPNS Stratum expansion factor. The expansion factor applied to all plots assigned to the stratum. The units of the expansion factor are acres/plot. This is a critical component for the FIA stratified estimator for producing population-attribute estimates and sampling errors.

8. ADJ_FACTOR_MICR

Stratum microplot adjustment factor. An adjustment factor used to adjust population estimates to account for nonsampled plots or portions of plots. It is computed as the inverse of the ratio of the total area of microplots sampled to the total area of microplots that were possible to sample. Using the adjustment factor is intended to minimize a potential bias in estimates caused by non-response and assumes that areas not sampled can be represented by the stratum mean of the areas that were sampled. This adjustment factor is used with any population estimates of elements sampled on microplots, such as saplings (trees with $1 \geq$ DIA < 5).

9. ADJ_FACTOR_SUBP

Stratum subplot adjustment factor. An adjustment factor used to adjust population estimates to account for nonsampled plots or portions of plots. It is computed as the inverse of the ratio of the total area of subplots sampled to the total area of subplots that were possible to sample. Using the adjustment factor is intended to minimize a potential bias in estimates caused by non-response and assumes that areas not sampled can be represented by the stratum mean of the areas that were sampled. This adjustment factor is used with any population estimates of elements sampled on subplots, such as trees (DIA ≥ 5) or area estimates (like FIELD_LANDUSE).

10. STRATUM_SOURCE

Stratum source. The source of the stratum information.

11. DESCRIPTION

Stratum description. A brief summary description of the stratum.

12. CREATED_BY Created by. See POPULATION.CREATED_BY description for definition.

13. CREATED_DATE

Created date. See POPULATION.CREATED_DATE description for definition.

14. CREATED_IN_INSTANCE

Created in instance. See POPULATION.CREATED_IN_ INSTANCE description for definition.

15. MODIFIED_BY

Modified by. See POPULATION.MODIFIED_BY description for definition.

16. MODIFIED_DATE

Modified date. See POPULATION.MODIFIED_DATE description for definition.

17. MODIFIED_IN_INSTANCE

Modified in instance. See POPULATION.MODIFIED_IN_ INSTANCE description for definition.

4.4. Population Statistical Sample Table (Oracle table name is POP_STAT_SAMP)

The purpose of the POP_STAT_SAMPLE table is to store the identity of statistical samples used, in combination with a stratification, to produce population-attribute estimates. This table is unique to the Urban Stage 1 structure and does not have a direct analog in the traditional FIADB data structure. Separating the identity of statistical samples into an independent table has two main benefits. First, it provides the ability to define samples that may be used by non-stratified estimators. This ability is lacking in the traditional FIADB data structure. Second, each defined statistical sample can be described by tagging it with one or more descriptive flags, such as the constraints used to form the sample (see REF_SAMPLE_CONSTRAINT table). The concept of a statistical sample is different from a field sample. In an annualized inventory, a field sample typically includes only a portion of the full number of plots. A statistical sample includes all available plots regardless of field season. For example, if a particular inventory is conducted on a five-year cycle length, then the full sample is divided into five approximately equal field samples. But the statistical sample includes all plots regardless of the field season it was collected in.

	Column Name	Descriptive Name	Oracle data type
1	CN	Statistical sample sequence number	VARCHAR2(34)
2	EVAL_CN	Evaluation sequence number	VARCHAR2(34)
3	NAME	Statistical sample name	VARCHAR2(50)
4	DESCRIPTION	Statistical sample description	VARCHAR2(2000)
5	CREATED_BY	Created by	VARCHAR2(30)
6	CREATED_DATE	Created date	DATE
7	CREATED_IN_INSTANCE	Created in instance	VARCHAR2(6)
8	MODIFIED_BY	Modified by	VARCHAR2(30)
9	MODIFIED_DATE	Modified date	DATE
10	MODIFIED_IN_INSTANCE	Modified in instance	VARCHAR2(6)

Type of Key	Column(s) order	Tables to link	Abbreviated notation
Primary	CN	N/A	PSS_PK
Unique	NAME	N/A	PSS_UK
Foreign	EVAL_CN	POP_STAT_SAMP to POP_EVAL	PSS_PE_FK

1. CN — Statistical sample sequence number. A unique sequence number identifying the statistical sample record.

2. EVAL_CN — Evaluation sequence number. Foreign key linking the statistical sample record to the evaluation record.

3. NAME — Statistical sample name. A name assigned to the statistical sample. The name functions as a unique identifier.

4. DESCRIPTION

Statistical sample description. A brief summary description of the statistical sample. It typically includes the purpose of the sample, the targeted population and time frame, and any special qualities about which the analyst should be informed.

5. CREATED_BY Created by. See POPULATION.CREATED_BY description for definition.

6. CREATED_DATE

Created date. See POPULATION.CREATED_DATE description for definition.

7. CREATED_IN_INSTANCE

Created in instance. See POPULATION.CREATED_IN_ INSTANCE description for definition.

8. MODIFIED_BY

Modified by. See POPULATION.MODIFIED_BY description for definition.

9. MODIFIED_DATE

Modified date. See POPULATION.MODIFIED_DATE description for definition.

10. MODIFIED_IN_INSTANCE

Modified in instance. See POPULATION.MODIFIED_IN_ INSTANCE description for definition.

4.5 Population Statistical Sample Constraint Assignment Table (Oracle table name is POP_STAT_SAMP_CONSTR_ASSGN)

The purpose of the POP_STRAT_SAMP_CONSTR_ASSGN table is to store the many-to-many relationship between a statistical sample (POP_STAT_SAMPLE table) and a sample constraint (REF_SAMPLE_CONSTRAINT table). Under this structure, each statistical sample may be assigned one or many sample constraints and each sample constraint may be assigned to one or many statistical samples.

	Column Name	Descriptive Name	Oracle data type
1	STATSAMP_CN	Statistical sample sequence number	VARCHAR2(34)
2	SAMP_CONSTR_NAME	Sample constraint name	VARCHAR2(34)
3	CREATED_BY	Created by	VARCHAR2(30)
4	CREATED_DATE	Created date	DATE
5	CREATED_IN_INSTANCE	Created in instance	VARCHAR2(6)
6	MODIFIED_BY	Modified by	VARCHAR2(30)
7	MODIFIED_IN_INSTANCE	Modified in instance	VARCHAR2(6)
8	MODIFIED_DATE	Modified date	DATE

Type of Key	Column(s)	Tables to link	Abbreviated notation
Primary	STATSAMP_CN, SAMP_CONSTR_NAME	N/A	PSSCA_PK
Foreign	SAMP_CONSTR_NAME	POP_STAT_SAMP_CONSTR_ASSGN to REF_SAMPLE_CONSTRAINT	PSSCA_RSC_FK
Foreign	STATSAMP_CN	POP_STAT_SAMP_CONSTR_ASSGN to POP_STAT_SAMP	PSSCA_PSS_FK

1. STATSAMP_CN

   Statistical sample sequence number. Foreign key linking the statistical sample constraint assignment record to the statistical sample record.

2. SAMP_CONSTR_NAME

   Sample constraint name. Foreign key linking the statistical sample constraint assignment record to the sample constraint record.

3. CREATED_BY Created by. See POPULATION.CREATED_BY description for definition.

4. CREATED_DATE

   Created date. See POPULATION.CREATED_DATE description for definition.

5. CREATED_IN_INSTANCE

    Created in instance. See POPULATION.CREATED_IN_ INSTANCE description for definition.

6. MODIFIED_BY

    Modified by. See POPULATION.MODIFIED_BY description for definition.

7. MODIFIED_IN_INSTANCE

    Modified in instance. See POPULATION.MODIFIED_IN_INSTANCE description for definition.

8. MODIFIED_DATE

    Modified date. See POPULATION.MODIFIED_DATE description for definition.

4.6 Population Evaluation Type Assignment Table (Oracle table name is POP_EVAL_TYPE_ASSGN)

The purpose of the POP_EVAL_TYPE_ASSGN table is to store the many-to-many relationship between an evaluation (POP_EVAL table) and an evaluation type (REF_POP_EVAL_TYPE table). Under this structure each evaluation may be assigned one or many evaluation types and each evaluation type can be assigned to one or many evaluations.

	Column Name	Descriptive Name	Oracle data type
1	EVAL_CN	Evaluation sequence number	VARCHAR2(34)
2	EVAL_TYPE_NAME	Evaluation type name	VARCHAR2(10)
3	CREATED_BY	Created by	VARCHAR2(30)
4	CREATED_DATE	Created date	DATE
5	CREATED_IN_INSTANCE	Created in instance	VARCHAR2(6)
6	MODIFIED_BY	Modified by	VARCHAR2(30)
7	MODIFIED_IN_INSTANCE	Modified in instance	VARCHAR2(6)
8	MODIFIED_DATE	Modified date	DATE

Type of Key	Column(s) order	Tables to link	Abbreviated notation
Primary	EVAL_CN, EVAL_TYPE_NAME	N/A	PETA_PK
Foreign	EVAL_TYPE_NAME	POP_EVAL_TYPE_ASSGN to REF_POP_EVAL_TYPE	PETA_RPET_FK
Foreign	EVAL_CN	POP_EVAL_TYPE_ASSGN to POP_EVAL	PETA_PE_FK

1. EVAL_CN Evaluation sequence number. Foreign key linking the evaluation type assignment record to the evaluation record.

2. EVAL_TYPE_NAME

   Evaluation type name. Foreign key linking the evaluation type assignment record to the evaluation type record.

3. CREATED_BY Created by. See POPULATION.CREATED_BY description for definition.

4. CREATED_DATE

   Created date. See POPULATION.CREATED_DATE description for definition.

5. CREATED_IN_INSTANCE

   Created in instance. See POPULATION.CREATED_IN_ INSTANCE description for definition.

6. MODIFIED_BY

Modified by. See POPULATION.MODIFIED_BY description for definition.

7. MODIFIED_IN_INSTANCE

Modified in instance. See POPULATION.MODIFIED_IN_INSTANCE description for definition.

8. MODIFIED_DATE

Modified date. See POPULATION.MODIFIED_DATE description for definition.

4.7 Plot Stratum Assignment Table (Oracle table name is PLOT_STRAT_ASSGN)

The purpose of the PLOT_STRAT_ASSGN table is to store the many-to-many relationship between plots (PLOT table) and strata (POP_STRATUM table). Under this structure each plot may be assigned to one or many strata and each stratum can include one or many plots. Note that to obtain a valid estimate of strata means and variances computed with the stratified estimator used by FIA, a minimum number of plots is required for each stratum. Therefore, in practice each stratum must include many plots.

	Column Name	**Descriptive Name**	**Oracle data type**
1	PLT_CN	Plot sequence number	VARCHAR2(34)
2	STRAT_CN	Stratum sequence number	VARCHAR2(34)
3	CREATED_BY	Created by	VARCHAR2(30)
4	CREATED_DATE	Created date	DATE
5	CREATED_IN_INSTANCE	Created in instance	VARCHAR2(6)
6	MODIFIED_BY	Modified by	VARCHAR2(30)
7	MODIFIED_IN_INSTANCE	Modified in instance	VARCHAR2(6)
8	MODIFIED_DATE	Modified date	DATE

Type of Key	**Column(s) order**	**Tables to link**	**Abbreviated notation**
Primary	PLT_CN, STRAT_CN	N/A	PLTSTRATASGN_PK
Foreign	PLT_CN	PLOT_STRAT_ASSGN to PLOT	PLTSTRATASGN _PLT_FK
Foreign	STRAT_CN	PLOT_STRAT_ASSGN to POP_STRATUM	PLTSTRATASGN _PS_FK

1. PLT_CN Plot sequence number. Foreign key linking the plot stratum assignment record to the plot record.

2. STRAT_CN Stratum sequence number. Foreign key linking the plot stratum assignment record to the stratum record.

3. CREATED_BY Created by. See POPULATION.CREATED_BY description for definition.

4. CREATED_DATE

   Created date. See POPULATION.CREATED_DATE description for definition.

5. CREATED_IN_INSTANCE

   Created in instance. See POPULATION.CREATED_IN_INSTANCE description for definition.

6. MODIFIED_BY

    Modified by. See POPULATION.MODIFIED_BY description for definition.

7. MODIFIED_IN_INSTANCE

    Modified in instance. See POPULATION.MODIFIED_IN_INSTANCE

8. MODIFIED_DATE

    Modified date. See POPULATION.MODIFIED_DATE description for definition.

4.8 Plot Statistical Sample Assignment Table (Oracle table name is PLOT_STATSAMP_ASSGN)

The purpose of the PLOT_STATSAMP_ASSGN table is to store the many-to-many relationship between plots (PLOT table) and statistical samples (POP_STAT_SAMPLE table). Each plot may be assigned to one or many statistical samples and each statistical sample is composed of one or many plots. In practice, a statistical sample of a single plot is of no value. Therefore, each statistical sample is composed of many plots.

	Column name	Descriptive name	Oracle data type
1	PLT_CN	Plot sequence number	VARCHAR2(34)
2	PSS_CN	Statistical sample sequence number	VARCHAR2(34)
3	CREATED_BY	Created by	VARCHAR2(30)
4	CREATED_DATE	Created date	DATE
5	CREATED_IN_INSTANCE	Created in instance	VARCHAR2(6)
6	MODIFIED_BY	Modified by	VARCHAR2(30)
7	MODIFIED_IIN_INSTANCE	Modified in instance	VARCHAR2(6)
8	MODIFIED_DATE	Modified date	DATE

Type of key	Column(s) order	Tables to link	Abbreviated notation
Primary	PLT_CN, PSS_CN	N/A	PLTSTATSAMPASGN_PK
Foreign	PLT_CN	PLOT_STATSAMP_ASSGN to PLOT	PLTSTATSAMPASGN _PLT_FK
Foreign	PSS_CN	PLOT_STATSAMP_ASSGN to PLOT_STAT_SAMP	PLTSTATSAMPASGN _PSS_FK

1. PLT_CN Plot sequence number. Foreign key linking the plot statistical sample assignment record to the plot record.

2. PSS_CN Statistical sample sequence number. Foreign key linking the plot statistical sample assignment record to the statistical sample record.

3. CREATED_BY Created by. See POPULATION.CREATED_BY description for definition.

4. CREATED_DATE

   Created date. See POPULATION.CREATED_DATE description for definition.

5. CREATED_IN_INSTANCE

   Created in instance. See POPULATION.CREATED_IN_INSTANCE description for definition.

6. MODIFIED_BY

   Modified by. See POPULATION.MODIFIED_BY description for definition.

7. MODIFIED_IN _INSTANCE

Modified in instance. See POPULATION.MODIFIED_IN_INSTANCE description for definition.

8. MODIFIED_DATE

Modified date. See POPULATION.MODIFIED_DATE description for definition.

4.9 Population Estimation Table Examples

The Population Estimation table group (or POP tables for short) contains information critical to using the FIA stratified estimator. The ability to work with these data and find the data best suited for the analysis is critical. Users who have experience working in the traditional FIADB are familiar with working with EVALID as a means of identifying the evaluation of interest. Because the Urban Stage 1 database design generalizes the concept of the population under study from a State to a generic population, however, identifying the proper data set has also changed. This section is intended to guide the user through the use of these tables to answer questions related to population estimation. A discussion of actual estimation scripts is included in chapter 8, *Estimation Guide*.

What evaluations are available for a given reporting year?

Evaluations are built to provide estimates for a specific point in time that is referred to as the reporting year. For one-time or periodic inventories this represents the year in which data collection completed and estimates were produced. In the case of annual inventories, estimates are updated every year. The reporting year represents the most recent data in these cases. Annual evaluations, however, will almost always include data from previous years as well.

One way of filtering through the information available in the database is to search for evaluations based on the reporting year. This is done by simply querying the POP_EVAL table with a constraint for the reporting year of interest. No other tables or joins are required.

```
SELECT pe.cn, pe.evalid, pe.name, pe.label, pe.description, pe.report_year
  FROM pop_eval pe
 WHERE pe.report_year = User-provided Reporting Year(yyyy);
```

What evaluations are available for my population of interest?

The most common method of searching for an evaluation is to begin with the population of interest. The Urban Stage 1 database design stores population definitions in a table. This allows flexibility to define whatever population is required. Evaluations can be joined to populations through the concept of estimation units to identify which evaluations provide estimates for the population of interest. This method requires that the analyst identifies the population by name and version prior to searching for evaluations.

The query to support this inquiry must include the POP_EVAL, POP_ESTN_UNIT, and POPULATION table. The POP_ESTN_UNIT table is joined to the POP_EVAL table through the evaluation CN value. The POP_ESTN_UNIT table is also joined to the POPULATION table through the population CN value. Once these relationships are established, a constraint can be applied to control which population (and version) the analyst is interested in. Note that a DISTINCT keyword is used in the query. The purpose of this is to limit the return to only one copy of each distinct record. This is used because the join between POPULATION and POP_EVAL tables goes through the POP_ESTIN_UNIT table. These are one-to-many joins because each evaluation can have one or many estimation units. This particular question, however, is only concerned with populations and evaluations. Therefore the output should only include one instance of each distinct population and evaluation combination.

Note that this same query can be used in reverse; meaning that one could constrain the evaluation of interest and return the distinct population or populations covered by evaluation. Recall that the Urban Stage 1 database structure is built to enable evaluations covering multiple populations to facilitate more regional analyses.

```
SELECT DISTINCT pop.name, pop.version, pe.evalid, pe.report_year
  FROM pop_eval pe, pop_estn_unit peu, population pop
 WHERE pe.cn = peu.eval_cn
   AND peu.popn_cn = pop.cn
   AND pop.name = 'User-provdided Population Name
   AND pop.version = 'User-provided Population Version;
```

<u>What estimation units are defined for my evaluation of interest?</u>

Estimation units are defined for two main purposes; to provide independent estimates of important subpopulations, and to account for differences in sampling intensity. It can sometimes be useful for analysts to understand what estimation units have been defined for a given evaluation. They may wish to work with estimates only for a particular subpopulation. Or they may wish to have a better understanding of the sampling errors, which is a function of sampling intensity.

The query required to execute this analysis is very similar to the previous example. The POPULATION, POP_ESTN_UNIT, and POP_EVAL tables are included and joined in the same way. Unlike the previous example, this query is interested in estimation units. To further describe what the estimation unit (polygon) is, the GEOAREA table must be included. The GEOAREA table simply joins to the POP_ESTN_UNIT table through the geographic area CN value. In this example, the analyst has identified an evaluation of interest. This evaluation identity (EVALID) is used as a constraint in the WHERE clause. The output includes the population identifier (NAME and VERSION) along with the evaluation's EVALID and the name of each geographic area serving as an estimation unit.

Note that this basic query structure can be slightly modified to answer other questions. For example, "What evaluations include my geographic area of interest?" In this case, rather than constraining the evaluation, the analyst would constrain the geographic area of interest by name or names.

```
SELECT pop.name    popn_name,
       pop.version popn_version,
       pe.evalid,
       geo.name    estn_unit_name
  FROM pop_eval pe, pop_estn_unit peu, population pop, geoarea geo
 WHERE pe.cn = peu.eval_cn
   AND peu.geoarea_cn = geo.cn
   AND peu.popn_cn = pop.cn
   AND pe.evalid = 'User-provided EVALID';
```

What population attributes are appropriate to estimate with my evaluation?

Analysts frequently have a particular population attribute of interest in mind when working with data. Once the analyst has identified the population and evaluation of interest, the next question is "What can I do with it?"

To address this type of question, the analyst must use information from four tables. The POP_EVAL table is included in order to specify which exact evaluation is under study. The REF_POP_ATTRIBUTE table defines the common population attributes available for study. The REF_POP_EVAL_TYPE provides a description of the evaluation type or types assigned to the evaluation. Finally, the POP_EVAL_TYPE_ASSGN table simply assigns evaluation types to evaluations; a many-to-many relationship. The joins required are straight forward. The POP_EVAL table joins to the POP_EVAL_TYPE_ASSGN table through the evaluation's CN value. The POP_EVAL_TYPE_ASSGN table joins to the REF_POP_EVAL_TYPE table through the evaluation type's NAME. The remaining join is between the POP_EVAL_TYPE_ASSGN table and the REF_POP_ATTRIBUTE table through the evaluation type name. Note that the inclusion of the REF_POP_EVAL_TYPE allows for the description of the evaluation type to be included, if desired, in addition to the name used for the evaluation type.

```
SELECT pe.evalid,
       rpa.attribute_nbr,
       rpa.calculation_nbr,
       rpa.name,
       rpa.description,
       rpet.name eval_type_name,
       rpet.description
  FROM pop_eval            pe,
       pop_eval_type_assgn peta,
       ref_pop_attribute   rpa,
       ref_pop_eval_type   rpet
 WHERE pe.cn = peta.eval_cn
   AND peta.eval_type_name = rpet.name
   AND peta.eval_type_name = rpa.eval_type
   AND pe.evalid = 'User-provided EVALID'
 ORDER BY pe.evalid, rpa.attribute_nbr;
```

What constraints were used to form the statistical sample assigned to my evaluation?

The basis of each evaluation is a sample. One of the main differences between evaluations of different types is the statistical sample each is based on. Analysts may wish to work with statistical samples outside of the context of stratified estimation. For this purpose, statistical samples are defined independently from stratifications in the Urban Stage 1 database design. Further, statistical samples are described by one or more sample constraints that were used to create the sample. This is very similar to evaluation types assigned to evaluations.

This example requires information from three tables. The POP_STAT_SAMP table stores the identities of statistical samples. The POP_STAT_SAMP_CONSTR_ASSGN table links each statistical sample to one or more constraints, which are stored in the REF_SAMPLE_CONSTRAINT table. The POP_STAT_SAMP table is joined to the POP_STAT_SAMP_CONSTR_ASSGN table through the sample's CN value. The

POP_STAT_SAMP_CONSTR_ASSGN table is joined to the REF_SAMPLE_CONSTRAINT table through the name of the constraint. In this example, the analyst has identified a sample of interest and is looking up the constraints used to form it. Therefore, the user must specify the name of the sample. The query, however, can be modified to specify a particular sample constraint, and then it would list the samples that are constrained by it.

```
SELECT ps.name          sample_name,
       ps.description   sample_descr,
       rsc.name         constraint_name,
       rsc.description  constr_descr
  FROM pop_stat_samp              ps,
       pop_stat_samp_constr_assgn psca,
       ref_sample_constraint      rsc
 WHERE ps.cn = psca.statsamp_cn
   AND psca.samp_constr_name = rsc.name
   AND ps.name = 'User-provided Statistical Sample Name';
```

Chapter 5 – Population Model Table Group

The population model table group stores output from various computer models that estimate properties of the urban forest at the population level. These model outputs are unique to the Urban inventory and have no counterpart within the traditional (forest land) FIADB. These models make use of inputs from various sources including but not limited to, climate/meteorological data, pollution flux data, economic data, and population estimates derived from inventory data. These data must be treated differently than other data when used for custom analyses. For more information on performing analyses using these data see section 8.9, *Analysis of Population Model Output*.

The model output is produced for a defined geographic area within a population studied by a given project for a given reporting year. All of the tables in the Population Model table group, therefore, include foreign keys linking outputs to the PROJECT, POPULATION, and GEOAREA tables. They also include a REPORT_YEAR column specifying the timeframe of the model output.

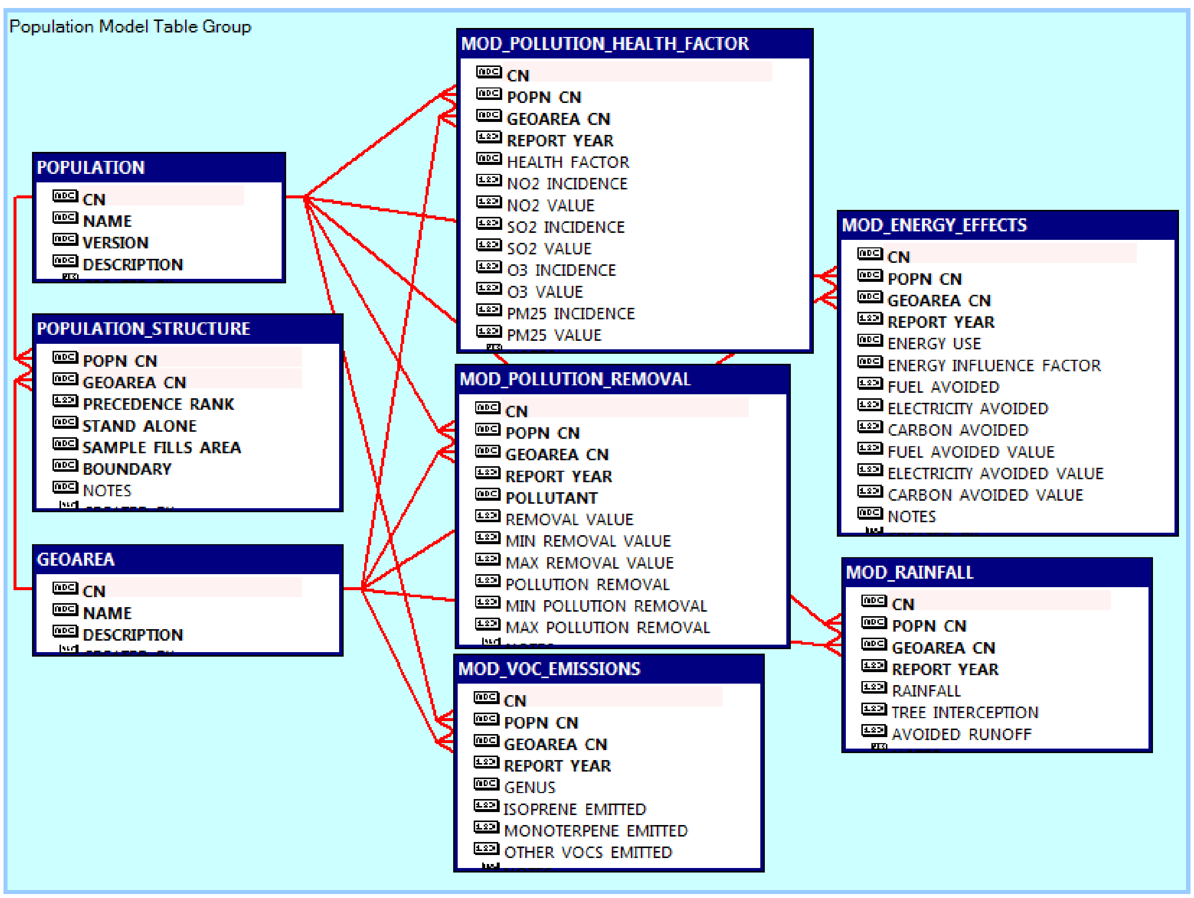


Figure 6. Population Model Table Group.

5.1 Model Energy Effects Table (Oracle table name is MOD_ENERGY_EFFECTS)

The purpose of the MOD_ENERGY_EFFECTS table is to organize output from the iTree energy effects model. This model estimates the effects urban trees have on energy consumption and carbon emissions of residential buildings (McPherson and Simpson 1999). These effects are broken down by energy use and energy influence type. Estimates quantify the amount of energy use avoided as well as an estimated dollar value of avoided energy consumption.

	Column name	Descriptive name	Oracle data type
1	CN	Energy effects sequence number	VARCHAR2(34)
2	POPN_CN	Population sequence number	VARCHAR2(34)
3	GEOAREA_CN	Geographic area sequence number	VARCHAR2(34)
4	REPORT_YEAR	Reporting year	NUMBER(4,0)
5	ENERGY_USE	Energy use	VARCHAR2(7)
6	ENERGY_EFFECT	Energy effect	VARCHAR2(9)
7	FUEL_AVOIDED	Fuel use avoided	NUMBER
8	ELECTRICITY_AVOIDED	Electricity use avoided	NUMBER
9	CARBON_AVOIDED	Carbon emissions avoided	NUMBER
10	FUEL_AVOIDED_VALUE	Fuel use avoided value	NUMBER
11	ELECTRICITY_AVOIDED_VALUE	Electricity use avoided value	NUMBER
12	CARBON_AVOIDED_VALUE	Carbon emissions avoided value	NUMBER
13	NOTES	Notes	VARCHAR2(2000)
14	CREATED_BY	Created by	VARCHAR2(30)
15	CREATED_DATE	Created date	DATE
16	CREATED_IN_INSTANCE	Created in instance	VARCHAR2(6)
17	MODIFIED_BY	Modified by	VARCHAR2(30)
18	MODIFIED_IN_INSTANCE	Modified in instance	VARCHAR2(6)
19	MODIFIED_DATE	Modified date	DATE

Type of key	Column(s) order	Tables to link	Abbreviated notation
Primary	CN	N/A	MEE_PK
Unique	POPN_CN, GEOAREA_CN, REPORT_YEAR, ENERGY_USE, ENERGY_EFFECT	N/A	MEE_UK
Foreign	GEOAREA_CN	MOD_ENERGY_EFFECTS to GEOAREA	MEE_GEOAREA_FK
Foreign	POPN_CN	MOD_ENERGY_EFFECTS to POPULATION	MEE_POPN_FK

1. CN — Energy effects sequence number. A unique sequence number identifying the energy effects record.

2. POPN_CN Population sequence number. Foreign key linking the energy effects record to the population record.

3. GEOAREA_CN

Geographic area sequence number. Foreign key linking the energy effects record to the geographic area record.

4. REPORT_YEAR

Reporting year. The year for which the model-generated estimates apply. The computer models generating these estimates are complex and require inputs from various sources that change over time, such as demographics or inventory data. Organizing model output by reporting year allows the same model to be applied over time using updated inputs as they become available.

5. ENERGY_USE

Energy use. The energy use category estimated by the record. The categories of energy use are HEATING and COOLING. Energy codes are defined in REF_ENERGY_USE.

Code	Description
HEATING	Energy used to heat the interior of a residential structure.
COOLING	Energy used to cool the interior of a residential structure.

6. ENERGY_EFFECT

Energy effect. The energy effect estimated by the record. These categories represent the different ways in which urban trees affect the energy consumption of residential buildings. The categories of energy effect are SHADING, WINDBREAK, and CLIMATE. Energy effect codes are defined in REF_ENERGY_EFFECT.

Code	Description
SHADING	Represents the influence of direct shading on the building.
WINDBREAK	Represents trees directly protecting residential buildings from wind.
CLIMATE	Represents the effect on residential space heating and cooling from non-adjacent trees (>50 feet) due to reductions in wind speed and summer air temperatures.

7. FUEL_AVOIDED

Fuel use avoided (MBTUs). The quantity of fuel consumption avoided due to the effect of urban trees on residential buildings expressed in millions of BTUs (British thermal units). Positive values represent energy consumption avoided (savings) and negative values represent energy consumption incurred. Fuels consumption estimates incorporate natural gas, fuel oil, and wood sources.

8. ELECTRICITY_AVOIDED

Electricity use avoided (MWh). The quantity of electricity consumption avoided due to the effect of urban tree on residential buildings expressed in mega-watt hours (MWh). Positive values represent energy consumption avoided (savings) and negative values represent energy consumption incurred.

9. CARBON_AVOIDED

Carbon emissions avoided (short tons). The quantity of carbon emissions avoided due to the effect of urban trees on residential buildings expressed in short tons. Positive values represent energy consumption avoided (savings) and negative values represent energy consumption incurred. This estimate reflects the reduction in fossil fuel-based power production sources.

10. FUEL_AVOIDED_VALUE

Fuel use avoided value (dollars). The estimated dollar value of fuel consumption avoided due to the effect of urban trees on residential buildings. Energy costs are based on data from the Energy Information Administration. Fuel costs are based on a weighted average of multiple fuel sources including natural gas, fuel oil, and wood.

11. ELECTRICITY_AVOIDED_VALUE

Electricity use avoided value (dollars). The estimated dollar value of electricity use avoided due to the effect of urban trees on residential buildings. Energy costs are based on data from the Energy Information Administration.

12. CARBON_AVOIDED_VALUE

Carbon emissions avoided value (dollars). The estimated social cost of carbon (SCC) emissions (based on Technical Update of the Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866 of May 2013). It estimates the dollar value of economic damages associated with carbon emissions. Under SCC, damages include, but are not limited to, net agricultural production and human health effects.

13. NOTES Notes. Any relevant notes related to energy effects estimates.

14. CREATED_BY Created by. See POPULATION.CREATED_BY description for definition.

15 . CREATED_DATE

Created date. See POPULATION.CREATED_DATE description for definition.

16. CREATED_IN_INSTANCE

    Created in instance. See POPULATION.CREATED_IN_INSTANCE description for definition.

17. MODIFIED_BY

    Modified by. See POPULATION.MODIFIED_BY description for definition.

18. MODIFIED_IN_INSTANCE

    Modified in instance. See POPULATION.MODIFIED_IN_INSTANCE description for definition.

19. MODIFIED_DATE

    Modified date. See POPULATION.MODIFIED_DATE description for definition.

5.2 Model Pollution Health Factor Table (Oracle table name is MOD_POLLUTION_HEALTH_FACTOR)

The purpose of the MOD_POLLUTION_HEALTH_FACTOR table is to organize output from the iTree Health Effects model. This model estimates the number of incidents and the total dollar value of several health factors related to four major pollutants; NO2, SO2, O3, and PM2.5 (see table below). Urban forests affect the level of these pollutants by acting as an air filter. Specifically, the leaf area of tree canopies filters these pollutants from the air. Due to this relationship, the population-level model output can be allocated across population domains of interest in proportion to the amount of leaf area in the domain of interest. For more information, see examples in section 8.9, *Analysis of Population Model Output*

Pollutant	Description
NO2	Nitrogen dioxide
SO2	Sulfur dioxide
O3	Ozone
PM25	Particulate Matter ≤ 2.5 micrometers (µm)

	Column name	Descriptive name	Oracle data type
1	CN	Pollution health factor sequence number	VARCHAR2(34)
2	POPN_CN	Population sequence number	VARCHAR2(34)
3	GEOAREA_CN	Geographic area sequence number	VARCHAR2(34)
4	REPORT_YEAR	Reporting year	NUMBER(4,0)
5	HEALTH_FACTOR	Health factor	VARCHAR2(50)
6	NO2_INCIDENCE	Nitrogen dioxide incidence	NUMBER
7	NO2_VALUE	Nitrogen dioxide value	NUMBER
8	SO2_INCIDENCE	Sulfur dioxide incidence	NUMBER
9	SO2_VALUE	Sulfur dioxide value	NUMBER
10	O3_INCIDENCE	Ozone incidence	NUMBER
11	O3_VALUE	Ozone value	NUMBER
12	PM25_INCIDENCE	Particulate matter incidence	NUMBER
13	PM25_VALUE	Particulate matter value	NUMBER
14	NOTES	Notes	VARCHAR2(2000)
15	MODIFIED_BY	Modified by	VARCHAR2(30)
16	MODIFIED_DATE	Modified date	DATE
17	MODIFIED_IN_INSTANCE	Modified in instance	VARCHAR2(6)
18	CREATED_BY	Created by	VARCHAR2(30)
19	CREATED_DATE	Created date	DATE
20	CREATED_IN_INSTANCE	Created in instance	VARCHAR2(6)

Type of key	Column(s) order	Tables to link	Abbreviated notation
Primary	CN	N/A	MPHF_PK
Unique	POPN_CN, GEOAREA_CN, REPORT_YEAR, HEALTH_FACTOR	N/A	MPHF_UK
Foreign	GEOAREA_CN	MOD_POLLUTION_HEALTH_EFFECTS to GEOAREA	MPHF_GEOAREA_FK
Foreign	POPN_CN	MOD_POLLUTION_HEALTH_EFFECTS to POPULATION	MPHF_POPN_FK

1. CN — Pollution health factor sequence number. A unique sequence number identifying the pollution health factor record.

2. POPN_CN — Population sequence number. Foreign key linking the pollution health factor record to the population record.

3. GEOAREA_CN

   Geographic area sequence number. Foreign key linking the pollution health factor record to the geographic area record.

4. REPORT_YEAR

   Reporting year. The year for which the estimates generated by the model apply. The computer models generating these estimates are complex and require inputs from various sources that change over time, such as demographics or inventory data. Organizing model output by reporting year allows the same model to be applied over time using updated inputs as they become available.

5. HEALTH_FACTOR

   Health factor. The adverse health factor described by the model.

6. NO2_INCIDENCE

   Nitrogen dioxide incidence (cases per year).

   $I = IM * \Delta Conc * Pop$

   Where:

   Pop = the population of the city
   IM = the incidence multiplier (incidence per change in concentration per person)
   ΔConc = the change in pollution concentration
   I = the number of adverse health effects as the result of a change in pollution concentration

7. NO2_VALUE Nitrogen dioxide value (dollars). The total value of the current health effect related to nitrogen dioxide. Positive values represent the cost in treatment and lost productivity avoided as a result of pollution reduction while negative values represent costs incurred as a result of pollution reduction. This value is a total and does not need to be multiplied by NO2_INCIDENCE. The economic value is estimated using a Health Impact Function that is based on a Concentration-Response (C-R) function. A C-R function estimates the relationship between adverse health effects and ambient air pollution. The calculation is summarized by the following expression.

$$V = VM * \Delta Conc * Pop$$

Where:

Pop = the population of the city
VM = the value multiplier of the county (value per change in concentration per person)
$\Delta Conc$ = the change in pollution concentration
V = the economic value associated with adverse health effects ($)

8. SO2_INCIDENCE

Sulfur dioxide incidence (cases per year). The number of cases avoided per year of the current health factor related to sulfur dioxide. Positive values indicate cases avoided and negative values indicate cases incurred. Changes in incidence are estimated using the following expression.

$$I = IM * \Delta Conc * Pop$$

Where:

Pop = the population of the city
IM = the incidence multiplier (incidence per change in concentration per person)
$\Delta Conc$ = the change in pollution concentration
I = the number of adverse health effects as the result of a change in pollution concentration

9. SO2_VALUE Sulfur dioxide value (dollars). The total value of the current health factor related to sulfur dioxide. Positive values represent the cost in treatment and lost productivity avoided as a result of pollution reduction while negative values represent costs incurred as a result of pollution reduction. This value is a total and does not need to be multiplied by SO2_INCIDENCE. The economic value is estimated using a Health Impact Function which is based on a Concentration-Response (C-R) function. A C-R function estimates the relationship between adverse health effects and ambient air pollution. The calculation is summarized by the following expression.

$V = VM * \Delta Conc * Pop$

Where:

Pop = the population of the city
VM = the value multiplier of the county (value per change in concentration per person)
ΔConc = the change in pollution concentration
V = the economic value associated with adverse health effects ($)

10. O3_INCIDENCE

Ozone incidence (cases per year). The number of cases avoided per year of the current health factor related to ozone. Positive values indicate cases avoided and negative values indicate cases incurred. Changes in incidence are estimated using the following expression.

$I = IM * \Delta Conc * Pop$

Where:

Pop = the population of the city
IM = the incidence multiplier (incidence per change in concentration per person)
ΔConc = the change in pollution concentration
I = the number of adverse health effects as the result of a change in pollution concentration

11. O3_VALUE Ozone value (dollars). The total value of the current health factor related to ozone. Positive values represent the cost in treatment and lost productivity avoided as a result of pollution reduction, while negative values represent costs incurred as a result of pollution reduction. This value is a total and does not need to be multiplied by O3_INCIDENCE. The economic value is estimated using a Health Impact Function which is based on a Concentration-Response (C-R) function. A C-R function estimates the relationship between adverse health effects and ambient air pollution. The calculation is summarized by the following expression.

$V = VM * \Delta Conc * Pop$

Where:

Pop = the population of the city
VM = the value multiplier of the county (value per change in concentration per person)
ΔConc = the change in pollution concentration
V = the economic value associated with adverse health effects ($)

12. PM25_INCIDENCE

Particulate matter (≤ 2.5µm) incidence (cases per year). The number of cases avoided per year of the current health factor related to particulate matter ≤2.5 µm. Positive values indicate cases avoided and negative values indicate cases incurred. Changes in incidence are estimated using the following expression.

$I = IM * \Delta Conc * Pop$

Where:

Pop = the population of the city
IM = the incidence multiplier (incidence per change in concentration per person)
$\Delta Conc$ = the change in pollution concentration
I = the number of adverse health effects as the result of a change in pollution concentration

13. PM25_VALUE Particulate matter (≤ 2.5µm) value(dollars). The total value of the current health factor related to particulate matter ≤2.5 µm. Positive values represent the cost in treatment and lost productivity avoided as a result of pollution reduction, while negative values represent costs incurred as a result of pollution reduction. This value is a total and does not need to be multiplied by PM25_INCIDENCE. The economic value is estimated using a Health Impact Function which is based on a Concentration-Response (C-R) function. A C-R function estimates the relationship between adverse health effects and ambient air pollution. The calculation is summarized by the following expression.

$V = VM * \Delta Conc * Pop$

Where:

Pop = the population of the city
VM = the value multiplier of the county (value per change in concentration per person)
$\Delta Conc$ = the change in pollution concentration
V = the economic value associated with adverse health effects ($)

14. NOTES Notes. Any relevant notes related to health factor estimates.

15. MODIFIED_BY

Modified by. See POPULATION.MODIFIED_BY description for definition.

16. MODIFIED_DATE

Modified date. See POPULATION.MODIFIED_DATE description for definition.

17. MODIFIED_IN_INSTANCE

Modified in instance. See POPULATION.MODIFIED_IN_INSTANCE description for definition.

18. CREATED_BY Created by. See POPULATION.CREATED_BY description for definition.

19. CREATED_DATE

Created date. See POPULATION.CREATED_DATE description for definition.

20. CREATED_IN_INSTANCE

Created in instance. See POPULATION.CREATED_IN_INSTANCE description for definition.

5.3 Model Pollution Removal Table (Oracle table name is MOD_POLLUTION_REMOVAL)

The purpose of the MOD_POLLUTION_REMOVAL table is to store estimates from a computer model that estimates the quantity and associated value of pollution reduction by urban forests. The four pollutants evaluated by the model are NO2, SO2, O3 and PM25, which are defined by the table below. Urban forests affect the level of these pollutants by acting as an air filter. Specifically, the leaf area of tree canopies filters these pollutants from the air. Due to this relationship the population-level model output can be allocated across population domains of interest in proportion to the amount of leaf area in the domain of interest. For more information see examples in section 8.9, *Analysis of Population Model Output*

Pollutant	Description
NO2	Nitrogen dioxide
SO2	Sulfur dioxide
O3	Ozone
PM2.5	Particulate Matter ≤ 2.5 micrometers (µm)

	Column name	Descriptive name	Oracle data type
1	CN	Pollution removal sequence number	VARCHAR2(34)
2	POPN_CN	Population sequence number	VARCHAR2(34)
3	GEOAREA_CN	Geographic area sequence number	VARCHAR2(34)
4	REPORT_YEAR	Reporting year	NUMBER(4,0)
5	POLLUTANT	Pollutant	VARCHAR2(10)
6	REMOVAL_VALUE	Pollutant removal value	NUMBER
7	MIN_REMOVAL_VALUE	Minimum pollution removal value	NUMBER
8	MAX_REMOVAL_VALUE	Maximum pollution removal value	NUMBER
9	POLLUTION_REMOVAL	Pollution removal	NUMBER
10	MIN_POLLUTION_REMOVAL	Minimum pollution removal	NUMBER
11	MAX_POLLUTION_REMOVAL	Maximum pollution removal	NUMBER
12	NOTES	Notes	VARCHAR2(2000)
13	MODIFIED_BY	Modified by	VARCHAR2(30)
14	MODIFIED_DATE	Modified date	DATE
15	MODIFIED_IN_INSTANCE	Modified in instance	VARCHAR2(6)
16	CREATED_BY	Created by	VARCHAR2(30)
17	CREATED_DATE	Created date	DATE
18	CREATED_IN_INSTANCE	Created in instance	VARCHAR2(6)

Type of key	Column(s) order	Tables to link	Abbreviated notation
Primary	CN	N/A	MPR_PK
Unique	POPN_CN, GEOAREA_CN, REPORT_YEAR, POLLUTANT	N/A	MPR_UK
Foreign	GEOAREA_CN	MOD_POLLUTION_REMOVAL to GEOAREA	MPR_GEOAREA_FK
Foreign	POPN_CN	MOD_POLLUTION_REMOVAL to POPULATION	MPR_POPN_FK

1. CN — Pollution removal sequence number. A unique sequence number identifying the pollution removal record.

2. POPN_CN — Population sequence number. Foreign key linking the pollution removal factor record to the population record.

3. GEOAREA_CN

   Geographic area sequence number. Foreign key linking the pollution removal factor record to the geographic area record.

4. REPORT_YEAR

   Reporting year. The year for which the estimates generated by the model apply. The computer models generating these estimates are complex and require inputs from various sources that change over time, such as demographics or inventory data. Organizing model output by reporting year allows the same model to be applied over time using updated inputs as they become available.

5. POLLUTANT — Pollutant. The pollutant described by the model. The four pollutants of interest are NO2, SO2, O3 and PM25, which are described in the table above.

6. REMOVAL_VALUE

   Pollutant pollution value (dollars). The total economic value of the change in pollutant concentration. A positive value indicates a cost savings due to fewer hospitalizations and other economic indicators. A negative value indicates a cost incurred.

7. MIN_REMOVAL_VALUE

   Minimum pollution removal value (dollars per year). The minimum pollution removal economic value. The minimum is estimated based on a minimum dry deposition velocity of pollutants. The minimum velocity is used to derive estimates of minimum economic value. This value is not the model error. It does provide, however, some measure of uncertainty in the overall value of pollution reduction.

8. MAX_REMOVAL_VALUE

Maximum pollution removal value (dollars per year). The maximum removal economic value. The maximum is estimated based on a maximum dry deposition velocity of pollutants. The maximum velocity is used to derive estimates of maximum economic value. This value is not the model error. It does, however, provide some measure of uncertainty in the overall value of pollution reduction.

9. POLLUTION_REMOVAL

Pollution removal (tons per year). The quantity of current pollutant removed from the air by urban forests. A positive value indicates a reduction in pollution concentration. A negative value indicates an increase in pollution concentration.

10. MIN_POLLUTION_REMOVAL

Minimum pollution removal (tons per year). The minimum pollution removal. The minimum is estimated based on a minimum dry deposition velocity of pollutants. The minimum velocity is used to derive estimates of minimum pollution removal. This value is not the model error. It does provide, however, some measure of uncertainty in the overall pollution reduction.

11. MAX_POLLUTION_REMOVAL

Maximum pollution removal (tons per year). The maximum pollution removal. The maximum is estimated based on a maximum dry deposition velocity of pollutants. The maximum velocity is used to derive estimates of maximum pollution removal. This value is not the model error. It does provide, however, some measure of uncertainty in the overall pollution reduction.

12. NOTES

Pollution removal notes. Any relevant notes concerning pollution removal estimates.

13. MODIFIED_BY

Modified by. See POPULATION.MODIFIED_BY description for definition.

14. MODIFIED_DATE

Modified date. See POPULATION.MODIFIED_DATE description for definition.

15. MODIFIED_IN_INSTANCE

Modified in instance. See POPULATION.MODIFIED_IN_INSTANCE description for definition.

16. CREATED_BY Created by. See POPULATION.CREATED_BY description for definition.

17. CREATED_DATE

Created date. See POPULATION.CREATED_DATE description for definition.

18. CREATED_IN_INSTANCE

Created in instance. See POPULATION.CREATED_IN_INSTANCE description for definition.

5.4 Model Rainfall Table (Oracle table name is MOD_RAINFALL)

The purpose of the MOD_RAINFALL table is to store output from a computer model that estimates the amount of rainfall intercepted by urban forest tree canopies as well as the volume of runoff avoided. Urban tree canopies intercept rainfall in proportion to the amount of leaf area in the canopy. Therefore, the model output can be allocated across population domains of interest by computing the proportion of the total leaf area that occurs in the domain of interest and multiplying that by the model output. For more information about producing estimates from this output see examples in section 8.9, *Analysis of Population Model Output*

	Column name	**Descriptive name**	**Oracle data type**
1	CN	Rainfall sequence number	VARCHAR2(34)
2	POPN_CN	Population sequence number	VARCHAR2(34)
3	GEOAREA_CN	Geographic area sequence number	VARCHAR2(34)
4	REPORT_YEAR	Reporting year	NUMBER(4,0)
5	RAINFALL	Rainfall	NUMBER
6	TREE_INTERCEPTION	Tree interception	NUMBER
7	AVOIDED_RUNOFF	Avoided runoff	NUMBER
8	NOTES	Notes	VARCHAR2(2000)
9	CREATED_BY	Created by	VARCHAR2(30)
10	CREATED_DATE	Created date	DATE
11	CREATED_IN_INSTANCE	Created in instance	VARCHAR2(6)
12	MODIFIED_BY	Modified by	VARCHAR2(30)
13	MODIFIED_IN_INSTANCE	Modified in instance	VARCHAR2(6)
14	MODIFIED_DATE	Modified date	DATE

Type of key	**Column(s) order**	**Tables to link**	**Abbreviated notation**
Primary	CN	N/A	MR_PK
Unique	POPN_CN, GEOAREA_CN, REPORT_YEAR	N/A	MR_UK
Foreign	GEOAREA_CN	MOD_RAINFALL to GEOAREA	MR_GEOAREA_FK
Foreign	POPN_CN	MOD_RAINFALL to POPULATION	MR_POPN_FK

1. CN — Rainfall sequence number. A unique sequence number identifying the rainfall model record.

2. POPN_CN — Population sequence number. Foreign key linking the rainfall model record to the population record.

3. GEOAREA_CN

   Geographic area sequence number. Foreign key linking the rainfall model factor record to the geographic area record.

4. REPORT_YEAR

   Reporting year. The year for which the estimates generated by the model apply. The computer models generating these estimates are complex and require inputs from various sources that change over time, such as demographics or inventory data. Organizing model output by reporting year allows the same model to be applied over time using updated inputs as they become available.

5. RAINFALL Rainfall (cubic feet per year). The total volume of rainfall on the target geographic area for the reporting year.

6. TREE_INTERCEPTION

   Tree interception (cubic feet per year). The volume of rainfall intercepted by tree canopies on the target geographic area for the reporting year.

7. AVOIDED_RUNOFF

   Avoided runoff (cubic feet per year). The volume of runoff avoided due to the mitigating influence of urban forests.

8. NOTES Rainfall notes. Any relevant notes concerning rainfall estimates.

9. CREATED_BY Created by. See POPULATION.CREATED_BY description for definition.

10. CREATED_DATE

    Created date. See POPULATION.CREATED_DATE description for definition.

11. CREATED_IN_INSTANCE

    Created in instance. See POPULATION.CREATED_IN_INSTANCE description for definition.

12. MODIFIED_BY

    Modified by. See POPULATION.MODIFIED_BY description for definition.

13. MODIFIED_IN_INSTANCE

    Modified in instance. See POPULATION.MODIFIED_IN_INSTANCE description for definition.

14. MODIFIED_DATE

Modified date. See POPULATION.MODIFIED_DATE description for definition.

5.5 Model Volatile Organic Compound (VOC) Emissions Table (Oracle table name is MOD_VOC_EMISSIONS)

The purpose of the MOD_VOC_EMISSIONS table is to store estimates of Volatile Organic Compound (VOC) emissions. Estimates of VOC emissions are produced by a computer model. VOC emission is correlated with the amount of leaf biomass. Further, different genera of trees emit different levels of VOCs. Therefore, the model produces VOC emission estimates by tree genus. Model outputs can be allocated across population domains of interest by computing the proportion of leaf biomass (by tree genus) occurring in the domain of interest and multiplying it by the model output for each genus.

	Colum name	Descriptive name	Oracle data type
1	CN	VOC emission sequence number	VARCHAR2(34)
2	POPN_CN	Population sequence number	VARCHAR2(34)
3	GEOAREA_CN	Geographic area sequence number	VARCHAR2(34)
4	REPORT_YEAR	Reporting year	NUMBER(4,0)
5	GENUS	Genus	VARCHAR2(50)
6	ISOPRENE_EMITTED	Isoprene emitted	NUMBER
7	MONOTERPENE_EMITTED	Monoterpene emitted	NUMBER
8	OTHER_VOCS_EMITTED	Other VOCs emitted	NUMBER
9	NOTES	VOC emission notes	VARCHAR2(2000)
10	MODIFIED_BY	Modified by	VARCHAR2(30)
11	MODIFIED_DATE	Modified date	DATE
12	MODIFIED_IN_INSTANCE	Modified in instance	VARCHAR2(6)
13	CREATED_BY	Created by	VARCHAR2(30)
14	CREATED_DATE	Created date	DATE
15	CREATED_IN_INSTANCE	Created in instance	VARCHAR2(6)

Type of key	**Column(s) order**	**Tables to link**	**Abbreviated notation**
Primary	CN	N/A	MVOCE_PK
Unique	POPN_CN, GEOAREA_CN, REPORT_YEAR, GENUS	N/A	MVOCE_UK
Foreign	GEOAREA_CN	MOD_VOC_EMISSIONS to GEOAREA	MVOCE_GEOAREA_FK
Foreign	POPN_CN	MOD_VOC_EMISSIONS to POPULATION	MVOCE_POPN_FK

1. CN — VOC emission sequence number. A unique sequence number identifying the VOC emissions record.

2. POPN_CN — Population sequence number. Foreign key linking the VOC emissions record to the population record.

3. GEOAREA_CN

Geographic area sequence number. Foreign key linking the VOC emissions record to the geographic area record.

4. REPORT_YEAR

Reporting year. The year for which the estimates generated by the model apply. The computer models generating these estimates are complex and require inputs from various sources that change over time, such as demographics or inventory data. Organizing model output by reporting year allows the same model to be applied over time using updated inputs as they become available.

5. GENUS

Genus. The genus for which the estimate of VOC emission applies.

6. ISOPRENE_EMITTED

Isoprene emitted (pounds per year). The quantity of isoprene emitted by the genus of the current record.

7. MONOTERPENE_EMITTED

Monoterpene emitted (pounds per year). The quantity of monoterpene emitted by the genus of the current record.

8. OTHER_VOCS_EMITTED

Other VOCs emitted (pounds per year). The quantity of other VOCs emitted by the genus of the current record. This value is not always populated by the model.

9. NOTES

VOC emission notes. Any relevant notes concerning VOC emission estimates.

10. MODIFIED_BY

Modified by. See POPULATION.MODIFIED_BY description for definition.

11. MODIFIED_DATE

Modified date. See POPULATION.MODIFIED_DATE description for definition.

12. MODIFIED_IN_INSTANCE

Modified in instance. See POPULATION.MODIFIED_IN_INSTANCE description for definition.

13. CREATED_BY Created by. See POPULATION.CREATED_BY description for definition.

14. CREATED_DATE

    Created date. See POPULATION.CREATED_DATE description for definition.

15. CREATED_IN_INSTANCE

    Created in instance. See POPULATION.CREATED_IN_INSTANCE description for definition.

5.6 Population Model Table Examples

The Population Model Table Group is unique in the way that it presents estimates relating to urban forests directly at the population level. Analysts must work with these data differently than data in the Inventory Data Table Group. For a more complete explanation on working with these data see section 8.9, *Analysis of Population Model Output*. That section explains the technique for analyzing all but the Energy Effects model output. This examples section will show how to query data from the Energy Effects model.

What are the energy effects for my population of interest?

The MOD_ENERGY_EFFECTS table stores population-level estimates of energy avoidance and the dollar value of energy avoidance. These model outputs are associated with a specific population and geographic area. Therefore, the POPULATION and GEOAREA tables should be joined in order to output the identities of these components in a single output. The MOD_ENERGY_EFFECTS table is joined to the POPULATION table through the POPN_CN foreign key. The MOD_ENERGY_EFFECTS table is also joined to the GEOAREA table through the GEOAREA_CN foreign key. With these joins, established information about the population and geographic areas for which the model was run can be output along with the estimates themselves.

```
SELECT pop.name,
       pop.version,
       geo.name,
       mee.energy_use,
       SUM(mee.fuel_avoided) fuel_avoided,
       SUM(mee.electricity_avoided) elec_avoided,
       SUM(mee.carbon_avoided) c_avoided,
       SUM(mee.fuel_avoided_value) fuel_value,
       SUM(mee.electricity_avoided_value) elec_value,
       SUM(mee.carbon_avoided_value) c_value
  FROM mod_energy_effects mee, population pop, geoarea geo
 WHERE mee.popn_cn = pop.cn
   AND mee.geoarea_cn = geo.cn
 GROUP BY pop.name, pop.version, geo.name, mee.energy_use
 ORDER BY pop.name, pop.version, geo.name, mee.energy_use;
```

Chapter 6 – Reference Data Table Group – Code Definitions Tables Subgroup

Reference data are static or semi-static data that define codes used in other table groups of the database. For example, a numeric code is used to specify the species identified by the field crew, which is more efficient for crews to record than common or scientific names. These codes can be translated back to the common or scientific name by joining to the appropriate reference data. As field protocols evolve, some codes can change over time. These changes are organized by the use of a manual version that controls which codes were valid under which field manual versions. Most reference data tables have a MANUAL_START and MANUAL_END column, which indicate the versions for which a set of codes was valid. A NULL value in MANUAL_END indicates that the most recent set of codes is still valid.

The reference table group can be further subdivided into two subgroups; code definition tables and population estimation reference tables. The following section provides a written and technical description of each table in the code definition subgroup and its contents along with an example query of how it is correctly joined to the appropriate table.

This subgroup of tables is used to store the definition of codes used to describe inventory data. Most of these codes are assigned in the field by the field crew and are populated on the appropriate table in the database. These data are useful when analyzing data as well as for presenting results in tabular form.

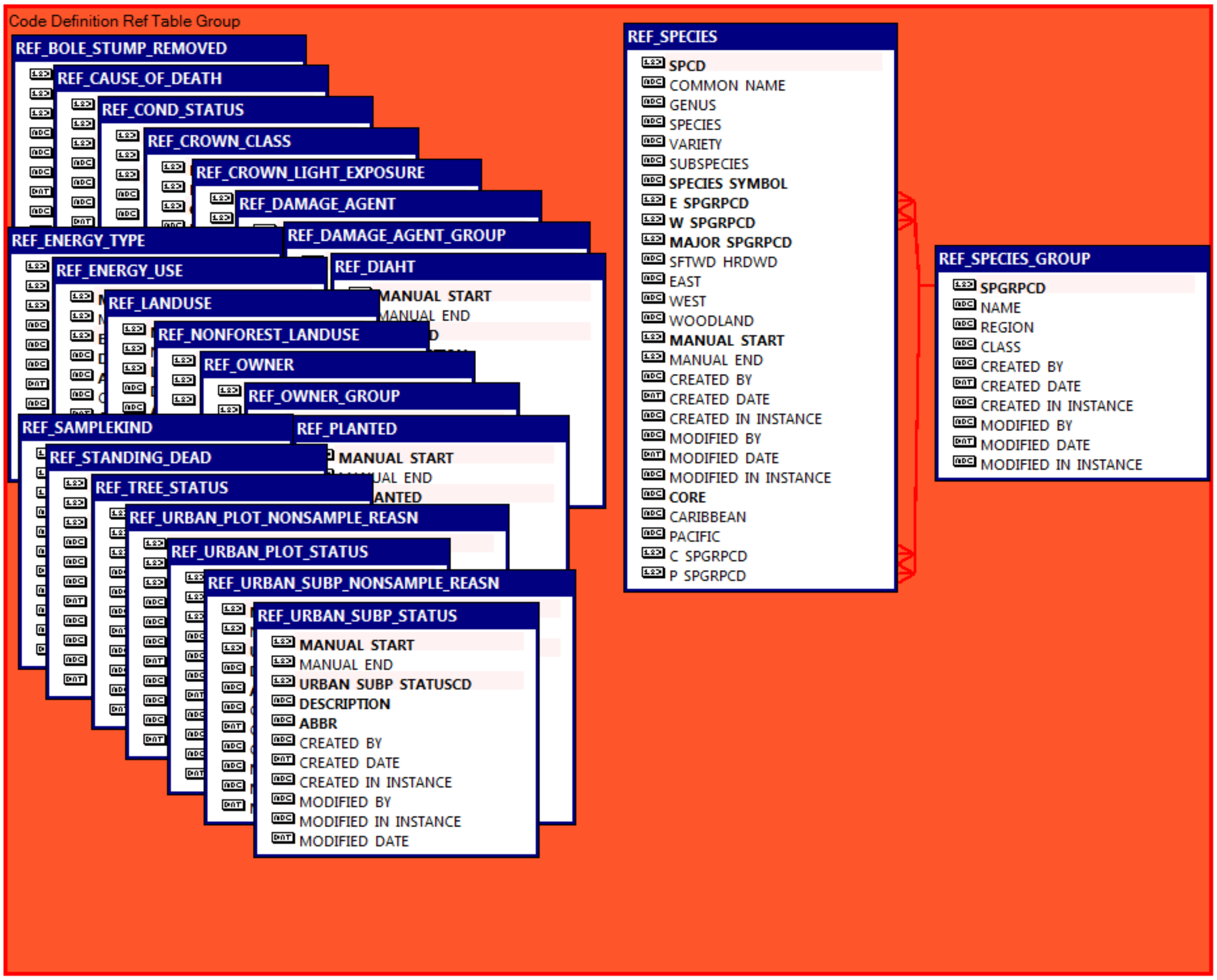


Figure 7. Reference data table group, code definitions tables subgroup.

6.1 Reference Bole/Stump Removed Table (Oracle table name is REF_BOLE_STUMP_REMOVED)

The REF_BOLE_STUMP_REMOVED table stores the definitions for the IS_BOLE_STUMP_REMOVED code set. The IS_BOLE_STUMP_REMOVED variable is stored on the TREE table and is populated on remeasurement trees that have been removed since the previous plot measurement. Consult the appropriate field guide version (as indicated on the corresponding PLOT record) for details on the collection of this variable.

	Column name	Descriptive name	Oracle data type
1	MANUAL_START	Starting manual version	NUMBER(3,1)
2	MANUAL_END	Ending manual version	NUMBER(3,1)
3	IS_BOLE_STUMP_REMOVED	Is bole/stump removed	NUMBER(1,0)
4	DESCRIPTION	Code description	VARCHAR2(1000)
5	ABBR	Code abbreviation	VARCHAR2(15)
6	CREATED_BY	Created by	VARCHAR2(30)
7	CREATED_DATE	Created date	DATE
8	CREATED_IN_INSTANCE	Created in instance	VARCHAR2(6)
9	MODIFIED_BY	Modified by	VARCHAR2(30)
10	MODIFIED_IN_INSTANCE	Modified in instance	VARCHAR2(6)
11	MODIFIED_DATE	Modified date	DATE

Type of key	Column(s) order	Tables to link	Abbreviated notation
Primary	MANUAL_START, IS_BOLE_STUMP_REMOVED	N/A	RBSR_PK

1. MANUAL_START

   Starting manual version. The first manual version for which the code set was valid.

2. MANUAL_END

   Ending manual version. The final manual version for which the code set was valid. A blank (null) value indicates that the code set is is still valid.

3. IS_BOLE_STUMP_REMOVED

   Is bole/stump removed. A code applied to trees removed since the previous measurement indicating if the bole, or the bole and stump were removed from the site.

Code	Description
1	Bole removed – The bole of the tree was removed but the stump remains on site.
2	Bole & stump removed – The bole and stump were removed from the site. Use this code if the entire surface of the stump has been reduced below ground level or removed completely.

4. DESCRIPTION

   Code description. A brief summary description of the meaning of the code.

5. ABBR Code abbreviation. A short descriptive phrase suitable for reporting.

6. CREATED_BY Created by. See POPULATION.CREATED_BY description for definition.

7. CREATED_DATE

   Created date. See POPULATION.CREATED_DATE description for definition.

8. CREATED_IN_INSTANCE

   Created in instance. See POPULATION.CREATED_IN_INSTANCE description for definition.

9. MODIFIED_BY

   Modified by. See POPULATION.MODIFIED_BY description for definition.

10. MODIFIED_IN _INSTANCE

    Modified in instance. See POPULATION.MODIFIED_IN_INSTANCE description for definition.

11. MODIFIED_DATE

    Modified date. See POPULATION.MODIFIED_DATE description for definition.

<u>Example: Count of trees by IS_BOLE_STUMP_REMOVED:</u>

```
SELECT t.is_bole_stump_removed, r.abbr, r.description, COUNT(*) tree_cnt
  FROM plot p, tree t, ref_bole_stump_removed r
 WHERE p.cn = t.plt_cn
   AND t.is_bole_stump_removed = r.is_bole_stump_removed
   AND p.urban_manual >= r.manual_start
   AND (r.manual_end IS NULL OR p.urban_manual <= r.manual_end)
 GROUP BY t.is_bole_stump_removed, r.abbr, r.description
 ORDER BY t.is_bole_stump_removed;
```

6.2 Reference Cause of Death Table (Oracle table name is REF_CAUSE_OF_DEATH)

The REF_CAUSE_OF_DEATH table contains the definitions for the codes used for the CAUSE_OF_DEATH variable. The CAUSE_OF_DEATH variable is a descriptive variable assigned to trees that were observed as live in the inventory and then observed as dead or removed during a remeasurement. Consult the appropriate field guide version (as indicated on the corresponding PLOT record) for details on the collection of this variable.

	Column name	Descriptive name	Oracle data type
1	MANUAL_START	Starting manual version	NUMBER(3,1)
2	MANUAL_END	Ending manual version	NUMBER(3,1)
3	CAUSE_OF_DEATH	Cause of death	NUMBER(2,0)
4	DESCRIPTION	Code description	VARCHAR2(1000)
5	ABBR	Code abbreviation	VARCHAR2(15)
6	CREATED_BY	Created by	VARCHAR2(30)
7	CREATED_DATE	Created date	DATE
8	CREATED_IN_INSTANCE	Created in instance	NUMBER(6)
9	MODIFIED_BY	Modified by	VARCHAR2(30)
10	MODIFIED_IN_INSTANCE	Modified in instance	NUMBER(6)
11	MODIFIED_DATE	Modified date	DATE

Type of key	Column(s) order	Tables to link	Abbreviated notation
Primary	MANUAL_START, CAUSE_OF_DEATH	N/A	RCOD_PK

1. MANUAL_START

   Starting manual version. The first manual version for which the code set was valid.

2. MANUAL_END

   Ending manual version. The final manual version for which the code set was valid. A blank (null) value indicates that the code set is still valid.

3. CAUSE_OF_DEATH

   Cause of death. A code indicating the likely cause of death as interpreted by the field crew.

Code	Description
10	Insect.
20	Disease.
30	Fire.

Code	Description
40	Animal.
50	Weather.
60	Vegetation (suppression, competition, vines/kudzu).
70	Unknown/not sure/other - includes death from human activity not related to silvicultural or land clearing activity (accidental, random, etc.). TREE NOTES required.
80	Silvicultural or land clearing activity (death caused by harvesting or other silvicultural activity, including girdling, chaining, etc., or to land clearing activity).

4. DESCRIPTION

   Code description. A brief summary description of the meaning of the code.

5. ABBR Code abbreviation. A short descriptive phrase suitable for reporting.

6. CREATED_BY Created by. See POPULATION.CREATED_BY description for definition.

7. CREATED_DATE

   Created date. See POPULATION.CREATED_DATE description for definition.

8. CREATED_IN_INSTANCE

   Created in instance. See POPULATION.CREATED_IN_INSTANCE description for definition.

9. MODIFIED_BY

   Modified by. See POPULATION.MODIFIED_BY description for definition.

10. MODIFIED_IN _INSTANCE

    Modified in instance. See POPULATION.MODIFIED_IN_INSTANCE description for definition.

11. MODIFIED_DATE

    Modified date. See POPULATION.MODIFIED_DATE description for definition.

Example: Count of trees by CAUSE_OF_DEATH:

```
SELECT t.cause_of_death, r.abbr, r.description, COUNT(*) tree_cnt
  FROM plot p, tree t, ref_cause_of_death r
 WHERE p.cn = t.plt_cn
   AND t.cause_of_death = r.cause_of_death
   AND p.urban_manual >= r.manual_start
   AND (r.manual_end IS NULL OR p.urban_manual <= r.manual_end)
 GROUP BY t.cause_of_death, r.abbr, r.description
 ORDER BY t.cause_of_death;
```

6.3 Reference Crown Class Table (Oracle table name is REF_CROWN_CLASS)

The REF_CROWN_CLASS table contains the definitions for the code used to describe the crown class of a tree. The crown class variable is stored on the TREE table and is called CROWN_CLASS_CD. Consult the appropriate field guide version (as indicated on the corresponding PLOT record) for details on the collection of this variable.

	Column name	Descriptive name	Oracle data type
1	MANUAL_START	Starting manual version	NUMBER(3,1)
2	MANUAL_END	Ending manual version	NUMBER(3,1)
3	CROWN_CLASS_CD	Crown class code	NUMBER(1,0)
4	DESCRIPTION	Code description	VARCHAR2(1000)
5	ABBR	Code abbreviation	VARCHAR2(15)
6	CREATED_BY	Created by	VARCHAR2(30)
7	CREATED_DATE	Created date	DATE
8	CREATED_IN_INSTANCE	Created in instance	NUMBER(6)
9	MODIFIED_BY	Modified by	VARCHAR2(30)
10	MODIFIED_IN_INSTANCE	Modified in instance	NUMBER(6)
11	MODIFIED_DATE	Modified date	DATE

Type of key	Column(s) order	Tables to link	Abbreviated notation
Primary	MANUAL_START, CROWN_CLASS_CD	N/A	RCC_PK

1. MANUAL_START

   Starting manual version. The first manual version for which the code set was valid.

2. MANUAL_END

   Ending manual version. The final manual version for which the code was valid. A blank (null) value indicates that the code set is still valid.

3. CROWN_CLASS_CD

   Crown class code. A code indicating the relative crown position of the tree within the stand.

Code	Description
1	Open Grown – trees with crowns that received full light from above and from all sides throughout most of its life, particularly during its early developmental period.

Code	Description
2	Dominant – trees with crown extending above the general level of the crown canopy and receiving full light from above and partly from the sides. These trees are taller than the average trees in the stand and their crowns are well developed, but they could be somewhat crowded on the sides. Also, trees whose crowns have received full light from above and from all sides during early development and most of their life. Their crown form or shape appears to be free of influence from neighboring trees.
3	Co-dominant – trees with crowns at the general level of the crown canopy. Crowns receive full light from above but little direct sunlight penetrates their sides. Usually they have medium-sized crowns and are somewhat crowded from the sides. In stagnated stands, co-dominant trees have small-sized crowns and are crowded on the sides.
4	Intermediate – trees that are shorter than dominants and co-dominant, but their crowns extend into the canopy of co-dominant and dominant trees. They receive little direct light from above and none from the sides. As a result, intermediate trees usually have small crowns and are very crowded from the sides.
5	Overtopped – trees with crowns entirely below the general level of the crown canopy that receive no direct sunlight either from above or the sides.

4. DESCRIPTION

   Code description. A brief summary description of the meaning of the code.

5. ABBR — Code abbreviation. A short descriptive phrase suitable for reporting.

6. CREATED_BY — Created by. See POPULATION.CREATED_BY description for definition.

7. CREATED_DATE

   Created date. See POPULATION.CREATED_DATE description for definition.

8. CREATED_IN_INSTANCE

   Created in instance. See POPULATION.CREATED_IN_INSTANCE description for definition.

9. MODIFIED_BY

   Modified by. See POPULATION.MODIFIED_BY description for definition.

10. MODIFIED_IN _INSTANCE

    Modified in instance. See POPULATION.MODIFIED_IN_INSTANCE description for definition.

11. MODIFIED_DATE

Modified date. See POPULATION.MODIFIED_DATE description for definition.

<u>Example: Count of trees by CROWN_CLASS_CD:</u>

```
SELECT t.crown_class_cd, r.abbr, r.description, COUNT(*) tree_cnt
  FROM plot p, tree t, ref_crown_class r
 WHERE p.cn = t.plt_cn
   AND t.crown_class_cd = r.crown_class_cd
   AND p.urban_manual >= r.manual_start
   AND (r.manual_end IS NULL OR p.urban_manual <= r.manual_end)
 GROUP BY t.crown_class_cd, r.abbr, r.description
 ORDER BY t.crown_class_cd;
```

6.4 Reference Crown Light Exposure Table (Oracle table name is REF_CROWN_LIGHT_EXPOSURE)

The REF_CROWN_LIGHT_EXPOSURE table contains the definitions for codes used to describe how much of a tree's crown is exposed to light. The crown light exposure variable is stored on the TREE table and is called CROWN_LIGHT_EXPOSURE. Consult the appropriate field guide version (as indicated on the corresponding PLOT record) for details on the collection of this variable.

	Column name	**Descriptive name**	**Oracle data type**
1	MANUAL_START	Starting manual version	NUMBER(3,1)
2	MANUAL_END	Ending manual version	NUMBER(3,1)
3	CROWN_LIGHT_EXPOSURE	Crown light exposure	NUMBER(1,0)
4	DESCRIPTION	Code description	VARCHAR2(1000)
5	ABBR	Code abbreviation	VARCHAR2(15)
6	CREATED_BY	Created by	VARCHAR2(30)
7	CREATED_DATE	Created date	DATE
8	CREATED_IN_INSTANCE	Created in instance	VARCHAR2(6)
9	MODIFIED_BY	Modified by	VARCHAR2(30)
10	MODIFIED_IN_INSTANCE	Modified in instance	VARCHAR2(6)
11	MODIFIED_DATE	Modified date	DATE

Type of key	**Column(s) order**	**Tables to link**	**Abbreviated notation**
Primary	MANUAL_START, CROWN_LIGHT_EXPOSURE	N/A	RCLE_PK

1. MANUAL_START

   Starting manual version. The first manual version for which the code set was valid.

2. MANUAL_END

   Ending manual version. The final manual version for which the code was valid. A blank (null) value indicates that the code set is still valid.

3. CROWN_LIGHT_EXPOSURE

   Crown class code. A code indicating the number of sides (including the top) of the crown that are exposed to direct sunlight.

Code	Description
0	The tree receives no full light because it is shaded by trees, vines, or other vegetation; the tree has no crown by definition.
1	The tree receives full light from the top or 1 quarter.
2	The tree receives full light from the top and 1 quarter (or 2 quarters without the top).
3	The tree receives full light from the top and 2 quarters (or 3 quarters without the top).
4	The tree receives full light from the top and 3 quarters.
5	The tree receives full light from the top and 4 quarters.

4. DESCRIPTION

   Code description. A brief summary description of the meaning of the code.

5. ABBR Code abbreviation. A short descriptive phrase suitable for reporting.

6. CREATED_BY Created by. See POPULATION.CREATED_BY description for definition.

7. CREATED_DATE

   Created date. See POPULATION.CREATED_DATE description for definition.

8. CREATED_IN_INSTANCE

   Created in instance. See POPULATION.CREATED_IN_INSTANCE description for definition.

9. MODIFIED_BY

   Modified by. See POPULATION.MODIFIED_BY description for definition.

10. MODIFIED_IN_INSTANCE

    Modified in instance. See POPULATION.MODIFIED_IN_INSTANCE description for definition.

11. MODIFIED_DATE

    Modified date. See POPULATION.MODIFIED_DATE description for definition.

<u>Example: Count of trees by CROWN_LIGHT_EXPOSURE:</u>

```
SELECT t.crown_light_exposure, r.abbr, r.description, COUNT(*) tree_cnt
  FROM plot p, tree t, ref_crown_light_exposure r
 WHERE p.cn = t.plt_cn
   AND t.crown_light_exposure = r.crown_light_exposure
   AND p.urban_manual >= r.manual_start
   AND (r.manual_end IS NULL OR p.urban_manual <= r.manual_end)
 GROUP BY t.crown_light_exposure, r.abbr, r.description
 ORDER BY t.crown_light_exposure;
```

6.5 Reference County Table (Oracle table name is REF_COUNTY)

The REF_COUNTY table stores the definition of county codes (COUNTYCD) that are used on the inventory data tables to describe the location of the sampling point. The codes were taken from the Federal Information Processing Standard (FIPS) code set developed to identify the primary divisions of States. In most States, these divisions are called counties. But in some States they are known as a parish, watershed, borough, or other name. This table also stores the relationship between counties and FIA survey units (UNITCD). The data in this table are useful for translating codes into labels for use in reporting.

	Column name	Descriptive name	Oracle data type
1	STATECD	State code	NUMBER(4,0)
2	UNITCD	Survey unit code	NUMBER(2,0)
3	COUNTYCD	County code	NUMBER(3,0)
4	COUNTYNM	County name	VARCHAR2(50)
5	CREATED_BY	Created by	VARCHAR2(30)
6	CREATED_DATE	Created date	DATE
7	CREATED_IN_INSTANCE	Created in instance	VARCHAR2(6)
8	MODIFIED_BY	Modified by	VARCHAR2(30)
9	MODIFIED_DATE	Modified date	DATE
10	MODIFIED_IN_INSTANCE	Modified in instance	VARCHAR2(6)

Type of key	Column(s) order	Tables to link	Abbreviated notation
Primary	STATECD, UNITCD, COUNTYCD	N/A	RCTY_PK

1. STATECD State code. A numeric code indicating the State. The code is taken from the Federal Information Processing Standards (FIPS) code set maintained by the Bureau of the Census. Refer to appendix B. Each State is also defined as a geographic area in the GEOAREA table.

2. UNITCD Survey unit code. Forest Inventory and Analysis (FIA) survey unit identification number. Survey units are groups of counties within States used to organize the population into logical groups for field logistics as well as for estimation purposes. Refer to appendix B for codes.

3. COUNTYCD County code. The identification code used for a county, parish, watershed, borough, or other similar governmental unit in a State. FIPS codes from the Bureau of the Census are used. Each county (or other governmental unit) is also defined in the GEOAREA table. Refer to appendix B for codes.

4. COUNTYNM County name. The name of a county, parish, watershed, borough, or other similar governmental unit in a State. FIPS codes from the Bureau of the Census are used. Each county (or other governmental unit) is also defined in the GEOAREA table. Refer to appendix B for codes.

5. CREATED_BY Created by. See POPULATION.CREATED_BY description for definition.

6. CREATED_DATE

   Created date. See POPULATION.CREATED_DATE description for definition.

7. CREATED_IN_INSTANCE

   Created in instance. See POPULATION.CREATED_IN_INSTANCE description for definition.

8. MODIFIED_BY

   Modified by. See POPULATION.MODIFIED_BY description for definition.

9. MODIFIED_DATE

   Modified date. See POPULATION.MODIFIED_DATE description for definition

10. MODIFIED_IN_INSTANCE

    Modified in instance. See POPULATION.MODIFIED_IN_INSTANCE description for definition.

6.6 Reference Damage Agent Table (Oracle table name is REF_DAMAGE_AGENT)

The REF_DAMAGE_AGENT table stores the definitions for the code set used to describe damage agents affecting trees. Under the national Urban field protocol, multiple damages may be recorded. These are stored in the TREE table and called DAMAGE_AGENT_CD1, DAMAGE_AGENT_CD2, and DAMAGE_AGENT_CD 3. Consult the appropriate field guide version (as indicated on the corresponding PLOT record) for details on the collection of this variable.

	Column name	Descriptive name	Oracle data type
1	MANUAL_START	Starting manual version	NUMBER(3,1)
2	MANUAL_END	Ending manual version	NUMBER(3,1)
3	DAMAGE_AGENT_CD	Damage agent code	NUMBER(5,0)
4	DAMAGE_AGENT_GROUP_CD	Damage agent group code	NUMBER(5,0)
5	COMMON_NAME	Damage agent common name	VARCHAR2(80)
6	SCIENTIFIC_NAME	Damage agent scientific name	VARCHAR2(80)
7	THRESHOLD	Damage agent threshold	VARCHAR2(2000)
8	REGION	Region	VARCHAR2(20)
9	CREATED_BY	Created by	VARCHAR2(30)
10	CREATED_DATE	Created date	DATE
11	CREATED_IN_INSTANCE	Created in instance	VARCHAR2(6)
12	MODIFIED_BY	Modified by	VARCHAR2(30)
13	MODIFIED_IN_INSTANCE	Modified in instance	VARCHAR2(6)
14	MODIFIED_DATE	Modified date	DATE

Type of key	Column(s) order	Tables to link	Abbreviated notation
Primary	MANUAL_START, DAMAGE_AGENT_CD	N/A	RDMGA_PK
Foreign	MANUAL_START, DAMAGE_AGENT_GROUP_CODE	REF_DAMAGE_AGENT to REF_DAMAGE_AGENT GROUP	RDMGA_RDMGAG_FK

1. MANUAL_START

Starting manual version. The first manual version for which the code was valid.

2. MANUAL_END

Ending manual version. The final manual version for which the code was valid. A blank (null) value indicates that the code set is still valid.

3. DAMAGE_AGENT_CD

Damage agent code. A code indicating a damage agent recorded by the field crew. See appendix E.

4. DAMAGE_AGENT_GROUP_CD

Damage agent group code. Damage agent codes are grouped into more general categories for organizational and reporting purposes. The damage agent group code indicates to which group the current damage agent is assigned. See appendix E. For definitions of damage agent groups see REF_DAMAGE_AGENT_GROUP.

5. COMMON_NAME

Damage agent common name. The common name associated with the damage agent. See appendix E.

6. SCIENTIFIC_NAME

Damage agent scientific name. The scientific name of the damage agent if one exists. Some damage agent codes represent generic agents or physical agents that do not require a scientific name. See appendix E.

7. THRESHOLD Damage agent threshold. A description of a minimum threshold of observable damage required for the crews to record the damage agent. Only selected damage agents have a threshold defined. A blank (null) value indicates no minimum threshold. See appendix E.

8. REGION Region. The region for which the damage agent is allowed and must be coded if present and meets the threshold requirement.

8. CREATED_BY Created by. See POPULATION.CREATED_BY description for definition.

9. CREATED_DATE

Created date. See POPULATION.CREATED_DATE description for definition.

10. CREATED_IN_INSTANCE

Created in instance. See POPULATION.CREATED_IN_INSTANCE description for definition.

11. MODIFIED_BY

Modified by. See POPULATION.MODIFIED_BY description for definition.

12. MODIFIED_IN_INSTANCE

Modified in instance. See POPULATION.MODIFIED_IN_INSTANCE description for definition.

13. MODIFIED_DATE

Modified date. See POPULATION.MODIFIED_DATE description for definition.

<u>Example: Count of trees by the first damage agent recorded:</u>

```
SELECT t.damage_agent_cd1,
       r.common_name,
       r.scientific_name,
       COUNT(*) tree_cnt
  FROM plot p, tree t, ref_damage_agent r
 WHERE p.cn = t.plt_cn
   AND t.damage_agent_cd1 = r.damage_agent_cd
   AND p.urban_manual >= r.manual_start
   AND (r.manual_end IS NULL OR p.urban_manual <= r.manual_end)
 GROUP BY t.damage_agent_cd1, r.common_name, r.scientific_name
 ORDER BY t.damage_agent_cd1;
```

6.7 Reference Damage Agent Group Table (Oracle table name is REF_DAMAGE_AGENT_GROUP)

The damage agents codes used to describe agents affecting tree health (see REF_DAMAGE_AGENT) can be grouped into more general categories. The groupings are stored in the REF_DAMAGE_AGENT_GROUP table and can be used to summarize damages recorded on trees at a coarser level of detail.

	Column name	**Descriptive name**	**Oracle data type**
1	MANUAL_START	Starting manual version	NUMBER(3,1)
2	MANUAL_END	Ending manual version	NUMBER(3,1)
3	DAMAGE_AGENT_GROUP_CD	Damage agent group code	NUMBER(5,0)
4	DESCRIPTION	Code description	VARCHAR2(2000)
5	CREATED_BY	Created by	VARCHAR2(30)
6	CREATED_DATE	Created date	DATE
7	CREATED_IN_INSTANCE	Created in instance	VARCHAR2(6)
8	MODIFIED_BY	Modified by	VARCHAR2(30)
9	MODIFIED_IN_INSTANCE	Modified in instance	VARCHAR2(6)
10	MODIFIED_DATE	Modified date	DATE

Type of key	**Column(s) order**	**Tables to link**	**Abbreviated notation**
Primary	MANUAL_START, DAMAGE_AGENT_GROUP_CD	N/A	RDMGAG_PK

1. MANUAL_START

   Starting manual version. The first manual version for which the code set was valid.

2. MANUAL_END

   Ending manual version. The final manual version for which the code was valid. A blank (null) value indicates that the code set is still valid.

3. DAMAGE_AGENT_GROUP_CD

   Damage agent group code. Damage agent codes are grouped into more general categories for organizational and reporting purposes. The damage agent group code indicates to which group the current damage agent is assigned. See appendix E. For definitions of damage agent groups see REF_DAMAGE_AGENT_GROUP.

4. DESCRIPTION

   Code description. A brief summary description of the meaning of the code.

5. CREATED_BY Created by. See POPULATION.CREATED_BY description for definition.

6. CREATED_DATE

   Created date. See POPULATION.CREATED_DATE description for definition.

7. CREATED_IN_INSTANCE

   Created in instance. See POPULATION.CREATED_IN_INSTANCE description for definition.

8. MODIFIED_BY

   Modified by. See POPULATION.MODIFIED_BY description for definition.

9. MODIFIED_IN_INSTANCE

   Modified in instance. See POPULATION.MODIFIED_IN_INSTANCE description for definition.

10. MODIFIED_DATE

    Modified date. See POPULATION.MODIFIED_DATE description for definition.

Example: Count of trees by damage agent group of the first damage agent recorded:

```
SELECT r2.damage_agent_group_cd, r2.description, COUNT(*) tree_cnt
  FROM plot p, tree t, ref_damage_agent r, ref_damage_agent_group r2
 WHERE p.cn = t.plt_cn
   AND t.damage_agent_cd1 = r.damage_agent_cd
   AND r.damage_agent_group_cd = r2.damage_agent_group_cd
   AND p.urban_manual >= r.manual_start
   AND (r.manual_end IS NULL OR p.urban_manual <= r.manual_end)
 GROUP BY r2.damage_agent_group_cd, r2.description
 ORDER BY r2.damage_agent_group_cd;
```

6.8 Reference Diameter Height Table (Oracle table name is REF_DIAHT)

The REF_DIAHT table contains code definitions for the diameter height code. The diameter height code is used to describe where the diameter measurement was taken for a given tree and is based on the species. This is stored on the TREE table and called DIAHTCD. Note that this code indicates the intended diameter location point, but it is not always possible to take reliable measurement at the indicated point due to obstructions or growth form. Consult the appropriate field guide version (as indicated on the corresponding PLOT record) for details on the collection of this variable.

	Column name	Descriptive name	Oracle data type
1	MANUAL_START	Starting manual version	NUMBER(3,1)
2	MANUAL_END	Ending manual version	NUMBER(3,1)
3	DIAHTCD	Diameter height code	NUMBER(1,0)
4	DESCRIPTION	Code description	VARCHAR2(1000)
5	ABBR	Code abbreviation	VARCHAR2(15)
6	CREATED_BY	Created by	VARCHAR2(30)
7	CREATED_DATE	Created date	DATE
8	CREATED_IN_INSTANCE	Created in instance	VARCHAR2(6)
9	MODIFIED_BY	Modified by	VARCHAR2(30)
10	MODIFIED_IN_INSTANCE	Modified in instance	VARCHAR2(6)
11	MODIFIED_DATE	Modified date	DATE

Type of key	Column(s) order	Tables to link	Abbreviated notation
Primary	MANUAL_START, DIAHTCD	N/A	RDHT_PK

1. MANUAL_START

   Starting manual version. The first manual version for which the code set was valid.

2. MANUAL_END

   Ending manual version. The final manual version for which the code set was valid. A blank (null) value indicates that the code set is still valid.

3. DIAHTCD Diameter height code. A code indicating the point of diameter measurement. For species considered to be “timber” species the diameter is taken at 4.5 feet above the ground and is referred to as Diameter at Breast Height (DBH). For species considered to be “woodland” species, the diameter is taken at the root collar (DRC). For woodland species with multiple stems, the diameter is computed as: DRC = SQRT[SUM(stem diameter^2)] where stem diameter is the diameter of each individual stem.

Code	Description
1	DBH - Diameter at breast height (DBH) is the targeted diameter measurement. If the tree form or other obstruction prevent this measurement, then the closest measurement to DBH is made according to the field protocol under which it was collected.
2	DRC - Diameter at the Root Collar (DRC) is the targeted diameter measurement.

4. DESCRIPTION

   Code description. A brief summary description of the meaning of the code.

5. ABBR — Code abbreviation. A short descriptive phrase suitable for reporting.

6. CREATED_BY — Created by. See POPULATION.CREATED_BY description for definition.

7. CREATED_DATE

   Created date. See POPULATION.CREATED_DATE description for definition.

8. CREATED_IN_INSTANCE

   Created in instance. See POPULATION.CREATED_IN_INSTANCE description for definition.

9. MODIFIED_BY

   Modified by. See POPULATION.MODIFIED_BY description for definition.

10. MODIFIED_IN_INSTANCE

    Modified in instance. See POPULATION.MODIFIED_IN_INSTANCE description for definition.

11. MODIFIED_DATE

    Modified date. See POPULATION.MODIFIED_DATE description for definition.

Example: Count of trees by diameter height location:

```
SELECT t.diahtcd, r.abbr, r.description, COUNT(*) tree_cnt
  FROM plot p, tree t, ref_diaht r
 WHERE p.cn = t.plt_cn
   AND t.diahtcd = r.diahtcd
   AND p.urban_manual >= r.manual_start
   AND (r.manual_end IS NULL OR p.urban_manual <= r.manual_end)
 GROUP BY t.diahtcd, r.abbr, r.description
 ORDER BY t.diahtcd;
```

6.9 Reference Energy Effect Table (Oracle table name is REF_ENERGY_EFFECT)

The REF_ENERGY_EFFECT table stores definitions for the energy effect categories used in the ENERGY table. Energy effect refers to the factors that influence the energy consumption of residential structures.

	Column name	Descriptive name	Oracle data type
1	MANUAL_START	Starting manual version	NUMBER(3,1)
2	MANUAL_END	Ending manual version	NUMBER(3,1)
3	ENERGY_EFFECT	Energy type	VARCHAR2(9)
4	DESCRIPTION	Code description	VARCHAR2(1000)
5	ABBR	Code abbreviation	VARCHAR2(15)
6	CREATED_BY	Created by	VARCHAR2(30)
7	CREATED_DATE	Created date	DATE
8	CREATED_IN_INSTANCE	Created in instance	VARCHAR2(6)
9	MODIFIED_BY	Modified by	VARCHAR2(30)
10	MODIFIED_IN_INSTANCE	Modified in instance	VARCHAR2(6)
11	MODIFIED_DATE	Modified date	DATE

Type of key	Column(s) order	Tables to link	Abbreviated notation
Primary	MANUAL_START, ENERGY_EFFECT	N/A	REGYE_PK

1. MANUAL_START

   Starting manual version. The first manual version for which the code set was valid.

2. MANUAL_END

   Ending manual version. The final manual version for which the code set was valid. A blank (null) value indicates that the code set is still valid.

3. ENERGY_EFFECT

   Energy type. The type of effect urban trees have on energy consumption of residential structures.

Values	Description
Shading	Effect on residential space heating and cooling due to direct shading of nearby trees.
Climate	Effect on residential space heating and cooling from non-adjacent trees (>50 feet) due to reductions in wind speed and summer air temperatures.
Windbreak	Effect on residential space heating and cooling due to reduction in wind speed by nearby trees.

4. DESCRIPTION

   Code description. A brief summary description of the meaning of the code.

5. ABBR Code abbreviation. A short descriptive phrase suitable for reporting.

6. CREATED_BY Created by. See POPULATION.CREATED_BY description for definition.

7. CREATED_DATE

   Created date. See POPULATION.CREATED_DATE description for definition.

8. CREATED_IN_INSTANCE

   Created in instance. See POPULATION.CREATED_IN_INSTANCE description for definition.

9. MODIFIED_BY

   Modified by. See POPULATION.MODIFIED_BY description for definition.

10. MODIFIED_IN_INSTANCE

    Modified in instance. See POPULATION.MODIFIED_IN_INSTANCE description for definition.

11. MODIFIED_DATE

    Modified date. See POPULATION.MODIFIED_DATE description for definition.

6.10 Reference Energy Use Table (Oracle table name is REF_ENERGY_USE)

The REF_ENERGY_USE table stores the energy use categories used to describe energy use avoidance in the ENERGY table. Energy use categories specify the purpose of the energy consumption for residential structures.

	Column name	Descriptive name	Oracle data type
1	MANUAL_START	Starting manual version	NUMBER(3,1)
2	MANUAL_END	Ending manual version	NUMBER(3,1)
3	ENERGY_USE	Energy use	VARCHAR2(7)
4	DESCRIPTION	Code description	VARCHAR2(1000)
5	ABBR	Code abbreviation	VARCHAR2(15)
6	CREATED_BY	Created by	VARCHAR2(30)
7	CREATED_DATE	Created date	DATE
8	CREATED_IN_INSTANCE	Created in instance	VARCHAR2(6)
9	MODIFIED_BY	Modified by	VARCHAR2(30)
10	MODIFIED_IN_INSTANCE	Modified in instance	VARCHAR2(6)
11	MODIFIED_DATE	Modified date	DATE

Type of key	Column(s) order	Tables to link	Abbreviated notation
Primary	MANUAL_START, ENERGY_USE	N/A	REGYU_PK

1. MANUAL_START

   Starting manual version. The first manual version for which the code set was valid.

2. MANUAL_END

   Ending manual version. The final manual version for which the code set was valid. A blank (null) value indicates that the code set is still valid.

3. ENERGY_USE

   Energy use. The purpose of energy consumption.

Values	Description
Heating	Energy consumption used to heat residential structures.
Cooling	Energy consumption used to cool residential structures.

4. DESCRIPTION

   Code description. A brief summary description of the meaning of the code.

5. ABBR Code abbreviation. A short descriptive phrase suitable for reporting.

6. CREATED_BY Created by. See POPULATION.CREATED_BY description for definition.

7. CREATED_DATE

   Created date. See POPULATION.CREATED_DATE description for definition.

8. CREATED_IN_INSTANCE

   Created in instance. See POPULATION.CREATED_IN_INSTANCE description for definition.

9. MODIFIED_BY

   Modified by. See POPULATION.MODIFIED_BY description for definition.

10. MODIFIED_IN_INSTANCE

    Modified in instance. See POPULATION.MODIFIED_IN_INSTANCE description for definition.

11. MODIFIED_DATE

    Modified date. See POPULATION.MODIFIED_DATE description for definition.

6.11 Reference Sample Kind Table (Oracle table name is REF_SAMPLKIND)

The REF_SAMPLEKIND table stores the definitions of codes used to describe the sample kind of a plot visit. The term sample kind is used to describe the kind of measurements that will be taken during the visit within an on-going annualized inventory. Some visits constitute the initial establishment of a permanent sampling point while other visits are remeasurements of a previously established point. The sample kind variable is stored on the PLOT table and is called URBAN_KINDCD. Consult the appropriate field guide version (as indicated on the corresponding PLOT record) for details on the collection of this variable.

	Column name	Descriptive name	Oracle data type
1	MANUAL_START	Starting manual version	NUMBER(3,1)
2	MANUAL_END	Ending manual version	NUMBER(3,1)
3	KINDCD	Sample kind code	NUMBER(1,0)
4	DESCRIPTION	Code description	VARCHAR2(1000)
5	ABBR	Code abbreviation	VARCHAR2(15)
6	CREATED_BY	Created by	VARCHAR2(30)
7	CREATED_DATE	Created date	DATE
8	CREATED_IN_INSTANCE	Created in instance	VARCHAR2(6)
9	MODIFIED_BY	Modified by	VARCHAR2(30)
10	MODIFIED_IN_INSTANCE	Modified in instance	VARCHAR2(6)
11	MODIFIED_DATE	Modified date	DATE

Type of key	Column(s) order	Tables to link	Abbreviated notation
Primary	MANUAL_START, KINDCD	N/A	RSKD_PK

1. MANUAL_START

   Starting manual version. The first manual version for which the code set was valid.

2. MANUAL_END

   Ending manual version. The final manual version for which the code set was valid. A blank (null) value indicates that the code set is still valid.

3. KINDCD Sample kind code. A sample kind is a code indicating the type of plot installation that occurred at the current visit.

Code	Description
1	Initial installation of a National design plot.
2	Remeasurement of previously installed design plot.
3	Replacement of previously installed National design plot.

4. DESCRIPTION

   Code description. A brief summary description of the meaning of the code.

5. ABBR — Code abbreviation. A short descriptive phrase suitable for reporting.

6. CREATED_BY — Created by. See POPULATION.CREATED_BY description for definition.

7. CREATED_DATE

   Created date. See POPULATION.CREATED_DATE description for definition.

8. CREATED_IN_INSTANCE

   Created in instance. See POPULATION.CREATED_IN_INSTANCE description for definition.

9. MODIFIED_BY

   Modified by. See POPULATION.MODIFIED_BY description for definition.

10. MODIFIED_IN_INSTANCE

    Modified in instance. See POPULATION.MODIFIED_IN_INSTANCE description for definition.

11. MODIFIED_DATE

    Modified date. See POPULATION.MODIFIED_DATE description for definition.

<u>Example: Count of plots by sample kind:</u>

```
SELECT p.urban_kindcd, r.abbr, r.description, COUNT(*) tree_cnt
  FROM plot p, ref_samplekind r
 WHERE p.urban_kindcd = r.kindcd
   AND p.urban_manual >= r.manual_start
   AND (r.manual_end IS NULL OR p.urban_manual <= r.manual_end)
 GROUP BY p.urban_kindcd, r.abbr, r.description
 ORDER BY p.urban_kindcd;
```

6.12 Reference Land Use Table (Oracle table name is REF_LANDUSE)

The REF_LANDUSE table stores the definitions for codes used to describe the land use at a given location. This code set was developed and used by the UFHHEQ research unit and adopted by the annualized urban inventory. There are two locations where this code set is used. The first is on the TREE record in a column called LANDUSE. This records the land use for the location of the tree. The second is on the FIELD_LANDUSE table in a column called LANDUSE. This records the land use observed on the plot footprint. Consult the appropriate field guide version (as indicated on the corresponding PLOT record) for details on the collection of this variable.

	Column name	**Descriptive name**	**Oracle data type**
1	MANUAL_START	Starting manual version	NUMBER(3,1)
2	MANUAL_END	Ending manual version	NUMBER(3,1)
3	LANDUSE	Land use	NUMBER(3,0)
4	DESCRIPTION	Code description	VARCHAR2(1000)
5	ABBR	Code abbreviation	VARCHAR2(15)
6	CREATED_BY	Created by	VARCHAR2(30)
7	CREATED_DATE	Created date	DATE
8	CREATED_IN_INSTANCE	Created in instance	VARCHAR2(6)
9	MODIFIED_BY	Modified by	VARCHAR2(30)
10	MODIFIED_IN_INSTANCE	Modified in instance	VARCHAR2(6)
11	MODIFIED_DATE	Modified date	DATE

Type of key	**Column(s) order**	**Tables to link**	**Abbreviated notation**
Primary	MANUAL_START, LANDUSE	N/A	RLU_PK

1. MANUAL_START

   Starting manual version. The first manual version for which the code set was valid.

2. MANUAL_END

   Ending manual version. The final manual version for which the code set was valid. A blank (null) value indicates that the code set is still valid.

3. LANDUSE — Land use. A set of codes developed to describe the land use of a given location. This code set was developed by the iTree program and is not the nonforest land use codes traditionally used by FIA.

Code	Description
10	Agriculture: Is defined as cropland, pasture, idle farmland, orchards, vineyards, nurseries, maintained wildlife openings, farmsteads and related buildings, feed lots, rangeland, and includes windbreaks and shelterbelts that do not meet the definition for forest land. Wooded areas /plantations that are managed for a specific crop such as nuts or Christmas trees or forest land that shows obvious evidence of management activity related specifically to wood production are also included.
20	Residential: Freestanding, and related green space, structures serving one to four families each.
21	Multi-family residential: Structures containing more than four residential units. [Note: A block of attached one- to four-family structures would be considered multi-family residential. A residential complex consisting of many separate one- to four-family structures and related green-space would be also considered multi-family residential].
22	Institutional: Schools, hospitals/medical complexes, colleges, religious buildings, government buildings, etc., and related green spaces.
23	Commercial/Industrial: In addition to standard commercial and industrial land uses, this category includes outdoor storage/staging areas as well as parking lots in downtown areas that are not connected with an institutional or residential use.
24	Vacant: This category includes land with no clear intended use. Abandoned buildings, vacant structures, and their associated infrastructure and green space should be classified based on their original intended use. For example, an overgrown parking lot and playground associated with an abandoned apartment complex would be classified as Multi-family Residential, not Vacant. Idle farmland should be classified as Agriculture. Forest land that is not clearly actively managed for timber production and is not contained within the boundaries of a Park, Golf course, or Cemetery land use would be coded as Vacant. For example forest land in the form of a woodlot in the middle of a corn field would be considered Vacant, as the land is not associated with a particular land use. Forest land contained within the boundaries of a Park, Golf Course, or Cemetery would be coded respectively.
25	Cemetery: Includes associated access roads, buildings, green space (maintained & unmaintained), and forest land within the Cemetery boundary.
30	Transportation: Includes limited access roadways and related green-spaces (such as interstate highways with on and off ramps, sometimes fenced); railroad stations, tracks and yards; shipyards; airports; etc. If plot falls on any other type of road, or associated median strip, classify according to nearest adjacent land use.
31	Utility: Power-generating facilities, sewage treatment facilities, covered and uncovered reservoirs, and empty storm-water runoff retention areas, flood control channels, conduits.
40	Park: Parks include associated access roads, buildings, green space (maintained and unmaintained), and forest land within the Park boundary.
41	Golf Course: Includes associated access roads, buildings, green space (maintained and unmaintained), and forest land within the Golf Course boundary.
50	Water/wetland: Streams, rivers, lakes, storm-water retention areas and other water bodies / wetlands (natural or manmade) that meet the definition of URBAN CONDITION CLASS STATUS 3 or 4 or areas meeting the definition of URBAN NONFOREST LAND USE 420. Areas of standing water / wetlands that do not meet minimum size requirements should be classified based on the adjacent land use; such areas may include small pools and fountains.
60	Other: Land uses that are not better described by one of the categories listed above. This designation should be used very sparingly as it provides very little useful information for the model.

4. DESCRIPTION

   Code description. A brief summary description of the meaning of the code.

5. ABBR — Code abbreviation. A short descriptive phrase suitable for reporting.

6. CREATED_BY — Created by. See POPULATION.CREATED_BY description for definition.

7. CREATED_DATE

   Created date. See POPULATION.CREATED_DATE description for definition.

8. CREATED_IN_INSTANCE

   Created in instance. See POPULATION.CREATED_IN_INSTANCE description for definition.

9. MODIFIED_BY

   Modified by. See POPULATION.MODIFIED_BY description for definition.

10. MODIFIED_IN_INSTANCE

    Modified in instance. See POPULATION.MODIFIED_IN_INSTANCE description for definition.

11. MODIFIED_DATE

    Modified date. See POPULATION.MODIFIED_DATE description for definition.

<u>Example: Count of trees by landuse:</u>

```
SELECT t.landuse, r.abbr, r.description, COUNT(*) tree_cnt
  FROM plot p, tree t, ref_landuse r
 WHERE p.cn = t.plt_cn
   AND t.landuse = r.landuse
   AND p.urban_manual >= r.manual_start
   AND (r.manual_end IS NULL OR p.urban_manual <= r.manual_end)
 GROUP BY t.landuse, r.abbr, r.description
 ORDER BY t.landuse;
```

6.13 Reference Nonforest Land Use Table (Oracle table name is REF_NONFOREST_LANDUSE)

The REF_NONFOREST_LANDUSE table stores codes used to describe the non-forest land use for the location of the tree. This code set was developed and used by FIA as part of the traditional FIA inventory that focused on forest land. It is stored on the TREE table and is called PRESENT_NONFOREST_LANDUSE. Consult the appropriate field guide version (as indicated on the corresponding PLOT record) for details on the collection of this variable.

	Column name	Descriptive name	Oracle data type
1	MANUAL_START	Starting manual version	NUMBER(3,1)
2	MANUAL_END	Ending manual version	NUMBER(3,1)
3	NONFOREST_LANDUSE	Nonforest land use	NUMBER(3,0)
4	DESCRIPTION	Code description	VARCHAR2(1000)
5	ABBR	Code abbreviation	VARCHAR2(15)
6	CREATED_BY	Created by	VARCHAR2(30)
7	CREATED_DATE	Created date	DATE
8	CREATED_IN_INSTANCE	Created in instance	VARCHAR2(6)
9	MODIFIED_BY	Modified by	VARCHAR2(30)
10	MODIFIED_IN_INSTANCE	Modified in instance	VARCHAR2(6)
11	MODIFIED_DATE	Modified date	DATE

Type of key	Column(s) order	Tables to link	Abbreviated notation
Primary	MANUAL_START, NONFOREST_LANDUSE	N/A	RNFLU_PK

1. MANUAL_START

   Starting manual version. The first manual version for which the code set was valid.

2. MANUAL_END

   Ending manual version. The final manual version for which the code set was valid. A blank (null) value indicates that the code set is still valid.

3. NONFOREST_LANDUSE

   Nonforest Land use. A code set developed to describe land uses other than forested land use. This code set was developed by the FIA program and has traditionally been used to describe only nonforest land according to the FIA definition.

Code	Description
100	Agricultural land - Land managed for crops, pasture, or other agricultural use. The area must be at least 1.0 acre in size and 120.0 feet wide (with the exception of windbreak/shelterbelt, which has no minimum width.)
110	Cropland - Land utilized for agricultural crops including silage and feed grains; and bare farm fields resulting from cultivation or harvest.
120	Pasture (improved through cultural practices) - Land maintained and used for grazing with canopy cover less than 10 percent in live trees (established seedlings, saplings or larger trees). Evidence of maintenance, besides the degree of grazing, includes condition of fencing, presence of stock ponds or water tanks. Land also may be periodically brush hogged indicated by seedlings 3 to 4 feet in height and basal scars present on trees.
130	Idle farmland - Former cropland or pasture that has not been tended within the last 2 years and that has less than 10 percent canopy cover with live trees, (established seedlings or larger trees) regardless of species.
140	Orchard / Nursery - Land utilized for orchards and nursery stock.
150	Christmas tree plantation.
160	Maintained wildlife opening - Land maintained as a permanent opening of primarily herbaceous vegetation within woodland areas to provide food and cover benefits for early successional wildlife species. [Source: USDA NRCS]
170	Windbreak/Shelterbelt - Windbreaks or shelterbelts are plantings of single or multiple rows of trees or shrubs that are established for environmental purposes. Windbreaks or shelterbelts are generally established to protect or shelter nearby leeward areas from troublesome winds. Such plantings are used to reduce wind erosion, protect growing plants (crops and forage), manage snow, and improve irrigation efficiency. Windbreaks also protect structures and livestock, provide wildlife habitat, improve aesthetics, and provide tree or shrub products. Also, when used as a living screen, windbreaks control views and lessen noise. [Source: USDA NRCS, Windbreak /Shelterbelt Conservation Practice Job Sheet 380, April 1997]
200	Rangeland - Land primarily composed of grasses, forbs, or shrubs. This includes lands vegetated naturally or artificially to provide a plant cover managed like native vegetation and does not meet the definition of pasture. The area must be at least 1.0 acre in size and 120.0 feet wide.
300	Developed - Land used primarily by humans for purposes other than forestry or agriculture.
310	Cultural: business (industrial/commercial), residential, and other places of intense human activity. The 310 code used only for land not better described by one of the more detailed sub-codes (e.g., 311).
311	Residential: Free standing structures and related green space serving one to four families each.
312	Multi-family residential: Structures containing more than four units each. A block of attached one-four family structures would be considered Multi-family residential. A residential complex consisting of many separate one-four family structure and related green space would be also considered Multi-family residential.
313	Institutional: Schools, hospitals/medical complexes, colleges, religious buildings, government buildings, etc., and related green space.
314	Commercial/Industrial: In addition to standard commercial and industrial land uses related green space, outdoor storage/staging areas, and parking lots in downtown areas that are not connected with institutional or residential use are also included. Home businesses, such as day care, tax preparation, hair styling, etc. that are run out of Residential buildings are considered Commercial.
315	Vacant: This category includes land with no clear intended use.
316	Cemetery. This category includes associated access roads, buildings and green space (maintained and unmaintained) while excluding obvious public roads which would be considered Rights-of-Way.

Code	Description
320	Right-of-way: improved roads, maintained canal.
321	Transportation: limited access roadway (on-off ramps), railway or airport and related green space.
322	Utility: power lines, pipelines, maintained levees and flood control channels.
330	Recreation: Skiing, campgrounds, playing fields, athletic, sports tracks, etc. These are areas where persons participate in sports and outdoor activities. This code excludes complexes such as professional football stadiums, such areas would be considered Commercial / Industrial.
331	Park: This category includes associated access roads, buildings and green space (maintained and unmaintained) while excluding obvious public roads which would be considered Rights-of-Way.
332	Golf courses. This category includes associated access roads, buildings and green space (maintained and unmaintained) while excluding obvious public roads which would be considered Rights-of-Way.
340	Mining and wasteland - Surface mining, gravel pits, dumps, landfills or reclaimed mining areas that are at least 1 acre and 120.0 feet in width.
400	Other - Land parcels greater than 1.0 acre in size and greater than 120.0 feet wide, which do not fall into one of the uses described above. Examples include undeveloped beaches, barren land (rock, sand), marshes, bogs, ice, and snow. The 400 code only used for cases not better described by sub-codes.
410	Nonvegetated.
420	Wetland - Areas subjected to periodic tidal flooding or other areas where water is present for extended periods during the growing season and for longer periods during the non-growing season. Water usually comes from rainfall, snowmelt, a rising water table, groundwater seepage, or incoming tides. Water may be present on the surface of wetlands for varying periods, as in flooded or ponded wetlands, or it may simply keep the underlying soils saturated near the surface with no surface water present. Wetlands include bogs, marshes, salt marshes, swamps, meadows and fens. [Source: Tiner (1997)]
430	Beach - Sandy or pebbly shore associated with an ocean or lake.
450	Nonforest-Chaparral.

4. DESCRIPTION

   Code description. A brief summary description of the meaning of the code.

5. ABBR Code abbreviation. A short descriptive phrase suitable for reporting.

6. CREATED_BY Created by. See POPULATION.CREATED_BY description for definition.

7. CREATED_DATE

   Created date. See POPULATION.CREATED_DATE description for definition.

8. CREATED_IN_INSTANCE

   Created in instance. See POPULATION.CREATED_IN_INSTANCE description for definition.

9. MODIFIED_BY

Modified by. See POPULATION.MODIFIED_BY description for definition.

10. MODIFIED_IN_INSTANCE

Modified in instance. See POPULATION.MODIFIED_IN_INSTANCE description for definition.

11. MODIFIED_DATE

Modified date. See POPULATION.MODIFIED_DATE description for definition.

__Example: Count of trees by PRESENT_NONFOREST_LANDUSE:__

```
SELECT t.present_nonforest_landuse, r.abbr, r.description, COUNT(*)
tree_cnt
  FROM plot p, tree t, ref_nonforest_landuse r
 WHERE p.cn = t.plt_cn
   AND t.present_nonforest_landuse = r.nonforest_landuse
   AND p.urban_manual >= r.manual_start
   AND (r.manual_end IS NULL OR p.urban_manual <= r.manual_end)
 GROUP BY t.present_nonforest_landuse, r.abbr, r.description
 ORDER BY t.present_nonforest_landuse;
```

6.14 Reference Owner Table (Oracle table name is REF_OWNER)

The REF_OWNER table stores the definitions for codes used to describe the class of ownership for the location of a tree. It is stored on the TREE table and is called OWNCD. Consult the appropriate field guide version (as indicated on the corresponding PLOT record) for details on the collection of this variable.

	Column name	Descriptive name	Oracle data type
1	MANUAL_START	Starting manual version	NUMBER(3,1)
2	MANUAL_END	Ending manual version	NUMBER(3,1)
3	OWNCD	Owner code	NUMBER(2,0)
4	DESCRIPTION	Code description	VARCHAR2(1000)
5	ABBR	Code abbreviation	VARCHAR2(15)
6	CREATED_BY	Created by	VARCHAR2(30)
7	CREATED_DATE	Created date	DATE
8	CREATED_IN_INSTANCE	Created in instance	VARCHAR2(6)
9	MODIFIED_BY	Modified by	VARCHAR2(30)
10	MODIFIED_IN_INSTANCE	Modified in instance	VARCHAR2(6)
11	MODIFIED_DATE	Modified date	DATE

Type of key	Column(s) order	Tables to link	Abbreviated notation
Primary	MANUAL_START, OWNCD	N/A	ROWN_PK

1. MANUAL_START

   Starting manual version. The first manual version for which the code set was valid.

2. MANUAL_END

   Ending manual version. The final manual version for which the code set was valid. A blank (null) value indicates that the code set is still valid.

3. OWNCD Owner code. A code designating the category of ownership of the land on which the tree was measured. Code definitions can be found by referencing REF_OWNER.

Code	Description
11	National Forest.
12	National Grassland.
13	Other national forest.
21	National Park Service.
22	Bureau of Land Management.
23	Fish and Wildlife Service.
24	Departments of Defense or Energy.

Code	Description
25	Other Federal.
31	State.
32	Local (county, municipal, etc.).
33	Other non-federal lands.

The following detailed private owner land codes are not available in this database because of the FIA data confidentiality policy. Users needing this type of information should contact the FIA Spatial Data Services (SDS) group by following the instructions provided at: http://www.fia.fs.fed.us/tools-data/spatial/.

Code	Description
41	Corporate.
42	Nongovernmental conservation.
43	Unincorporated local association or club.
44	Native American.
45	Individual.
46	Undifferentiated private.

4. DESCRIPTION

Code description. A brief summary description of the meaning of the code.

5. ABBR Code abbreviation. A short descriptive phrase suitable for reporting.

6. CREATED_BY Created by. See POPULATION.CREATED_BY description for definition.

7. CREATED_DATE

Created date. See POPULATION.CREATED_DATE description for definition.

8. CREATED_IN_INSTANCE

Created in instance. See POPULATION.CREATED_IN_INSTANCE description for definition.

9. MODIFIED_BY

Modified by. See POPULATION.MODIFIED_BY description for definition.

10. MODIFIED_IN_INSTANCE

Modified in instance. See POPULATION.MODIFIED_IN_INSTANCE description for definition.

11. MODIFIED_DATE

Modified date. See POPULATION.MODIFIED_DATE description for definition.

__Example: Count of trees by OWNCD:__

```
SELECT t.owncd, r.abbr, r.description, COUNT(*) tree_cnt
  FROM plot p, tree t, ref_owner r
 WHERE p.cn = t.plt_cn
   AND t.owncd = r.owncd
   AND p.urban_manual >= r.manual_start
   AND (r.manual_end IS NULL OR p.urban_manual <= r.manual_end)
 GROUP BY t.owncd, r.abbr, r.description
 ORDER BY t.owncd;
```

6.15 Reference Owner Group Table (Oracle table name is REF_OWNER_GROUP)

The REF_OWNER_GROUP table stores the definitions for codes used to group owner classes (see REF_OWNCD) into more general categories for summarization. This variable is used on a TREE record and is called OWNGRPCD. Consult the appropriate field guide version (as indicated on the corresponding PLOT record) for details on the collection of this variable.

	Column name	Descriptive name	Oracle data type
1	MANUAL_START	Starting manual version	NUMBER(3,1)
2	MANUAL_END	Ending manual version	NUMBER(3,1)
3	OWNGRPCD	Owner group code	NUMBER(2,0)
4	DESCRIPTION	Code description	VARCHAR2(1000)
5	ABBR	Code abbreviation	VARCHAR2(15)
6	CREATED_BY	Created by	VARCHAR2(30)
7	CREATED_DATE	Created date	DATE
8	CREATED_IN_INSTANCE	Created in instance	VARCHAR2(6)
9	MODIFIED_BY	Modified by	VARCHAR2(30)
10	MODIFIED_IN_INSTANCE	Modified in instance	VARCHAR2(6)
11	MODIFIED_DATE	Modified date	DATE

Type of key	Column(s) order	Tables to link	Abbreviated notation
Primary	MANUAL_START, OWNGRPCD	N/A	ROWNG_PK

1. MANUAL_START

Starting manual version. The first manual version for which the code set was valid.

2. MANUAL_END

Ending manual version. The final manual version for which the code set was valid. A blank (null) value indicates that the code set is still valid.

3. OWNGRPCD Owner group code. A code designating a group of ownership for reporting purposes.

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

4. DESCRIPTION

Code description. A brief summary description of the meaning of the code.

5. ABBR Code abbreviation. A short descriptive phrase suitable for reporting.

6. CREATED_BY Created by. See POPULATION.CREATED_BY description for definition.

7. CREATED_DATE

   Created date. See POPULATION.CREATED_DATE description for definition.

8. CREATED_IN_INSTANCE

   Created in instance. See POPULATION.CREATED_IN_INSTANCE description for definition.

9. MODIFIED_BY

   Modified by. See POPULATION.MODIFIED_BY description for definition.

10. MODIFIED_IN_INSTANCE

    Modified in instance. See POPULATION.MODIFIED_IN_INSTANCE description for definition.

11. MODIFIED_DATE

    Modified date. See POPULATION.MODIFIED_DATE description for definition.

Example: Count of trees by OWNGRPCD:

```
SELECT t.owngrpcd, r.abbr, r.description, COUNT(*) tree_cnt
  FROM plot p, tree t, ref_owner_group r
 WHERE p.cn = t.plt_cn
   AND t.owngrpcd = r.owngrpcd
   AND p.urban_manual >= r.manual_start
   AND (r.manual_end IS NULL OR p.urban_manual <= r.manual_end)
 GROUP BY t.owngrpcd, r.abbr, r.description
 ORDER BY t.owngrpcd;
```

6.16 Reference Planted Table (Oracle table name is REF_PLANTED)

The REF_PLANTED table is used to store definitions for the IS_PLANTED variable located on the TREE table. This variable is used to indicate if a tree was planted, was generated naturally, or if this determination could not be made. Consult the appropriate field guide version (as indicated on the corresponding PLOT record) for details on the collection of this variable.

	Column name	Descriptive name	Oracle data type
1	MANUAL_START	Starting manual version	NUMBER(3,1)
2	MANUAL_END	Ending manual version	NUMBER(3,1)
3	IS_PLANTED	Is tree planted	NUMBER(1,0)
4	DESCRIPTION	Code description	VARCHAR2(1000)
5	ABBR	Code abbreviation	VARCHAR2(15)
6	CREATED_BY	Created by	VARCHAR2(30)
7	CREATED_DATE	Created date	DATE
8	CREATED_IN_INSTANCE	Created in instance	VARCHAR2(6)
9	MODIFIED_BY	Modified by	VARCHAR2(30)
10	MODIFIED_IN_INSTANCE	Modified in instance	VARCHAR2(6)
11	MODIFIED_DATE	Modified date	DATE

Type of key	Column(s) order	Tables to link	Abbreviated notation
Primary	MANUAL_START, IS_PLANTED	N/A	RPTD_PK

1. MANUAL_START

   Starting manual version. The first manual version for which the code set was valid.

2. MANUAL_END

   Ending manual version. The final manual version for which the code set was valid. A blank (null) value indicates that the code set is still valid.

3. IS_PLANTED Is the tree planted. A code indicating the origin of the tree.

Code	Description
1	Planted - Tree appears to have been planted at some point in the past.
2	Natural - Tree appears to be of a natural origin.
3	Not sure - Unable to confidently determine if the tree was planted or not.

4. DESCRIPTION

   Code description. A brief summary description of the meaning of the code.

5. ABBR Code abbreviation. A short descriptive phrase suitable for reporting.

6. CREATED_BY Created by. See POPULATION.CREATED_BY description for definition.

7. CREATED_DATE

   Created date. See POPULATION.CREATED_DATE description for definition.

8. CREATED_IN_INSTANCE

   Created in instance. See POPULATION.CREATED_IN_INSTANCE description for definition.

9. MODIFIED_BY

   Modified by. See POPULATION.MODIFIED_BY description for definition.

10. MODIFIED_IN_INSTANCE

    Modified in instance. See POPULATION.MODIFIED_IN_INSTANCE description for definition.

11. MODIFIED_DATE

    Modified date. See POPULATION.MODIFIED_DATE description for definition.

Example: Count of trees by IS_PLANTED:

```
SELECT t.is_planted, r.abbr, r.description, COUNT(*) tree_cnt
  FROM plot p, tree t, ref_planted r
 WHERE p.cn = t.plt_cn
   AND t.is_planted = r.is_planted
   AND p.urban_manual >= r.manual_start
   AND (r.manual_end IS NULL OR p.urban_manual <= r.manual_end)
 GROUP BY t.is_planted, r.abbr, r.description
 ORDER BY t.is_planted;
```

6.17 Reference Species Table (Oracle table name is REF_SPECIES)

The REF_SPECIES table is a critical reference table that stores the definitions of codes used to indicate the species of every measured tree in the annualized urban inventory. In addition, other information describing the species is included. By relying on the same reference data for species, greater integration between the traditional and urban inventories is achieved, enhancing the analysis across the rural-to-urban gradient. This variable is stored on the TREE table and is called SPCD. Consult the appropriate field guide version (as indicated on the corresponding PLOT record) for details on the collection of this variable.

	Column Name	**Descriptive Name**	**Oracle Data Type**
1	SPCD	Species code	NUMBER
2	COMMON_NAME	Common name	VARCHAR2(100)
3	GENUS	Genus	VARCHAR2(40)
4	SPECIES	Species	VARCHAR2(50)
5	VARIETY	Variety	VARCHAR2(50)
6	SUBSPECIES	Subspecies	VARCHAR2(50)
7	SPECIES_SYMBOL	Species symbol	VARCHAR2(8)
8	E_SPGRPCD	Eastern species group	NUMBER(2,0)
9	W_SPGRPCD	Western species group	NUMBER(2,0)
10	MAJOR_SPGRPCD	Major species group code	NUMBER(1,0)
11	SFTWD_HRDWD	Softwood/hardwood	VARCHAR2(1)
12	EAST	East	VARCHAR2(1)
13	WEST	West	VARCHAR2(1)
14	WOODLAND	Woodland	VARCHAR2(1)
15	MANUAL_START	Manual start	NUMBER(3,1)
16	MANUAL_END	Manual end	NUMBER(3,1)
17	CREATED_BY	Created by	VARCHAR2(30)
18	CREATED_DATE	Created date	DATE
19	CREATED_IN_INSTANCE	Created in instance	VARCHAR2(6)
20	MODIFIED_BY	Modified by	VARCHAR2(30)
21	MODIFIED_DATE	Modified date	DATE
22	MODIFIED_IN_INSTANCE	Modified in instance	VARCHAR2(6)
23	CORE	Core	VARCHAR2(1)
24	CARIBBEAN	Caribbean	VARCHAR2(1)
25	PACIFIC	Pacific	VARCHAR2(1)
26	C_SPGRPCD	Caribbean species group code	NUMBER(2,0)
27	P_SPGRPCD	Pacific species group code	NUMBER(2,0)

Type of Key	**Column(s) order**	**Tables to link**	**Abbreviated notation**
Primary	SPCD	N/A	RSPC_PK
Unique	SPECIES_SYMBOL	N/A	RSPC_UK
Foreign	E_SPGRPCD	REF_SPECIES to REF_SPECIES_GROUP	RSPC_RSPCGP_FK1
Foreign	W_SPGRPCD	REF_SPECIES to REF_SPECIES_GROUP	RSPC_RSPCGP_FK2
Foreign	C_SPGRPCD	REF_SPECIES to REF_SPECIES_GROUP	RSPC_RSPCGP_FK3
Foreign	P_SPGRPCD	REF_SPECIES to REF_SPECIES_GROUP	RSPC_RSPCGP_FK4

1. SPCD Species code. An FIA numeric code identifying the species of the tree. See appendix D.

2. COMMON_NAME

   Common name. The common name of the species. See appendix D.

3. GENUS Genus. The genus name of the species. See appendix D.

4. SPECIES Species. The species name of the species. See appendix D.

5. VARIETY Variety. The variety associated with the species if appropriate. See appendix D.

6. SUBSPECIES Subspecies. The subspecies associated with the code if appropriate. See appendix D.

7. SPECIES_SYMBOL

   Species symbol. The NRCS PLANTS database code associated with the code. See appendix D.

8. E_SPGRPCD Eastern species group code. Foreign key linking the reference species record to the reference species group record under the context of the Eastern United States. See appendix D.

9. W_SPGRPCD Western species group code. Foreign key linking the reference species record to the reference species group record under the context of the Western United States. See appendix D.

10. MAJOR_SPGRPCD

    Major species group code. The major species group assignment for the code. Major species groups are generic categories defined for organizational and reporting purposes. See appendix D. Major species groups are defined by the following table.

Code	Description
1	Pine.
2	Other conifers.
3	Soft hardwood.
4	Hard hardwood.

11. SFTWD_HRDWD

Softwood/hardwood. Hardwood or Softwood designation of the species associated with the code. Softwood is marked with S and hardwood with H.

12. EAST

East. Indicates if the species associated with the code can occur in the Eastern United States. Valid eastern species are marked with an E.

13. WEST

West. Indicates if the species associated with the code can occur in the Western United States. Valid western species are marked with a W.

14. WOODLAND

Woodland. Indicates if the species is classified as a woodland species, meaning that the diameter is measured as root collar. Woodland species are marked with an X.

15. MANUAL_START

Manual start. The first manual version for with the code set was valid.

16. MANUAL_END

Manual end. The last manual version for which the code set was valid. A blank (null) value indicates that the code set is still valid.

17. CREATED_BY

Created by. See POPULATION.CREATED_BY description for definition.

18. CREATED_DATE

Created date. See POPULATION.CREATED_DATE description for definition.

19. CREATED_IN_INSTANCE

Created in instance. See POPULATION.CREATED_IN_INSTANCE description for definition.

20. MODIFIED_BY

Modified by. See POPULATION.MODIFIED_BY description for definition.

21. MODIFIED_DATE

Modified date. See POPULATION.MODIFIED_DATE description for definition.

22. MODIFIED_IN_INSTANCE

Modified in instance. See POPULATION.MODIFIED_IN_INSTANCE description for definition.

23. CORE — Core. Indicates that the species associated with the code must be tallied (measured) by all FIA work units. Species marked with Y are considered to be CORE species. Species marked with N are considered CORE OPTIONAL.

24. CARIBBEAN — Caribbean. Indicates if the species can occur in the Caribbean. Valid Caribbean species are marked with a C.

25. PACIFIC — Pacific. Indicates if the species can occur in the pacific area. Valid pacific species are marked with a P.

26. C_SPGRPCD — Caribbean species group code. Foreign key linking the reference species record to the reference species group record under the context of the Caribbean.

27. P_SPGRPCD — Pacific species group code. Foreign key linking the reference species record to the reference species group record under the context of the pacific area.

<u>Example: Count of trees by SPCD:</u>

```
SELECT t.spcd, r.common_name, r.genus, r.species, COUNT(*) tree_cnt
  FROM plot p, tree t, ref_species r
 WHERE p.cn = t.plt_cn
   AND t.spcd = r.spcd
   AND p.urban_manual >= r.manual_start
   AND (r.manual_end IS NULL OR p.urban_manual <= r.manual_end)
 GROUP BY t.spcd, r.common_name, r.genus, r.species
 ORDER BY t.spcd;
```

6.18 Reference Species Group Table (Oracle table name is REF_SPECIES_GROUP)

The REF_SPECIES_GROUP table stores the definition of species groups that are used to aggregate individual species into logical groupings for summarization. As with the REF_SPECIES table, this is a critical table for both the traditional and urban inventories, and was copied from the traditional inventory for use in the urban inventory. The SPGRPCD variable is located on the TREE table, but is not collected by the field crews. It is populated post-field.

	Column name	**Descriptive name**	**Oracle data type**
1	SPGRPCD	Species group code	NUMBER(2,0)
2	NAME	Name	VARCHAR2(40)
3	REGION	Region	VARCHAR2(8)
4	CLASS	Class	VARCHAR2(8)
5	CREATED_BY	Created by	VARCHAR2(30)
6	CREATED_DATE	Created date	DATE
7	CREATED_IN_INSTANCE	Created in instance	VARCHAR2(6)
8	MODIFIED_BY	Modified by	VARCHAR2(30)
9	MODIFIED_DATE	Modified date	DATE
10	MODIFIED_IN_INSTANCE	Modified in instance	VARCHAR2(6)

Type of key	**Column(s) order**	**Tables to link**	**Abbreviated notation**
Primary	SPGRPCD	N/A	RSPCGP_PK

1. SPGRPCD — Species group code. A code designating a general grouping of similar species for the purposes of organization and reporting. See appendix C.

2. NAME — Name. A descriptive name for the species group code.

3. REGION — Region. A description of the section of the country in which the species, and therefore species group is commonly found. Values are ‘EASTERN’ and ‘WESTERN.’

4. CLASS — Class. A descriptor for the classification of the species type within the species group. Values are ‘SOFTWOOD’ and ‘HARDWOOD.’

5. CREATED_BY — Created by. See POPULATION.CREATED_BY description for definition.

6. CREATED_DATE

   Created date. See POPULATION.CREATED_DATE description for definition.

7. CREATED_IN_INSTANCE

   Created in instance. See POPULATION.CREATED_IN_INSTANCE description for definition.

8. MODIFIED_BY

   Modified by. See POPULATION.MODIFIED_BY description for definition.

9. MODIFIED_DATE

   Modified date. See POPULATION.MODIFIED_DATE description for definition.

10. MODIFIED_IN_INSTANCE

    Modified in instance. See POPULATION.MODIFIED_IN_INSTANCE description for definition.

Example: Count of trees by SPGRPCD:

```
SELECT t.spgrpcd, r2.name, r2.class, COUNT(*) tree_cnt
  FROM plot p, tree t, ref_species r, ref_species_group r2
 WHERE p.cn = t.plt_cn
   AND t.spcd = r.spcd
   AND t.spgrpcd = r2.spgrpcd
   AND p.urban_manual >= r.manual_start
   AND (r.manual_end IS NULL OR p.urban_manual <= r.manual_end)
 GROUP BY t.spgrpcd, r2.name, r2.class
 ORDER BY t.spgrpcd;
```

Example: Count of trees by Urban versus CORE SPGRPCD:

Urban versus CORE species can be distinguished by decoding the SPGRPCD. All of the urban-specific species are organized in species groups 55 and 56.

```
SELECT CASE
         WHEN t.spgrpcd IN (55, 56) THEN
          'URBAN'
         ELSE
          'CORE'
       END urban_core,
       r2.name,
       r2.class,
       r.common_name,
```

```
      COUNT(*) tree_cnt
 FROM plot p, tree t, ref_species r, ref_species_group r2
WHERE p.cn = t.plt_cn
  AND t.spcd = r.spcd
  AND t.spgrpcd = r2.spgrpcd
  AND p.urban_manual >= r.manual_start
  AND (r.manual_end IS NULL OR p.urban_manual <= r.manual_end)
GROUP BY CASE
        WHEN t.spgrpcd IN (55, 56) THEN
         'URBAN'
        ELSE
         'CORE'
      END, r2.name, r2.class, r.common_name
ORDER BY urban_core, CLASS, COMMON_NAME;
```

6.19 Reference Standing Dead Table (Oracle table name is REF_STANDING_DEAD)

The REF_STANDING_DEAD table stores the definition of codes used to describe dead trees as either standing or downed. The standing dead variable is stored on the TREE table and is called STANDING_DEAD_CD. Consult the appropriate field guide version (as indicated on the corresponding PLOT record) for details on the collection of this variable.

	Column name	Descriptive name	Oracle data type
1	MANUAL_START	Starting manual version	NUMBER(3,1)
2	MANUAL_END	Ending manual version	NUMBER(3,1)
3	STANDING_DEAD_CD	Standing dead code	NUMBER(1,0)
4	DESCRIPTION	Code description	VARCHAR2(1000)
5	ABBR	Code abbreviation	VARCHAR2(15)
6	CREATED_BY	Created by	VARCHAR2(30)
7	CREATED_DATE	Created date	DATE
8	CREATED_IN_INSTANCE	Created in instance	VARCHAR2(6)
9	MODIFIED_BY	Modified by	VARCHAR2(30)
10	MODIFIED_IN_INSTANCE	Modified in instance	VARCHAR2(6)
11	MODIFIED_DATE	Modified date	DATE

Type of key	Column(s) order	Tables to link	Abbreviated notation
Primary	MANUAL_START, STANDING_DEAD_CD	N/A	RSD_PK

1. MANUAL_START

   Starting manual version. The first manual version for which the code set was valid.

2. MANUAL_END

   Ending manual version. The final manual version for which the code set was valid. A blank (null) value indicates that the code set is still valid.

3. STANDING_DEAD_CD

   Standing dead code. A code indicating whether or not a tree qualifies as standing dead.

Code	Description
0	No - Tree does not qualify as standing dead.
1	Yes - Tree qualifies as standing dead.

4. DESCRIPTION

   Code description. A brief summary description of the meaning of the code.

5. ABBR — Code abbreviation. A short descriptive phrase suitable for reporting.

6. CREATED_BY — Created by. See POPULATION.CREATED_BY description for definition.

7. CREATED_DATE

   Created date. See POPULATION.CREATED_DATE description for definition.

8. CREATED_IN_INSTANCE

   Created in instance. See POPULATION.CREATED_IN_INSTANCE description for definition.

9. MODIFIED_BY

   Modified by. See POPULATION.MODIFIED_BY description for definition.

10. MODIFIED_IN_INSTANCE

    Modified in instance. See POPULATION.MODIFIED_IN_INSTANCE description for definition.

11. MODIFIED_DATE

    Modified date. See POPULATION.MODIFIED_DATE description for definition.

6.20 Reference State Table (Oracle table name is REF_STATE)

The REF_STATE table stores the definition of State codes (STATECD) that are used on the inventory data tables to describe the location of the sampling point. The codes were taken from the Federal Information Processing Standard (FIPS) code set developed to identify the States. The two-letter State abbreviations designated by the U.S. postal service are also stored in this table for convenience. The data in this table are useful for translating codes into labels for use in reporting.

	Column name	**Descriptive name**	**Oracle data type**
1	STATECD	State code	NUMBER(4,0)
2	STATENM	State name	VARCHAR2(80)
3	STATEABBR	State abbreviation	VARCHAR2(2)
4	CREATED_BY	Created by	VARCHAR2(30)
5	CREATED_DATE	Created date	DATE
6	CREATED_IN_INSTANCE	Created in instance	VARCHAR2(6)
7	MODIFIED_BY	Modified by	VARCHAR2(30)
8	MODIFIED_DATE	Modified date	DATE
9	MODIFIED_IN_INSTANCE	Modified in instance	VARCHAR2(6)

Type of key	**Column(s) order**	**Tables to link**	**Abbreviated notation**
Primary	STATECD	N/A	RST_PK

1. STATECD State code. A numeric code indicating the State. The code is taken from the Federal Information Processing Standards (FIPS) code set maintained by the Bureau of the Census. Refer to appendix B. Each State is also defined as a geographic area in the GEOAREA table.

2. STATENM State name. The name of the State or territory. The name is taken from the Federal Information Processing Standards (FIPS) code set maintained by the Bureau of the Census. Refer to appendix B for names.

3. STATEABBR State abbreviation. The two-letter abbreviation associated with a State or territory. The abbreviation is taken from the Federal Information Processing Standards (FIPS) code set maintained by the Bureau of the Census. Refer to appendix B for abbreviations.

4. CREATED_BY Created by. See POPULATION.CREATED_BY description for definition.

5. CREATED_DATE

   Created date. See POPULATION.CREATED_DATE description for definition.

6. CREATED_IN_INSTANCE

   Created in instance. See POPULATION.CREATED_IN_INSTANCE description for definition.

7. MODIFIED_BY

   Modified by. See POPULATION.MODIFIED_BY description for definition.

8. MODIFIED_DATE

   Modified date. See POPULATION.MODIFIED_DATE description for definition

9. MODIFIED_IN_INSTANCE

   Modified in instance. See POPULATION.MODIFIED_IN_INSTANCE description for definition.

.

6.21 Reference Tree Status Table (Oracle table name is REF_TREE_STATUS)

The REF_TREE_STATUS table contains the definitions for codes used to describe the status of a tree at the time of measurement. This variable is stored on the TREE record and is called STATUSCD. Consult the appropriate field guide version (as indicated on the corresponding PLOT record) for details on the collection of this variable.

	Column name	Descriptive name	Oracle data type
1	MANUAL_START	Starting manual version	NUMBER(3,1)
2	MANUAL_END	Ending manual version	NUMBER(3,1)
3	STATUSCD	Tree status code	NUMBER(1,0)
4	DESCRIPTION	Code description	VARCHAR2(1000)
5	ABBR	Code abbreviation	VARCHAR2(15)
6	CREATED_BY	Created by	VARCHAR2(30)
7	CREATED_DATE	Created date	DATE
8	CREATED_IN_INSTANCE	Created in instance	VARCHAR2(6)
9	MODIFIED_BY	Modified by	VARCHAR2(30)
10	MODIFIED_IN_INSTANCE	Modified in instance	VARCHAR2(6)
11	MODIFIED_DATE	Modified date	DATE

Type of key	Column(s) order	Tables to link	Abbreviated notation
Primary	MANUAL_START, STATUSCD	N/A	RTS_PK

1. MANUAL_START

Starting manual version. The first manual version for which the code set was valid.

2. MANUAL_END

Ending manual version. The final manual version for which the code set was valid. A blank (null) value indicates that the code set is still valid.

3. STATUSCD Tree status code. The current status of the tree.

Code	Description
0	No status – tree is not presently in the sample (remeasurement plots only). Tree was incorrectly tallied at the previous inventory, currently is not tallied due to definition or procedural change, or is not tallied due to natural causes.
1	Live tree – any live tree (new, remeasured or ingrowth).
2	Dead tree – any dead tree (new, remeasured, or ingrowth) where the bole of the tree remains on the site, regardless of cause of death. Includes all previously standing dead trees that no longer qualify as standing dead. Does not include trees that are removed from the site.

Code	Description
3	Cut & Utilized – Collected on remeasurement trees only. A tree that occupied a forested condition in the previous inventory only. A tree that has been cut and removed by direct human activity related to harvesting, silviculture or land clearing. The tree is assumed to have been utilized for a commercial purposes, such as timber, chips, or firewood, and noncommercial purposes such as domestic firewood, landscaping, and fence posts.
4	Removed – Collected on remeasurement trees only. A tree that has been removed by direct human activity but not likely utilized for a commercial product, such as timber, chips, or firewood, and noncommercial purposes such as domestic firewood, landscaping, and fence posts.

4. DESCRIPTION

   Code description. A brief summary description of the meaning of the code.

5. ABBR Code abbreviation. A short descriptive phrase suitable for reporting.

6. CREATED_BY Created by. See POPULATION.CREATED_BY description for definition.

7. CREATED_DATE

   Created date. See POPULATION.CREATED_DATE description for definition.

8. CREATED_IN_INSTANCE

   Created in instance. See POPULATION.CREATED_IN_INSTANCE description for definition.

9. MODIFIED_BY

   Modified by. See POPULATION.MODIFIED_BY description for definition.

10. MODIFIED_IN_INSTANCE

    Modified in instance. See POPULATION.MODIFIED_IN_INSTANCE description for definition.

11. MODIFIED_DATE

    Modified date. See POPULATION.MODIFIED_DATE description for definition.

<u>Example: Count of trees by STATUSCD:</u>

```
SELECT t.statuscd, r.abbr, r.description, COUNT(*) tree_cnt
  FROM plot p, tree t, ref_tree_status r
 WHERE p.cn = t.plt_cn
   AND t.statuscd = r.statuscd
   AND p.urban_manual >= r.manual_start
   AND (r.manual_end IS NULL OR p.urban_manual <= r.manual_end)
 GROUP BY t.statuscd, r.abbr, r.description
 ORDER BY t.statuscd;
```

6.22 Reference Unit Table (Oracle table name is REF_UNIT)

The REF_UNIT table stores the definition of FIA survey unit codes (UNITCD) that are used on the inventory data tables to describe the location of the sampling point. FIA survey units are contiguous groups of counties within States. FIA survey units, in combination with States and counties, form a geographic hierarchy such that States are divided into one or more units and units are divided into one or more counties. Each level of the hierarchy is nested within the previous. They were developed and are used for both reporting as well as organizing field logistics. Most units divide the State into logical subdivisions that follow rough ecological divisions. Some units developed during older periodic FIA inventories, however, may be based on lands of a particular ownership. The codes were developed by FIA for its own purposes and are not part of a larger governmental data standard. The data in this table are useful for translating codes into labels for use in reporting.

	Column name	Descriptive name	Oracle data type
1	STATECD	State code	NUMBER(4,0)
2	UNITCD	Unit code	NUMBER(2,0)
3	UNITNM	Unit name	VARCHAR2(80)
4	CREATED_BY	Created by	VARCHAR2(30)
5	CREATED_DATE	Created date	DATE
6	CREATED_IN_INSTANCE	Created in instance	VARCHAR2(6)
7	MODIFIED_BY	Modified by	VARCHAR2(30)
8	MODIFIED_DATE	Modified date	DATE
9	MODIFIED_IN_INSTANCE	Modified in instance	VARCHAR2(6)

Type of key	Column(s) order	Tables to link	Abbreviated notation
Primary	STATECD, UNITCD	N/A	RUNT_PK

1. STATECD State code. A numeric code indicating the State. The code is taken from the Federal Information Processing Standards (FIPS) code set maintained by the Bureau of the Census. Refer to appendix B. Each State is also defined as a geographic area in the GEOAREA table.

2. UNITCD Survey unit code. Forest Inventory and Analysis (FIA) survey unit identification number. Survey units are groups of counties within States used to organize the population into logical groups for field logistics as well as for estimation purposes. Refer to appendix B for codes.

3. UNITNM Unit name. The survey unit code name. Survey units are groups of counties within States used to organize the population into logical groups for field logistics as well as for estimation purposes. Refer to appendix B for codes.

4. CREATED_BY Created by. See POPULATION.CREATED_BY description for definition.

5. CREATED_DATE

   Created date. See POPULATION.CREATED_DATE description for definition.

6. CREATED_IN_INSTANCE

   Created in instance. See POPULATION.CREATED_IN_INSTANCE description for definition.

7. MODIFIED_BY

   Modified by. See POPULATION.MODIFIED_BY description for definition.

8. MODIFIED_DATE

   Modified date. See POPULATION.MODIFIED_DATE description for definition.

9. MODIFIED_IN_INSTANCE

   Modified in instance. See POPULATION.MODIFIED_IN_INSTANCE description for definition.

6.23 Reference Urban Plot Nonsampled Reason Table (Oracle table name is REF_URBAN_PLOT_NONSAMPLE_REASN)

The REF_URBAN_PLOT_NONSAMPLE_REASN table contains definitions for a set of codes used to describe the reason for a nonsampled plot or portion of a plot. This variable is stored on the PLOT table and is called URBAN_PLOT_NONSAMPLE_REASN_CD. Consult the appropriate field guide version (as indicated on the corresponding PLOT record) for details on the collection of this variable.

	Column name	Descriptive name	Oracle data type
1	MANUAL_START	Starting manual version	NUMBER(3,1)
2	MANUAL_END	Ending manual version	NUMBER(3,1)
3	URBAN_PLOT_NONSAMPLE_REASN_CD	Urban plot nonsampled reason code	NUMBER(2,0)
4	DESCRIPTION	Code description	VARCHAR2(1000)
5	ABBR	Code abbreviation	VARCHAR2(15)
6	CREATED_BY	Created by	VARCHAR2(30)
7	CREATED_DATE	Created date	DATE
8	CREATED_IN_INSTANCE	Created in instance	VARCHAR2(6)
9	MODIFIED_BY	Modified by	VARCHAR2(30)
10	MODIFIED_IN_INSTANCE	Modified in instance	VARCHAR2(6)
11	MODIFIED_DATE	Modified date	DATE

Type of key	Column(s) order	Tables to link	Abbreviated notation
Primary	MANUAL_START, URBAN_PLOT_NONSAMPLE_REASN_CD	N/A	RUPNR_PK

1. MANUAL_START

   Starting manual version. The first manual version for which the code set was valid.

2. MANUAL_END

   Ending manual version. The final manual version for which the code set was valid. A blank (null) value indicates that the code set is still valid.

3. URBAN_PLOT_NONSAMPLE_REASN_CD

   Urban plot nonsampled reason code. A code describing the reason an urban plot was entirely nonsampled.

Code	Description
01	Outside U.S. boundary – Entire plot is outside of the U.S. border.
02	Denied access – Access to the entire plot is denied by the legal owner, or by the owner of the only reasonable route to the plot.
03	Hazardous – Entire plot cannot be accessed because of a hazard or danger, for example cliffs, quarries, strip mines, illegal substance plantations, high water, etc.
05	Lost data – Plot data file was discovered to be corrupt after a panel was completed and submitted for processing. This code is applied at the time of processing after notification to the units. This code is for office use only.
06	Lost plot – Entire plot cannot be found. Whenever this code is assigned, a replacement plot is required.
07	Wrong location – Previous plot can be found, but its placement is beyond the tolerance limits for plot location. Whenever this code is assigned, a replacement plot is required.
08	Skipped visit – Entire plot skipped. Used for plots that are not completed prior to the time a panel is finished and submitted for processing. This code is for office use only.
09	Dropped intensified plot - Intensified plot dropped due to a change in grid density. This code used only by units engaged in intensification. This code is for office use only.
10	Other – Entire plot not sampled due to a reason other than one of the specific reasons already listed.
11	Ocean – Plot falls in ocean water below mean high tide line.

4. DESCRIPTION

Code description. A brief summary description of the meaning of the code.

5. ABBR Code abbreviation. A short descriptive phrase suitable for reporting.

6. CREATED_BY Created by. See POPULATION.CREATED_BY description for definition.

7. CREATED_DATE

Created date. See POPULATION.CREATED_DATE description for definition.

8. CREATED_IN_INSTANCE

Created in instance. See POPULATION.CREATED_IN_INSTANCE description for definition.

9. MODIFIED_BY

Modified by. See POPULATION.MODIFIED_BY description for definition.

10. MODIFIED_IN_INSTANCE

Modified in instance. See POPULATION.MODIFIED_IN_INSTANCE description for definition.

11. MODIFIED_DATE

Modified date. See POPULATION.MODIFIED_DATE description for definition

<u>Example: Count of plots by URBAN_PLOT_NONSAMPLE_REASN_CD:</u>

```
SELECT p.urban_plot_nonsample_reasn_cd, r.abbr, r.description, COUNT(*)cnt
  FROM plot p, ref_urban_plot_nonsample_reasn r
 WHERE p.urban_plot_nonsample_reasn_cd = r.urban_plot_nonsample_reasn_cd
   AND p.urban_manual >= r.manual_start
   AND (r.manual_end IS NULL OR p.urban_manual <= r.manual_end)
 GROUP BY p.urban_plot_nonsample_reasn_cd, r.abbr, r.description
 ORDER BY p.urban_plot_nonsample_reasn_cd;
```

6.24 Reference Urban Plot Status Table (Oracle table name is REF_URBAN_PLOT_STATUS)

The REF_URBAN_PLOT_STATUS table contains the definitions for codes used to describe the sampling status of a plot visit. The sampling status variable is stored on the PLOT table and is called URBAN_PLOT_STATUS_CD. Consult the appropriate field guide version (as indicated on the corresponding PLOT record) for details on the collection of this variable.

	Column name	Descriptive name	Oracle data type
1	MANUAL_START	Starting manual version	NUMBER(3,1)
2	MANUAL_END	Ending manual version	NUMBER(3,1)
3	URBAN_PLOT_STATUS_CD	Urban plot status code	NUMBER(1,0)
4	DESCRIPTION	Code description	VARCHAR2(1000)
5	ABBR	Code abbreviation	VARCHAR2(15)
6	CREATED_BY	Created by	VARCHAR2(30)
7	CREATED_DATE	Created date	DATE
8	CREATED_IN_INSTANCE	Created in instance	VARCHAR2(6)
9	MODIFIED_BY	Modified by	VARCHAR2(30)
10	MODIFIED_IN_INSTANCE	Modified in instance	VARCHAR2(6)
11	MODIFIED_DATE	Modified date	DATE

Type of key	Column(s) order	Tables to link	Abbreviated notation
Primary	MANUAL_START, URBAN_PLOT_STATUS_CD	N/A	RUPS_PK

1. MANUAL_START

   Starting manual version. The first manual version for which the code set was valid.

2. MANUAL_END

   Ending manual version. The final manual version for which the code set was valid. A blank (null) value indicates that the code set is still valid.

3. URBAN_PLOT_STATUS_CD

   Urban plot status code. The plot status code under the urban protocol. A code describing the sampling status of an urban plot visit. Because there is only one subplot on the urban plot footprint, the term subplot is synonymous with plot in the code definitions.

Code	Description
1	Sampled – at least one accessible forest land condition present on subplot.
2	Sampled- no accessible forest or nonforest land condition present on subplot, i.e. Subplot is either census and / or noncensus water.
3	Nonsampled.

4. DESCRIPTION

   Code description. A brief summary description of the meaning of the code.

5. ABBR Code abbreviation. A short descriptive phrase suitable for reporting.

6. CREATED_BY Created by. See POPULATION.CREATED_BY description for definition.

7. CREATED_DATE

   Created date. See POPULATION.CREATED_DATE description for definition.

8. CREATED_IN_INSTANCE

   Created in instance. See POPULATION.CREATED_IN_INSTANCE description for definition.

9. MODIFIED_BY

   Modified by. See POPULATION.MODIFIED_BY description for definition.

10. MODIFIED_IN_INSTANCE

    Modified in instance. See POPULATION.MODIFIED_IN_INSTANCE description for definition.

11. MODIFIED_DATE

    Modified date. See POPULATION.MODIFIED_DATE description for definition.

Example: Count of plots by URBAN_PLOT_STATUS_CD:

```
SELECT p.urban_plot_status_cd, r.abbr, r.description, COUNT(*)cnt
  FROM plot p, ref_urban_plot_status r
 WHERE p.urban_plot_status_cd = r.urban_plot_status_cd
   AND p.urban_manual >= r.manual_start
   AND (r.manual_end IS NULL OR p.urban_manual <= r.manual_end)
 GROUP BY p.urban_plot_status_cd, r.abbr, r.description
 ORDER BY p.urban_plot_status_cd;
```

6.25 Reference Urban Subplot Nonsampled Reason Table (Oracle table name is REF_URBAN_SUBP_NONSAMPLE_REASN)

The REF_URBAN_SUBP_NONSAMPLE_REASN table contains code definitions for describing the reason an element of the plot footprint (subplot or microplot) was not sampled. This variable is located on the SUBPLOT table and is called URBAN_SUBP_NONSAMPLE_REASN_CD. Consult the appropriate field guide version (as indicated on the corresponding PLOT record) for details on the collection of this variable.

	Column name	Descriptive name	Oracle data type
1	MANUAL_START	Starting manual version	NUMBER(3,1)
2	MANUAL_END	Ending manual version	NUMBER(3,1)
3	URBAN_SUBP_NONSAMPLE_REASN_CD	Urban subplot nonsampled reason code	NUMBER(2,0)
4	DESCRIPTION	Code description	VARCHAR2(1000)
5	ABBR	Code abbreviation	VARCHAR2(15)
6	CREATED_BY	Created by	VARCHAR2(30)
7	CREATED_DATE	Created date	DATE
8	CREATED_IN_INSTANCE	Created in instance	VARCHAR2(6)
9	MODIFIED_BY	Modified by	VARCHAR2(30)
10	MODIFIED_IN_INSTANCE	Modified in instance	VARCHAR2(6)
11	MODIFIED_DATE	Modified date	DATE

Type of key	Column(s) order	Tables to link	Abbreviated notation
Primary	MANUAL_START, URBAN_SUBP_NONSAMPLE_REASN_CD	N/A	RUSNR_PK

1. MANUAL_START

   Starting manual version. The first manual version for which the code set was valid.

2. MANUAL_END

   Ending manual version. The final manual version for which the code set was valid. A blank (null) value indicates that the code set is still valid.

3. URBAN_SUBP_NONSAMPLE_REASN_CD

   Urban subplot nonsampled reason code. The subplot nonsampled reason code under the urban protocol. A nonsampled reason code describes why a subplot was not sampled.

Code	Description
1	Outside U.S. boundary – Assign this code to condition classes beyond the U.S. border.
2	Denied access area – Any area within the sampled area of a plot to which access is denied by the legal owner, or to which an owner of the only reasonable route to the plot denies access. There are no minimum area or width requirements for a condition class delineated by denied access.
3	Hazardous situation – Any area within the sampled area on plot that cannot be accessed because of a hazard or danger, for example cliffs, quarries, strip mines, illegal substance plantations, temporary high water, etc. There are no minimum size or width requirements for a condition class delineated by a hazardous condition.
4	Time limitation – This code applies to full subplots that cannot be sampled due to a time restriction. This code is reserved for areas with limited access and in situations where it is imperative for the crew to leave before the plot can be completed (e.g., scheduled helicopter rendezvous).
5	Lost data – The plot data file was discovered to be corrupt after a panel was completed and submitted for processing. This code is assigned to entire plots or full subplots that could not be processed, and is applied at the time of processing after notification to the region. Note: This code is for office use only.
6	Lost plot – Entire plot cannot be found. Used for the subplots that are required for this plot.
7	Wrong location – Previous plot can be found, but its placement is beyond the tolerance limits for plot location.
8	Skipped visit – Entire plot skipped. Used for plots that are not completed prior to the time a panel is finished and submitted for processing.
9	Dropped intensified plot - Intensified plot dropped due to a change in grid density. Used only by units engaged in intensification.
10	Other – This code is used whenever a plot or condition class is not sampled due to a reason other than one of the specific reasons already listed.
11	Ocean – Subplot falls in ocean water below mean high tide line.

4. DESCRIPTION

   Code description. A brief summary description of the meaning of the code.

5. ABBR — Code abbreviation. A short descriptive phrase suitable for reporting.

6. CREATED_BY — Created by. See POPULATION.CREATED_BY description for definition.

7. CREATED_DATE

   Created date. See POPULATION.CREATED_DATE description for definition.

8. CREATED_IN_INSTANCE

   Created in instance. See POPULATION.CREATED_IN_INSTANCE description for definition.

9. MODIFIED_BY

Modified by. See POPULATION.MODIFIED_BY description for definition.

10. MODIFIED_IN_INSTANCE

Modified in instance. See POPULATION.MODIFIED_IN_INSTANCE description for definition.

11. MODIFIED_DATE

Modified date. See POPULATION.MODIFIED_DATE description for definition.

Example: Count of subplots and microplots by URBAN_SUBP_NONSAMPLE_REASN_CD:

```
SELECT sp.urban_subp_nonsample_reasn_cd,
       r.abbr,
       r.description,
       COUNT(*) cnt
  FROM plot p, subplot sp, ref_urban_subp_nonsample_reasn r
 WHERE p.cn = sp.plt_cn
   AND sp.urban_subp_nonsample_reasn_cd = r.urban_subp_nonsample_reasn_cd
   AND p.urban_manual >= r.manual_start
   AND (r.manual_end IS NULL OR p.urban_manual <= r.manual_end)
 GROUP BY sp.urban_subp_nonsample_reasn_cd, r.abbr, r.description
 ORDER BY sp.urban_subp_nonsample_reasn_cd;
```

6.26 Reference Urban Subplot Status Table (Oracle table name is REF_URBAN_SUBP_STATUS)

The REF_URBAN_SUBP_STATUS table contains the definitions for codes used to describe the sampling status of footprint elements (subplots and microplots). This variable is located on the SUBPLOT table and is called URBAN_SUBP_STATUS_CD. Consult the appropriate field guide version (as indicated on the corresponding PLOT record) for details on the collection of this variable.

	Column name	Descriptive name	Oracle data type
1	MANUAL_START	Starting manual version	NUMBER(3,1)
2	MANUAL_END	Ending manual version	NUMBER(3,1)
3	URBAN_SUBP_STATUSCD	Urban subplot status code	NUMBER(1,0)
4	DESCRIPTION	Code description	VARCHAR2(1000)
5	ABBR	Code abbreviation	VARCHAR2(15)
6	CREATED_BY	Created by	VARCHAR2(30)
7	CREATED_DATE	Created date	DATE
8	CREATED_IN_INSTANCE	Created in instance	VARCHAR2(6)
9	MODIFIED_BY	Modified by	VARCHAR2(30)
10	MODIFIED_IN_INSTANCE	Modified in instance	VARCHAR2(6)
11	MODIFIED_DATE	Modified date	DATE

Type of key	Column(s) order	Tables to link	Abbreviated notation
Primary	MANUAL_START, URBAN_SUBP_STATUSCD	N/A	RUSS_PK

1. MANUAL_START

   Starting manual version. The first manual version for which the code set was valid.

2. MANUAL_END

   Ending manual version. The final manual version for which the code set was valid. A blank (null) value indicates that the code set is still valid.

3. URBAN_SUBP_STATUSCD

   Urban subplot status code. The subplot status under the urban protocol. A status code describes the sampling status of the subplot.

Code	Description
1	Sampled – at least one accessible forest land condition present on subplot.
2	Sampled – no accessible forest or accessible nonforest land condition present on subplot, i.e., Subplot is either census and/or noncensus water.
3	Nonsampled.

4. DESCRIPTION

   Code description. A brief summary description of the meaning of the code.

5. ABBR Code abbreviation. A short descriptive phrase suitable for reporting.

6. CREATED_BY Created by. See POPULATION.CREATED_BY description for definition.

7. CREATED_DATE

   Created date. See POPULATION.CREATED_DATE description for definition.

8. CREATED_IN_INSTANCE

   Created in instance. See POPULATION.CREATED_IN_INSTANCE description for definition.

9. MODIFIED_BY

   Modified by. See POPULATION.MODIFIED_BY description for definition.

10. MODIFIED_IN_INSTANCE

    Modified in instance. See POPULATION.MODIFIED_IN_INSTANCE description for definition.

11. MODIFIED_DATE

    Modified date. See POPULATION.MODIFIED_DATE description for definition.

Example: Count of subplots and microplots by URBAN_SUBP_STATUS_CD:

```
SELECT sp.urban_subp_statuscd, r.abbr, r.description, COUNT(*) tree_cnt
  FROM plot p, subplot sp, ref_urban_subp_status r
 WHERE p.cn = sp.plt_cn
   AND sp.urban_subp_statuscd = r.urban_subp_statuscd
   AND p.urban_manual >= r.manual_start
   AND (r.manual_end IS NULL OR p.urban_manual <= r.manual_end)
 GROUP BY sp.urban_subp_statuscd, r.abbr, r.description
 ORDER BY sp.urban_subp_statuscd;
```

6.27 Reference Database Version Table (Oracle table name is REF_DB_VERSION)

The REF_DB_VERSION table is unique. It stores the current version of the database. This version indicates the current standard of data (both collected and calculated) contained within the database. As FIA gains experience in conducting the annualized inventory of populations of interest, it changes the way data are collected and compiled for analysis. All data within the database are updated (to the greatest extent possible) to exist at the same data standard indicated by the database version. This enables more robust analysis across time and across different populations of interest.

	Column name	Descriptive name	Oracle data type
1	VERSION	Version number	VARCHAR2(40)
2	DESCR	Version description	VARCHAR2(2000)
3	INSTALL_TYPE	Installation type	VARCHAR2(10)
4	CREATED_BY	Created by	VARCHAR2(30)
5	CREATED_DATE	Created date	DATE
6	CREATED_IN_INSTANCE	Created in instance	VARCHAR2(6)
7	MODIFIED_BY	Modified by	VARCHAR2(30)
8	MODIFIED_DATE	Modified date	DATE
9	MODIFIED_IN_INSTANCE	Modified in instance	VARCHAR2(6)

Type of key	Column(s) order	Tables to link	Abbreviated notation
Primary	VERSION	N/A	RDBVER_PK

1. VERSION Version number. A unique number used to identify a REF_DB_VERION record. Version equals the currently available version of the UFIADB.

2. DESCR Version description. A description of the UFIADB version. This may include a literature citation and internet links to documentation.

3. INSTALL_TYPE

   Installation type. Installation method used for this version update. This attribute is intentionally left blank in download files.

4. CREATED_BY Created by. See POPULATION.CREATED_BY description for definition.

5. CREATED_DATE

   Created date. See POPULATION.CREATED_DATE description for definition.

6. CREATED_IN_INSTANCE

   Created in instance. See POPULATION.CREATED_IN_INSTANCE description for definition.

7. MODIFIED_BY

   Modified by. See POPULATION.MODIFIED_BY description for definition.

8. MODIFIED_DATE

   Modified date. See POPULATION.MODIFIED_DATE description for definition.

9. MODIFIED_IN_INSTANCE

   Modified in instance. See POPULATION.MODIFIED_IN_INSTANCE description for definition.

Chapter 7 – Reference Data Table Group – Population Estimation Tables Subgroup

Reference data are static or semi-static data that define codes used in other table groups of the database. For example, a numeric code is used to specify the species identified by the field crew, which is more efficient for crews to record than common or scientific names. These codes can be translated back to the common or scientific name by joining to the appropriate reference data. As field protocols evolve, some codes can change over time. These changes are organized by the use of a manual version that controls which codes were valid under which field manual versions. Most reference data tables have a MANUAL_START and MANUAL_END column, which indicate the versions for which a set of codes was valid. A NULL value in MANUAL_END indicates that the most recent set of codes is still valid.

The reference table group can be further subdivided into two subgroups; code definition tables and population estimation reference tables. The following section provides a written and technical description of each table in the population estimation subgroup and its contents along with an example query of how it is correctly joined to the appropriate table.

The tables in the Population Estimation subgroup support various aspects of population estimation. Rather than storing definitions of codes used by the field crew, these tables define concepts involved in population estimation. These types of metadata are critical when conveying what types of estimates can be made with which evaluations stored in the database. These tables work together to allow the users to understand what is available. For examples of how these tables can be queried refer to chapter 8, *Estimation Guide*.

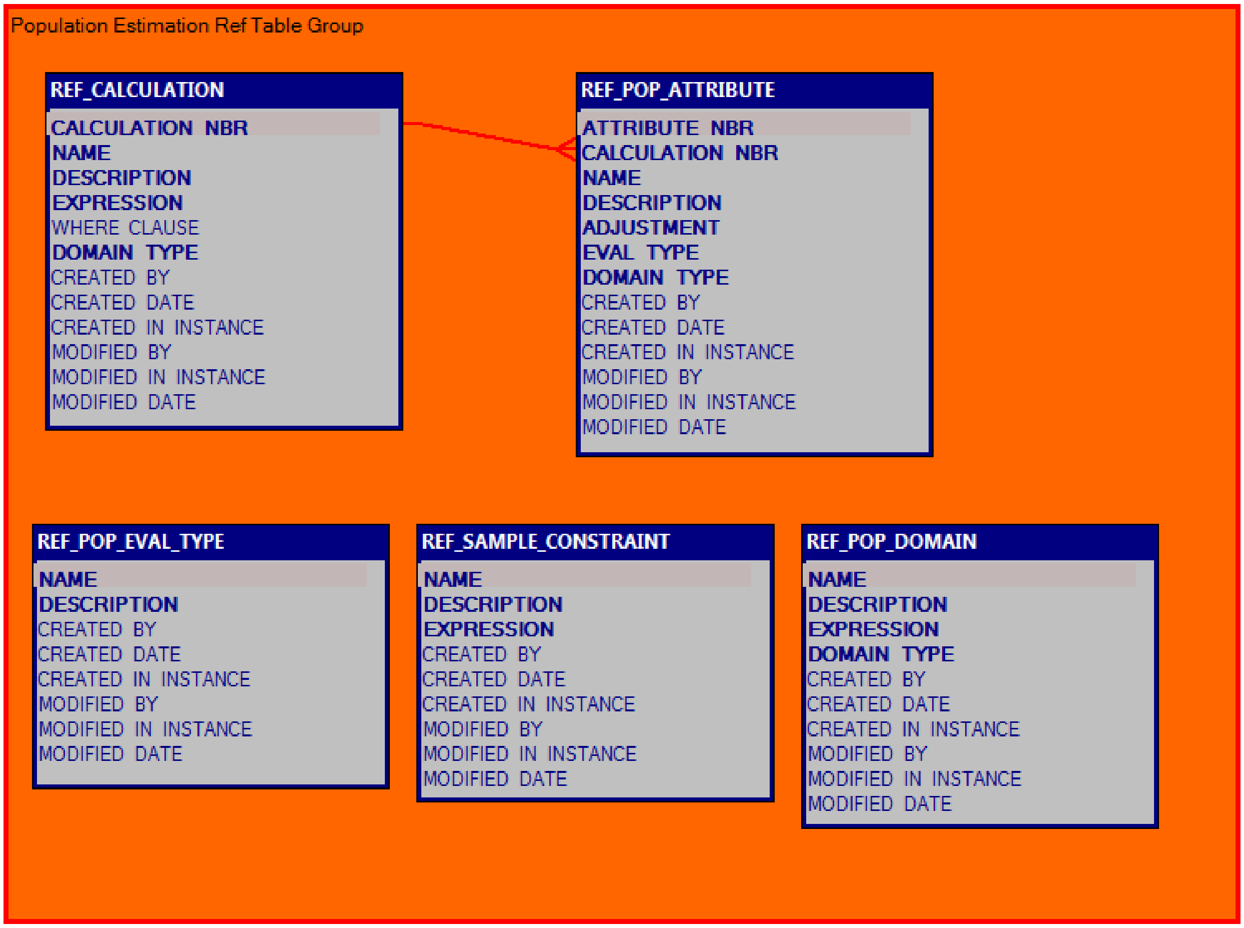


Figure 8. Reference data table group, population estimation tables subgroup.

7.1 Reference Population Attribute Table (Oracle table name is REF_POP_ATTRIBUTE)

The REF_POP_ATTRIBUTE table contains a list of population attributes that can be estimated. This list is not exhaustive and is not meant to limit analysis. Rather, this list represents common attributes of a population used in standard reporting. This table is similar to a table from the traditional FIADB with the same name. There are some fundamental differences, however, between this table and the traditional one. The REF_POP_ATTRIBUTE table from the traditional FIADB consolidates the concepts of a population attribute, the calculation used to estimate that attribute, and a domain filter into a single table. For example, attribute number 4 from the traditional FIADB table is defined as, Number of live trees on forestland. This single record is composed of the unique combination of the attribute *number of trees*, with domain filters for *live trees* and *forestland*. These filters control which trees are tallied in the attribute estimate of number of trees. In addition, the traditional REF_POP_ATTRIBUTE from FIADB includes an expression, which shows the calculation made at the tree level combined with the stratum-level adjustment for non-response (see the *Estimation Guide*, chapter 8). There is also a WHERE_CLAUSE column, which specifies how the particular domain filters are applied along with other information such as required table joins and evaluation type constraints. In contrast to this structure, the REF_POP_ATTRIBUTE used in the Urban Stage 1 structure divides these components into separate tables that can be combined as necessary.

	Column name	**Descriptive name**	**Oracle data type**
1	ATTRIBUTE_NBR	Population attribute number	NUMBER(3,0)
2	CALCULATION_NBR	Calculation number	NUMBER(3,0)
3	NAME	Population attribute name	VARCHAR2(30)
4	DESCRIPTION	Population attribute description	VARCHAR2(2000)
5	ADJUSTMENT	Adjustment	VARCHAR2(2000)
6	EVAL_TYPE	Evaluation type	VARCHAR2(15)
7	DOMAIN_TYPE	Domain type	VARCHAR2(15)
8	CREATED_BY	Created by	VARCHAR2(30)
9	CREATED_DATE	Created date	DATE
10	CREATED_IN_INSTANCE	Created in instance	VARCHAR2(6)
11	MODIFIED_BY	Modified by	VARCHAR2(30)
12	MODIFIED_IN_INSTANCE	Modified in instance	VARCHAR2(6)
13	MODIFIED_DATE	Modified date	DATE

Type of key	**Column(s) order**	**Tables to link**	**Abbreviated notation**
Primary	ATTRIBUTE_NBR	N/A	RPA_PK
Unique	NAME	N/A	RPA_UK
Foreign	CALCULATION_NBR	REF_POP_ATTRIBUTE to REF_CALCULATION	RPA_RC_FK

1. ATTRIBUTE_NBR

   Attribute number. A unique numeric value identifying the population attribute.

2. CALCULATION_NBR

   Calculation number. Foreign key linking the population attribute record to the calculation record.

3. NAME Population attribute name. A descriptive name for the population attribute.

4. DESCRIPTION

   Population attribute description. A brief summary description of the population attribute.

5. ADJUSTMENT Adjustment. An expression showing the appropriate stratum adjustment to make when computing an estimate of the population attribute using the FIA stratified estimator.

6. EVAL_TYPE Evaluation type. The evaluation type most appropriate for computing estimates of the population attribute.

7. DOMAIN_TYPE

   Domain type. The domain type of the population attribute. The domain type describes what general population component is described by the population attribute.

8. CREATED_BY Created by. See POPULATION.CREATED_BY description for definition.

9. CREATED_DATE

   Created date. See POPULATION.CREATED_DATE description for definition.

10. CREATED_IN_INSTANCE

    Created in instance. See POPULATION.CREATED_IN_INSTANCE description for definition.

11. MODIFIED_BY

    Modified by. See POPULATION.MODIFIED_BY description for definition.

12. MODIFIED_IN_INSTANCE

Modified in instance. See POPULATION.MODIFIED_IN_INSTANCE description for definition.

13. MODIFIED_DATE

Modified date. See POPULATION.MODIFIED_DATE description for definition.

7.2 Reference Population Domain Table (Oracle table name is REF_POP_DOMAIN)

The REF_POP_DOMAIN table contains a list of population domains along with an expression that can be used to apply the domain as a filter during population estimation. Every population domain is assigned to a domain type; Tree or Land. This list of population domains is not meant to be exhaustive and should not limit analysis. Rather, it is a list of common population domains used in standard reporting.

	Column name	Descriptive name	Oracle data type
1	NAME	Population domain name	VARCHAR2(30)
2	DESCRIPTION	Population domain description	VARCHAR2(2000)
3	EXPRESSION	Population domain expression	VARCHAR2(2000)
4	DOMAIN_TYPE	Domain type	VARCHAR2(15)
5	CREATED_BY	Created by	VARCHAR2(30)
6	CREATED_DATE	Created date	DATE
7	CREATED_IN_INSTANCE	Created in instance	VARCHAR2(6)
8	MODIFIED_BY	Modified by	VARCHAR2(30)
9	MODIFIED_IN_INSTANCE	Modified in instance	VARCHAR2(6)
10	MODIFIED_DATE	Modified date	DATE

Type of key	Column(s) order	Tables to link	Abbreviated notation
Primary	NAME	N/A	RPD_PK

1. NAME Population domain name. A descriptive name for the population domain.

2. DESCRIPTION

   Population domain description. A brief summary description of the population domain.

3. EXPRESSION Population domain expression. An expression than can be used to constrain a set of records to the population domain. The expression is in the form of TABLE_NAME.COLUMN_NAME [OPERATOR] [CONSTRAINT]. For example TREE.STATUSCD = 1: TREE is the table name, STATUSCD is the column name, "=" is the operator, and 1 is the constraint.

4. DOMAIN_TYPE

   Domain type. The domain type of the population domain. The domain type describes what general component of the population is refined by the population domain.

5. CREATED_BY Created by. See POPULATION.CREATED_BY description for definition.

6. CREATED_DATE

   Created date. See POPULATION.CREATED_DATE description for definition.

7. CREATED_IN_INSTANCE

   Created in instance. See POPULATION.CREATED_IN_INSTANCE description for definition.

8. MODIFIED_BY

   Modified by. See POPULATION.MODIFIED_BY description for definition.

9. MODIFIED_IN_INSTANCE

   Modified in instance. See POPULATION.MODIFIED_IN_INSTANCE description for definition.

10. MODIFIED_DATE

   Modified date. See POPULATION.MODIFIED_DATE description for definition.

7.3 Reference Population Evaluation Type Table (Oracle table name is REF_POP_EVAL_TYPE)

The REF_POP_EVAL_TYPE table contains a list of defined evaluation types. Every statistical evaluation is assigned to one or more evaluation types. The purpose of the evaluation type is to specify the purpose of evaluation in terms of population-attribute estimation. For example, the CURR evaluation type specifies that an evaluation is appropriate for use in estimating the current area of a population, or domains within the population.

	Column name	Descriptive name	Oracle data type
1	NAME	Evaluation type name	VARCHAR2(10)
2	DESCRIPTION	Evaluation type description	VARCHAR2(1000)
3	CREATED_BY	Created by	VARCHAR2(30)
4	CREATED_DATE	Created date	DATE
5	CREATED_IN_INSTANCE	Created in instance	VARCHAR2(6)
6	MODIFIED_BY	Modified by	VARCHAR2(30)
7	MODIFIED_IN_INSTANCE	Modified in instance	VARCHAR(6)
8	MODIFIED_DATE	Modified date	DATE

Type of key	Column(s) order	Tables to link	Abbreviated notation
Primary	NAME	N/A	RPET_PK

1. NAME Evaluation type name. A short name serving as a unique identifier for the evaluation type.

2. DESCRIPTION

   Evaluation type description. A brief summary description of the evaluation type and what its purpose is.

3. CREATED_BY Created by. See POPULATION.CREATED_BY description for definition.

4. CREATED_DATE

   Created date. See POPULATION.CREATED_DATE description for definition.

5. CREATED_IN_INSTANCE

   Created in instance. See POPULATION.CREATED_IN_INSTANCE description for definition.

6. MODIFIED_BY

   Modified by. See POPULATION.MODIFIED_BY description for definition.

7. MODIFIED_IN_INSTANCE

Modified in instance. See POPULATION.MODIFIED_IN_INSTANCE description for definition.

8. MODIFIED_DATE

Modified date. See POPULATION.MODIFIED_DATE description for definition.

7.4 Reference Calculation Table (Oracle table name is REF_CALCULATION)

The REF_CALCULATION table contains a list of named calculations along with the expression required to perform the calculation and any constraints required. The expression defines the value that should be summed to a single value for each plot in each domain of interest (see the *Estimation Guide*, chapter 8). The strata correction to account for non-response is not incorporated because that correction is only appropriate when summarizing to the population-level, whereas these calculations are appropriate at the plot-level. For example, one could use a given calculation to compute a plot-level estimate for the purpose of creating a map.

	Column name	**Descriptive name**	**Oracle data type**
1	CALCULATION_NBR	Calculation number	NUMBER(3,0)
2	NAME	Calculation name	VARCHAR2(30)
3	DESCRIPTION	Calculation description	VARCHAR2(2000)
4	EXPRESSION	Expression	VARCHAR2(2000)
5	WHERE_CLAUSE	Where clause	VARCHAR2(2000)
6	DOMAIN_TYPE	Domain type	VARCHAR2(15)
7	CREATED_BY	Created by	VARCHAR2(30)
8	CREATED_DATE	Created date	DATE
9	CREATED_IN_INSTANCE	Created in instance	VARCHAR2(6)
10	MODIFIED_BY	Modified by	VARCHAR2(30)
11	MODIFIED_IN_INSTANCE	Modified in instance	VARCHAR2(6)
12	MODIFIED_DATE	Modified date	DATE

Type of key	**Column(s) order**	**Tables to link**	**Abbreviated notation**
Primary	CALCULATION_NBR	N/A	RC_PK
Unique	NAME	N/A	RC_UK

1. CALCULATION_NBR

   Calculation number. A unique numeric identifier for the calculation.

2. NAME — Calculation name. A descriptive name for the calculation.

3. DESCRIPTION

   Calculation description. A brief summary description of the calculation.

4. EXPRESSION — Expression. An expression that is used to execute the calculation. The expression is formatted to conform with standard SQL.

5. WHERE_CLAUSE

   Where clause. A SQL expression that must be included in the WHERE clause in order for the calculation to be correctly executed.

6. DOMAIN_TYPE

   Domain type. The general population component described by the calculation.

7. CREATED_BY Created by. See POPULATION.CREATED_BY description for definition.

8. CREATED_DATE

   Created date. See POPULATION.CREATED_DATE description for definition.

9. CREATED_IN_INSTANCE

   Created in instance. See POPULATION.CREATED_IN_INSTANCE description for definition.

10. MODIFIED_BY

    Modified by. See POPULATION.MODIFIED_BY description for definition.

11. MODIFIED_IN_INSTANCE

    Modified in instance. See POPULATION.MODIFIED_IN_INSTANCE description for definition.

12. MODIFIED_DATE

    Modified date. See POPULATION.MODIFIED_DATE description for definition.

7.5 Reference Sample Constraint Table (Oracle table name is REF_SAMPLE_CONSTRAINT)

The REF_SAMPLE_CONSTRAINT table contains a list of sample constraints that can be applied to any defined statistical sample. This metadata is useful for discerning the difference between various samples defined for the same population and reporting year. For example, a sample constraint of Sampled would require that every plot included in the sample is at least partially sampled. Fully nonsampled plots would be excluded. There is a close relationship between the concept of a sample constraint and evaluation type. Largely, it is the sample and its constraints that determine the evaluation type or types assigned to a given statistical evaluation. For example, if a sample is constrained by the Remeasured constraint, then every plot in the sample must be at least partially sampled at two consecutive points in time. Such a sample would support a statistical evaluation assigned to the evaluation type of GROW, which specifies it is appropriate for use in estimating population attributes pertaining to the growth of standing trees. Such estimates are only possible for remeasurement plots.

	Column name	Descriptive name	Oracle data type
1	NAME	Sample constraint name	VARCHAR2(30)
2	DESCRIPTION	Sample constraint description	VARCHAR2(2000)
3	EXPRESSION	Expression	VARCHAR2(2000)
4	CREATED_BY	Created by	VARCHAR2(30)
5	CREATED_DATE	Created date	DATE
6	CREATED_IN_INSTANCE	Created in instance	VARCHAR2(6)
7	MODIFIED_BY	Modified by	VARCHAR2(30)
8	MODIFIED_IN_INSTANCE	Modified in instance	VARCHAR2(6)
9	MODIFIED_DATE	Modified date	DATE

Type of key	Column(s) order	Tables to link	Abbreviated notation
Primary	NAME	N/A	RSC_PK

1. NAME Sample constraint name. A descriptive name for the sample constraint.

2. DESCRIPTION

   Sample constraint description. A brief summary description of the sample constraint.

3. EXPRESSION Expression. A SQL expression that enforces the constraint when placed in the WHERE clause of a SQL expression.

4. CREATED_BY Created by. See POPULATION.CREATED_BY description for definition.

5. CREATED_DATE

Created date. See POPULATION.CREATED_DATE description for definition.

6. CREATED_IN_INSTANCE

Created in instance. See POPULATION.CREATED_IN_INSTANCE description for definition.

7. MODIFIED_BY

Modified by. See POPULATION.MODIFIED_BY description for definition.

8. MODIFIED_IN_INSTANCE

Modified in instance. See POPULATION.MODIFIED_IN_INSTANCE description for definition.

9. MODIFIED_DATE

Modified date. See POPULATION.MODIFIED_DATE description for definition.

Chapter 8 – Estimation Guide

This Estimation Guide is intended to assist a user with understanding the concepts and structures involved in using the FIA stratified estimator to generate estimates of population attributes. The goal of this procedure is to compute population-level estimates of interest for each population domain of interest. This type of estimation procedure is one of the main uses of the data stored in the public database. It is not the only use. Activities such as using plot-level summaries to make descriptive maps (such as interpolated maps), or as inputs into other spatial models constitute other uses for these data and fall outside the scope of this guide.

This section of the estimation guide involves tables from the Sample Organization, Population Estimation, and Inventory Data table groups, supported by tables from the Reference table group. The procedure described in this section falls under the design-based framework of estimation and produces design-based estimates along with sampling errors. The tables from the Population Model table group require a different approach. These data are discussed in a separate section below. This section includes many example queries written in standard Oracle SQL language.

8.1 Concepts and Terms

Population: A defined geographic area for which estimates of population attributes are desired.

Domain: A subgroup of a population under study that is of particular interest, and for which separate estimates are required. Domains can be geographic, or can be defined by the properties of a particular population entity. Domains frequently cut across strata (when stratified estimation is employed).

Filter: An expression that controls which population entities (such as trees) contribute a non-zero value to an estimate and which are filtered out. Filters are frequently applied in support of a particular domain for which the user requires an independent estimate. Filters can take one of two forms. They can exist as part of the calculation expression, which applies the filter logic and decodes some entities as zero and allows others to contribute a non-zero value to a calculation. Such an expression is referred to as a *domain indicator function*. The other form is as a constraint included in the WHERE clause of the SQL statement used to fetch the record set used for estimation. In this case, records not meeting the filter requirements are simply excluded from the record set. For example, a filter can be used to constrain a population estimate to only using trees that were alive at the time of measurement (live tree domain).

Partition: A factor by which a large estimate is divided into smaller, mutually exclusive estimates of interest. Partitions are frequently based on a multi-factored population domain, such as tree species. Partitions form the column or row heading in standard tabular output. When estimation is performed, each distinct cell constitutes an independent estimate and every sampling point has the opportunity to contribute a non-zero value to the estimate. Small or rare domains typically have high sampling errors because so few sampling points observed anything within that particular domain. Unlike filters, partitions do not exclude any observation for contributing to an estimate.

Estimation Unit: A distinct subpopulation within a given population of interest that has a known area. Estimation units are defined as part of the stratification of a population. Estimation units may not overlap with any other estimation unit, and the sum of the area of all estimation units equals the area of the population. A population is first divided into estimation units, and then each estimation unit is stratified. Estimation units are declared for two main reasons. First, it is a subpopulation for which an independent estimate is desired, such as a particular park within a larger population. Second, estimation units are defined whenever there is a difference in sampling intensity between subpopulations. This constrains the difference in precision due to differing sampling intensities to the appropriate subpopulations. Estimates of the population are made by summing the totals and the variances of the totals for each estimation unit using the assumption that each estimation unit is independent.

Stratum: A non-overlapping subdivision of the population of a known area. Strata are defined with estimation units and are thought to have a predictive relationship with population attributes of interest. For example, if tree density (either numbers of trees or basal area of trees) varies by land cover, then stratifying each estimation unit by non-overlapping land covers of known (or well-estimated) areas will enhance the precision of any estimate of a population attribute that is a function of tree density, such as biomass. Sampling points are assigned to strata within estimation units during the formation of an evaluation.

Evaluation: An evaluation is the unique combination of a statistical sample, a target population, and a stratification for the purpose of producing estimates of a certain set of population attributes at a given point in time. The particular population attributes targeted by a given evaluation is a function of the statistical sample. Evaluations are a standard convention for packaging data required to produce such estimates. Evaluations are the primary entity users will engage with during estimation.

Statistical Sample: A defined set of plots (sampling points) that constitutes a representative sample of a given target population over a given period of time. Statistical samples are constrained to meet specific requirements for different evaluations. For example, a sample used as part of an evaluation for estimating the current area of a population is constrained so that only plots that are at least partially sampled are included. Plots that are completely nonsampled are excluded. But a statistical sample used as part of an evaluation for estimating change on trees is constrained such that only plots that are at least partially sampled at two consecutive points in time are included, and all other are excluded.

Stratum Adjustment: A value that is multiplied by the calculation of interest which compensates for non-response in the sample. This is done by expanding the areas or entities that were sampled by a small amount to compensate for the areas or entities that were not sampled. The adjustment factor is computed at the stratum level and is a function of the sampling points assigned to that stratum. Specifically, it is computed as the inverse of the sampling fraction; the proportion of the plot footprint that was sampled divided by the total area that was possible.

8.2 Identify the Evaluation of Interest

Evaluations are pre-packaged entities (see definition) that target one (or more) population(s). Selecting an evaluation that targets the population and attributes of interest is the first step in generating an estimate. There are multiple ways of identifying the evaluation of interest. A good way is to begin with a query such as this:

```
SELECT DISTINCT pe.evalid,
                pe.report_year,
                popn.name        popn_name,
                popn.version     popn_version,
                geo.name         geoarea_name,
                geo.description  geoarea_description
  FROM population popn, geoarea geo, pop_estn_unit peu, pop_eval pe
 WHERE pe.cn = peu.eval_cn
   AND peu.popn_cn = popn.cn
   AND peu.geoarea_cn = geo.cn
ORDER BY pe.evalid, pe.report_year, geo.name;
```

This query identifies each distinct evaluation by its EVALID and the population(s) included in the evaluation. The REPORT_YEAR indicates the time period for which the evaluation is relevant. The name and description of each geographic area is also returned, which provides a detailed description of the areas included in the evaluation. These results can be examined and candidate evaluations can be identified based on the criteria of a target population and time period.

Once one or a small number of candidate evaluations has been selected they can be examined in more detail by executing a query such as the following. Note that the user provides a specific EVALID in question in the place indicated by the bold font.

```
SELECT pe.evalid,
       pe.name,
       pe.report_year,
       pe.description      eval_description,
       peta.eval_type_name,
       r.description       type_description
  FROM pop_eval pe, pop_eval_type_assgn peta, ref_pop_eval_type r
 WHERE PE.EVALID = 'USER_PROVIDED_EVALID'
   AND pe.cn = peta.eval_cn
   AND peta.eval_type_name = r.name
 ORDER BY pe.evalid, peta.eval_type_name;
```

Results from this query provide details of the evaluation type or types assigned to the evaluation. These types indicate what the supported set of population attributes are. Table 8.1 provides a description of evaluation types. Note that evaluation types are also defined in REF_POP_EVAL_TYPE. The analyst should review the associated evaluation types and select the evaluation associated with the type of interest. For example, if the analyst is interested in an estimate of the area of different domains of the population, then they would select the candidate evaluation associated with the CURR evaluation type.

Table 8.1 – Description of evaluation types

EVAL_TYPE	DESCRIPTION
CURR	Evaluation is appropriate for use in estimating the current area of the population or domains of the population.
VOL	Evaluation is appropriate for use in estimating the current volume, biomass, carbon or other similar attributes of standing trees.
GROW	Evaluation is appropriate for use in estimating the growth of standing trees.
REMV	Evaluation is appropriate for use in estimating removal of standing trees.
MORT	Evaluation is appropriate for use in estimating the mortality of standing trees.
DWM	Evaluation is appropriate for use in estimating quantities of down woody material.
REGEN	Evaluation is appropriate for use in estimating regeneration of forests.
CHNG	Evaluation is appropriate for use in estimating area change.
ALL	Evaluation is appropriate for use in estimating total area of the population and response rates of the sample.

8.3 Identify the Attribute of Interest

Once the evaluation type or types have been determined for a candidate evaluation, population attributes associated with each type can be examined by executing a simple query.

```
SELECT r.attribute_nbr,
       r.calculation_nbr,
       r.name,
       r.description,
       r.adjustment,
       r.eval_type,
       r.domain_type
  FROM ref_pop_attribute r
 WHERE r.eval_type = 'USER_PROVDED_EVAL_TYPE';
```

Results show the attributes associated with a user-provided evaluation type, along with supporting information. The CALCULATION_NBR identifies the calculation to be performed to estimate the selected population attribute. The ADJUSTMENT expression shows the adjustment to the calculation required to adjust for non-response within the stratum. This expression must be included in the calculation to achieve an adjusted value at the population level. The DOMAIN_TYPE shows the type of domain being estimated by the population attribute. After reviewing the list of associated population attributes, the analyst can select which candidate evaluation meets their requirements.

Recall that the content of the REF_POP_ATTRIBUTE table is not an exhaustive list. It is a list of the standard attributes included in a typical report. Analysts are free to compute additional population attributes provided they select the most appropriate evaluation for the purpose. For example, if the attribute is a function of trees but not listed in REF_POP_ATTRIBUTE, an evaluation with a VOL type should be used. If the attribute is an area estimate, an evaluation with a CURR type is appropriate.

8.4 Determine the Domain Filter

The attributes defined in REF_POP_ATTRIBUTE are generic and estimate coarse population totals. Analysts are commonly interested in focusing the results for a specific population domain, such as estimating only live trees, or trees of a specific size range. Population entities (such as trees) that do not meet the filter requirements are excluded from estimation.

Common domains used in standard reporting can be identified by querying the REF_POP_DOMAIN table, as shown below.

```
SELECT r.name, r.description, r.expression, r.domain_type
  FROM ref_pop_domain r;
```

The results provide the name of the population domain as well as the expression required to implement a filter for this domain. The domain type is also provided. The expression can be used in the WHERE clause of a SQL statement, which will exclude records not meeting the filter requirements, or as part of a domain indicator function implemented as part of the calculation itself. When working with SQL, it is often easier to exclude records by adding the expression to the WHERE clause.

The list of population domains provided in REF_POP_DOMAIN is not exhaustive. There are many domains that may be of interest to a particular analysis that are not included in the reference data. Analysts are free to declare any domain filter that may be needed and are not limited to those provided. Ideas for potential domain filters can be generated by examining the descriptions of the tables in the Inventory Data Table Group; particularly the TREE table.

It is important to note that domain filters can be applied to any aspect of an estimate. For example, if attribute number 9 (Total Trees) is selected, the analyst may choose to apply a tree filter and limit the results to only live trees. A land filter, however, may also be used to further focus the estimate to live trees measured on a particular land use, for example. In other words, the land on which the tree was measured can also be filtered.

8.5 Determine the Domain Partition

Once the evaluation, attribute, and domain filters have been identified, then the decision on how to partition the estimate must be made. In some cases, no domain partition is needed. In most cases, however, it is desirable for the estimate to be partitioned into meaningful and descriptive categories according to one or more population domains. These domains form the column and row headings on standard tabular output. Most report tables have several row and column headings with sub- and grand-totals available at the row and/or column margins. Note that, unlike domain filters, domain partitions simply divide the estimates into smaller pieces but do not exclude any records from the estimate.

There is no reference table that provides a list of standard domain partitions. It is left to the analyst to review the available factors by reviewing the Inventory Data Table Group and determining what domain partition, if any, is most meaningful for the current analysis. Common partitions include tree species or species group, diameter classes of various widths, and tree status.

8.6 Tying it All Together

Following the determination of the evaluation, the population attribute, and the domain filters and partitions, the analyst can assemble all these components and compute the desired estimate. The following explanation is presented in standard Oracle SQL. The concepts will be explained so that analysts employing different software can adapt to the concepts as needed.

The calculation of a population using the FIA standard stratified estimator (see GTR SRS-80 chapter 4) involves several steps. Because of this, it results in a rather lengthy SQL statement. But this statement can be broken down into logical blocks that serve a specific purpose. Below is a description of the various steps in the calculation. Each block is named and associated with a different color.

1. Compute Plot Summary: Compute the desired value and sum to the plot level for each domain partition of interest
   1.1. Each plot has a chance to contribute a value in each domain partition
2. Compute Plot-Stratum Summary: Compute the sufficient statistics for each domain partition
   2.1. Sufficient statistics for the stratified estimator for population totals and means are the sum of x, the sum of x^2, and n_h (the sample size in each stratum), where ‘x’ is the plot-level value being calculated. The n_h statistic, however, is provided by the Stratification Summary Statistics portion of the calculation.
   2.2. The number of non-zero plots, though not a sufficient statistic, can be useful in interpreting the output and can be included in this step
3. Compute the Stratification Summary Statistics:

3.1. Stratification summary statistics are derived from the stratification data and include the total area of the population, the area of each estimation unit, the stratum weights, the total sample size, and the sample size in each stratum.

4. Estimation Unit Summary:

4.1. Combine the Stratification Summary Statistics and Plot-Stratum summaries to compute a population value for each estimation unit and domain partition

5. Population Summary:

5.1. Sum across each estimation unit for each domain partition and express the final estimate in the desired format

8.6.1 Plot Summary Query

```
--This subquery produces an adjusted, plot-level
 --estimate of the variable of interest for each
 --pop_stratum and domain of interest.
  (SELECT strat.cn   strat_cn,
          strat.name strat_name,
          p.cn       plt_cn,
          --domains would go here and in the group by
          1 plt_cnt,
          SUM(USER_PROVIDED_CALCULATION *
              USER_PROVIDED_ADJUSTMENT) x
     FROM pop_eval              eval,
          pop_stat_samp         samp,
          pop_estn_unit         eu,
          pop_stratum           strat,
          plot_statsamp_assgn sampassgn,
          plot_strat_assgn      stratassgn,
          plot                  p
    WHERE eval.evalid = 'USER_PROVIDED_EVALID'
      AND eval.cn = samp.eval_cn
      AND samp.cn = sampassgn.pss_cn
      AND sampassgn.plt_cn = p.cn
      AND p.cn = stratassgn.plt_cn
      AND stratassgn.strat_cn = strat.cn
      AND strat.estn_unit_cn = eu.cn
      AND eu.eval_cn = eval.cn
    GROUP BY strat.estn_unit_cn,
             strat.cn,
             strat.name,
             p.cn,
             1) plot_sum
```

The above sample query is an example of a plot summary. The user provides the calculation expression (USER_PROVIDED_CALCULATION) and the stratum adjustment expression

(USER_PROVIDED_ADJUSTMENT). The user also must provide the identity of the evaluation (USER_PROVIDED_EVALID). The query includes not only the PLOT table from the Inventory Data Table Group, but also tables from the Population Estimation Table Group. The later tables are required in order to identify the correct sample as well as to associate each plot with its assigned stratum under the current evaluation. Calculation of various population attributes by various domain partitions will require additional tables to be added to the FROM clause and joined together in the WHERE clause.

The WHERE clause of this statement has two functions. First, all the tables involved must be correctly joined. Second, it is the location of any domain filters that constrain the resulting records to only those of interest to the analysis.

The SELECT statement is where the actual calculation occurs using the records that meet all the filters that were applied in the WHERE clause. It is critical that the stratum CN value (which is unique to each individual stratum record) be included in the results. It is also critical that the plot CN value be included. The goal is to sum the calculation of interest to the plot level and to associate each plot-level summary (with in any domain partition) with the appropriate stratum. Any domain partitions desired are included in this SELECT statement anywhere below the comment (--domains would go here and in the group by). If any domain partitions are used, they must be specified both in the SELECT statement as well as in the GROUP BY clause at the end of the SQL statement. The GROUP BY clause forces SQL to sum everything not declared in the GROUP BY statement. Anything not included in the GROUP BY clause should be a calculation to be summed.

8.6.2 Plot-Stratum Summary Query

```
( --This subquery computes the sum of x and x^2
 --for each pop_stratum and domain of interest.
 SELECT strat_cn,
        strat_name,
        --domains would go here and in the group by
        SUM(x) sum_x,
        SUM(x * x) sum_x2,
        SUM(decode(nvl(x, 0), 0, 0, 1)) non_zero_plt_cnt
   FROM (PLOT SUMMARY QUERY)
  GROUP BY strat_cn, strat_name) strat_sum
```

The *plot-stratum summary query* is a wrapper query around the *plot summary query* (above). This means the record set returned by the *plot summary query* is treated as a table in the FROM clause of the *plot-stratum summary query*. The plot-stratum summary query simply computes the sufficient statistics of the sum of x and x^2, plus it computes the number of plots that contribute a non-zero value to each domain partition. This last item is not strictly required but can be useful when interpreting the output.

Any domain partitions declared in the *plot summary query* (above) should be repeated both in the SELECT and GROUP BY clauses of the *plot-stratum summary query*. It is common to use an alias when defining a domain partition in the *plot summary query*, particularly if the domain partition is the result of a function. The *plot-stratum summary* will use whatever alias is defined in the *plot summary query* as the name of the domain partition. This results in the sufficient statistics being computed for each domain within each stratum.

The resulting record set is the first piece of data required for population estimation. This will be combined with the Stratification Summary Statistics, which provides information about the stratification of the population under the current evaluation.

8.6.3 Stratification Summary Statistics Query

```
             --This subquery returns the stratification summary statistics
                 --used to support stratified estimation.
                 SELECT pop.name popn_name,
                         pop.version popn_version,
                         eu.cn estn_unit_cn,
                         geo.name est_unit_name,
                         strat.cn strat_cn,
                         strat.name strat_name,
                         strat.description,
                         strat.area strat_acres,
                         (SELECT SUM(area)
                            FROM pop_stratum strat2
                           WHERE strat2.estn_unit_cn = eu.cn) total_acres,
                         strat.area /
                         (SELECT SUM(area)
                            FROM pop_stratum strat2
                           WHERE strat2.estn_unit_cn = eu.cn) w_h,
                         (SELECT COUNT(psa.plt_cn)
                            FROM plot_strat_assgn    psa,
                                 plot_statsamp_assgn pssa,
                                 pop_stat_samp       samp,
                                 plot                p
                           WHERE psa.strat_cn = strat.cn
                             AND samp.eval_cn = eval.cn
                             AND pssa.pss_cn = samp.cn
                             AND pssa.plt_cn = p.cn
                             AND psa.plt_cn = p.cn) n_h,
                         (SELECT COUNT(pssa.plt_cn)
                            FROM plot_statsamp_assgn pssa, pop_stat_samp samp
                           WHERE samp.eval_cn = eval.cn
                             AND pssa.pss_cn = samp.cn) n
                   FROM pop_eval      eval,
                         pop_estn_unit eu,
                         pop_stratum   strat,
                         geoarea       geo,
                         population    pop
                  WHERE eval.evalid = 'USER_PROVIDED_EVALID'
                    AND eval.cn = eu.eval_cn
                    AND eu.cn = strat.estn_unit_cn
                    AND eu.geoarea_cn = geo.cn
                    AND eu.popn_cn = pop.cn) strat_sum_stat,
```

The stratification summary statistics query returns critical information about the stratification of the population employed by the current evaluation. The current evaluation is provided by the user and is entered in place of USER_PROVIDED_EVALID. This query is the first place where the estimation unit is used. Each estimation unit is uniquely identified by its CN value. Each estimation unit is divided into one or more strata. The stratification summary statistics query must produce the total area of the population, the strata weight of each stratum (computed as the ratio of the stratum area over the total area), n_h (sample size per stratum), and n (the total sample size). Note that both n_h and n are computed as part of the stratification summary statistics summary and are not part of the plot summary or the plot-stratum summary. This is a more reliable method when using SQL due the complexities introduced by domain filters and partitions. Note that some of these outputs are produced using nested subqueries within the SELECT statement. This is a powerful technique supported by Oracle SQL that relies on careful use of table aliases.

The sample script above does include a few more items in the output than are strictly required, such as the strata name and descriptions. The purpose of these additional items is to provide an easy way to review the stratification summary statistics by executing this query alone.

The resulting record set is the second piece of data required for population estimation and is combined with the plot-stratum summary, which provides the sufficient statistics for each domain within each stratum derived from the inventory data.

8.6.4 Estimation Unit Summary Query

```
( --This subquery produces population estimates
        --for each estimation unit defined by the evaluation.
        SELECT  strat_sum_stat.strat_sum_stat.popn_name,
                strat_sum_stat.strat_sum_stat.popn_version,
                strat_sum_stat.strat_sum_stat.estn_unit_cn,
                strat_sum_stat.strat_sum_stat.est_unit_name,
                SUM(sum_x / strat_sum_stat.strat_sum_stat.n_h *
(strat_sum_stat.strat_sum_stat.total_acres) *
strat_sum_stat.strat_sum_stat.w_h) estimate,
                strat_sum_stat.strat_sum_stat.n plt_cnt,
                SUM(strat_sum.non_zero_plt_cnt) non_zero_plt_cnt,
                strat_sum_stat.strat_sum_stat.total_acres,
                (power(total_acres, 2) / strat_sum_stat.strat_sum_stat.n) *
                ((SUM(strat_sum_stat.strat_sum_stat.w_h *
strat_sum_stat.strat_sum_stat.n_h *
                      (((strat_sum.sum_x2 /
strat_sum_stat.strat_sum_stat.n_h) -
                      (strat_sum.sum_x / strat_sum_stat.strat_sum_stat.n_h *
strat_sum.sum_x /
                      strat_sum_stat.strat_sum_stat.n_h)) /
(strat_sum_stat.strat_sum_stat.n_h - 1)))) +
                1 / strat_sum_stat.strat_sum_stat.n *
                (SUM((1 - strat_sum_stat.strat_sum_stat.w_h) *
strat_sum_stat.strat_sum_stat.n_h *
                      (((strat_sum.sum_x2 /
strat_sum_stat.strat_sum_stat.n_h) -
                      (strat_sum.sum_x / strat_sum_stat.strat_sum_stat.n_h *
```

```
strat_sum.sum_x /
                      strat_sum_stat.strat_sum_stat.n_h)) /
(strat_sum_stat.strat_sum_stat.n_h - 1))))) var_estimate
          FROM (STRAT_SUMMARY_STATS) strat_sum_stat,
(STRATUM_SUMMARY)strat_sum
         WHERE strat_sum_stat.strat_sum_stat.strat_cn = strat_sum.strat_cn(+)
         GROUP BY strat_sum_stat.strat_sum_stat.popn_name,
                   strat_sum_stat.strat_sum_stat.popn_version,
                   strat_sum_stat.strat_sum_stat.estn_unit_cn,
                   strat_sum_stat.strat_sum_stat.est_unit_name,
                   strat_sum_stat.strat_sum_stat.total_acres,
                   strat_sum_stat.strat_sum_stat.n) est_unit_sum
```

The estimation unit summary query treats the stratification summary statistics query and the plot-stratum summary query like tables in the FROM clause. The record set output by the *stratification summary statistics query* (STRAT_SUMMARY_STATS) is aliased by strat_sum_stat, and the record set output by the *plot-stratum summary query* (STRATUM_SUMMARY) is aliased with strat_sum. These are arbitrary names that allow the joins between these two record sets to be made more easily. The two record sets are joined through the stratum CN value (which is included in both record sets) using an outer join (+) on the plot-stratum summary record set. The reason for the outer join is to include a stratum even when there are no non-zero values for that stratum due to domain filters or partitions, but the stratum must still be accounted for.

The SELECT clause must include the CN value for the estimation unit. The example script above includes other information that can be useful when working with the estimation unit estimates directly, such as the population name, the version, and the estimation unit name. Any such items in addition to the estimation unit CN must also be declared in the GROUP BY clause. Note that the total acres of the population and the total sample size (n) are included in the GROUP BY because these variables occur at or above the level of an estimation unit. Anything not included in the GROUP BY must be part of a calculation, which is summed to the estimation unit level. Any domain partitions declared in the *plot summary query* and carried through the *plot-stratum summary query* should also be included in both this SELECT clause and the GROUP BY clause. This results in domain partition estimates within each estimation unit.

The SELECT clause of this query is where the first population-level estimates are computed. The FIA stratified estimator (described in Chapter 4 of GTR SRS-80) is used here to compute the population total and the variance of the population total for each estimation unit in the population. The following statement computes the population total estimate:

```
SUM(sum_x / strat_sum_stat.n_h * (strat_sum_stat.total_acres) *
strat_sum_stat.w_h) estimate,
```

This expression is simply the stratum mean multiplied by the total area of the population multiplied by the stratum weight. For area estimates, the units for the stratum mean should be a unitless proportion. Therefore, when multiplied by the total population acres and a unit-less stratum weight it yields an estimate in acres. For estimates for tree-level population attributes, the stratum mean should be in per acre units (e.g., biomass per acre). When multiplied by the total population acres and a unitless stratum weight, it yields a population total (e.g., biomass in whatever units it was expressed).

The following expression computes the estimate of the variance of the population total:

```
(power(total_acres, 2) / strat_sum_stat.n) *
((SUM(strat_sum_stat.w_h * strat_sum_stat.n_h *
(((strat_sum.sum_x2 / strat_sum_stat.n_h) -
(strat_sum.sum_x / strat_sum_stat.n_h * strat_sum.sum_x /
strat_sum_stat.n_h)) / (strat_sum_stat.n_h - 1)))) +
1 / strat_sum_stat.n *
(SUM((1 - strat_sum_stat.w_h) * strat_sum_stat.n_h *
(((strat_sum.sum_x2 / strat_sum_stat.n_h) -
(strat_sum.sum_x / strat_sum_stat.n_h * strat_sum.sum_x /
strat_sum_stat.n_h)) / (strat_sum_stat.n_h - 1))))) var_estimate
```

This expression is based on equation 4.6 from GTR SRS-80. It is composed of the square of the population total area multiplied by the sum of two terms. The first term is essentially the stratum variance weighted by the stratum weight. This term assumes proportional allocation of the sample across strata. This assumption is usually a good one under the FIA sampling procedures unless the area being sampled is very small or has a very linear or irregular distribution across the landscape. The second term reflects the fact that the sample sizes per stratum are not fixed but rather random. This approximation of the variance of the population total is considered to be conservative.

In addition to the population total and the variance of the population total, the number of non-zero plots per domain partition is also computed. While not required, it can be helpful when interpreting the output.

The output of the *estimation unit summary query* is a population-level estimate (and variance estimate) for each domain partition within each estimation unit. These data are used by the final query to produce the final population-level estimate.

8.6.5 Population Summary Query

```
--This outer query sums the estimates of all estimation units
--defined by the evaluation and computes the final estimates
--and sampling error.
SELECT popn_name,
       popn_version,
       SUM(estimate) estimate,
       CASE
         WHEN SUM(est_unit_sum.var_estimate) > 0 THEN
          round(sqrt(SUM(est_unit_sum.var_estimate)) /
                SUM(est_unit_sum.estimate) * 100,
                3)
         ELSE
          0
       END AS se_of_estimate_pct,
       SUM(est_unit_sum.var_estimate) var_of_estimate,
       sqrt(SUM(est_unit_sum.var_estimate)) se_of_estimte,
       plt_cnt total_plots,
       SUM(non_zero_plt_cnt) total_non_zero_plots,
       total_acres total_acres
  FROM (ESTIMATION_UNIT_SUMMARY) est_unit_sum
GROUP BY popn_name, popn_version, total_acres, plt_cnt;
```

The *population summary query* is the final query when producing an estimate of a population attribute. It uses the *estimation unit summary query* (ESTIMATION_UNIT_SUMMARY) as a table in the FROM clause. Therefore, the only items that can be included in the output of the query must be included in the *estimation unit summary query*. This includes items such as the population name and version. All such items must also be declared in the GROUP BY clause. The SELECT clause must include any domain partitions that have been carried through the entire calculation procedure. Any domain partitions must also be included in the GROUP BY clause. Anything not included in the GROUP BY clause must be part of a calculation.

The assumption made by this method is that the estimation units are independent and therefore estimates of the population total and variance of the population total can be summed without having to compute a covariance. The population total estimates for all estimation units in the population are simply summed using the expression:

```
SUM(estimate) estimate,
```

The sampling error (expressed as a percentage of the estimate) is computed using the expression:

```
CASE
  WHEN SUM(est_unit_sum.var_estimate) > 0 THEN
   round(sqrt(SUM(est_unit_sum.var_estimate)) /
         SUM(est_unit_sum.estimate) * 100,
         3)
  ELSE
   0
END AS se_of_estimate_pct,
```

Note that this expression is using a CASE statement. This allows the code to check that there is a non-zero estimate for the domain of interest before attempting to divide by that estimate. This simply prevents a divide-by-zero error from being thrown during execution.

The variance of the population total is computed using the expression:

```
SUM(est_unit_sum.var_estimate) var_of_estimate,
```

This simply sums the estimation unit estimates of the variance of the population total under the assumption of independence.

The sample error expressed in the units of the estimate is computed as:

```
sqrt(SUM(est_unit_sum.var_estimate)) se_of_estimte,
```

Finally, the number of non-zero plots within each domain partition is computed as:

```
SUM(non_zero_plt_cnt) total_non_zero_plots,
```

Note that the n (total_plots) and the total acres of the population are not computed, but rather carried from the *stratification summary statistics query*, through the *estimation unit summary query*, and finally to the *population summary query*.

The output for this query is a population total (with sampling error and variance) for each domain partition defined.

8.7 Population Means

The above description results in an estimate of a population total. If a population mean is preferred, then some simple adjustments must be made. These changes occur in the *Population Summary query*. First, the calculation for the population total must be altered as follows:

```
            SUM(estimate/total_acres) estimate,
```

This adjustment simply divides by the total acres of the population (strat_sum_stat.total_acres). Here, the total area of the population is a known constant, not a random variable. Dividing by the total area converts the population total to an estimate of the population mean. In the case of a tree-level population attribute, the mean is expressed in per acre units. In the case of an area estimate, the mean is expressed as a unit-less proportion.

Second, the calculation of the sampling error expressed as a percent must be altered as follows:

```
    CASE
       WHEN SUM(est_unit_sum.var_estimate) > 0 THEN
        round(sqrt(SUM(est_unit_sum.var_estimate/power(total_acres,2))) /
              SUM(est_unit_sum.estimate/total_acres) * 100,
              3)
       ELSE
        0
     END AS se_of_estimate_pct,
```

In this expression, the variance of the total is divided by the squared total area of the population (power(total_acres,2). Since this calculation expresses the sampling error in terms of percent, the population total must also be converted to a population mean by dividing by the total acres of the population. The result is the sampling error of the mean expressed as a percentage of the estimate.

The *Population Summary Query* also produces an estimate of the variance. This is similarly adjusted by dividing by the squared total area of the population as shown below:

```
      SUM(est_unit_sum.var_estimate/power(total_acres,2)) var_of_estimate,
```

The sampling error expressed in the units of the estimate must also be adjusted in the same way as shown here:

```
      sqrt(SUM(est_unit_sum.var_estimate/power(total_acres,2))) se_of_estimte,
```

The above adjustments simply remove the total area constant during the final step of the calculation. Because the total area is considered a known constant, this is not a ratio estimate. If the desired output is expressed in units of something other than this known area, however, then a ratio estimate is required. For example, if instead of the mean trees per acre the analyst required mean trees per acre of public land, then a ratio estimator is required. This is because acres of public land is not a known constant and must be estimated by the data.

Note that while all calculations of means of population attributes are possible, not all of them are meaningful. The analyst must decide what is useful and what is not.

8.8 Ratio Estimates

There are times when an analysis calls for estimating the ratio of two random variables. For example, an estimate of the total number of trees per acre of privately-owned land is the ratio of two values that are unknown and must be estimated. When this is done, the estimate of the variance of the ratio is more complex than the standard variance estimation calculation. It must account for the covariance between the numerator and the denominator. To accomplish this, the sufficient statistics of the sum of x, x^2, y, y^2 and xy (cross products) must be computed for each domain partition within each stratum where x represents the denominator and y represents the numerator random variable. When this type of analysis is performed, the analyst must think carefully about the domain filters and domain partitions desired. The filters could be different for the numerator and denominator, but the domain partitions should be the same so that they are partitioned across the same domain categories.

The calculation required to achieve this type of population attribute estimate is longer and more complex. Like the above population-attribute estimate query, it can be broken down into identifiable steps. The following discussion will break down the necessary steps in a ratio calculation using similar color coding.

1. Compute the Denominator Plot Summary: Compute the desired value and sum to the plot level for each domain partition of interest
   1.1. Each plot has a chance to contribute a non-zero value to each domain

2. Compute the Numerator Plot Summary: Compute the desired value and sum to the plot level for each domain partition of interest
   2.1. Each plot has a chance to contribute a non-zero value to each domain

3. Compute the Plot Counts: Compute the total number of plots per stratum
   3.1. Assists with joining the denominator and numerator record sets

4. Compute the Plot-Stratum Summary: Compute the sufficient statistics for each domain partition
   4.1. Sufficient statistics for the stratified estimator for population ratios are the sum of x, the sum of x^2 for the denominator, sum of y, sum of y^2 for the numerator, sum of xy (cross product) and n_h (the sample size in each stratum. The n_h statistic, however, is provided by the stratification summary statistics portion of the calculation.
   4.2. The number of non-zero plots for both the numerator and denominator, though not a sufficient statistic, can be useful in interpreting the output and can be included in this step.

5. Compute the Stratification Summary Statistics:
   5.1. Stratification summary statistics are derived from the stratification data and include the total area of the population, the area of each estimation unit, the stratum weights, the total sample size, and the sample size in each stratum.

6. Compute the Estimate Summary:
   6.1. Combine the stratification summary statistics and plot-stratum summaries to compute a population ratio value for the entire population.
   6.2. It is also useful to produce the numerator and denominator estimates at the same time along with estimates of variance and sampling error

7. Summarize Final Estimate:
   7.1. Express variances as sampling errors for final summary

8.8.1 Denominator Plot Summary Query

```
                         --This subquery produces an adjusted, plot-level
                         --estimate of the variable of interest for each
                         --stratum and domain of interest for the demoninator
                         (SELECT strat.cn   strat_cn,
                                 strat.name strat_name,
                                 p.cn       plt_cn,
                                 --domains would go here and in the group by
                                 1 plt_cnt,
                                 SUM(USER_PROVIDED_CALCULATION *
                                      USER_PROVIDED_ADJUSTMENT) x
                            FROM pop_eval eval,
                                 statistical_sample     samp,
                                 estimation_unit        eu,
                                 stratum                strat,
                                 plot_statsamp_assgn    sampassgn,
                                 plot_strat_assgn       stratassgn,
                                 plot                   p
                           WHERE eval.evalid = 'USER_PROVIDED_EVALID'
                             AND eval.cn = samp.stat_eval_cn
                             AND samp.cn = sampassgn.pss_cn
                             AND sampassgn.plt_cn = p.cn
                             AND p.cn = stratassgn.plt_cn
                             AND stratassgn.strat_cn = strat.cn
                             AND strat.estn_unit_cn = eu.cn
                             AND eu.stat_eval_cn = eval.cn
                           GROUP BY strat.estn_unit_cn,
                                    strat.cn,
                                    strat.name,
                                    p.cn,
                                    1) x_plot_sum
```

The above sample query is an example of a denominator plot summary query. The user provides the calculation expression (USER_PROVIDED_CALCULATION) and the stratum adjustment expression (USER_PROVIDED_ADJUSTMENT). The user also must provide the identity of the evaluation (USER_PROVIDED_EVALID). The query includes not only the PLOT table from the Inventory Data Table Group, but also tables from the Population Estimation Table Group. The later tables are required in order to identify the correct sample as well as to associate each plot with its assigned stratum under the current evaluation. Calculation of various population attributes by various domain partitions will require that additional tables be added to the FROM clause and joined together in the WHERE clause.

The SELECT statement is where the actual calculation occurs using the records that meet all the filters that were applied in the WHERE clause. It is critical that the stratum CN value (which is unique to each individual stratum record) be included in the results. It is also critical that the plot CN value be included. The goal is to sum the calculation of interest to the plot level and to associate each plot-level summary (within any domain partition) with the appropriate stratum. Any domain partitions desired are included in this SELECT statement anywhere below the comment (--domains would go here and in the group by). If any domain partitions are used, they must be specified both in the SELECT statement as well as in the GROUP BY clause at the end of the SQL statement. The GROUP BY clause forces SQL to sum everything not declared in the GROUP BY statement. Anything not included in the GROUP BY clause should be a calculation to be summed.

8.8.2 Numerator Plot Summary Query

```
                         --This subquery produces an adjusted, plot-level
                         --estimate of the variable of interest for each
                         --stratum and domain of interest for the numerator
                         (SELECT strat.cn   strat_cn,
                                 strat.name strat_name,
                                 p.cn       plt_cn,
                                 --domains would go here and in the group by
                                 1 plt_cnt,
                                 SUM(nvl(t.tpa_unadj, 0) * t.carbon_storage *
                                     0.453592 *
                                     decode(t.subp,
                                            1,
                                            strat.adj_factor_subp,
                                            strat.adj_factor_micr)) y
                            FROM pop_eval eval,
                                 statistical_sample     samp,
                                 estimation_unit        eu,
                                 stratum                strat,
                                 plot_statsamp_assgn    sampassgn,
                                 plot_strat_assgn       stratassgn,
                                 plot                   p
                           WHERE eval.evalid = 'Austin2014Curr'
                             AND eval.cn = samp.stat_eval_cn
                             AND samp.cn = sampassgn.pss_cn
                             AND sampassgn.plt_cn = p.cn
                             AND p.cn = stratassgn.plt_cn
                             AND stratassgn.strat_cn = strat.cn
                             AND strat.estn_unit_cn = eu.cn
                             AND eu.stat_eval_cn = eval.cn
```

```
                         GROUP BY strat.estn_unit_cn,
                                  strat.cn,
                                  strat.name,
                                  p.cn,
                                  1) y_plot_sum,
```

The *numerator summary query* has the same structure and function as the *denominator summary query* except that the values returned will be used as the numerator of the ratio calculation in a later step of the calculation.

8.8.3 Plot Count Query

```
(--This subquery computes the simple count of plots per each
                         --stratum and domain of interest.
                          SELECT strat.cn   strat_cn,
                                 strat.name strat_name,
                                 p.cn       plt_cn,
                                 1 plt_cnt
                            FROM pop_eval eval,
                                 statistical_sample     samp,
                                 estimation_unit        eu,
                                 stratum                strat,
                                 plot_statsamp_assgn    sampassgn,
                                 plot_strat_assgn       stratassgn,
                                 plot                   p
                           WHERE eval.evalid = 'Austin2014Curr'
                             AND eval.cn = samp.stat_eval_cn
                             AND samp.cn = sampassgn.pss_cn
                             AND sampassgn.plt_cn = p.cn
                             AND p.cn = stratassgn.plt_cn
                             AND stratassgn.strat_cn = strat.cn
                             AND strat.estn_unit_cn = eu.cn
                             AND eu.stat_eval_cn = eval.cn
                           GROUP BY strat.estn_unit_cn,
                                    strat.cn,
                                    strat.name,
                                    p.cn,
                                    1) all_plot_sum,
```

The plot count query has the same basic structure as both the numerator and denominator summary queries. The purpose of this query, however, is simply to return a list of all the plots in the sample. This is used to join the numerator and denominator results so that no plots are left out of the estimate due to a problem with the joining of records. It is not necessary to declare any domain filters or domain partitions in this query. It serves a merely mechanical purpose.

8.8.4 Plot-Stratum Summary Query

```
( --This subquery computes sufficient statistics of the sum of y, y^2, x,
x^2, and xy (crossproduct)
```

```
                  --for each stratum and domain of interest.
                  SELECT all_plot_sum.strat_cn,
                          all_plot_sum.strat_name,
                          --domains would go here and in the group by
                          SUM(y) sum_y,
                          SUM(y * y) sum_y2,
                          SUM(x) sum_x,
                          SUM(x * x) sum_x2,
                          SUM(x * y) sum_xy,
                          SUM(decode(nvl(y, 0), 0, 0, 1)) non_zero_y_cnt,
                          SUM(decode(nvl(x, 0), 0, 0, 1)) non_zero_x_cnt
                    FROM (PLOT_COUNT_QUERY) ALL_PLOT_SUM,
                         (NUMERATOR_SUMMARY_QUERY) y_plot_sum,
                         (DENOMINATOR_SUMMARY_QUERY) x_plot_sum
                   WHERE all_plot_sum.plt_cn = x_plot_sum.plt_cn(+)
                     AND all_plot_sum.plt_cn = y_plot_sum.plt_cn(+)
                   GROUP BY all_plot_sum.strat_cn, all_plot_sum.strat_name)
strat_sum
```

The *plot-stratum summary query* is a wrapper query that uses the results of the *plot count query*, *numerator summary query*, and *denominator summary query* as tables in the FROM clause. As with any multi-table query, the contributing tables must be joined properly. This is where the *plot count summary query* is used. Both the *numerator and denominator summary scripts* are joined to the plot count summary results through the plot CN in the WHERE clause.

The sufficient statistics for the ratio estimator are calculated in the SELECT clause. These include the sum and sum or squares for the numerator (y & y^2 respectively), the sum and sum of squares for the denominator (x & x^2 respectively), as well as the sum of the cross products (xy). In addition to these, the query computes the number of non-zero observations within each domain partition within each stratum. These are not strictly required, but can be useful when interpreting the output.

Any domain partitions defined in the numerator and denominator summary queries should also be declared in the SELECT and GROUP BY clauses of the *plot-stratum summary query*. It is common to use an alias when defining a domain partition in the numerator and denominator summary queries, particularly if the domain partition is the result of a function. The plot-stratum summary query will use whatever alias is defined by these other queries as the name of the domain partition. The results of the query include the sufficient statistics and non-zero observations for every domain partition within each stratum of the current evaluation. This result is the first piece of data required for population ratio estimation. This is combined with the stratification summary statistics, which provides information about the stratification of the population under the current evaluation.

8.8.5 Stratification Summary Statistics Query

The *stratification summary statistics query* used for the ratio estimate is identical to the one use for normal population attribute estimates. See the above section for a full description.

8.8.6 Estimate Summary Query

```
( --This subquery produces the population ratio estimate
        --and estimates of variance for the entire population.
  SELECT strat_sum_stat.popn_name,
          strat_sum_stat.popn_version,
          --est_unit_name,
          CASE
            WHEN SUM(nvl(sum_x, 0)) = 0 THEN
             999999999999
            ELSE
             SUM(sum_y / strat_sum_stat.n_h * (strat_sum_stat.total_acres) *
                 strat_sum_stat.w_h) /
             SUM(sum_x / strat_sum_stat.n_h * (strat_sum_stat.total_acres) *
                 strat_sum_stat.w_h)
          END estimate,
          SUM(sum_y / strat_sum_stat.n_h * (strat_sum_stat.total_acres) *
                strat_sum_stat.w_h) estimate_numerator,
          SUM(sum_x / strat_sum_stat.n_h * (strat_sum_stat.total_acres) *
                strat_sum_stat.w_h) estimate_denominator,
          strat_sum_stat.n plt_cnt,
          SUM(strat_sum.non_zero_y_cnt) non_zero_num_plt_cnt,
          SUM(strat_sum.non_zero_x_cnt) non_zero_den_plt_cnt,
          strat_sum_stat.total_acres,

         (1 / power(SUM(sum_x / strat_sum_stat.n_h *
            (strat_sum_stat.total_acres) *
             strat_sum_stat.w_h),
                    2)) *
         (((power(total_acres, 2) / strat_sum_stat.n) *
         ((SUM(strat_sum_stat.w_h * strat_sum_stat.n_h *
                 (((strat_sum.sum_y2 / strat_sum_stat.n_h) -
                 (strat_sum.sum_y / strat_sum_stat.n_h * strat_sum.sum_y /
                 strat_sum_stat.n_h)) / (strat_sum_stat.n_h - 1)))) +
         1 / strat_sum_stat.n *
         (SUM((1 - strat_sum_stat.w_h) * strat_sum_stat.n_h *
                 (((strat_sum.sum_y2 / strat_sum_stat.n_h) -
                 (strat_sum.sum_y / strat_sum_stat.n_h * strat_sum.sum_y /
                 strat_sum_stat.n_h)) / (strat_sum_stat.n_h - 1)))))) +
                          --var(yhat)
       power(SUM(sum_y / strat_sum_stat.n_h * (strat_sum_stat.total_acres) *
                    strat_sum_stat.w_h) /
             SUM(sum_x / strat_sum_stat.n_h * (strat_sum_stat.total_acres) *
                  strat_sum_stat.w_h),
             2) * --Ratio^2
               ((power(total_acres, 2) / strat_sum_stat.n) *
               ((SUM(strat_sum_stat.w_h * strat_sum_stat.n_h *
               (((strat_sum.sum_x2 / strat_sum_stat.n_h) -
               (strat_sum.sum_x / strat_sum_stat.n_h * strat_sum.sum_x /
                strat_sum_stat.n_h)) / (strat_sum_stat.n_h - 1)))) +
         1 / strat_sum_stat.n *
         (SUM((1 - strat_sum_stat.w_h) * strat_sum_stat.n_h *
                 (((strat_sum.sum_x2 / strat_sum_stat.n_h) -
                 (strat_sum.sum_x / strat_sum_stat.n_h * strat_sum.sum_x /
                  strat_sum_stat.n_h)) / (strat_sum_stat.n_h - 1)))))) –
                      --Var(xhat)
```

```
          2 * (SUM(sum_y / strat_sum_stat.n_h * (strat_sum_stat.total_acres) *
                    strat_sum_stat.w_h) /
          SUM(sum_x / strat_sum_stat.n_h * (strat_sum_stat.total_acres) *
                     strat_sum_stat.w_h)) * --2*Ratio
          (power(strat_sum_stat.total_acres, 2) / strat_sum_stat.n *
          (SUM(strat_sum_stat.w_h * strat_sum_stat.n_h *
                 ((sum_xy - strat_sum_stat.n_h * (sum_x / strat_sum_stat.n_h) *
                 (sum_y / strat_sum_stat.n_h)) /
                 (strat_sum_stat.n_h * (strat_sum_stat.n_h - 1)))) +
                        --Cov(ybar,xbar)
       SUM((1 - strat_sum_stat.w_h) * (strat_sum_stat.n_h / strat_sum_stat.n) *
                ((sum_xy - strat_sum_stat.n_h * (sum_x / strat_sum_stat.n_h) *
                (sum_y / strat_sum_stat.n_h)) /
                (strat_sum_stat.n_h * (strat_sum_stat.n_h - 1))))
                       --cov(ybar,xbar)
        ))) var_y_x,

        (power(total_acres, 2) / strat_sum_stat.n) * --A_T/n
        ((SUM(strat_sum_stat.w_h * strat_sum_stat.n_h * --Sum of W_h*n_h
              (((strat_sum.sum_y2 / strat_sum_stat.n_h) -
              (strat_sum.sum_y / strat_sum_stat.n_h * strat_sum.sum_y /
              strat_sum_stat.n_h)) / (strat_sum_stat.n_h - 1)))) + --v(x_h)
       1 / strat_sum_stat.n *
       (SUM((1 - strat_sum_stat.w_h) * strat_sum_stat.n_h *
            (((strat_sum.sum_y2 / strat_sum_stat.n_h) -
            (strat_sum.sum_y / strat_sum_stat.n_h * strat_sum.sum_y /
            strat_sum_stat.n_h)) / (strat_sum_stat.n_h - 1))))) var_numerator,
                   --v(x_h)

       (power(total_acres, 2) / strat_sum_stat.n) * --A_T/n
       ((SUM(strat_sum_stat.w_h * strat_sum_stat.n_h * --Sum of W_h*n_h
           (((strat_sum.sum_x2 / strat_sum_stat.n_h) -
           (strat_sum.sum_x / strat_sum_stat.n_h * strat_sum.sum_x /
             strat_sum_stat.n_h)) / (strat_sum_stat.n_h - 1)))) + --v(x_h)
       1 / strat_sum_stat.n *
       (SUM((1 - strat_sum_stat.w_h) * strat_sum_stat.n_h *
            (((strat_sum.sum_x2 / strat_sum_stat.n_h) -
             (strat_sum.sum_x / strat_sum_stat.n_h * strat_sum.sum_x /
           strat_sum_stat.n_h)) / (strat_sum_stat.n_h - 1))))) var_denominator
                  --v(x_h)

  FROM (STRAT_SUMMARY_STATS) strat_sum_stat, (STRATUM_SUMMARY)strat_sum
  WHERE strat_sum_stat.strat_cn = strat_sum.strat_cn(+)
  GROUP BY strat_sum_stat.popn_name,
           strat_sum_stat.popn_version,
           strat_sum_stat.total_acres,
           strat_sum_stat.n) estimate_sum
```

The *estimate summary query* is similar to the *estimation unit summary query* for standard population estimates. The major difference is that, unlike the *estimation unit summary query*, the *estimate summary query* skips the estimation unit and computes the desired ratio directly at the population level. The reason for this is because ratios, unlike population totals and variances of totals, cannot be summed across estimation units to arrive at a population total. The main function for this step is to compute the ratio, the numerator and denominator estimates, and the variances of all of these. The final step (*summarize final estimates*) will express the variances as sampling errors.

The *estimate summary query* treats the *stratification summary statistics query* and the *plot-stratum summary query* like tables in the FROM clause. The record set output by the *stratification summary statistics query* (STRAT_SUMMARY_STATS) is aliased by strat_sum_stat, and the record set output by the *plot-stratum summary query* (STRATUM_SUMMARY) is aliased with strat_sum. These are arbitrary names that allow the joins between these two record sets to be made more easily. The two record sets are joined through the stratum CN value (which is included in both record sets) using an outer join (+) on the stratum summary record set. The reason for the outer join is to include a stratum even when there are no non-zero values for that stratum due to domain filters or partitions, but the stratum must still be accounted for.

The SELECT clause must include any information desired during the final summary of the estimate, such as the name and version of the population being estimated. Any such supporting items must also be included in the GROUP BY clause. This includes any domain partitions defined by the *stratum summary query*. All other items in the SELECT statement are calculations based on the two input record sets. The result of this query will be population estimates for each domain partition in the population.

This SELECT clause is where the population ratio estimate is computed. The ratio itself is computed using the following calculation:

```
              CASE
              WHEN SUM(nvl(sum_x, 0)) = 0 THEN
               999999999999
              ELSE
               SUM(sum_y / strat_sum_stat.n_h * (strat_sum_stat.total_acres) *
                   strat_sum_stat.w_h) /
               SUM(sum_x / strat_sum_stat.n_h * (strat_sum_stat.total_acres) *
                   strat_sum_stat.w_h)
              END estimate,
```

The CASE statement is simply a technique to prevent a divide-by-zero error from occurring. It first checks to see if the denominator estimate for a given domain partition within a stratum is not missing or zero. If not, it computes the ratio estimate as the ratio of the numerator and denominator population estimates. If the denominator is missing or zero, it computes it as a large constant value (999999999999) so that it is obvious in the results. The calculation of the numerator and denominator population estimates is done exactly as it was in the standard population estimation query. These values are also included in the output to aid in the interpretation of the results.

The variance of the ratio is a more complex calculation involving the estimation of the covariance between the numerator and denominator. This calculation comes from equation 4.17 in GTR SRS-80. The estimate of the covariance comes from equation 4.18. The following expression computes this estimate of the variance of the ratio of population attributes:

```
    (1 / power(SUM(sum_x / strat_sum_stat.n_h * (strat_sum_stat.total_acres) *
                   strat_sum_stat.w_h),
               2)) one_over_x_2, --*1/x^2
```

```
    (1 / power(SUM(sum_x / strat_sum_stat.n_h * (strat_sum_stat.total_acres) *
                   strat_sum_stat.w_h),
               2)) *
    (((power(total_acres, 2) / strat_sum_stat.n) *
    ((SUM(strat_sum_stat.w_h * strat_sum_stat.n_h *
            (((strat_sum.sum_y2 / strat_sum_stat.n_h) -
            (strat_sum.sum_y / strat_sum_stat.n_h * strat_sum.sum_y /
            strat_sum_stat.n_h)) / (strat_sum_stat.n_h - 1)))) +
    1 / strat_sum_stat.n *
    (SUM((1 - strat_sum_stat.w_h) * strat_sum_stat.n_h *
            (((strat_sum.sum_y2 / strat_sum_stat.n_h) -
            (strat_sum.sum_y / strat_sum_stat.n_h * strat_sum.sum_y /
            strat_sum_stat.n_h)) / (strat_sum_stat.n_h - 1)))))) + --var(yhat)
    power(SUM(sum_y / strat_sum_stat.n_h * (strat_sum_stat.total_acres) *
               strat_sum_stat.w_h) /
           SUM(sum_x / strat_sum_stat.n_h * (strat_sum_stat.total_acres) *
               strat_sum_stat.w_h),
           2) * --Ratio^2
    ((power(total_acres, 2) / strat_sum_stat.n) *
    ((SUM(strat_sum_stat.w_h * strat_sum_stat.n_h *
            (((strat_sum.sum_x2 / strat_sum_stat.n_h) -
            (strat_sum.sum_x / strat_sum_stat.n_h * strat_sum.sum_x /
             strat_sum_stat.n_h)) / (strat_sum_stat.n_h - 1)))) +
    1 / strat_sum_stat.n *
    SUM((1 - strat_sum_stat.w_h) * strat_sum_stat.n_h *
            (((strat_sum.sum_x2 / strat_sum_stat.n_h) -
            (strat_sum.sum_x / strat_sum_stat.n_h * strat_sum.sum_x /
            strat_sum_stat.n_h)) / (strat_sum_stat.n_h - 1)))))) - --Var(xhat)
    2 * (SUM(sum_y / strat_sum_stat.n_h * (strat_sum_stat.total_acres) *
               strat_sum_stat.w_h) /
    SUM(sum_x / strat_sum_stat.n_h * (strat_sum_stat.total_acres) *
              strat_sum_stat.w_h)) * --2*Ratio
    (power(strat_sum_stat.total_acres, 2) / strat_sum_stat.n *
    (SUM(strat_sum_stat.w_h * strat_sum_stat.n_h *
           ((sum_xy - strat_sum_stat.n_h * (sum_x / strat_sum_stat.n_h) *
           (sum_y / strat_sum_stat.n_h)) /
           (strat_sum_stat.n_h * (strat_sum_stat.n_h - 1)))) +
                    --Cov(ybar,xbar)
    SUM((1 - strat_sum_stat.w_h) * (strat_sum_stat.n_h / strat_sum_stat.n) *
           ((sum_xy - strat_sum_stat.n_h * (sum_x / strat_sum_stat.n_h) *
           (sum_y / strat_sum_stat.n_h)) /
           (strat_sum_stat.n_h * (strat_sum_stat.n_h - 1)))) --cov(ybar,xbar)
    ))) var_y_
```

In addition to this estimated variance of the population ratio, the variance of both the numerator and denominator estimates are also output for convenience. The count of non-zero observations for both the numerator and denominator are also included, which can be helpful when interpreting the output.

8.8.7 Summarize Final Estimates Query

```
--This outer query summarizes the final estimates and computes
--the sampling errors.
SELECT popn_name,
```

```
       popn_version,
       SUM(estimate) ratio_estimate,
       SUM(estimate_numerator) numerator_estimate,
       SUM(estimate_denominator) denominator_estimate,
       CASE
         WHEN SUM(estimate_sum.var_y_x) > 0 THEN
    round(sqrt(SUM(estimate_sum.var_y_x)) / SUM(estimate_sum.estimate) * 100,
                3)
         ELSE
          0
       END AS se_of_ratio_estimate_pct,
       CASE
         WHEN SUM(estimate_sum.var_numerator) > 0 THEN
          round(sqrt(SUM(estimate_sum.var_numerator)) /
                SUM(estimate_sum.estimate_numerator) * 100,
                3)
         ELSE
          0
       END AS se_of_numerator_estimate_pct,
       CASE
         WHEN SUM(estimate_sum.var_denominator) > 0 THEN
          round(sqrt(SUM(estimate_sum.var_denominator)) /
                SUM(estimate_sum.estimate_denominator) * 100,
                3)
         ELSE
          0
       END AS se_of_denominator_estimate_pct,
       SUM(estimate_sum.var_y_x) var_of_ratio_estimate,
       sqrt(SUM(estimate_sum.var_y_x)) se_of_ratio_estimte,
       SUM(estimate_sum.var_numerator) var_of_numerator_estimate,
       sqrt(SUM(estimate_sum.var_numerator)) se_of_numerator_estimte,
       SUM(estimate_sum.var_denominator) var_of_denominator_estimate,
       sqrt(SUM(estimate_sum.var_denominator)) se_of_denominator_estimte,
       plt_cnt total_plots,
       SUM(non_zero_num_plt_cnt) tot_non_zero_numerator_plots,
       SUM(non_zero_den_plt_cnt) tot_non_zero_denominator_plots,
       total_acres total_acres
  FROM (ESTIMATE_SUMMARY) estimate_sum
GROUP BY popn_name, popn_version, total_acres, plt_cnt;
```

The *summarize final estimates query* is the final query when producing an estimate of a population ratio. It uses the *estimate summary query* (ESTIMATE_SUMMARY) as a table in the FROM clause. Therefore, the only items that can be included in the output of the query must be included in the *estimate summary query*. This includes items such as the population name and version. All such items must also be declared in the GROUP BY clause. The SELECT clause must include any domain partitions that have been carried through the entire calculation procedure. Any domain partitions must also be included in the GROUP BY clause. Anything not included in the GROUP BY clause must be part of a calculation.

This final step is different from the final step of a standard population-attribute estimate where the population totals and variances of totals are summed across estimation units during the final step. Unlike population total, ratios cannot be summed. The main purpose of this final step is to express the variances computed in the estimate summary query in the form of sampling errors for interpretation. It is possible to do this during the previous step (estimate summary query), but it results in more cluttered code for little performance gain. The final output includes the ratio estimate along with the numerator and denominator estimates, plus the sampling errors and variances for each, and the number of non-zero observations for each domain partition in the population.

Example 8.8.7.1: Total Biomass of Live Trees by Land Use

In this example, the analyst is interested in estimating the total biomass in dry pounds for the live tree domain, and to summarize this by land use. Using the terminology developed by this document, the analyst will use live trees as a domain filter, which will exclude any trees not classified as live from the estimate. Land use will be used as a domain partition.

This example will assume that the analyst is interested in the population of Austin, Texas. Using the query provided in *8.2 Identify the Evaluation of Interest*, the following results are returned.

```
SELECT DISTINCT pe.evalid,
                pe.report_year,
                popn.name        popn_name,
                popn.version     popn_version,
                geo.name         geoarea_name,
                geo.description  geoarea_description
  FROM population popn, geoarea geo, pop_estn_unit peu, pop_eval pe
 WHERE pe.cn = peu.eval_cn
   AND peu.popn_cn = popn.cn
   AND peu.geoarea_cn = geo.cn
ORDER BY pe.evalid, pe.report_year, geo.name;
```

Table 8.2 – Austin, TX evaluations

EVALID	REPORT_YEAR	POPN_NAME	POPN_VERSION	GEOAREA_NAME	GEOAREA_ DESCRIPTION
Austin2014All	2014	Austin Texas Urban Area	1.0	Austin City, TX	Austin City, TX
Austin2014Curr	2014	Austin Texas Urban Area	1.0	Austin City, TX	Austin City, TX

From this list, the user notes there are two evaluations for Austin for the reporting year of 2014. To learn more about each of these the following query is run:

```
SELECT pe.evalid,
       pe.name,
       pe.report_year,
       pe.description      eval_description,
       peta.eval_type_name,
       r.description       type_description
  FROM pop_eval pe, pop_eval_type_assgn peta, ref_pop_eval_type r
 WHERE PE.EVALID = 'USER_PROVIDED_EVALID'
   AND pe.cn = peta.eval_cn
   AND peta.eval_type_name = r.name
 ORDER BY pe.evalid, peta.eval_type_name;
```

Only ‘Austin2014Curr’ is assigned to the VOL evaluation type:

EVALID	NAME	REPORT_YEAR	EVAL_DESCRIPTION	EVAL_TYPE_NAME	TYPE_DESCRIPTION
Austin2014Curr	Austin, TX 2014 Current Estimates	2014	Evaluation used to produce current estimates of area and tree population attributes for the city of Austin, Texas. The city boundary was defined using the 2010 U.S. Census Places spatial layer.	CURR	Evaluation is appropriate for use in estimating the current area of the population or domains of the population.
Austin2014Curr	Austin, TX 2014 Current Estimates	2014	Evaluation used to produce current estimates of area and tree population attributes for the city of Austin, Texas. The city boundary was defined using the 2010 U.S. Census Places spatial layer.	VOL	Evaluation is appropriate for use in estimating the current volume, biomass, C or other similar attributes of standing trees.

The VOL evaluation type is associated with the following population attributes:

```
SELECT r.attribute_nbr,
       r.calculation_nbr,
       r.name,
       r.description,
       r.adjustment,
       r.eval_type,
       r.domain_type
  FROM ref_pop_attribute r
WHERE r.eval_type = 'VOL';
```

ATTRIBUTE_NBR	CALCULATION_NBR	NAME	DESCRIPTION	…[a]
9	9	Total Trees	The total number of trees in the population	…
10	9	Mean Trees per acre	The mean trees per acre in the population	…
11	10	Total Tree BA (Sq. Ft.)	The total basal area (Sq. Ft.) of trees in the population	…
12	11	Total Tree Biomass	The total biomass (dry Lbs.) of trees in the population	…
13	11	Mean Tree Biomass per Acre	The mean tree biomass per acre (dry Lbs.) of the population	…

[a]… means there is more output.

Total tree biomass is appropriate to compute with the ‘Austin2014Curr’ evaluation and is selected. This population attribute is associated with calculation number 11. That is defined by the following:

```
SELECT * FROM ref_calculation WHERE calculation_nbr = 11;
```

CALCULATION_NBR	NAME	DESCRIPTION	EXPRESSION
11	Biomass per acre	Biomass (dry pounds) per acre	TREE.TREE_BIOMASS*TREE.TPA_UNADJ

This expression will be used in the first step of the population estimation calculation. Note that the calculation required that the TREE table be added to the query so that the required variables are available for calculation. The TREE table must be added to both the FROM and WHERE clauses of the plot summary query before the calculation can be made.

To isolate the domain filter of Live Trees, the REF_POP_DOMAIN table is queried as follows:

```
SELECT * FROM ref_pop_domain;
```

NAME	DESCRIPTION	EXPRESSION	DOMAIN_TYPE
Live Tree	Live trees 1" DBH/DRC or greater	TREE.STATUSCD=1	Tree
Dead Tree	Dead trees 5" DBH/DRC or greater	TREE.STATUSCD=2	Tree
Removed Tree	A previously observed tree that has been removed (regardless of the tree being utilized or not). This domain can only be used on remeaurement plots.	TREE.STATUSCD IN (3,4)	Tree
Standing Dead Tree	Dead trees 5" DBH/DRC or greater that are standing	TREE.STATUSCD=2 AND TREE.STANDING_DEAD_CD = 1	Tree
Maintained Area Tree	A tree 1" DBH/DRC or greater occupying a maintained area	TREE.IS_MAINTAINED =1	Tree
Riparian Tree	A tree 1" DBH/DRC or greater occurring in a riparian zone.	TREE.IS_RIPARIAN=1	Tree
Street Tree	A tree 1" DBH/DRC or greater classified as a street tree	TREE.IS_STREET_TREE=1	Tree
Planted Tree	A new or reconciled tree that has been planted since the previous measurement. This domain can only be used with remeaurement plots.	TREE.IS_PLANTED=1	Tree

Live Tree is a common domain available from this table along with the expression required to implement it. This constraint will be used during the first step of the population estimation calculation.

The domain partition of interest is land use, which is a variable on the TREE record. Land use is a categorical variable assigned to trees based on the land condition on which it was measured. All such categorical variables have an associated reference table that can be used to better display and define resulting estimates. This example will demonstrate the correct way to join the reference table to display results.

The following population estimate query is based on the query provided in *the 8.6 Tying it All Together* section above.

```
--This outer query sums the estimates of all estimation units
--defined by the evaluation and computes the final estimates
--and sampling error.
SELECT popn_name,
       popn_version,
       landuse,
```

```
        SUM(estimate) estimate,
        CASE
          WHEN SUM(est_unit_sum.var_estimate) > 0 THEN
           round(sqrt(SUM(est_unit_sum.var_estimate)) /
                 SUM(est_unit_sum.estimate) * 100,
                 3)
          ELSE
           0
        END AS se_of_estimate_pct,
        SUM(est_unit_sum.var_estimate) var_of_estimate,
        sqrt(SUM(est_unit_sum.var_estimate)) se_of_estimte,
        plt_cnt total_plots,
        SUM(non_zero_plt_cnt) total_non_zero_plots,
        total_acres total_acres
   FROM
```

```
 ( --This subquery produces population estimates
        --for each estimation unit defined by the evaluation.
  SELECT strat_sum_stat.popn_name,
          strat_sum_stat.popn_version,
          strat_sum_stat.estn_unit_cn,
          strat_sum_stat.est_unit_name,
          strat_sum.landuse,
          SUM(sum_x / strat_sum_stat.n_h * (strat_sum_stat.total_acres) *
              strat_sum_stat.w_h) estimate,
          strat_sum_stat.n plt_cnt,
          SUM(strat_sum.non_zero_plt_cnt) non_zero_plt_cnt,
          strat_sum_stat.total_acres,
          (power(total_acres, 2) / strat_sum_stat.n) * --A_T/n
          ((SUM(strat_sum_stat.w_h * strat_sum_stat.n_h * --Sum of W_h*n_h
              (((strat_sum.sum_x2 / strat_sum_stat.n_h) -
              (strat_sum.sum_x / strat_sum_stat.n_h * strat_sum.sum_x /
              strat_sum_stat.n_h)) / (strat_sum_stat.n_h - 1)))) + --v(x_h)
          1 / strat_sum_stat.n *
          (SUM((1 - strat_sum_stat.w_h) * strat_sum_stat.n_h *
             (((strat_sum.sum_x2 / strat_sum_stat.n_h) -
             (strat_sum.sum_x / strat_sum_stat.n_h * strat_sum.sum_x /
              strat_sum_stat.n_h)) / (strat_sum_stat.n_h - 1))))) var_estimate
                    --v(x_h)
    FROM (
```

```
              --This subquery returns the stratification summary statistics
                  --used to support stratified estimation.
                  SELECT pop.name popn_name,
                          pop.version popn_version,
                          eu.cn estn_unit_cn,
                          geo.name est_unit_name,
                          strat.cn strat_cn,
                          strat.name strat_name,
                          strat.description,
                          strat.area strat_acres,
                          (SELECT SUM(area)
                             FROM pop_stratum strat2
                            WHERE strat2.estn_unit_cn = eu.cn) total_acres,
                          strat.area /
                          (SELECT SUM(area)
```

```
                FROM pop_stratum strat2
               WHERE strat2.estn_unit_cn = eu.cn) w_h,
             (SELECT COUNT(psa.plt_cn)
                FROM plot_strat_assgn    psa,
                     plot_statsamp_assgn pssa,
                     pop_stat_samp       samp,
                     plot                p
               WHERE psa.strat_cn = strat.cn
                 AND samp.eval_cn = eval.cn
                 AND pssa.pss_cn = samp.cn
                 AND pssa.plt_cn = p.cn
                 AND psa.plt_cn = p.cn) n_h,
             (SELECT COUNT(pssa.plt_cn)
                FROM plot_statsamp_assgn pssa, pop_stat_samp samp
               WHERE samp.eval_cn = eval.cn
                 AND pssa.pss_cn = samp.cn) n
         FROM pop_eval      eval,
              pop_estn_unit eu,
              pop_stratum   strat,
              geoarea       geo,
              population    pop
        WHERE eval.evalid = 'Austin2014Curr'
          AND eval.cn = eu.eval_cn
          AND eu.cn = strat.estn_unit_cn
          AND eu.geoarea_cn = geo.cn
          AND eu.popn_cn = pop.cn) strat_sum_stat,
```

```
     ( --This subquery computes the sum of x and x^2
       --for each pop_stratum and domain of interest.
       SELECT strat_cn,
              strat_name,
              --domains would go here and in the group by
              landuse,
              SUM(x) sum_x,
              SUM(x * x) sum_x2,
              SUM(x) / SUM(plt_cnt) x_bar,
              ((SUM(x * x) / SUM(plt_cnt)) -
              (SUM(x) / SUM(plt_cnt) * SUM(x) / SUM(plt_cnt))) /
              (SUM(plt_cnt) - 1) strat_var,
              SUM(plt_cnt) n_h,
              SUM(decode(nvl(x, 0), 0, 0, 1)) non_zero_plt_cnt
         FROM
```

```
--This subquery produces an adjusted, plot-level estimate of the variable
-- of interest for each pop_stratum and domain of interest.
                        (SELECT strat.cn   strat_cn,
                                strat.name strat_name,
                                p.cn       plt_cn,
--domains would go here and in the group by
                                r.abbr landuse,
                                1 plt_cnt,
                                SUM(t.tpa_unadj * t.tree_biomass *
                                    decode(t.subp,
                                           1,
                                           strat.adj_factor_subp,
                                           strat.adj_factor_micr)) x
```

```
                                    FROM pop_eval             eval,
                                         pop_stat_samp        samp,
                                         pop_estn_unit        eu,
                                         pop_stratum          strat,
                                         plot_statsamp_assgn  sampassgn,
                                         plot_strat_assgn     stratassgn,
                                         plot                 p,
                                         tree                 t,
                                         ref_landuse          r
                                   WHERE eval.evalid = 'Austin2014Curr'
                                     AND t.statuscd = 1
                                     AND eval.cn = samp.eval_cn
                                     AND samp.cn = sampassgn.pss_cn
                                     AND sampassgn.plt_cn = p.cn
                                     AND p.cn = stratassgn.plt_cn
                                     AND stratassgn.strat_cn = strat.cn
                                     AND strat.estn_unit_cn = eu.cn
                                     AND eu.eval_cn = eval.cn
                                     AND p.cn = t.plt_cn
                                     AND t.landuse = r.landuse
                                     AND p.urban_manual >= r.manual_start
                                     AND (r.manual_end is NULL OR
                                          p.urban_manual <= r.manual_end)
                                   GROUP BY strat.estn_unit_cn,
                                            strat.cn,
                                            strat.name,
                                            p.cn,
                                            r.abbr,
                                            1) plot_sum
```

```
                        GROUP BY strat_cn, strat_name, landuse) strat_sum
```

```
          WHERE strat_sum_stat.strat_cn = strat_sum.strat_cn(+)
          GROUP BY strat_sum_stat.popn_name,
                   strat_sum_stat.popn_version,
                   strat_sum_stat.estn_unit_cn,
                   strat_sum_stat.est_unit_name,
                   strat_sum_stat.total_acres,
                   strat_sum_stat.n,
                   strat_sum.landuse) est_unit_sum
```

```
GROUP BY popn_name, popn_version, total_acres, plt_cnt,landuse;
```

This query provides an estimate of tree biomass in dry pounds on live trees partitioned by land use. There are several comments to make about this in the next few paragraphs. These comments are organized by the five steps outlined in the *8.6 Tying it All Together* section above. The same color coding is used for clarity.

The actual calculation occurs in the *plot summary query*: `t.tpa_unadj * t.tree_biomass`. This calculation was identified from the results of the REF_CALCULATION table query. Note that in the results from that query, the calculation was described as: TREE.TREE_BIOMASS*TREE.TPA_UNADJ. Therefore, the TREE table must be added to the

FROM clause. The typical alias for the TREE table is simply *t* (though it can be whatever the user wants). In the above query, however, the TREE table identifier was replaced with the alias for the TREE table (t) defined in the FROM clause of the plot summary query. In the WHERE clause, the TREE table is simply joined to the plot table through the plot CN value.

The domain partition used was land use. To implement this, the REF_LANDUSE table was added to the FROM clause of the plot summary query. This table must be joined correctly with the other tables otherwise a Cartesian join will occur resulting in erroneous results. This join is simply the code from the data table to the code in the reference table: AND t.landuse = r.landuse. In addition, the version of the land use codes must be constrained to those of the current plot. This is accomplished by the statement `p.urban_manual >= r.manual_start AND (r.manual_end is NULL OR p.urban_manual <= r.manual_end)`. Once added, the domain partition must be carried through all subsequent steps in the calculation except for the stratification summary statistics query. Within the plot summary query, the abbreviation for the land use is added to the SELECT clause and the alias *landuse* is assigned to it like this: r.abbr landuse,. Because the domain partition is not part of any calculation, it must also be included in the GROUP BY clause. Note that the alias is not included in the GROUP BY clause. This is part of the Oracle implementation of SQL and may not apply to all forms of SQL. The result of the final plot summary query is a calculation of live tree biomass where every plot has the opportunity to contribute a non-zero value to every domain within every stratum of the evaluation.

The only change to the plot-stratum summary query is to add any domain partitions that may be called for. In this case, the domain partition is *landuse*. This was defined in the plot summary query as an alias for the land use abbreviation value. The *landuse* domain partition is added to both the SELECT and GROUP BY clauses. The result is a query that returns the sufficient statistics for each domain with in each stratum of the evaluation.

The stratification summary statistics query is unchanged. This query simply provides the critical information about the stratification itself. Recall that domains are simply subgroups of the population and can cut across strata. Mechanically, each strata description returned in the stratification summary statistics query is joined to each domain within the corresponding stratum from the plot-stratum summary query; a one-to-many join.

Similar to the plot-stratum summary query, the only change to the estimation unit summary query is to add any appropriate domain partitions to both the SELECT and GROUP BY clauses. In this case, there is a single domain partition called *strat_sum.landuse*. In this example the *landuse* domain is fully qualified (table_name.column_name), meaning the *stratum_sum* is included to to make the origin of the domain partition very clear. This also prevents error in case the alias chosen by the analyst happens to also be the name of a column in another table. This is rare, but can happen. The result of this query is a population estimate for each domain within each estimation unit defined by the evaluation. Recall that estimation units are independent subpopulations and are considered valid estimates by themselves.

The final step is to sum all the domain estimates for each estimation unit defined by the evaluation. The only change to the query is to add any domain partitions required to both the SELECT and GROUP BY clauses of the population summary query. In this case, the domain partition *landuse* is added to both clauses. The result of this query is a single population estimate for each domain in the population. Associated with each domain partition estimate are sampling errors, variance estimates, and plot counts to help the analyst interpret the results and draw conclusions.

Example 8.8.7.2: Mean Dead Trees per Acre by Land Use:
In this example the analyst is interested in estimating how many dead trees per acre exist on different land uses. The first thing to realize about this example is that the number of trees per acre does not require a ratio estimator. This is because “acre” in “trees per acre” refers to the acres of the total population, which is a known constant. If the “acre” is refined to mean a particular area expressed in acres, such as acres of residential land or public ownership, then these acres are not known constants and must be estimated. In these cases a ratio estimator would be called for.

As with the previous example, the analyst is interested in the population of Austin, Texas. The discussion of identifying the proper evaluation will not be repeated here to save space.

The analyst learned from the previous example that estimates of mean trees are computed with evaluations with the VOL evaluation type. The evaluation ‘Austin2014Curr’ qualifies and will be used for this analysis.

Next, the analyst queries the REF_POP_ATTRIBUTE_TABLE to identify the population attribute of interest.

```
SELECT r.attribute_nbr,
       r.calculation_nbr,
       r.name,
       r.description,
       r.adjustment,
       r.eval_type,
       r.domain_type
  FROM ref_pop_attribute r
WHERE r.eval_type = 'VOL';
```

ATTRIBUTE_NBR	CALCULATION_NBR	NAME	DESCRIPTION
9	9	Total Trees	The total number of trees in the population
10	9	Mean Trees per acre	The mean trees per acre in the population
11	10	Total Tree BA (Sq. Ft.)	The total basal area (sq. ft) of trees in the population
12	11	Total Tree Biomass	The total biomass (dry lbs) of trees in the population
13	11	Mean Tree Biomass per Acre	The mean tree biomass per acre (dry lbs) of the population
14	12	Total Tree Carbon	The total carbon content (dry lbs) of trees in the population
15	12	Mean Tree Carbon per Acre	The mean tree carbon content per acre (dry lbs) in the population

From the results, the analyst sees that calculation 9 is required for the attribute Mean Trees per Acre. To fetch the expression for calculation 9, the analyst queries the REF_CALCULATION table.

```
SELECT * FROM ref_calculation WHERE calculation_nbr = 9;
```

CALCULATION_NBR	NAME	DESCRIPTION	EXPRESSION
9	Tree per acre	The number of trees per acre	TREE.TPA_UNADJ

In this case, the calculation is trivial and simply uses the unadjusted trees per acre (TPA) expander, which is a function of the plot footprint on which the trees were sampled.

Next the domain filter of Dead Trees must be defined. For this, the user queries the REF_DOMAIN table.

```
SELECT * FROM ref_pop_domain;
```

NAME	DESCRIPTION	EXPRESSION	DOMAIN_TYPE
Live Tree	Live trees 1" DBH/DRC or greater	TREE.STATUSCD=1	Tree
Dead Tree	Dead trees 5" DBH/DRC or greater	TREE.STATUSCD=2	Tree
Removed Tree	A previously observed tree that has been removed (regardless of the tree being utilized or not). This domain can only be used on remeaurement plots.	TREE.STATUSCD IN (3,4)	Tree
Standing Dead Tree	Dead trees 5" DBH/DRC or greater that are standing	TREE.STATUSCD=2 AND TREE.STANDING_DEAD_CD = 1	Tree
Maintained Area Tree	A tree 1" DBH/DRC or greater occupying a maintained area	TREE.IS_MAINTAINED=1	Tree
Riparian Tree	A tree 1" DBH/DRC or greater occurring in a riparian zone.	TREE.IS_RIPARIAN=1	Tree
Street Tree	A tree 1" DBH/DRC or greater classified as a street tree	TREE.IS_STREET_TREE=1	Tree
Planted Tree	A new or reconciled tree that has been planted since the previous measurement. This domain can only be used with remeaurement plots.	TREE.IS_PLANTED=1	Tree

The Dead Tree domain is defined here and the domain filter can be implemented by including the constraint TREE.STATUSCD = 2 in the WHERE clause of the *plot summary query*. Any tree not meeting this requirement will be excluded for the results.

The domain partition of land use was selected. Land use is a categorical variable assigned to each tree. The REF_LANDUSE table defines each code and provides a useful abbreviation that can be used in queries such as this. This table is included in the FROM clause of the *plot summary query* and used to define the domain partition.

```
--This outer query sums the estimates of all estimation units
--defined by the evaluation and computes the final estimates
--and sampling error.
SELECT popn_name,
       popn_version,
       landuse,
```

```
        SUM(estimate / total_acres) estimate,
        CASE
          WHEN SUM(est_unit_sum.var_estimate) > 0 THEN
          round(sqrt(SUM(est_unit_sum.var_estimate / power(total_acres, 2))) /
                 SUM(est_unit_sum.estimate / total_acres) * 100,
                 3)
          ELSE
           0
        END AS se_of_estimate_pct,
        SUM(est_unit_sum.var_estimate / power(total_acres, 2))
             var_of_estimate,
        sqrt(SUM(est_unit_sum.var_estimate / power(total_acres, 2)))
             se_of_estimte,
        plt_cnt total_plots,
        SUM(non_zero_plt_cnt) total_non_zero_plots,
        total_acres total_acres
   FROM
```

```
 ( --This subquery produces population estimates
        --for each estimation unit defined by the evaluation.
   SELECT strat_sum_stat.popn_name,
           strat_sum_stat.popn_version,
           strat_sum_stat.estn_unit_cn,
           strat_sum_stat.est_unit_name,
           strat_sum_stat.label stratum,
           landuse,
           SUM(sum_x / strat_sum_stat.n_h * /*(strat_sum_stat.total_acres) **/
               strat_sum_stat.w_h) estimate,
           strat_sum_stat.n plt_cnt,
           SUM(strat_sum.non_zero_plt_cnt) non_zero_plt_cnt,
           strat_sum_stat.total_acres,
           ( /*power(total_acres, 2)*/
            1 / strat_sum_stat.n) * --A_T/n
           ((SUM(strat_sum_stat.w_h * strat_sum_stat.n_h * --Sum of W_h*n_h
                 (((strat_sum.sum_x2 / strat_sum_stat.n_h) -
                 (strat_sum.sum_x / strat_sum_stat.n_h * strat_sum.sum_x /
                 strat_sum_stat.n_h)) / (strat_sum_stat.n_h - 1)))) + --v(x_h)
           1 / strat_sum_stat.n *
           (SUM((1 - strat_sum_stat.w_h) * strat_sum_stat.n_h *
                 (((strat_sum.sum_x2 / strat_sum_stat.n_h) -
                 (strat_sum.sum_x / strat_sum_stat.n_h * strat_sum.sum_x /
              strat_sum_stat.n_h)) / (strat_sum_stat.n_h - 1))))) var_estimate
                        --v(x_h)
     FROM (
```

```
              --This subquery returns the stratification summary stistics
              --used to support stratified estimation.
                   SELECT pop.name popn_name,
                           pop.version popn_version,
                           eu.cn estn_unit_cn,
                           geo.name est_unit_name,
                           strat.cn strat_cn,
                           strat.name strat_name,
                           strat.description,
                           strat.label,
                           strat.area strat_acres,
```

```
                        (SELECT SUM(area)
                           FROM pop_stratum strat2
                          WHERE strat2.estn_unit_cn = eu.cn) total_acres,
                        strat.area /
                        (SELECT SUM(area)
                           FROM pop_stratum strat2
                          WHERE strat2.estn_unit_cn = eu.cn) w_h,
                        (SELECT COUNT(psa.plt_cn)
                           FROM plot_strat_assgn    psa,
                                plot_statsamp_assgn pssa,
                                pop_stat_samp       samp,
                                plot                p
                          WHERE psa.strat_cn = strat.cn
                            AND samp.eval_cn = eval.cn
                            AND pssa.pss_cn = samp.cn
                            AND pssa.plt_cn = p.cn
                            AND psa.plt_cn = p.cn) n_h,
                        (SELECT COUNT(pssa.plt_cn)
                           FROM plot_statsamp_assgn pssa, pop_stat_samp samp
                          WHERE samp.eval_cn = eval.cn
                            AND pssa.pss_cn = samp.cn) n
                  FROM pop_eval      eval,
                        pop_estn_unit eu,
                        pop_stratum   strat,
                        georarea      geo,
                        population    pop
                 WHERE eval.evalid = '&Evalid'
                   AND eval.cn = eu.eval_cn
                   AND eu.cn = strat.estn_unit_cn
                   AND eu.georarea_cn = geo.cn
                   AND eu.popn_cn = pop.cn) strat_sum_stat,
```

```
                ( --This subquery computes the sum of x and x^2
                 --for each pop_stratum and domain of interest.
                 SELECT strat_cn,
                        strat_name,
                        --domains would go here and in the group by
                        landuse,
                        SUM(x) sum_x,
                        SUM(x * x) sum_x2,
                        SUM(x) / SUM(plt_cnt) x_bar,
                        ((SUM(x * x) / SUM(plt_cnt)) -
                        (SUM(x) / SUM(plt_cnt) * SUM(x) / SUM(plt_cnt))) /
                        SUM(plt_cnt) n_h,
                        SUM(decode(nvl(x, 0), 0, 0, 1)) non_zero_plt_cnt
                  FROM
```

```
--This subquery produces an adjusted, plot-level estimate of the variable
                  -- of interest for each pop_stratum and domain of interest.
                         (SELECT strat.cn   strat_cn,
                                 strat.name strat_name,
                                 p.cn       plt_cn,
                                 --domains would go here and in the group by
                                 r.abbr  landuse,
                                 1 plt_cnt,
```

```
                                   SUM(t.tpa_unadj *
                                       decode(t.subp,
                                              1,
                                              strat.adj_factor_subp,
                                              strat.adj_factor_micr)) x
                              FROM pop_eval             eval,
                                   pop_stat_samp        samp,
                                   pop_estn_unit        eu,
                                   pop_stratum          strat,
                                   plot_statsamp_assgn sampassgn,
                                   plot_strat_assgn     stratassgn,
                                   plot                 p,
                                   tree                 t,
                                   ref_landuse          r
                             WHERE eval.evalid = '&Evalid'
                               AND eval.cn = samp.eval_cn
                               AND samp.cn = sampassgn.pss_cn
                               AND sampassgn.plt_cn = p.cn
                               AND p.cn = stratassgn.plt_cn
                               AND stratassgn.strat_cn = strat.cn
                               AND strat.estn_unit_cn = eu.cn
                               AND eu.eval_cn = eval.cn
                               AND p.cn = t.plt_cn
                               AND t.landuse = r.landuse
                               AND p.urban_manual >= r.manual_start
                               AND (r.manual_end IS NULL OR
                                   p.urban_manual <= r.manual_end)
                             GROUP BY strat.estn_unit_cn,
                                      strat.cn,
                                      strat.name,
                                      p.cn,
                                      r.abbr,
                                      1) plot_sum
```

```
                    GROUP BY strat_cn, strat_name, landuse
                   ) strat_sum
```

```
          WHERE strat_sum_stat.strat_cn = strat_sum.strat_cn(+)
          GROUP BY strat_sum_stat.popn_name,
                    strat_sum_stat.popn_version,
                    strat_sum_stat.estn_unit_cn,
                    strat_sum_stat.est_unit_name,
                    strat_sum_stat.total_acres,
                    strat_sum_stat.n,
                    strat_sum_stat.label,
                    landuse
         ) est_unit_sum
```

```
GROUP BY popn_name, popn_version, total_acres, plt_cnt, landuse;
```

This query provides an estimate of the dead trees per acre by land use. There are several comments to make about this in the next few paragraphs. These comments are organized by the five steps outlined in the *8.6 Tying it All Together* section above. The same color coding is used for clarity.

The actual calculation of trees per acre occurs in the *plot summary query*: `t.tpa_unadj`. The alias "t" was chosen for the TREE table in the FROM clause. The choice of a table alias is arbitrary and can be anything the user desires.

The domain partition of land use was selected for this analysis. To implement this, the REF_LANDUSE table was added to the FROM clause of the plot summary query. This table must be joined correctly with the other tables, otherwise a Cartesian join will occur resulting in erroneous results. This join is simply the code from the data table to the code in the reference table: AND t.landuse = r.landuse. In addition, the version of the land use codes must be constrained to those of the current plot. This is accomplished by the statement: `p.urban_manual >= r.manual_start AND (r.manual_end is NULL OR p.urban_manual <= r.manual_end)`. Once added, the domain partition must be carried through all subsequent steps in the calculation except for the stratification summary statistics query. Within the plot summary query, the abbreviation for the land use is added to the SELECT clause and the alias *landuse* is assigned to it like this: r.abbr landuse,. Because the domain partition is not part of any calculation, it must also be included in the GROUP BY clause. Note that the alias is not included in the GROUP BY clause. This is part of the Oracle implementation of SQL and may not apply to all forms of SQL. The result of the final plot summary query is a calculation of dead trees per acre where every plot has the opportunity to contribute a non-zero value to every domain within every stratum of the evaluation.

The only change to the plot-stratum summary query is to add any domain partitions that may be called for. In this case, the domain partition is *landuse*. This was defined in the plot summary query as an alias for the land use abbreviation value. The *landuse* domain partition is added to both the SELECT and GROUP BY clauses. The result is a query that returns the sufficient statistics for each domain within each stratum of the evaluation.

The stratification summary statistics query is unchanged. This query simply provides the critical information about the stratification itself. Recall that domains are simply subgroups of the population and can cut across strata. Mechanically, each strata description returned in the stratification summary statistics query is joined to each domain within the corresponding stratum from the plot-stratum summary query; a one-to-many join.

Similar to the plot-stratum summary query, the only change to the estimation unit summary query is to add any appropriate domain partitions to both the SELECT and GROUP BY clauses. In this case, there is a single domain partition called *strat_sum.landuse*. In this example the *lanuse* domain is fully qualified (table_name.column_name), meaning the *stratum_sum* is included to make the origin of the domain partition very clear. This also prevents error in case the alias chosen by the analyst happens to also be the name of a column in another table. This is rare, but can happen. The result of this query is a population estimate for each domain within each estimation unit defined by the evaluation. Recall that estimation units are independent subpopulations and are considered valid estimates by themselves.

The final step is to sum all the domain estimates for each estimation unit defined by the evaluation. Any domain partitions required must be added to both the SELECT and GROUP BY clauses of the population summary query. In this case, the domain partition *landuse* is added to both clauses. In addition the calculations for the estimate, sampling errors, and variances are adjusted to produce per unit area estimates in place of population totals. Specifically, the estimate is changed to:

```
SUM(estimate / total_acres) estimate.
```

The calculation of sampling error expressed as a percentage of the estimate is:

```
CASE
         WHEN SUM(est_unit_sum.var_estimate) > 0 THEN
          round(sqrt(SUM(est_unit_sum.var_estimate / power(total_acres, 2))) /
                SUM(est_unit_sum.estimate / total_acres) * 100,
                3)
         ELSE
          0
       END AS se_of_estimate_pct,
```

The estimate of the variance is adjusted to:

```
SUM(est_unit_sum.var_estimate / power(total_acres, 2)) var_of_estimate,
```

And the estimate of the sampling error expressed in the units of the estimate is:

```
sqrt(SUM(est_unit_sum.var_estimate / power(total_acres, 2))) se_of_estimte,
```

The result of this query is a single population estimate per unit area for each domain in the population. Associated with each domain partition estimate there are sampling errors, variance estimates, and plot counts to help the analyst interpret the results and draw conclusions.

Example 8.8.7.3: Carbon (in kg) per live tree by Crown Light Exposure:
In this example the analyst is interested in distribution of carbon content per live trees across different levels of crown light exposure. The first thing to recognize about this estimate is that both the amount of carbon on live trees and the number of live trees are values that must be estimated. Therefore, this analysis requires a ratio estimate. As with the previous examples it is assumed that the analyst is interested in the population of Austin, Texas. The discussion of identifying the proper evaluation will not be repeated here to save space.

The analyst learned from the previous example that estimates of total tree carbon and total number of trees are appropriate to compute using an evaluation with a VOL type. And from the previous example, the evaluation with EVALID = ‘Austin2014Curr’ qualifies. That will be the evaluation used for this analysis.

Next the required calculations for the numerator and denominator of the ratio must be defined. A query of the REF_POP_ATTRIBUTE table identifies the calculations by ID:

```
SELECT r.attribute_nbr,
       r.calculation_nbr,
       r.name,
       r.description,
       r.adjustment,
       r.eval_type,
       r.domain_type
  FROM ref_pop_attribute r
WHERE r.eval_type = 'VOL';
```

ATTRIBUTE_NBR	CALCULATION_NBR	NAME	DESCRIPTION
9	9	Total Trees	The total number of trees in the population
10	9	Mean Trees per acre	The mean trees per acre in the population
11	10	Total Tree BA (Sq. Ft.)	The total basal area (Sq. Ft.) of trees in the population
12	11	Total Tree Biomass	The total biomass (dry Lbs.) of trees in the population
13	11	Mean Tree Biomass per Acre	The mean tree biomass per acre (dry Lbs.) of the population
14	12	Total Tree Carbon	The total carbon content (dry Lbs.) of trees in the population
15	12	Mean Tree Carbon per Acre	The mean tree carbon content per acre (dry Lbs.) in the population

From the above results, calculation number 12 will be used for the numerator and 9 for the denominator. The specific calculations are found by querying the REF_CALCULATION table:

```
SELECT * FROM ref_calculation WHERE calculation_nbr IN (9, 12);
```

CALCULATION_NBR	NAME	DESCRIPTION	EXPRESSION	WHERE_CLAUSE
9	Tree per acre	The number of trees per acre	TREE.TPA_UNADJ	
12	C Content per acre	C (dry pounds) per acre	TREE.CARBON_STORAGE*TREE.TPA_UNADJ	

The expressions returned will be used in the numerator and denominator summary scripts for the ratio estimator.

The live tree domain will be used as the domain filter for this analysis. The previous example identified the expression required to implement this filter. Remember, that as a filter, any tree not meeting the requirement is excluded from the analysis.

The domain partition selected was crown light exposure, which is a categorical code collected at the tree level describing how many sides of the tree crown (including the top) are exposed to direct sunlight. To use this domain partition the corresponding reference table (REF_CROWN_LIGHT_EXPOSURE) is joined to the tree table in all three plot summary queries. Recall that the ratio estimator query includes a plot summary for both the numerator and the denominator, plus a plot count query that supports joins.

All of these elements of the analysis are implemented in the following code, which uses the same color coding as was used in the description for Ratio Estimates.

```
--This outer query sums the estimates of all estimation units
--defined by the evaluation and computes the final estimates
--and sampling error.
SELECT popn_name,
       popn_version,
       crown_light_exposure,
       SUM(estimate) ratio_estimate,
       SUM(estimate_numerator) numerator_estimate,
       SUM(estimate_denominator) denominator_estimate,
       CASE
         WHEN SUM(est_unit_sum.var_y_x) > 0 THEN
          round(sqrt(SUM(est_unit_sum.var_y_x)) / SUM(est_unit_sum.estimate)
                   * 100,
                3)
         ELSE
          0
       END AS se_of_ratio_estimate_pct,       CASE
         WHEN SUM(est_unit_sum.var_numerator) > 0 THEN
          round(sqrt(SUM(est_unit_sum.var_numerator)) /
                SUM(est_unit_sum.estimate_numerator) * 100,
                3)
         ELSE
          0
       END AS se_of_numerator_estimate_pct,
       CASE
         WHEN SUM(est_unit_sum.var_denominator) > 0 THEN
          round(sqrt(SUM(est_unit_sum.var_denominator)) /
                SUM(est_unit_sum.estimate_denominator) * 100,
                3)
         ELSE
          0
       END AS se_of_denominator_estimate_pct,
       CASE
         WHEN SUM(est_unit_sum.var_y_x) > 0 THEN
          SUM(est_unit_sum.var_y_x)
       END var_of_ratio_estimate,
       CASE
         WHEN SUM(est_unit_sum.var_y_x) > 0 THEN
          sqrt(SUM(est_unit_sum.var_y_x))
       END se_of_ratio_estimte,
       SUM(est_unit_sum.var_numerator) var_of_numerator_estimate,
       sqrt(SUM(est_unit_sum.var_numerator)) se_of_numerator_estimte,
       SUM(est_unit_sum.var_denominator) var_of_denominator_estimate,
       sqrt(SUM(est_unit_sum.var_denominator)) se_of_denominator_estimte,
       plt_cnt total_plots,
       SUM(non_zero_num_plt_cnt) tot_non_zero_numerator_plots,
       SUM(non_zero_den_plt_cnt) tot_non_zero_denominator_plots,
       total_acres total_acres
  FROM
```

```
( --This subquery produces population estimates
        --for each estimation unit defined by the evaluation.
 SELECT strat_sum_stat.popn_name,
```

```
          strat_sum_stat.popn_version,
          est_unit_name,
          crown_light_exposure,
          CASE
            WHEN SUM(nvl(sum_x, 0)) = 0 THEN
             999999999999
            ELSE
             SUM(sum_y / strat_sum_stat.n_h *
                 (strat_sum_stat.total_acres) * strat_sum_stat.w_h) /
             SUM(sum_x / strat_sum_stat.n_h *
                 (strat_sum_stat.total_acres) * strat_sum_stat.w_h)
          END estimate,
          SUM(sum_y / strat_sum_stat.n_h * (strat_sum_stat.total_acres) *
              strat_sum_stat.w_h) estimate_numerator,
          SUM(sum_x / strat_sum_stat.n_h * (strat_sum_stat.total_acres) *
              strat_sum_stat.w_h) estimate_denominator,
          strat_sum_stat.n plt_cnt,
          SUM(strat_sum.non_zero_y_cnt) non_zero_num_plt_cnt,
          SUM(strat_sum.non_zero_x_cnt) non_zero_den_plt_cnt,
          strat_sum_stat.total_acres,

          power(SUM(sum_y / strat_sum_stat.n_h *
                    (strat_sum_stat.total_acres) * strat_sum_stat.w_h) /
                SUM(sum_x / strat_sum_stat.n_h *
                    (strat_sum_stat.total_acres) * strat_sum_stat.w_h),
                2) ratio_2,

          (1 /
          power(SUM(sum_x / strat_sum_stat.n_h *
                     (strat_sum_stat.total_acres) * strat_sum_stat.w_h),
                 2)) one_over_x_2, --*1/x^2
          (1 /
          power(SUM(sum_x / strat_sum_stat.n_h *
                     (strat_sum_stat.total_acres) * strat_sum_stat.w_h),
                 2)) *
          (((power(total_acres, 2) / strat_sum_stat.n) *
          ((SUM(strat_sum_stat.w_h * strat_sum_stat.n_h *
                  (((strat_sum.sum_y2 / strat_sum_stat.n_h) -
                  (strat_sum.sum_y / strat_sum_stat.n_h *
                  strat_sum.sum_y / strat_sum_stat.n_h)) /
                  (strat_sum_stat.n_h - 1)))) +
          1 / strat_sum_stat.n *
          (SUM((1 - strat_sum_stat.w_h) * strat_sum_stat.n_h *
                  (((strat_sum.sum_y2 / strat_sum_stat.n_h) -
                  (strat_sum.sum_y / strat_sum_stat.n_h *
                  strat_sum.sum_y / strat_sum_stat.n_h)) /
                  (strat_sum_stat.n_h - 1)))))) + --var(yhat)
          power(SUM(sum_y / strat_sum_stat.n_h *
                     (strat_sum_stat.total_acres) * strat_sum_stat.w_h) /
                 SUM(sum_x / strat_sum_stat.n_h *
                     (strat_sum_stat.total_acres) * strat_sum_stat.w_h),
                 2) * --Ratio^2
          ((power(total_acres, 2) / strat_sum_stat.n) *
          ((SUM(strat_sum_stat.w_h * strat_sum_stat.n_h *
                  (((strat_sum.sum_x2 / strat_sum_stat.n_h) -
                  (strat_sum.sum_x / strat_sum_stat.n_h *
                  strat_sum.sum_x / strat_sum_stat.n_h)) /
```

```
                (strat_sum_stat.n_h - 1)))) +
        1 / strat_sum_stat.n *
        (SUM((1 - strat_sum_stat.w_h) * strat_sum_stat.n_h *
                (((strat_sum.sum_x2 / strat_sum_stat.n_h) -
                (strat_sum.sum_x / strat_sum_stat.n_h *
                strat_sum.sum_x / strat_sum_stat.n_h)) /
                (strat_sum_stat.n_h - 1)))))) - --Var(xhat)
        2 *
        (SUM(sum_y / strat_sum_stat.n_h *
              (strat_sum_stat.total_acres) * strat_sum_stat.w_h) /
        SUM(sum_x / strat_sum_stat.n_h *
              (strat_sum_stat.total_acres) * strat_sum_stat.w_h)) *
                     --2*Ratio
        (power(strat_sum_stat.total_acres, 2) / strat_sum_stat.n *
        (SUM(strat_sum_stat.w_h * strat_sum_stat.n_h *
               ((sum_xy -
               strat_sum_stat.n_h * (sum_x / strat_sum_stat.n_h) *
               (sum_y / strat_sum_stat.n_h)) /
               (strat_sum_stat.n_h * (strat_sum_stat.n_h - 1)))) +
                     --Cov(ybar,xbar)
        SUM((1 - strat_sum_stat.w_h) *
               (strat_sum_stat.n_h / strat_sum_stat.n) *
               ((sum_xy -
               strat_sum_stat.n_h * (sum_x / strat_sum_stat.n_h) *
               (sum_y / strat_sum_stat.n_h)) /
               (strat_sum_stat.n_h * (strat_sum_stat.n_h - 1))))
                    --cov(ybar,xbar)
        ))) var_y_x,

        (power(strat_sum_stat.total_acres, 2) / strat_sum_stat.n *
        (SUM(strat_sum_stat.w_h * strat_sum_stat.n_h *
              ((sum_xy -
              strat_sum_stat.n_h * (sum_x / strat_sum_stat.n_h) *
              (sum_y / strat_sum_stat.n_h)) /
              (strat_sum_stat.n_h * (strat_sum_stat.n_h - 1)))) +
                     --Cov(ybar,xbar)
        SUM((1 - strat_sum_stat.w_h) *
              (strat_sum_stat.n_h / strat_sum_stat.n) *
              ((sum_xy -
              strat_sum_stat.n_h * (sum_x / strat_sum_stat.n_h) *
              (sum_y / strat_sum_stat.n_h)) /
              (strat_sum_stat.n_h * (strat_sum_stat.n_h - 1))))
                     --cov(ybar,xbar)
        )) cov_ybar_xbar,

        (power(total_acres, 2) / strat_sum_stat.n) * --A_T/n
        ((SUM(strat_sum_stat.w_h * strat_sum_stat.n_h * --Sum of W_h*n_h
              (((strat_sum.sum_y2 / strat_sum_stat.n_h) -
              (strat_sum.sum_y / strat_sum_stat.n_h *
              strat_sum.sum_y / strat_sum_stat.n_h)) /
              (strat_sum_stat.n_h - 1)))) + --v(x_h)
        1 / strat_sum_stat.n *
        (SUM((1 - strat_sum_stat.w_h) * strat_sum_stat.n_h *
              (((strat_sum.sum_y2 / strat_sum_stat.n_h) -
              (strat_sum.sum_y / strat_sum_stat.n_h *
              strat_sum.sum_y / strat_sum_stat.n_h)) /
              (strat_sum_stat.n_h - 1))))) var_numerator, --v(x_h)
```

```
        (power(total_acres, 2) / strat_sum_stat.n) * --A_T/n
        ((SUM(strat_sum_stat.w_h * strat_sum_stat.n_h * --Sum of W_h*n_h
              (((strat_sum.sum_x2 / strat_sum_stat.n_h) -
              (strat_sum.sum_x / strat_sum_stat.n_h *
              strat_sum.sum_x / strat_sum_stat.n_h)) /
              (strat_sum_stat.n_h - 1)))) + --v(x_h)
        1 / strat_sum_stat.n *
        (SUM((1 - strat_sum_stat.w_h) * strat_sum_stat.n_h *
              (((strat_sum.sum_x2 / strat_sum_stat.n_h) -
              (strat_sum.sum_x / strat_sum_stat.n_h *
              strat_sum.sum_x / strat_sum_stat.n_h)) /
              (strat_sum_stat.n_h - 1))))) var_denominator --v(x_h)

  FROM (
```

```
            --This subquery returns the stratification summary stistics
                 --used to support stratified estimation.
                 SELECT pop.name popn_name,
                        pop.version popn_version,
                        eu.cn estn_unit_cn,
                        geo.name est_unit_name,
                        strat.cn strat_cn,
                        strat.name strat_name,
                        strat.description,
                        strat.label,
                        strat.area strat_acres,
                        (SELECT SUM(area)
                           FROM pop_stratum strat2
                          WHERE strat2.estn_unit_cn = eu.cn) total_acres,
                        strat.area /
                        (SELECT SUM(area)
                           FROM pop_stratum strat2
                          WHERE strat2.estn_unit_cn = eu.cn) w_h,
                        (SELECT COUNT(psa.plt_cn)
                           FROM plot_strat_assgn    psa,
                                plot_statsamp_assgn pssa,
                                pop_stat_samp       samp,
                                plot                p
                          WHERE psa.strat_cn = strat.cn
                            AND samp.eval_cn = eval.cn
                            AND pssa.pss_cn = samp.cn
                            AND pssa.plt_cn = p.cn
                            AND psa.plt_cn = p.cn) n_h,
                        (SELECT COUNT(pssa.plt_cn)
                           FROM plot_statsamp_assgn pssa, pop_stat_samp samp
                          WHERE samp.eval_cn = eval.cn
                            AND pssa.pss_cn = samp.cn) n
                   FROM pop_eval      eval,
                        pop_estn_unit eu,
                        pop_stratum   strat,
                        georarea      geo,
                        population    pop
                  WHERE eval.evalid = '&Evalid'
                    AND eval.cn = eu.eval_cn
                    AND eu.cn = strat.estn_unit_cn
```

```
                    AND eu.geoarea_cn = geo.cn
                    AND eu.popn_cn = pop.cn) strat_sum_stat,
```

```
 ( --This subquery computes sufficient statistics of the sum of y, y^2, x,
x^2, and xy (crossproduct)
                 --for each pop_stratum and domain of interest.
                 SELECT all_plot_sum.strat_cn,
                         all_plot_sum.strat_name,
                         --domains would go here and in the group by
                         all_plot_sum.crown_light_exposure,
                         SUM(y) sum_y,
                         SUM(y * y) sum_y2,
                         SUM(x) sum_x,
                         SUM(x * x) sum_x2,
                         SUM(x * y) sum_xy,
                         SUM(all_plot_sum.plt_cnt) n_h,
                         SUM(decode(nvl(y, 0), 0, 0, 1)) non_zero_y_cnt,
                         SUM(decode(nvl(x, 0), 0, 0, 1)) non_zero_x_cnt
                   FROM
```

```
--This subquery computes the simple count of plots per each
                         --stratum and domain of interest.
                          (SELECT strat.cn    strat_cn,
                                  strat.name strat_name,
                                  p.cn       plt_cn,
                                  --domains would go here and in the group by
                                  r.abbr crown_light_exposure,
                                  1      plt_cnt
                             FROM pop_eval                     eval,
                                  pop_stat_samp                samp,
                                  pop_estn_unit                eu,
                                  pop_stratum                  strat,
                                  plot_statsamp_assgn          sampassgn,
                                  plot_strat_assgn             stratassgn,
                                  plot                         p,
                                  ref_crown_light_exposure r
                            WHERE eval.evalid = '&Evalid'
                              AND eval.cn = samp.eval_cn
                              AND samp.cn = sampassgn.pss_cn
                              AND sampassgn.plt_cn = p.cn
                              AND p.cn = stratassgn.plt_cn
                              AND stratassgn.strat_cn = strat.cn
                              AND strat.estn_unit_cn = eu.cn
                              AND eu.eval_cn = eval.cn
                            GROUP BY strat.estn_unit_cn,
                                     strat.cn,
                                     strat.name,
                                     p.cn,
                                     r.abbr,
                                     1) all_plot_sum,
```

```
 --This subquery produces an adjusted, plot-level estimate of the variable
  -- of interest for each stratum and domain of interest for the numerator
               (SELECT strat.cn    strat_cn,
```

```
                  strat.name strat_name,
                  p.cn       plt_cn,
                   --domains would go here and in the group by
                  r.abbr crown_light_exposure,
                  1 plt_cnt,
                  SUM(t.tpa_unadj * t.carbon_storage  * 0.453592 *
                      decode(t.subp,
                             1,
                             strat.adj_factor_subp,
                             strat.adj_factor_micr)) y
             FROM pop_eval                   eval,
                  pop_stat_samp              samp,
                  pop_estn_unit              eu,
                  pop_stratum                strat,
                  plot_statsamp_assgn        sampassgn,
                  plot_strat_assgn           stratassgn,
                  plot                       p,
                  tree                       t,
                  ref_crown_light_exposure r
            WHERE eval.evalid = '&Evalid'
              AND eval.cn = samp.eval_cn
              AND samp.cn = sampassgn.pss_cn
              AND sampassgn.plt_cn = p.cn
              AND p.cn = stratassgn.plt_cn
              AND stratassgn.strat_cn = strat.cn
              AND strat.estn_unit_cn = eu.cn
              AND eu.eval_cn = eval.cn
              AND p.cn = t.plt_cn(+)
              AND t.crown_light_exposure = r.crown_light_exposure
              AND p.urban_manual >= r.manual_start
              AND (r.manual_end IS NULL OR
                  p.urban_manual <= r.manual_end)
              AND t.statuscd = 1
            GROUP BY strat.estn_unit_cn,
                     strat.cn,
                     strat.name,
                     p.cn,
                     r.abbr,
                     1) y_plot_sum,
```

```
--This subquery produces an adjusted, plot-level estimate of the variable of
-- interest for each stratum and domain of interest for the demoninator
              (SELECT strat.cn   strat_cn,
                      strat.name strat_name,
                      p.cn       plt_cn,
                         --domains would go here and in the group by
                      r.abbr crown_light_exposure,
                      1 plt_cnt,
                      SUM(t.tpa_unadj *
                          decode(t.subp,
                                 1,
                                 strat.adj_factor_subp,
                                 strat.adj_factor_micr)) x
                 FROM pop_eval                   eval,
                      pop_stat_samp              samp,
                      pop_estn_unit              eu,
                      pop_stratum                strat,
```

```
                  plot_statsamp_assgn      sampassgn,
                  plot_strat_assgn         stratassgn,
                  plot                     p,
                  tree                     t,
                  ref_crown_light_exposure r
            WHERE eval.evalid = '&Evalid'
              AND eval.cn = samp.eval_cn
              AND samp.cn = sampassgn.pss_cn
              AND sampassgn.plt_cn = p.cn
              AND p.cn = stratassgn.plt_cn
              AND stratassgn.strat_cn = strat.cn
              AND strat.estn_unit_cn = eu.cn
              AND eu.eval_cn = eval.cn
              AND p.cn = t.plt_cn
              AND t.crown_light_exposure = r.crown_light_exposure
              AND p.urban_manual >= r.manual_start
              AND (r.manual_end IS NULL OR
                  p.urban_manual <= r.manual_end)
              AND t.statuscd = 1
            GROUP BY strat.estn_unit_cn,
                     strat.cn,
                     strat.name,
                     p.cn,
                     r.abbr,
                     1) x_plot_sum
```

```
            WHERE all_plot_sum.plt_cn = x_plot_sum.plt_cn(+)
              AND all_plot_sum.plt_cn = y_plot_sum.plt_cn(+)
              AND all_plot_sum.crown_light_exposure =
                  x_plot_sum.crown_light_exposure(+)
              AND all_plot_sum.crown_light_exposure =
                  y_plot_sum.crown_light_exposure(+)
            GROUP BY all_plot_sum.strat_cn,
                       all_plot_sum.strat_name,
                       all_plot_sum.crown_light_exposure
           HAVING(SUM(x) > 0)) strat_sum
```

```
        WHERE strat_sum_stat.strat_cn = strat_sum.strat_cn(+)
        GROUP BY strat_sum_stat.popn_name,
                     strat_sum_stat.popn_version,
                     est_unit_name,
                     crown_light_exposure,
                     strat_sum_stat.total_acres,
                     strat_sum_stat.n) est_unit_sum
```

```
 GROUP BY popn_name,
          popn_version,
          total_acres,
          plt_cnt,
          crown_light_exposure;
```

This sample script computes an estimate of the ratio of tree carbon content over the total number of trees to produce an estimate of carbon per tree. There are many comments to make about this script.

These comments are made below and organized by the different steps outlined in the *8.8 Ratio Estimates* section above. The same color coding used in that section will be used here for clarity.

The calculation of the denominator occurs in the denominator plot summary query: `t.tpa_unadj`. Note that the alias for the tree table (t) was used in the query. The choice of table alias is arbitrary and can be whatever the analyst defines in the FROM clause. The domain filter of live tree was implemented by including the constraint in the WHERE clause: `t.statuscd = 1`. Any trees not meeting this constraint are excluded from the calculation. The domain partition of crown light exposure categories was implemented by joining the REF_CROWN_LIGHT_EXPOSURE table to the tree table and constraining it to the field guide version used to collect the codes. This is accomplished with the following statements in the WHERE clause:

```
AND t.crown_light_exposure = r.crown_light_exposure
                             AND p.urban_manual >= r.manual_start
                             AND (r.manual_end IS NULL OR
                                 p.urban_manual <= r.manual_end)
```

Once joined, the abbreviations for the codes can be used in the SELECT statement as domain partitions like this:

```
--domains would go here and in the group by
                                 r.abbr crown_light_exposure,
```

Note that the ABBR column was used but it was aliased as *crown_light_exposure*. This is the identity of the domain partition that will be used in other steps of the calculation. It must also be the same identity used in the other plot-level summary queries in order to insure a proper join.

The calculation of the numerator occurs in the numerator plot summary query: `t.tpa_unadj * t.carbon_storage * 0.453592`. Note that the alias for TREE table (t) defined in the FROM clause was used. The addition of the value 0.453592 is a conversion factor for pounds to kilograms. The addition of the live tree domain filter and the crown light exposure domain partition are identical to the denominator plot summary query. The only real difference is the actual calculation performed.

The plot count summary produces a list of every plot in the sample within every domain defined. This forms a superset that can be used to join the numerator and denominator record sets without the risk of data being excluded due to a problem with a join. For example, if the numerator contained a non-zero observation of a particular domain partition that did not exist in the denominator record set, then they would not join correctly and the numerator record would be left out of the analysis, which would be an error.

The plot-stratum summary query uses the plot count summary to join record sets as discussed in the above paragraph as shown here:

```
                    WHERE all_plot_sum.plt_cn = x_plot_sum.plt_cn(+)
                      AND all_plot_sum.plt_cn = y_plot_sum.plt_cn(+)
                      AND all_plot_sum.crown_light_exposure =
                          x_plot_sum.crown_light_exposure(+)
                      AND all_plot_sum.crown_light_exposure =
                          y_plot_sum.crown_light_exposure(+)
```

Note how the x_plot_sum and y_plot_sum record sets never join to each other. They only join to all_plot_sum record set. The joins occur through both the plot CN value as well as any domain partition values defined. This is why the plot count summary query must return every plot assigned to every domain. It ensures that all data will be correctly joined and assigned to the correct stratum.

The plot-stratum summary query includes the domain partition crown_light_exposure from the all_plot_sum record set to ensure that all domains observed in either the numerator or denominator are included.

The stratification summary statistics query is unchanged. This component is identical for both the standard population estimation script and the ratio estimation script.

As mentioned in the *8.8 Ratio Estimates* section, the estimate summary query functions differently than its counterpart in the standard population estimation query. It computes estimates directly at the population level without computing anything at the estimation unit level. The crown light exposure domain partition is used here so that the desired ratios are computed for the desired domains. This query computes not only the estimates themselves but also the variances which will be expressed as sampling errors in the final summary query. This could all be done in one section of code, but it would make that code much more cumbersome and difficult to work with for little gain in performance.

The final summary query simply continues the domain partition of crown light exposure. The only real calculation performed is to convert the variances into sampling errors. This final summary can be output and formatted in tabular or graphic format. It contains a lot of information to assist the analyst in interpreting the results and the level of confidence in those results.

8.9 Analysis of Population Model Output

This section describes techniques for analyses of the Population Model Table Group. The Population Model output has no counterpart in the traditional FIADB. The output in this table group represents population-level estimates of parameters related to the urban forest and its influence on the target population. The technique used to form a custom analysis of this output for all but the Energy Effects model is to allocate the model output across the population domains of interest proportionally. This assumes that the distribution of the model output is uniform across the population. For example, when proportionally allocating rainfall interception by tree canopies across the population, it is assumed that rainfall is uniformly distributed across the population.

The model output must be allocated across the population by computing a proportion for each domain of interest using the inventory data and standard population estimators (see above estimation guide). The exception to this is the Energy Effects model, which cannot be allocated proportionally across the population. The specific proportion computed from the inventory data must correlate with the model output in a way that makes biological or physical sense. For example, it is the surface area of leaves that act as filters by providing a surface for dry deposition of pollutants (MOD_POLLUTION_REMOVAL). Therefore, to allocate pollution removal across a population domain, such as tree species or ownership, the proportion of the total population leaf area within each population domain must be computed. This proportion is multiplied by the model output to determine the amount represented by that domain. The tabulation below shows the appropriate proportion to compute when allocating each of the model outputs.

Model	Database Table	Proportion
Pollution Health Factors	MOD_POLLUTION_HEALTH_FACTOR	Leaf Area
Pollution Removal	MOD_POLLUTION_REVMOVAL	Leaf Area
Rainfall Interception	MOD_RAINFALL	Leaf Area
VOC Emissions	MOD_VOC_EMISSIONS	Leaf Biomass
Energy Effects	MOD_ENERGY_EFFECTS	Not Possible

Estimating the uncertainty in proportionally allocated results is difficult. The total error in such an estimate (ignoring measurement error) is generally composed of sampling error (from the proportion) and model error. The sampling error can be estimated by standard FIA estimation procedures (detailed in the above sections). The computer models that generate the estimates in the Population Model Table Group, however, are complex and quantification of model error is not currently possible. This means the true uncertainty is not known. The user must exercise caution when performing comparisons between domains or between populations.

To compute the proportion of leaf area (for use with the Pollution Health Factors, Pollution Removal, and Rainfall Interception models), compute a ratio estimate where the ratio is total leaf area in the domain of interest to the total leaf area in the population. This ratio can be computed over any domains that are appropriate for tree-level analysis. For example, ownership, species, land use, crown class, and other tree-level domains are available for analysis.

Allocation of the VOC Emissions model requires additional explanation. The model produces estimates of VOC emission by genus. Therefore, when allocating across domains using proportion leaf biomass, values must always be computed at the genus level before being recombined. This accounts for the non-uniform distribution of emissions across genera. There is a further complication relating to uncertainty estimation. Once the leaf biomass ratio has been computed for genus and any other domains of interest, the variance of each ratio cannot be summed. These estimates are not independent because each plot observes multiple genera and each genus produces different estimates of VOC emissions. The other three models are not affected by this issue because their output is uniform across the population, and their output is not genus-specific or constrained to any other domain.

Domain filters (which exclude records from the analysis) should not be used in the allocation procedure. These values resulting from the allocation procedure are not true tree-level variables. Therefore, filtering certain tree records, such as only live trees or trees greater than a size threshold, is not appropriate. All trees are required to compute the best proportion estimate in the domains of interest possible.

Example 8.9.1: Pollution Health Factor by Land Use:
In this example, the analyst is interested in the distribution of health factors across different land uses. Specifically, the analyst is interested in the reduction of incidence of acute respiratory symptoms across all pollutants. As with previous examples, the analyst will work with the Austin, Texas population and use the 'Austin2014Curr' evaluation to perform the analysis.

The first step is to recognize that the appropriate ratio to compute in order to allocate the population model output across land use is proportion leaf area by land use. This is because leaf surface area is most strongly correlated with the pollution reduction capacity of urban forests. The proportion leaf area by land use is a ratio estimate (see the ratio estimation section). Land use is the domain partition and no domain filter is needed. This ratio estimate is computed by the following SQL statement.

```
--The following query produces a ratio estimate of proportion leaf area
       --by species with variance.
       ( --This outer query summarizes the final estimates and computes
        --the sampling errors.
SELECT popn_name,
        popn_version,
        popn_cn,
        landuse,
        /*SUM(*/
        estimate /*)*/ ratio_estimate,
        SUM(estimate_numerator) numerator_estimate,
        SUM(estimate_denominator) denominator_estimate,
        CASE
          WHEN SUM(estimate_sum.var_y_x) > 0 THEN
           round(sqrt(SUM(estimate_sum.var_y_x)) /
                 SUM(estimate_sum.estimate) * 100,
                 3)
          ELSE
           0
        END AS se_of_ratio_estimate_pct,
        CASE
          WHEN SUM(estimate_sum.var_numerator) > 0 THEN
           round(sqrt(SUM(estimate_sum.var_numerator)) /
                 SUM(estimate_sum.estimate_numerator) * 100,
                 3)
          ELSE
           0
        END AS se_of_numerator_estimate_pct,
        CASE
          WHEN SUM(estimate_sum.var_denominator) > 0 THEN
           round(sqrt(SUM(estimate_sum.var_denominator)) /
                 SUM(estimate_sum.estimate_denominator) * 100,
                 3)
          ELSE
           0
        END AS se_of_denominator_estimate_pct,
        SUM(estimate_sum.var_y_x) var_of_ratio_estimate,
        sqrt(SUM(estimate_sum.var_y_x)) se_of_ratio_estimate,
```

```
      SUM(estimate_sum.var_numerator) var_of_numerator_estimate,
      sqrt(SUM(estimate_sum.var_numerator)) se_of_numerator_estimate,
      SUM(estimate_sum.var_denominator) var_of_denominator_estimate,
      sqrt(SUM(estimate_sum.var_denominator)) se_of_denominator_estimate,
      plt_cnt total_plots,
      SUM(non_zero_num_plt_cnt) tot_non_zero_numerator_plots,
      SUM(non_zero_den_plt_cnt) tot_non_zero_denominator_plots,
      total_acres total_acres
FROM ( --This subquery produces the population ratio estimate
       --and estimates of variance for the entire population.
       SELECT strat_sum_stat.popn_name,
               strat_sum_stat.popn_version,
               strat_sum_stat.popn_cn,
               landuse,
               --est_unit_name,
               CASE
                 WHEN SUM(nvl(sum_x, 0)) = 0 THEN
                  999999999999
                 ELSE
                  SUM(sum_y / strat_sum_stat.n_h * (strat_sum_stat.total_acres) *
                      strat_sum_stat.w_h) /
                  SUM(sum_x / strat_sum_stat.n_h * (strat_sum_stat.total_acres) *
                      strat_sum_stat.w_h)
               END estimate,
               SUM(sum_y / strat_sum_stat.n_h * (strat_sum_stat.total_acres) *
                   strat_sum_stat.w_h) estimate_numerator,
               SUM(sum_x / strat_sum_stat.n_h * (strat_sum_stat.total_acres) *
                   strat_sum_stat.w_h) estimate_denominator,
               strat_sum_stat.n plt_cnt,
               SUM(strat_sum.non_zero_y_cnt) non_zero_num_plt_cnt,
               SUM(strat_sum.non_zero_x_cnt) non_zero_den_plt_cnt,
               strat_sum_stat.total_acres,

               (1 / power(SUM(sum_x / strat_sum_stat.n_h *
                              (strat_sum_stat.total_acres) * strat_sum_stat.w_h),
                          2)) *
               (((power(total_acres, 2) / strat_sum_stat.n) *
               ((SUM(strat_sum_stat.w_h * strat_sum_stat.n_h *
                       (((strat_sum.sum_y2 / strat_sum_stat.n_h) -
                       (strat_sum.sum_y / strat_sum_stat.n_h *
                       strat_sum.sum_y / strat_sum_stat.n_h)) /
                       (strat_sum_stat.n_h - 1)))) +
               1 / strat_sum_stat.n *
               (SUM((1 - strat_sum_stat.w_h) * strat_sum_stat.n_h *
                       (((strat_sum.sum_y2 / strat_sum_stat.n_h) -
                       (strat_sum.sum_y / strat_sum_stat.n_h *
                       strat_sum.sum_y / strat_sum_stat.n_h)) /
                       (strat_sum_stat.n_h - 1)))))) + --var(yhat)
               power(SUM(sum_y / strat_sum_stat.n_h * (strat_sum_stat.total_acres) *
                          strat_sum_stat.w_h) /
                      SUM(sum_x / strat_sum_stat.n_h * (strat_sum_stat.total_acres) *
                          strat_sum_stat.w_h),
                      2) * --Ratio^2
               ((power(total_acres, 2) / strat_sum_stat.n) *
               ((SUM(strat_sum_stat.w_h * strat_sum_stat.n_h *
                       (((strat_sum.sum_x2 / strat_sum_stat.n_h) -
                       (strat_sum.sum_x / strat_sum_stat.n_h *
                       strat_sum.sum_x / strat_sum_stat.n_h)) /
                       (strat_sum_stat.n_h - 1)))) +
               1 / strat_sum_stat.n *
               (SUM((1 - strat_sum_stat.w_h) * strat_sum_stat.n_h *
                       (((strat_sum.sum_x2 / strat_sum_stat.n_h) -
                       (strat_sum.sum_x / strat_sum_stat.n_h *
                       strat_sum.sum_x / strat_sum_stat.n_h)) /
```

```
                (strat_sum_stat.n_h - 1)))))) - --Var(xhat)
        2 * (SUM(sum_y / strat_sum_stat.n_h * (strat_sum_stat.total_acres) *
                  strat_sum_stat.w_h) /
        SUM(sum_x / strat_sum_stat.n_h * (strat_sum_stat.total_acres) *
                  strat_sum_stat.w_h)) * --2*Ratio
        (power(strat_sum_stat.total_acres, 2) / strat_sum_stat.n *
        (SUM(strat_sum_stat.w_h * strat_sum_stat.n_h *
               ((sum_xy - strat_sum_stat.n_h * (sum_x / strat_sum_stat.n_h) *
               (sum_y / strat_sum_stat.n_h)) /
               (strat_sum_stat.n_h * (strat_sum_stat.n_h - 1)))) +
                --Cov(ybar,xbar)
        SUM((1 - strat_sum_stat.w_h) * (strat_sum_stat.n_h / strat_sum_stat.n) *
               ((sum_xy - strat_sum_stat.n_h * (sum_x / strat_sum_stat.n_h) *
               (sum_y / strat_sum_stat.n_h)) /
               (strat_sum_stat.n_h * (strat_sum_stat.n_h - 1))))
               --cov(ybar,xbar)
        ))) var_y_x,

        (power(total_acres, 2) / strat_sum_stat.n) * --A_T/n
        ((SUM(strat_sum_stat.w_h * strat_sum_stat.n_h * --Sum of W_h*n_h
              (((strat_sum.sum_y2 / strat_sum_stat.n_h) -
              (strat_sum.sum_y / strat_sum_stat.n_h * strat_sum.sum_y /
              strat_sum_stat.n_h)) / (strat_sum_stat.n_h - 1)))) + --v(x_h)
        1 / strat_sum_stat.n *
        (SUM((1 - strat_sum_stat.w_h) * strat_sum_stat.n_h *
              (((strat_sum.sum_y2 / strat_sum_stat.n_h) -
              (strat_sum.sum_y / strat_sum_stat.n_h * strat_sum.sum_y /
              strat_sum_stat.n_h)) / (strat_sum_stat.n_h - 1))))) var_numerator,
               --v(x_h)

        (power(total_acres, 2) / strat_sum_stat.n) * --A_T/n
        ((SUM(strat_sum_stat.w_h * strat_sum_stat.n_h * --Sum of W_h*n_h
              (((strat_sum.sum_x2 / strat_sum_stat.n_h) -
              (strat_sum.sum_x / strat_sum_stat.n_h * strat_sum.sum_x /
              strat_sum_stat.n_h)) / (strat_sum_stat.n_h - 1)))) + --v(x_h)
        1 / strat_sum_stat.n *
       (SUM((1 - strat_sum_stat.w_h) * strat_sum_stat.n_h *
              (((strat_sum.sum_x2 / strat_sum_stat.n_h) -
              (strat_sum.sum_x / strat_sum_stat.n_h * strat_sum.sum_x /
             strat_sum_stat.n_h)) / (strat_sum_stat.n_h - 1))))) var_denominator
               --v(x_h)

  FROM ( --This subquery returns the stratification summary staistics
         --used to support stratified estimation.
         SELECT pop.name popn_name,
                  pop.version popn_version,
                  pop.cn popn_cn,
                  eu.cn estn_unit_cn,
                  geo.name est_unit_name,
                  strat.cn strat_cn,
                  strat.name strat_name,
                  strat.description,
                  strat.area strat_acres,
                 (SELECT SUM(area)
                    FROM pop_stratum strat2
                   WHERE strat2.estn_unit_cn = eu.cn) total_acres,
                  strat.area /
                  (SELECT SUM(area)
                    FROM pop_stratum strat2
                   WHERE strat2.estn_unit_cn = eu.cn) w_h,
                 (SELECT COUNT(psa.plt_cn)
                    FROM plot_strat_assgn    psa,
                         plot_statsamp_assgn pssa,
                         pop_stat_samp       samp,
```

```
                plot                p
          WHERE psa.strat_cn = strat.cn
            AND samp.eval_cn = eval.cn
            AND pssa.pss_cn = samp.cn
            AND pssa.plt_cn = p.cn
            AND psa.plt_cn = p.cn) n_h,
        (SELECT COUNT(pssa.plt_cn)
           FROM plot_statsamp_assgn pssa,
                pop_stat_samp       samp
          WHERE samp.eval_cn = eval.cn
            AND pssa.pss_cn = samp.cn) n
   FROM pop_eval eval,
        pop_estn_unit eu,
        pop_stratum strat,
        geoarea geo,
        population pop,
        (SELECT DISTINCT popn_cn, geoarea_cn, report_year
           FROM mod_pollution_removal) hf
  WHERE eval.evalid = 'Austin2014Curr'
    AND eval.cn = eu.eval_cn
    AND eu.cn = strat.estn_unit_cn
    AND eu.geoarea_cn = geo.cn
    AND eu.popn_cn = pop.cn
    AND hf.popn_cn = eu.popn_cn
    AND hf.geoarea_cn = eu.geoarea_cn
    AND hf.report_year = eval.report_year) strat_sum_stat,
( --This subquery computes sufficient statistics of the sum of y, y^2,
  -- x, x^2, and xy (crossproduct)
 --for each pop_stratum and domain of interest.
 SELECT all_plot_sum.strat_cn,
        all_plot_sum.strat_name,
        --domains would go here and in the group by
        all_plot_sum.landuse,
        SUM(y) sum_y,
        SUM(y * y) sum_y2,
        SUM(x) sum_x,
        SUM(x * x) sum_x2,
        SUM(x * y) sum_xy,
        SUM(all_plot_sum.plt_cnt) n_h,
        SUM(decode(nvl(y, 0), 0, 0, 1)) non_zero_y_cnt,
        SUM(decode(nvl(x, 0), 0, 0, 1)) non_zero_x_cnt
   FROM ( --This subquery computes the simple count of plots per each
         --pop_stratum and domain of interest.
         SELECT strat.cn   strat_cn,
                strat.name strat_name,
                r.landuse,
                p.cn       plt_cn,
                1          plt_cnt
           FROM pop_eval eval,
                pop_stat_samp samp,
                pop_estn_unit eu,
                pop_stratum strat,
                plot_statsamp_assgn sampassgn,
                plot_strat_assgn stratassgn,
                plot p,
                (SELECT DISTINCT popn_cn,
                                 geoarea_cn,
                                 report_year
                   FROM mod_pollution_removal) hf,
            --This subquery returns the distinct land uses
              --associated with the current sample
```

```
                (SELECT DISTINCT r.abbr landuse
                  FROM pop_eval              eval,
                       pop_stat_samp         samp,
                       plot_statsamp_assgn sampassgn,
                       plot                     p,
                       tree                     t,
                       ref_landuse              r
                 WHERE eval.evalid = 'Austin2014Curr'
                   AND eval.cn = samp.eval_cn
                   AND sampassgn.pss_cn = samp.cn
                   AND sampassgn.plt_cn = p.cn
                   AND p.cn = t.plt_cn
                   AND p.urban_manual >= r.manual_start
                   AND (r.manual_end IS NULL OR
                       p.urban_manual <= r.manual_end)
                   AND t.landuse = r.landuse) r
  WHERE eval.evalid = 'Austin2014Curr'
    AND eval.cn = samp.eval_cn
    AND samp.cn = sampassgn.pss_cn
    AND sampassgn.plt_cn = p.cn
    AND p.cn = stratassgn.plt_cn
    AND stratassgn.strat_cn = strat.cn
    AND strat.estn_unit_cn = eu.cn
    AND eu.eval_cn = eval.cn
    AND hf.popn_cn = eu.popn_cn
    AND hf.geoarea_cn = eu.geoarea_cn
    AND hf.report_year = eval.report_year
  GROUP BY strat.estn_unit_cn,
           strat.cn,
           strat.name,
           p.cn,
           r.landuse,
           1) all_plot_sum,
--This subquery produces an adjusted, plot-level
--estimate of the variable of interest for each
--pop_stratum and domain of interest for the numerator
(SELECT strat.cn   strat_cn,
        strat.name strat_name,
        p.cn       plt_cn,
        --domains would go here and in the group by
        r.abbr landuse,
        1 plt_cnt,
        SUM(nvl(t.tpa_unadj, 0) * t.leaf_area *
            decode(t.subp,
                   1,
                   strat.adj_factor_subp,
                   strat.adj_factor_micr)) y
   FROM pop_eval eval,
        pop_stat_samp samp,
        pop_estn_unit eu,
        pop_stratum strat,
        plot_statsamp_assgn sampassgn,
        plot_strat_assgn stratassgn,
        plot p,
```

```
        tree t,
        ref_landuse r,
        (SELECT DISTINCT popn_cn,
                         geoarea_cn,
                         report_year
           FROM mod_pollution_removal) hf
  WHERE eval.evalid = 'Austin2014Curr'
    AND eval.cn = samp.eval_cn
    AND samp.cn = sampassgn.pss_cn
    AND sampassgn.plt_cn = p.cn
    AND p.cn = stratassgn.plt_cn
    AND stratassgn.strat_cn = strat.cn
    AND strat.estn_unit_cn = eu.cn
    AND eu.eval_cn = eval.cn
    AND p.cn = t.plt_cn(+)
    AND p.urban_manual >= r.manual_start
    AND (r.manual_end IS NULL OR
        p.urban_manual <= r.manual_end)
    AND t.landuse = r.landuse
    AND hf.popn_cn = eu.popn_cn
    AND hf.geoarea_cn = eu.geoarea_cn
    AND hf.report_year = eval.report_year
  GROUP BY strat.estn_unit_cn,
           strat.cn,
           strat.name,
           p.cn,
           r.abbr,
           1) y_plot_sum,
--This subquery produces an adjusted, plot-level
--estimate of the variable of interest for each
--pop_stratum and domain of interest for the denominator
  (SELECT strat.cn   strat_cn,
        strat.name strat_name,
        p.cn       plt_cn,
        --domains would go here and in the group by
        1 plt_cnt,
        SUM(nvl(t.tpa_unadj, 0) * t.leaf_area *
            decode(t.subp,
                   1,
                   strat.adj_factor_subp,
                   strat.adj_factor_micr)) x
   FROM pop_eval eval,
        pop_stat_samp samp,
        pop_estn_unit eu,
        pop_stratum strat,
        plot_statsamp_assgn sampassgn,
        plot_strat_assgn stratassgn,
        plot p,
        tree t,
        (SELECT DISTINCT popn_cn,
                         geoarea_cn,
                         report_year
           FROM mod_pollution_removal) hf
  WHERE eval.evalid = 'Austin2014Curr'
    AND eval.cn = samp.eval_cn
    AND samp.cn = sampassgn.pss_cn
    AND sampassgn.plt_cn = p.cn
    AND p.cn = stratassgn.plt_cn
    AND stratassgn.strat_cn = strat.cn
    AND strat.estn_unit_cn = eu.cn
    AND eu.eval_cn = eval.cn
```

```
                                          AND p.cn = t.plt_cn(+)
                                          AND hf.popn_cn = eu.popn_cn
                                          AND hf.geoarea_cn = eu.geoarea_cn
                                          AND hf.report_year = eval.report_year
                                        GROUP BY strat.estn_unit_cn,
                                                 strat.cn,
                                                 strat.name,
                                                 p.cn,
                                                 1) x_plot_sum
                               WHERE all_plot_sum.plt_cn = x_plot_sum.plt_cn(+)
                                 AND all_plot_sum.plt_cn = y_plot_sum.plt_cn(+)
                                 AND all_plot_sum.landuse = y_plot_sum.landuse(+)
                               GROUP BY all_plot_sum.strat_cn,
                                        all_plot_sum.strat_name,
                                        all_plot_sum.landuse) strat_sum
                      WHERE strat_sum_stat.strat_cn = strat_sum.strat_cn(+)
                      GROUP BY strat_sum_stat.popn_name,
                               strat_sum_stat.popn_version,
                               strat_sum_stat.popn_cn,
                               strat_sum_stat.total_acres,
                               strat_sum_stat.n,
                               landuse) estimate_sum
 GROUP BY popn_name,
          popn_version,
          popn_cn,
          estimate,
          total_acres,
          plt_cnt,
          landuse) ratio_est
```

Note that the entire statement above is wrapped in parentheses and given an alias of `ratio_est`. This is because the entire output is used as a table in the final output script (see below). The structure of this ratio estimate is almost the same as previously discussed in the Ratio Estimates section. There are, however, a few minor changes made to work for this application of the ratio estimator.

Beginning in `all_plot_sum` subquery, a separate subquery (highlighted in light grey) is used to produce a list of all distinct land uses recorded in the statistical sample. This list is combined with the complete list of plots in the sample produced by `all_plot_sum`. The result is the super set of all possible domains on all plots. This technique can be expanded by using a subquery for additional domain subdivisions of interest. The more domain subdivisions used, however, the more demanding the query is to execute and fewer non-zero plots occur in each subdomain. This superset is used to join to the numerator and denominator scripts; `y_plot_sum` and `x_plot_sum`, respectively.

The numerator script (`y_plot_sum`) computes the leaf area per acre by land use for every plot. Note the use of the reference table, which translates the actual land use codes collected by the crew to the more interpretable abbreviation in the reference table.

The denominator script (`x_plot_sum`) simply computes the leaf area per acre for every plot with no domains of interest. The reason for this is the denominator should produce an estimate of the total population leaf area.

The code highlighted in purple was added to support joining between the ratio estimate output and the population model output. The code highlighted in aqua was added to constrain the inputs of the ratio estimate to only those areas and reporting year for which the model is representative. These modifications have two components. First, a subquery was added to the FROM clause at four points. This subquery returns the distinct population CN, geographic area CN, and reporting year for all model output. The second component joins this subquery output to the other tables in the FROM clause such that only estimation units for which population model outputs exist and for which the repoting years match are included.

The rest of the script is identical to the previous examples and discussion of ratio estimators. The result of the script is the proportion of leaf area by land use with sampling error (for abbreviated results see table below). The denominator estimate is the same for every domain because it represents the population total.

POPN_NAME	POPN_VERSION	LANDUSE	RATIO_ESTIMATE	NUMERATOR_ESTIMATE	DENOMINATOR_ESTIMATE	SE_OF_RATIO_ESTIMATE_PCT
Austin, Texas Urban Area	1.0	Agriculture	0.15	1,817,534,907	12,021,243,080	35.50
Austin, Texas Urban Area	1.0	Commercial	0.03	360,121,781	12,021,243,080	30.15
Austin, Texas Urban Area	1.0	Golf Course	0.01	136,586,306	12,021,243,080	112.64
Austin, Texas Urban Area	1.0	Institutional	0.02	189,324,007	12,021,243,080	57.66
Austin, Texas Urban Area	1.0	Muli-family	0.01	133,285,597	12,021,243,080	43.89
Austin, Texas Urban Area	1.0	Park	0.35	4,151,234,978	12,021,243,080	17.46
Austin, Texas Urban Area	1.0	Residential	0.24	2,833,272,810	12,021,243,080	17.10
Austin, Texas Urban Area	1.0	Transportation	0.01	109,266,009	12,021,243,080	78.30
Austin, Texas Urban Area	1.0	Utility	0.01	77,310,503	12,021,243,080	55.75
Austin, Texas Urban Area	1.0	Vacant	0.18	2,213,306,182	12,021,243,080	24.79

The ratio computed by the above SQL statement is used as an input to the final calculation. The output from the ratio estimation script is treated as a table in the final output and joined to the results of the population model output in MOD_POLLUTION_HEALTH_FACTOR. This is shown in the script below.

```
--This script computes a ratio estimate of leaf area proportion by land use and uses that
--ratio to allocate the pollution health effects across land uses
--tab=HEALTHFACTOR_LANDUSE
SELECT ratio_est.popn_name,
       ratio_est.popn_version,
       hf.health_factor,
       ratio_est.landuse,
       --Acute Respiratory Symptoms, all pollutants
       ratio_est.ratio_estimate * (hf.no2_incidence + hf.so2_incidence +
```

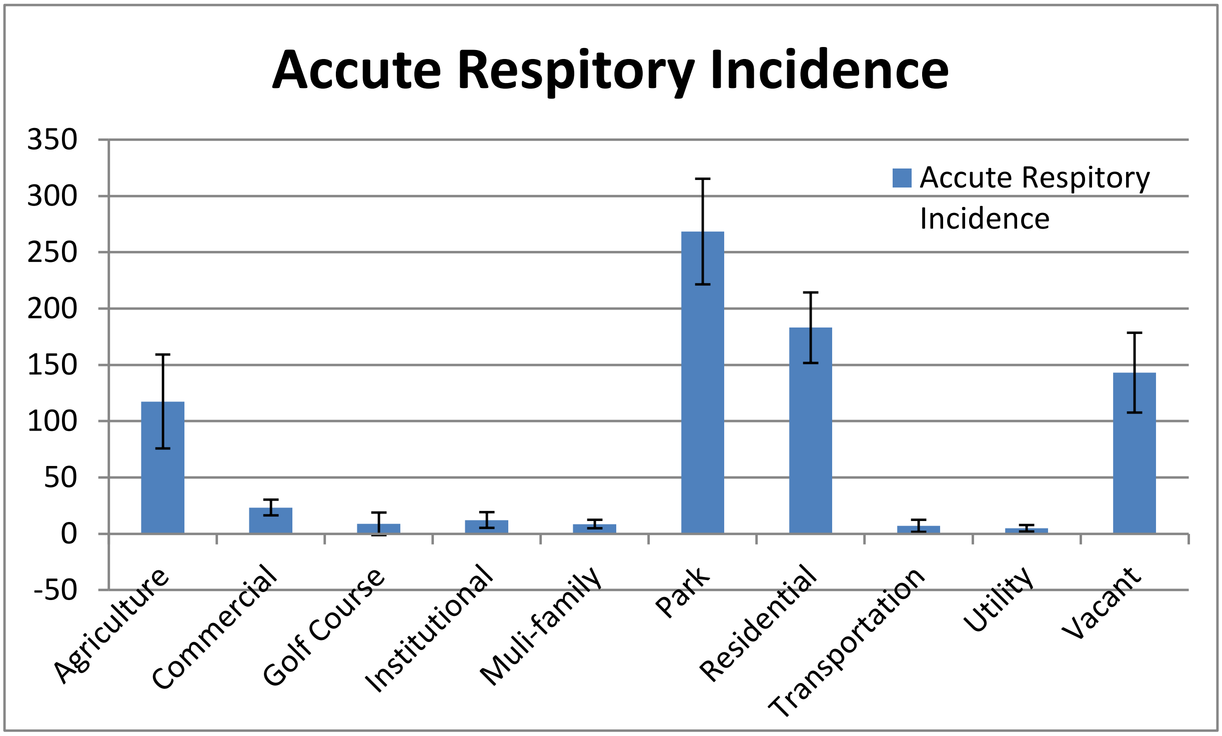
```
      hf.o3_incidence + hf.pm25_incidence) ars_visit_incidence,
      power(hf.no2_incidence + hf.so2_incidence + hf.o3_incidence +
            hf.pm25_incidence,
            2) * ratio_est.var_of_ratio_estimate var_ars_visit_incidence,
      sqrt(power(hf.no2_incidence + hf.so2_incidence + hf.o3_incidence +
                 hf.pm25_incidence,
                 2) * ratio_est.var_of_ratio_estimate) se_ars_visit_incidence,
      ratio_est.ratio_estimate * (hf.no2_incidence + hf.so2_incidence +
      hf.o3_incidence + hf.pm25_incidence)+
      sqrt(power(hf.no2_incidence + hf.so2_incidence + hf.o3_incidence +
                 hf.pm25_incidence,
                 2) * ratio_est.var_of_ratio_estimate) one_se_upper_bound,
      ratio_est.ratio_estimate * (hf.no2_incidence + hf.so2_incidence +
      hf.o3_incidence + hf.pm25_incidence)-
      sqrt(power(hf.no2_incidence + hf.so2_incidence + hf.o3_incidence +
                 hf.pm25_incidence,
                 2) * ratio_est.var_of_ratio_estimate) one_se_lower_bound,
      hf.no2_incidence + hf.so2_incidence + hf.o3_incidence +
      hf.pm25_incidence total_ars_incidence,
      ratio_est.ratio_estimate        prop_leaf_area,
      ratio_est.se_of_ratio_estimate  se_prop_leaf_area,
      ratio_est.var_of_ratio_estimate var_prop_leaf_area
 FROM mod_pollution_health_factor hf,
      (ratio_estimate_query) ratio_est
WHERE hf.popn_cn = ratio_est.popn_cn
  AND hf.health_factor = 'Acute Respiratory Symptoms'
ORDER BY hf.health_factor, landuse;
```

Note the (**ratio_estimate_query**) in the FROM clause. This represents the above ratio script as a table to be joined in the final output statement. The results of the ratio estimation script are joined with the MOD_POLLUTION_HEALTH_FACTOR through the population CN value.

The analysis was only interested in the Acute Respiratory Symptoms health factor. To constrain the results to only this health factor, the `hf.health_factor = 'Acute Respiratory Symptoms'` statement is added to the WHERE clause.

The proportional allocation of the incidence of Acute Respiratory Symptoms is computed in the section highlighted green. It simply multiplies the ratio for the land use domain by the sum of the pollutant incidences. To compute the sampling error component of total error, the sum of the incidences is treated like a constant. This constant is squared and multiplied by the variance for the ratio estimate within the land use domain. The calculation is highlighted dark blue. The sampling error is simply the square root of the variance calculation. The script also computes the upper and lower bounds of a one-standard-error margin of error. Also included in the output is the total incidence for Acute Respiratory Symptoms from the population model output and the leaf area ratio with variance and sampling error. These items are included for the convenience of the analyst and not strictly required by the analysis.

The output of this script can easily be graphed as shown below. There are a few important comments to make about this output. First, the positive values indicate a reduction in incidence. Negative values would indicate an increase in incidence for the health factor. Second, the error bars shown are a single standard error. There is not accounting for model error in these error bars, and therefore they underrepresent the total error of these domain estimates. Care must be taken when comparing between domains or comparison with other populations.



Example 8.9.2: Pollution Removal by Species:
In this example, the analyst is interested in looking at the amount of pollution reduction by different species within the population. The model output includes estimates for four pollutants; NO_2, SO_2, O_3, and $PM_{2.5}$. The analyst is interested in looking at overall reduction and will include all pollutants in the estimate. The analyst, however, would like to show the reduction by individual pollutants in the output as well.

To begin, the analyst recognizes that the proportion leaf area is required to allocate pollution removal estimates across species. This is because the surface area of leaves is most strongly correlated with pollution reduction. To complete the analysis, the ratio of leaf area by species is computed and multiplied by the pollution reduction estimates for each species.

The calculation of the proportion of leaf area by species uses the standard ratio estimation methodology described previously. The following SQL script produces this estimate for the Austin, Texas population using the 'Austin2014Curr' evaluation, as was used in previous examples. The script is the same as described in the Ratio Estimates section with a few minor changes to support this application of the technique. Those changes will be discussed below.

```
--The following query produces a ratio estimate of proportion leaf area by species with
variance.
( --This outer query summarizes the final estimates and computes
  --the sampling errors.
SELECT popn_name,         popn_version,
        popn_cn,
```

```
        common_name,
        /*SUM(*/
        estimate /*)*/ ratio_estimate,
        SUM(estimate_numerator) numerator_estimate,
        SUM(estimate_denominator) denominator_estimate,
        CASE
          WHEN SUM(estimate_sum.var_y_x) > 0 THEN
           round(sqrt(SUM(estimate_sum.var_y_x)) /
                 SUM(estimate_sum.estimate) * 100,
                 3)
          ELSE
           0
        END AS se_of_ratio_estimate_pct,
        CASE
          WHEN SUM(estimate_sum.var_numerator) > 0 THEN
           round(sqrt(SUM(estimate_sum.var_numerator)) /
                 SUM(estimate_sum.estimate_numerator) * 100,
                 3)
          ELSE
           0
        END AS se_of_numerator_estimate_pct,
        CASE
          WHEN SUM(estimate_sum.var_denominator) > 0 THEN
           round(sqrt(SUM(estimate_sum.var_denominator)) /
                 SUM(estimate_sum.estimate_denominator) * 100,
                 3)
          ELSE
           0
        END AS se_of_denominator_estimate_pct,
        SUM(estimate_sum.var_y_x) var_of_ratio_estimate,
        sqrt(SUM(estimate_sum.var_y_x)) se_of_ratio_estimate,
        SUM(estimate_sum.var_numerator) var_of_numerator_estimate,
        sqrt(SUM(estimate_sum.var_numerator)) se_of_numerator_estimate,
        SUM(estimate_sum.var_denominator) var_of_denominator_estimate,
        sqrt(SUM(estimate_sum.var_denominator)) se_of_denominator_estimate,
        plt_cnt total_plots,
        SUM(non_zero_num_plt_cnt) tot_non_zero_numerator_plots,
        SUM(non_zero_den_plt_cnt) tot_non_zero_denominator_plots,
        total_acres total_acres
  FROM ( --This subquery produces the population ratio estimate
         --and estimates of variance for the entire population.
         SELECT strat_sum_stat.popn_name,
                strat_sum_stat.popn_version,
                strat_sum_stat.popn_cn,
                common_name,
                CASE
                 WHEN SUM(nvl(sum_x, 0)) = 0 THEN
                   999999999999
                  ELSE
                   SUM(sum_y / strat_sum_stat.n_h * (strat_sum_stat.total_acres) *
                       strat_sum_stat.w_h) /
                   SUM(sum_x / strat_sum_stat.n_h * (strat_sum_stat.total_acres) *
                       strat_sum_stat.w_h)
                END estimate,
                SUM(sum_y / strat_sum_stat.n_h * (strat_sum_stat.total_acres) *
                    strat_sum_stat.w_h) estimate_numerator,
                SUM(sum_x / strat_sum_stat.n_h * (strat_sum_stat.total_acres) *
                    strat_sum_stat.w_h) estimate_denominator,
                strat_sum_stat.n plt_cnt,
                SUM(strat_sum.non_zero_y_cnt) non_zero_num_plt_cnt,
                SUM(strat_sum.non_zero_x_cnt) non_zero_den_plt_cnt,
                strat_sum_stat.total_acres,

                (1 / power(SUM(sum_x / strat_sum_stat.n_h *
```

```
               (strat_sum_stat.total_acres) * strat_sum_stat.w_h),
           2)) *
(((power(total_acres, 2) / strat_sum_stat.n) *
((SUM(strat_sum_stat.w_h * strat_sum_stat.n_h *
        (((strat_sum.sum_y2 / strat_sum_stat.n_h) -
        (strat_sum.sum_y / strat_sum_stat.n_h *
        strat_sum.sum_y / strat_sum_stat.n_h)) /
        (strat_sum_stat.n_h - 1)))) +
1 / strat_sum_stat.n *
(SUM((1 - strat_sum_stat.w_h) * strat_sum_stat.n_h *
        (((strat_sum.sum_y2 / strat_sum_stat.n_h) -
        (strat_sum.sum_y / strat_sum_stat.n_h *
        strat_sum.sum_y / strat_sum_stat.n_h)) /
        (strat_sum_stat.n_h - 1)))))) + --var(yhat)
power(SUM(sum_y / strat_sum_stat.n_h * (strat_sum_stat.total_acres) *
           strat_sum_stat.w_h) /
      SUM(sum_x / strat_sum_stat.n_h * (strat_sum_stat.total_acres) *
           strat_sum_stat.w_h),
       2) * --Ratio^2
((power(total_acres, 2) / strat_sum_stat.n) *
((SUM(strat_sum_stat.w_h * strat_sum_stat.n_h *
        (((strat_sum.sum_x2 / strat_sum_stat.n_h) -
        (strat_sum.sum_x / strat_sum_stat.n_h *
        strat_sum.sum_x / strat_sum_stat.n_h)) /
        (strat_sum_stat.n_h - 1)))) +
1 / strat_sum_stat.n *
(SUM((1 - strat_sum_stat.w_h) * strat_sum_stat.n_h *
        (((strat_sum.sum_x2 / strat_sum_stat.n_h) -
        (strat_sum.sum_x / strat_sum_stat.n_h *
        strat_sum.sum_x / strat_sum_stat.n_h)) /
        (strat_sum_stat.n_h - 1)))))) - --Var(xhat)
2 * (SUM(sum_y / strat_sum_stat.n_h * (strat_sum_stat.total_acres) *
          strat_sum_stat.w_h) /
SUM(sum_x / strat_sum_stat.n_h * (strat_sum_stat.total_acres) *
          strat_sum_stat.w_h)) * --2*Ratio
(power(strat_sum_stat.total_acres, 2) / strat_sum_stat.n *
(SUM(strat_sum_stat.w_h * strat_sum_stat.n_h *
       ((sum_xy - strat_sum_stat.n_h * (sum_x / strat_sum_stat.n_h) *
       (sum_y / strat_sum_stat.n_h)) /
       (strat_sum_stat.n_h * (strat_sum_stat.n_h - 1)))) +
           --Cov(ybar,xbar)
SUM((1 - strat_sum_stat.w_h) * (strat_sum_stat.n_h / strat_sum_stat.n) *
       ((sum_xy - strat_sum_stat.n_h * (sum_x / strat_sum_stat.n_h) *
       (sum_y / strat_sum_stat.n_h)) /
       (strat_sum_stat.n_h * (strat_sum_stat.n_h - 1))))
           --cov(ybar,xbar)
))) var_y_x,

(power(total_acres, 2) / strat_sum_stat.n) * --A_T/n
((SUM(strat_sum_stat.w_h * strat_sum_stat.n_h * --Sum of W_h*n_h
      (((strat_sum.sum_y2 / strat_sum_stat.n_h) -
      (strat_sum.sum_y / strat_sum_stat.n_h * strat_sum.sum_y /
      strat_sum_stat.n_h)) / (strat_sum_stat.n_h - 1)))) + --v(x_h)
1 / strat_sum_stat.n *
(SUM((1 - strat_sum_stat.w_h) * strat_sum_stat.n_h *
      (((strat_sum.sum_y2 / strat_sum_stat.n_h) -
      (strat_sum.sum_y / strat_sum_stat.n_h * strat_sum.sum_y /
      strat_sum_stat.n_h)) / (strat_sum_stat.n_h - 1))))) var_numerator,
                    --v(x_h)

(power(total_acres, 2) / strat_sum_stat.n) * --A_T/n
((SUM(strat_sum_stat.w_h * strat_sum_stat.n_h * --Sum of W_h*n_h
      (((strat_sum.sum_x2 / strat_sum_stat.n_h) -
      (strat_sum.sum_x / strat_sum_stat.n_h * strat_sum.sum_x /
```

```
                  strat_sum_stat.n_h)) / (strat_sum_stat.n_h - 1)))) + --v(x_h)
            1 / strat_sum_stat.n *
            (SUM((1 - strat_sum_stat.w_h) * strat_sum_stat.n_h *
                  (((strat_sum.sum_x2 / strat_sum_stat.n_h) -
                  (strat_sum.sum_x / strat_sum_stat.n_h * strat_sum.sum_x /
                 strat_sum_stat.n_h)) / (strat_sum_stat.n_h - 1))))) var_denominator
                              --v(x_h)

      FROM ( --This subquery returns the stratification summary statistics
             --used to support stratified estimation.
             SELECT pop.name popn_name,
                     pop.version popn_version,
                     pop.cn popn_cn,
                     eu.cn estn_unit_cn,
                     geo.name est_unit_name,
                     strat.cn strat_cn,
                     strat.name strat_name,
                     strat.description,
                     strat.area strat_acres,
                   (SELECT SUM(area)
                       FROM pop_stratum strat2
                      WHERE strat2.estn_unit_cn = eu.cn) total_acres,
                     strat.area /
                   (SELECT SUM(area)
                        FROM pop_stratum strat2
                       WHERE strat2.estn_unit_cn = eu.cn) w_h,
                      (SELECT COUNT(psa.plt_cn)
                        FROM plot_strat_assgn    psa,
                             plot_statsamp_assgn pssa,
                             pop_stat_samp       samp,
                             plot                p
                       WHERE psa.strat_cn = strat.cn
                         AND samp.eval_cn = eval.cn
                         AND pssa.pss_cn = samp.cn
                         AND pssa.plt_cn = p.cn
                         AND psa.plt_cn = p.cn) n_h,
                     (SELECT COUNT(pssa.plt_cn)
                        FROM plot_statsamp_assgn pssa,
                             pop_stat_samp       samp
                       WHERE samp.eval_cn = eval.cn
                         AND pssa.pss_cn = samp.cn) n
               FROM pop_eval eval,
                      pop_estn_unit eu,
                      pop_stratum strat,
                      georea geo,
                      population pop,
                     (SELECT DISTINCT popn_cn, georea_cn, report_year
                        FROM mod_pollution_removal) pr
              WHERE eval.evalid = 'Austin2014Curr'
                AND eval.cn = eu.eval_cn
                AND eu.cn = strat.estn_unit_cn
                AND eu.georea_cn = geo.cn
                AND eu.popn_cn = pop.cn
                AND pr.popn_cn = eu.popn_cn
                AND pr.georea_cn = eu.georea_cn
                AND pr.report_year = eval.report_year) strat_sum_stat,
            ( --This subquery computes sufficient statistics of the sum of y, y^2,
              --x, x^2, and xy (crossproduct)
              --for each pop_stratum and domain of interest.
             SELECT all_plot_sum.strat_cn,
                     all_plot_sum.strat_name,
                     --domains would go here and in the group by
```

```
                 all_plot_sum.common_name,
                 SUM(y) sum_y,
                 SUM(y * y) sum_y2,
                 SUM(x) sum_x,
                 SUM(x * x) sum_x2,
                 SUM(x * y) sum_xy,
                 SUM(all_plot_sum.plt_cnt) n_h,
                 SUM(decode(nvl(y, 0), 0, 0, 1)) non_zero_y_cnt,
                 SUM(decode(nvl(x, 0), 0, 0, 1)) non_zero_x_cnt
           FROM ( --This subquery computes the simple count of plots per each
                  --pop_stratum and domain of interest.
                 SELECT strat.cn      strat_cn,
                        strat.name    strat_name,
                        r.common_name,
                        p.cn          plt_cn,
                        1             plt_cnt
                   FROM pop_eval eval,
                        pop_stat_samp samp,
                        pop_estn_unit eu,
                        pop_stratum strat,
                        plot_statsamp_assgn sampassgn,
                        plot_strat_assgn stratassgn,
                        plot p,
                        (SELECT DISTINCT popn_cn, geoarea_cn, report_year
                           FROM mod_pollution_removal) pr,
                        --This subquery returns the distinct species
                        --associated with the current sample
                       (SELECT DISTINCT r.common_name
                            FROM pop_eval            eval,
                                 pop_stat_samp       samp,
                                 plot_statsamp_assgn sampassgn,
                                 plot                p,
                                 tree                t,
                                 ref_species         r
                           WHERE eval.evalid = 'Austin2014Curr'
                             AND eval.cn = samp.eval_cn
                             AND sampassgn.pss_cn = samp.cn
                             AND sampassgn.plt_cn = p.cn
                             AND p.cn = t.plt_cn
                             AND p.urban_manual >= r.manual_start
                             AND (r.manual_end IS NULL OR
                                 p.urban_manual <= r.manual_end)
                             AND t.spcd = r.spcd) r
                  WHERE eval.evalid = 'Austin2014Curr'
                    AND eval.cn = samp.eval_cn
                    AND samp.cn = sampassgn.pss_cn
                    AND sampassgn.plt_cn = p.cn
                    AND p.cn = stratassgn.plt_cn
                    AND stratassgn.strat_cn = strat.cn
                    AND strat.estn_unit_cn = eu.cn
                    AND eu.eval_cn = eval.cn
                    AND pr.popn_cn = eu.popn_cn
                    AND pr.geoarea_cn = eu.geoarea_cn
                    AND pr.report_year = eval.report_year
                  GROUP BY strat.estn_unit_cn,
                           strat.cn,
                           strat.name,
                           p.cn,
                           r.common_name,
                           1) all_plot_sum,
--This subquery produces an adjusted, plot-level estimate of the variable of interest for
--each pop_stratum and domain of interest for the numerator
```

```
                          (SELECT strat.cn   strat_cn,
                                  strat.name strat_name,
                                  p.cn       plt_cn,
                                  --domains would go here and in the group by
                                  r.common_name,
                                  1 plt_cnt,
                                  SUM(nvl(t.tpa_unadj, 0) * t.leaf_area *
                                      /*0.453592 **/
                                      decode(t.subp,
                                             1,
                                             strat.adj_factor_subp,
                                             strat.adj_factor_micr)) y
                             FROM pop_eval eval,
                                  pop_stat_samp samp,
                                  pop_estn_unit eu,
                                  pop_stratum strat,
                                  plot_statsamp_assgn sampassgn,
                                  plot_strat_assgn stratassgn,
                                  plot p,
                                  tree t,
                                  ref_species r,
                                  (SELECT DISTINCT popn_cn, geoarea_cn, report_year
                                     FROM mod_pollution_removal) pr
                            WHERE eval.evalid = 'Austin2014Curr'
                              AND eval.cn = samp.eval_cn
                              AND samp.cn = sampassgn.pss.cn
                              AND sampassgn.plt_cn = p.cn
                              AND p.cn = stratassgn.plt_cn
                              AND stratassgn.strat_cn = strat.cn
                              AND strat.estn_unit_cn = eu.cn
                              AND eu.eval_cn = eval.cn
                              AND p.cn = t.plt_cn(+)
                              AND p.urban_manual >= r.manual_start
                              AND (r.manual_end IS NULL OR
                                  p.urban_manual <= r.manual_end)
                              AND t.spcd = r.spcd
                              AND pr.popn_cn = pr.popn_cn
                              AND pr.geoarea_cn = pr.geoarea_cn
                              AND pr.report_year = eval.report_year
                            GROUP BY strat.estn_unit_cn,
                                     strat.cn,
                                     strat.name,
                                     p.cn,
                                     r.common_name,
                                     1) y_plot_sum,
--This subquery produces an adjusted, plot-level estimate of the variable of interest for
--each pop_stratum and domain of interest for the demoninator
                          (SELECT strat.cn   strat_cn,
                                  strat.name strat_name,
                                  p.cn       plt_cn,
                                  --domains would go here and in the group by
                                  1 plt_cnt,
                                  SUM(nvl(t.tpa_unadj, 0) * t.leaf_area *
                                      decode(t.subp,
                                             1,
                                             strat.adj_factor_subp,
                                             strat.adj_factor_micr)) x
                             FROM pop_eval eval,
                                  pop_stat_samp samp,
                                  pop_estn_unit eu,
                                  pop_stratum strat,
                                  plot_statsamp_assgn sampassgn,
```

```
                                          plot_strat_assgn stratassgn,
                                          plot p,
                                          tree t,
                                          (SELECT DISTINCT popn_cn, geoarea_cn, report_year
                                             FROM mod_pollution_removal) pr
                                    WHERE eval.evalid = 'Austin2014Curr'
                                      AND eval.cn = samp.eval_cn
                                      AND samp.cn = sampassgn.pss_cn
                                      AND sampassgn.plt_cn = p.cn
                                      AND p.cn = stratassgn.plt_cn
                                      AND stratassgn.strat_cn = strat.cn
                                      AND strat.estn_unit_cn = eu.cn
                                      AND eu.eval_cn = eval.cn
                                      AND p.cn = t.plt_cn(+)
                                      AND pr.popn_cn = eu.popn_cn
                                      AND pr.geoarea_cn = eu.geoarea_cn
                                      AND pr.report_year = eval.report_year
                                    GROUP BY strat.estn_unit_cn,
                                             strat.cn,
                                             strat.name,
                                             p.cn,
                                             1) x_plot_sum
                           WHERE all_plot_sum.plt_cn = x_plot_sum.plt_cn(+)
                             AND all_plot_sum.plt_cn = y_plot_sum.plt_cn(+)
                             AND all_plot_sum.common_name =
                                 y_plot_sum.common_name(+)
                            GROUP BY all_plot_sum.strat_cn,
                                     all_plot_sum.strat_name,
                                     all_plot_sum.common_name) strat_sum
                  WHERE strat_sum_stat.strat_cn = strat_sum.strat_cn(+)
                  GROUP BY strat_sum_stat.popn_name,
                           strat_sum_stat.popn_version,
                           strat_sum_stat.popn_cn,
                           strat_sum_stat.total_acres,
                           strat_sum_stat.n,
                          common_name) estimate_sum
         GROUP BY popn_name,
                   popn_version,
                   popn_cn,
                   estimate,
                   total_acres,
                   plt_cnt,
                    common_name) ratio_est
```

This execution of the ratio estimator is the same as the previous example except that species is used as the domain partition. Recall that no domain filters should be used with this technique. The sections of code highlighted in purple represent additions to the standard code used to join the results with the population model output. Code highlighted in aqua is used to constrain the ratio estimates to only those areas and reporting year for which the population model output is representative. An abbreviated output for the top ten species is provided in the table below. Note that the denominator estimate is constant across all domains. Only the numerator changes by domain.

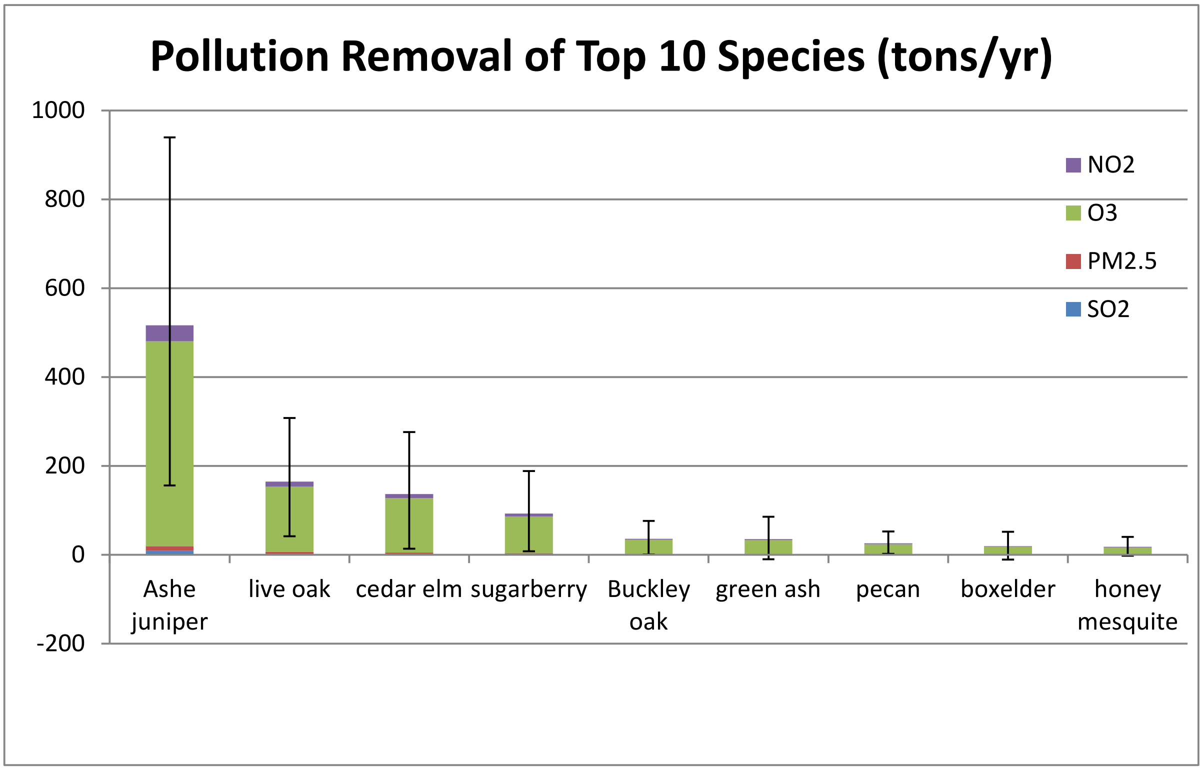
POPN_NAME	POPN_ VERSION	LANDUSE	RATIO_ ESTIMATE	NUMERATOR_ ESTIMATE	DENOMINATOR _ESTIMATE	SE_OF_ RATIO_ ESTIMATE_ PCT
Austin, Texas Urban Area	1.0	Ashe juniper	.38	5,172,542,716.11	13,653,271,991.22	15.72
Austin, Texas Urban Area	1.0	live oak	0.12	1,580,979,092.84	13,653,271,991.22	18.11
Austin, Texas Urban Area	1.0	Shumard oak	0.11	1,486,780,156.06	13,653,271,991.22	97.93
Austin, Texas Urban Area	1.0	cedar elm	0.10	1,310,283,207.19	13,653,271,991.22	32.86
Austin, Texas Urban Area	1.0	sugarberry	0.07	888,418,501.72	13,653,271,991.22	34.61
Austin, Texas Urban Area	1.0	Buckley oak	0.03	347,469,334.73	13,653,271,991.22	40.56
Austin, Texas Urban Area	1.0	green ash	0.02	341,293,399.54	13,653,271,991.22	69.53
Austin, Texas Urban Area	1.0	pecan	0.02	247,383,301.00	13,653,271,991.22	31.88
Austin, Texas Urban Area	1.0	boxelder	0.01	186,460,773.73	13,653,271,991.22	96.89
Austin, Texas Urban Area	1.0	honey mesquite	0.01	172,216,863.79	13,653,271,991.22	53.63

The results of the ratio estimation script are used as an input in the final results script shown below. The ratio estimation script is treated like a table in this script and is indicated as **ratio_estimate_query**. It is joined to the population model output (MOD_POLLUTION_REVMOVAL) through the target population CN number that was added to the ratio script (in purple above).

```
--This script computes a ratio estimate of leaf area proportion by species and uses that
--ratio to compute the POLLUTION per species
--tab=POLLUTION_SPECIES
SELECT ratio_est.popn_name,
       ratio_est.popn_version,
       pr.pollutant,
       ratio_est.common_name,
       --REMOVAL
       ratio_est.ratio_estimate * pr.pollution_removal poll_remv,
       power(pr.pollution_removal, 2) * ratio_est.var_of_ratio_estimate var_poll_remv,
       sqrt(power(pr.pollution_removal, 2) * ratio_est.var_of_ratio_estimate) se_poll_remv,
       ratio_est.ratio_estimate * pr.pollution_removal +
       sqrt(power(pr.pollution_removal, 2) * ratio_est.var_of_ratio_estimate) one_se_upper_bound,
       ratio_est.ratio_estimate * pr.pollution_removal -
       sqrt(power(pr.pollution_removal, 2) * ratio_est.var_of_ratio_estimate) one_se_lower_bound,
       (ratio_est.ratio_estimate * pr.max_pollution_removal) -
       (ratio_est.ratio_estimate * pr.pollution_removal) model_upper_error,
       (ratio_est.ratio_estimate * pr.pollution_removal) -
       (ratio_est.ratio_estimate * pr.min_pollution_removal) model_lower_error ,
       (ratio_est.ratio_estimate * pr.max_pollution_removal) model_upper_bound,
       (ratio_est.ratio_estimate * pr.min_pollution_removal) model_lower_bound,
       (sqrt(power(pr.pollution_removal, 2) * ratio_est.var_of_ratio_estimate)) +
       ((ratio_est.ratio_estimate * pr.max_pollution_removal) -
       (ratio_est.ratio_estimate * pr.pollution_removal)) total_upper_error,
       (sqrt(power(pr.pollution_removal, 2) * ratio_est.var_of_ratio_estimate)) +
       ((ratio_est.ratio_estimate * pr.pollution_removal) -
       (ratio_est.ratio_estimate * pr.min_pollution_removal)) total_lower_error,
       ratio_est.ratio_estimate * pr.pollution_removal +
```

```
       (sqrt(power(pr.pollution_removal, 2) * ratio_est.var_of_ratio_estimate)) +
       ((ratio_est.ratio_estimate * pr.max_pollution_removal) -
       (ratio_est.ratio_estimate * pr.pollution_removal)) total_upper_bound,
       ratio_est.ratio_estimate * pr.pollution_removal -
       (sqrt(power(pr.pollution_removal, 2) * ratio_est.var_of_ratio_estimate)) -
       ((ratio_est.ratio_estimate * pr.pollution_removal) -
       (ratio_est.ratio_estimate * pr.min_pollution_removal)) total_lower_bound,
       pr.pollution_removal total_pollution_removed,
       --LEAF AREA
       ratio_est.ratio_estimate        prop_leaf_area,
       ratio_est.se_of_ratio_estimate  se_prop_leaf_area,
       ratio_est.var_of_ratio_estimate var_prop_leaf_area
  FROM mod_pollution_removal pr,
       (ratio_estimate_query) ratio_est
 WHERE pr.popn_cn = ratio_est.popn_cn
ORDER BY pr.pollutant, poll_remv DESC;
```

The MOD_POLLUTION_REMOVAL table organizes the population model output by pollutant, meaning each different pollutant has its own record in the table. Thus, the POLLUTANT column from the MOD_POLLUTION_REMOVAL table is included in the output. The domain partition of species (expressed as a common name) is also included. The proportional allocation of the population model output across species is accomplished with the code highlighted as dark blue. The sampling error calculation of this allocation treats the population model output as a constant. Therefore, the variance is computed as the population model output squared multiplied by the variance of the ratio. The sampling error is simply the square root of the variance calculation. The pollution removal model includes the upper and lower bounds of pollution removal expressed as maximum and minimums. These can be treated as surrogate model error. They are not, however, actually model error as they really reflect the maximum and minimum pollution concentrations from the pollution flux data submitted to the model. Nonetheless, they reflect a range of possible values that can inform the analyst about the magnitude of variability in the model inputs. This range is not symmetrical and is expressed as `model_upper_error` and `model_lower_error`. These errors can also be easily expressed as upper and lower bounds. If the sampling error and the "model error" surrogate can be assumed to be additive, then they can be combined to obtain an estimate of "total error." The code highlighted in dark green is an example that computes the total upper error by adding sampling error and the surrogate model error. Note that the leaf area estimate along with variance and sampling error are included for the convenience of the analyst. The analyst is cautioned against treating these errors as truly known total error when performing comparisons between domains or between populations.



Example 8.9.3: Runoff Avoided by Ownership:
In this example, the analyst is interested in the amount of runoff avoided due to urban forests by ownership. As with the previous examples, the analyst must first compute the proportion of leaf area for each ownership class in the sample. Thus, ownership is the domain partition of interest. Leaf area is used because it correlates most strongly with the urban forests ability to intercept water, slow it down, and allow it to be absorbed before it can run off of the surface.

The following script computes the leaf area proportion by ownership. This script follows the same pattern as described in the Ratio Estimates section with a few minor changes to support this application of the techniques. Those modifications will be discussed below.

```
--The following query produces a ratio estimates of proportion leaf area
       --by species with variance.
( --This outer query summarizes the final estimates and computes
        --the sampling errors.
 SELECT popn_name,
         popn_version,
         popn_cn,
         owner,
         estimate  ratio_estimate,
         SUM(estimate_numerator) numerator_estimate,
         SUM(estimate_denominator) denominator_estimate,
         CASE
           WHEN SUM(estimate_sum.var_y_x) > 0 THEN
            round(sqrt(SUM(estimate_sum.var_y_x)) /
                  SUM(estimate_sum.estimate) * 100,
                  3)
           ELSE
            0
```

```
       END AS se_of_ratio_estimate_pct,
       CASE
         WHEN SUM(estimate_sum.var_numerator) > 0 THEN
          round(sqrt(SUM(estimate_sum.var_numerator)) /
                SUM(estimate_sum.estimate_numerator) * 100,
                3)
         ELSE
          0
       END AS se_of_numerator_estimate_pct,
      CASE
        WHEN SUM(estimate_sum.var_denominator) > 0 THEN
          round(sqrt(SUM(estimate_sum.var_denominator)) /
                SUM(estimate_sum.estimate_denominator) * 100,
                3)
         ELSE
          0
       END AS se_of_denominator_estimate_pct,
       SUM(estimate_sum.var_y_x) var_of_ratio_estimate,
       sqrt(SUM(estimate_sum.var_y_x)) se_of_ratio_estimate,
       SUM(estimate_sum.var_numerator) var_of_numerator_estimate,
       sqrt(SUM(estimate_sum.var_numerator)) se_of_numerator_estimate,
       SUM(estimate_sum.var_denominator) var_of_denominator_estimate,
       sqrt(SUM(estimate_sum.var_denominator)) se_of_denominator_estimate,
       plt_cnt total_plots,
       SUM(non_zero_num_plt_cnt) tot_non_zero_numerator_plots,
       SUM(non_zero_den_plt_cnt) tot_non_zero_denominator_plots,
       total_acres total_acres
 FROM ( --This subquery produces the population ratio estimate
        --and estimates of variance for the entire population.
        SELECT strat_sum_stat.popn_name,
                strat_sum_stat.popn_version,
                strat_sum_stat.popn_cn,
                owner,
                CASE
                  WHEN SUM(nvl(sum_x, 0)) = 0 THEN
                   999999999999
                  ELSE
                   SUM(sum_y / strat_sum_stat.n_h * (strat_sum_stat.total_acres) *
                       strat_sum_stat.w_h) /
                   SUM(sum_x / strat_sum_stat.n_h * (strat_sum_stat.total_acres) *
                       strat_sum_stat.w_h)
               END estimate,
               SUM(sum_y / strat_sum_stat.n_h * (strat_sum_stat.total_acres) *
                   strat_sum_stat.w_h) estimate_numerator,
               SUM(sum_x / strat_sum_stat.n_h * (strat_sum_stat.total_acres) *
                   strat_sum_stat.w_h) estimate_denominator,
               strat_sum_stat.n plt_cnt,
               SUM(strat_sum.non_zero_y_cnt) non_zero_num_plt_cnt,
               SUM(strat_sum.non_zero_x_cnt) non_zero_den_plt_cnt,
               strat_sum_stat.total_acres,

               (1 / power(SUM(sum_x / strat_sum_stat.n_h *
                              (strat_sum_stat.total_acres) * strat_sum_stat.w_h),
                          2)) *
               (((power(total_acres, 2) / strat_sum_stat.n) *
               ((SUM(strat_sum_stat.w_h * strat_sum_stat.n_h *
                       (((strat_sum.sum_y2 / strat_sum_stat.n_h) -
                       (strat_sum.sum_y / strat_sum_stat.n_h *
                       strat_sum.sum_y / strat_sum_stat.n_h)) /
                       (strat_sum_stat.n_h - 1)))) +
               1 / strat_sum_stat.n *
               (SUM((1 - strat_sum_stat.w_h) * strat_sum_stat.n_h *
                       (((strat_sum.sum_y2 / strat_sum_stat.n_h) -
                       (strat_sum.sum_y / strat_sum_stat.n_h *
```

```
                strat_sum.sum_y / strat_sum_stat.n_h)) /
                (strat_sum_stat.n_h - 1)))))) + --var(yhat)
        power(SUM(sum_y / strat_sum_stat.n_h * (strat_sum_stat.total_acres) *
                   strat_sum_stat.w_h) /
               SUM(sum_x / strat_sum_stat.n_h * (strat_sum_stat.total_acres) *
                   strat_sum_stat.w_h),
               2) * --Ratio^2
        ((power(total_acres, 2) / strat_sum_stat.n) *
        ((SUM(strat_sum_stat.w_h * strat_sum_stat.n_h *
                (((strat_sum.sum_x2 / strat_sum_stat.n_h) -
                (strat_sum.sum_x / strat_sum_stat.n_h *
                strat_sum.sum_x / strat_sum_stat.n_h)) /
                (strat_sum_stat.n_h - 1)))) +
        1 / strat_sum_stat.n *
        (SUM((1 - strat_sum_stat.w_h) * strat_sum_stat.n_h *
                (((strat_sum.sum_x2 / strat_sum_stat.n_h) -
                (strat_sum.sum_x / strat_sum_stat.n_h *
                strat_sum.sum_x / strat_sum_stat.n_h)) /
                (strat_sum_stat.n_h - 1)))))) - --Var(xhat)
        2 * (SUM(sum_y / strat_sum_stat.n_h * (strat_sum_stat.total_acres) *
                  strat_sum_stat.w_h) /
        SUM(sum_x / strat_sum_stat.n_h * (strat_sum_stat.total_acres) *
                  strat_sum_stat.w_h)) * --2*Ratio
        (power(strat_sum_stat.total_acres, 2) / strat_sum_stat.n *
        (SUM(strat_sum_stat.w_h * strat_sum_stat.n_h *
               ((sum_xy - strat_sum_stat.n_h * (sum_x / strat_sum_stat.n_h) *
               (sum_y / strat_sum_stat.n_h)) /
               (strat_sum_stat.n_h * (strat_sum_stat.n_h - 1)))) +
                  --Cov(ybar,xbar)
        SUM((1 - strat_sum_stat.w_h) * (strat_sum_stat.n_h / strat_sum_stat.n) *
               ((sum_xy - strat_sum_stat.n_h * (sum_x / strat_sum_stat.n_h) *
               (sum_y / strat_sum_stat.n_h)) /
               (strat_sum_stat.n_h * (strat_sum_stat.n_h - 1))))
                   --cov(ybar,xbar)
        ))) var_y_x,

        (power(total_acres, 2) / strat_sum_stat.n) * --A_T/n
        ((SUM(strat_sum_stat.w_h * strat_sum_stat.n_h *
               --Sum of W_h*n_h
              (((strat_sum.sum_y2 / strat_sum_stat.n_h) -
              (strat_sum.sum_y / strat_sum_stat.n_h * strat_sum.sum_y /
              strat_sum_stat.n_h)) / (strat_sum_stat.n_h - 1)))) +
                --v(x_h)
        1 / strat_sum_stat.n *
        (SUM((1 - strat_sum_stat.w_h) * strat_sum_stat.n_h *
              (((strat_sum.sum_y2 / strat_sum_stat.n_h) -
              (strat_sum.sum_y / strat_sum_stat.n_h * strat_sum.sum_y /
              strat_sum_stat.n_h)) / (strat_sum_stat.n_h - 1))))) var_numerator,
                --v(x_h)

        (power(total_acres, 2) / strat_sum_stat.n) * --A_T/n
        ((SUM(strat_sum_stat.w_h * strat_sum_stat.n_h * --Sum of W_h*n_h
              (((strat_sum.sum_x2 / strat_sum_stat.n_h) -
              (strat_sum.sum_x / strat_sum_stat.n_h * strat_sum.sum_x /
              strat_sum_stat.n_h)) / (strat_sum_stat.n_h - 1)))) + --v(x_h)
        1 / strat_sum_stat.n *
        (SUM((1 - strat_sum_stat.w_h) * strat_sum_stat.n_h *
             (((strat_sum.sum_x2 / strat_sum_stat.n_h) -
              (strat_sum.sum_x / strat_sum_stat.n_h * strat_sum.sum_x /
             strat_sum_stat.n_h)) / (strat_sum_stat.n_h - 1))))) var_denominator
                  --v(x_h)

  FROM ( --This subquery returns the stratification summary statistics
         --used to support stratified estimation.
```

```
                  SELECT pop.name popn_name,
                         pop.version popn_version,
                         pop.cn popn_cn,
                         eu.cn estn_unit_cn,
                         geo.name est_unit_name,
                         strat.cn strat_cn,
                         strat.name strat_name,
                         strat.description,
                         strat.area strat_acres,
                         (SELECT SUM(area)
                            FROM pop_stratum strat2
                           WHERE strat2.estn_unit_cn = eu.cn) total_acres,
                         strat.area /
                         (SELECT SUM(area)
                            FROM pop_stratum strat2
                           WHERE strat2.estn_unit_cn = eu.cn) w_h,
                         (SELECT COUNT(psa.plt_cn)
                            FROM plot_strat_assgn    psa,
                                 plot_statsamp_assgn pssa,
                                 pop_stat_samp       samp,
                                 plot                p
                          WHERE psa.strat_cn = strat.cn
                             AND samp.eval_cn = eval.cn
                             AND pssa.pss_cn = samp.cn
                             AND pssa.plt_cn = p.cn
                             AND psa.plt_cn = p.cn) n_h,
                         (SELECT COUNT(pssa.plt_cn)
                            FROM plot_statsamp_assgn pssa,
                                 pop_stat_samp       samp
                           WHERE samp.eval_cn = eval.cn
                             AND pssa.pss_cn = samp.cn) n
                    FROM pop_eval      eval,
                         pop_estn_unit eu,
                         pop_stratum   strat,
                         population    pop,
                         (SELECT DISTINCT popn_cn, georarea_cn, report_year
                                      FROM mod_rainfall) mod
                   WHERE eval.evalid = 'Austin2014Curr'
                     AND eval.cn = eu.eval_cn
                     AND eu.cn = strat.estn_unit_cn
                     AND eu.geoarea_cn = geo.cn
                     AND eu.popn_cn = pop.cn
                     AND mod.popn_cn = eu.popn_cn
                     AND mod.geoarea_cn = eu.geoarea_cn
                     AND mod.report_year = eval.report_year) strat_sum_stat,
( --This subquery computes sufficient statistics of the sum of y, y^2, x, x^2,
--and xy (crossproduct)for each pop_stratum and domain of interest.
                  SELECT all_plot_sum.strat_cn,
                         all_plot_sum.strat_name,
                         --domains would go here and in the group by
                         all_plot_sum.owner,
                         SUM(y) sum_y,
                         SUM(y * y) sum_y2,
                         SUM(x) sum_x,
                         SUM(x * x) sum_x2,
                         SUM(x * y) sum_xy,
                         SUM(all_plot_sum.plt_cnt) n_h,
                         SUM(decode(nvl(y, 0), 0, 0, 1)) non_zero_y_cnt,
                         SUM(decode(nvl(x, 0), 0, 0, 1)) non_zero_x_cnt
                  FROM ( --This subquery computes the simple count of plots per
                         --each pop_stratum and domain of interest.
                          SELECT strat.cn      strat_cn,
```

```
              strat.name    strat_name,
              r.owner,
              p.cn          plt_cn,
              1             plt_cnt
        FROM pop_eval eval,
              pop_stat_samp samp,
              pop_estn_unit eu,
              pop_stratum strat,
              plot_statsamp_assgn sampassgn,
              plot_strat_assgn stratassgn,
              plot p,
              (SELECT DISTINCT popn_cn, geoarea_cn, report_year
                 FROM mod_rainfall) mod,
            --This subquery returns the distinct species
                      --associated with the current sample
              (SELECT DISTINCT r.abbr owner
                 FROM pop_eval              eval,
                      pop_stat_samp         samp,
                      plot_statsamp_assgn sampassgn,
                      plot                  p,
                      tree                  t,
                      ref_owner           r
                WHERE eval.evalid = 'Austin2014Curr'
                  AND eval.cn = samp.eval_cn
                  AND sampassgn.pss_cn = samp.cn
                  AND sampassgn.plt_cn = p.cn
                  AND p.cn = t.plt_cn
                  AND p.urban_manual >= r.manual_start
                  AND (r.manual_end IS NULL OR
                      p.urban_manual <= r.manual_end)
                  AND t.owncd = r.owncd) r
       WHERE eval.evalid = 'Austin2014Curr'
         AND eval.cn = samp.eval_cn
         AND samp.cn = sampassgn.pss_cn
         AND sampassgn.plt_cn = p.cn
         AND p.cn = stratassgn.plt_cn
         AND stratassgn.strat_cn = strat.cn
         AND strat.estn_unit_cn = eu.cn
         AND eu.eval_cn = eval.cn
         AND mod.popn_cn = eu.popn_cn
         AND mod.geoarea_cn = eu.geoarea_cn
         AND mod.report_year = eval.report_year
       GROUP BY strat.estn_unit_cn,
                strat.cn,
                strat.name,
                p.cn,
                r.owner,
                1) all_plot_sum,
--This subquery produces an adjusted, plot-level
--estimates of the variable of interest for each
--pop_stratum and domain of interest for the numerator
(SELECT strat.cn   strat_cn,
        strat.name strat_name,
        p.cn       plt_cn,
        --domains would go here and in the group by
        owner.abbr owner,
        1 plt_cnt,
        SUM(nvl(t.tpa_unadj, 0) * nvl(t.leaf_area,0) *
            decode(t.subp,
                   1,
                   strat.adj_factor_subp,
                   strat.adj_factor_micr)) y
```

```
          FROM pop_eval             eval,
               pop_stat_samp        samp,
               pop_estn_unit        eu,
               pop_stratum          strat,
               plot_statsamp_assgn  sampassgn,
               plot_strat_assgn     stratassgn,
               plot                 p,
               tree                 t,
               ref_owner            owner,
               (SELECT DISTINCT popn_cn, geoarea_cn, report_year
                   FROM mod_rainfall) mod
         WHERE eval.evalid = 'Austin2014Curr'
           AND eval.cn = samp.eval_cn
           AND samp.cn = sampassgn.pss_cn
           AND sampassgn.plt_cn = p.cn
           AND p.cn = stratassgn.plt_cn
           AND stratassgn.strat_cn = strat.cn
           AND strat.estn_unit_cn = eu.cn
           AND eu.eval_cn = eval.cn
           AND p.cn = t.plt_cn(+)
           AND (owner.manual_end IS NULL OR
               p.urban_manual <= owner.manual_end)
           AND t.owncd = owner.owncd
           AND mod.popn_cn = eu.popn_cn
           AND mod.geoarea_cn = eu.geoarea_cn
           AND mod.report_year = eval.report_year
         GROUP BY strat.estn_unit_cn,
                  strat.cn,
                  strat.name,
                  owner.abbr,
                  1) y_plot_sum,
    --This subquery produces an adjusted, plot-level
    --estimates of the variable of interest for each
    --pop_stratum and domain of interest for the denominator
      (SELECT strat.cn   strat_cn,
               strat.name strat_name,
               p.cn       plt_cn,
      --domains would go here and in the group by
               1 plt_cnt,
               SUM(nvl(t.tpa_unadj, 0) * nvl(t.leaf_area,0) *
                   decode(t.subp,
                          1,
                          strat.adj_factor_subp,
                          strat.adj_factor_micr)) x
          FROM pop_eval             eval,
               pop_stat_samp        samp,
               pop_estn_unit        eu,
               pop_stratum          strat,
               plot_statsamp_assgn  sampassgn,
               plot_strat_assgn     stratassgn,
               plot                 p,
               tree                 t,
               (SELECT DISTINCT popn_cn, geoarea_cn, report_year
                   FROM mod_rainfall) mod
         WHERE eval.evalid = 'Austin2014Curr'
           AND eval.cn = samp.eval_cn
           AND samp.cn = sampassgn.pss_cn
           AND sampassgn.plt_cn = p.cn
           AND p.cn = stratassgn.plt_cn
           AND stratassgn.strat_cn = strat.cn
           AND strat.estn_unit_cn = eu.cn
           AND eu.eval_cn = eval.cn
```

```
                                            AND p.cn = t.plt_cn(+)
                                            AND mod.popn_cn = eu.popn_cn
                                            AND mod.geoarea_cn = eu.geoarea_cn
                                            AND mod.report_year = eval.report_year
                                          GROUP BY strat.estn_unit_cn,
                                                   strat.cn,
                                                   strat.name,
                                                   p.cn,
                                                   1) x_plot_sum
                                 WHERE all_plot_sum.plt_cn = x_plot_sum.plt_cn(+)
                                   AND all_plot_sum.plt_cn = y_plot_sum.plt_cn(+)
                                   AND all_plot_sum.owner = y_plot_sum.owner(+)
                                 GROUP BY all_plot_sum.strat_cn,
                                          all_plot_sum.strat_name,
                                          all_plot_sum.owner) strat_sum
                        WHERE strat_sum_stat.strat_cn = strat_sum.strat_cn(+)
                        GROUP BY strat_sum_stat.popn_name,
                                 strat_sum_stat.popn_version,
                                 strat_sum_stat.popn_cn,
                                 strat_sum_stat.total_acres,
                                 strat_sum_stat.n,
                                 owner) estimate_sum
 GROUP BY popn_name,
          popn_version,
          popn_cn,
          estimate,
          total_acres,
          plt_cnt,
          owner) ratio_est
```

The above SQL script computes the proportion of leaf area in each ownership class detected by the sample. The numerator (`y_plot_sum`) computes leaf area by ownership for each plot. The denominator (`x_plot_sum`) computes the total leaf area for each plot. The code highlighted in purple was added to support the join between the ratio estimate results and the population model output in MOD_RAINFALL. The code highlighted in aqua was added to constrain the ratio calculation to only those areas and reporting years for which the model output is applicable. Abbreviated output from this script is shown in the table below. Note that the denominator estimate is constant across all domains because it represents the population total. This output is treated as an input to the final estimate query below.

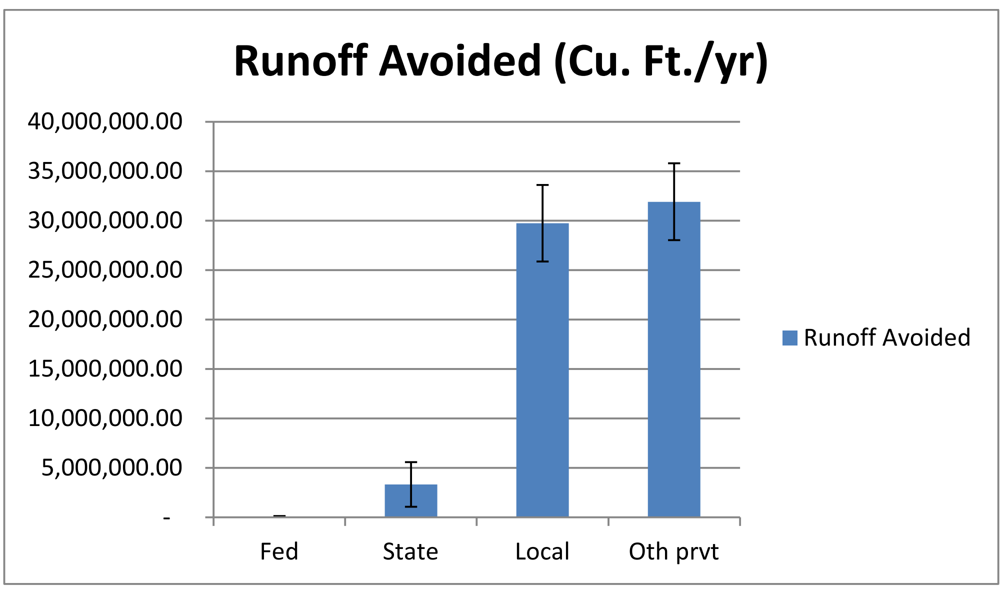
POPN_NAME	POPN _VERSION	OWNER	RATIO _ESTIMATE	NUMERATOR _ESTIMATE	DENOMINATOR _ESTIMATE	SE_OF_RATIO _ESTIMATE_PCT
Austin, Texas Urban Area	1.0	Fed	0.001	11,658,661	12,021,243,080	98.29
Austin, Texas Urban Area	1.0	State	0.051	613,752,615	12,021,243,080	68.02
Austin, Texas Urban Area	1.0	Oth prvt	0.491	5,898,042,930	12,021,243,080	12.18
Austin, Texas Urban Area	1.0	Local	0.457	5,497,788,874	12,021,243,080	13.06

```
--This script computes a ratio estimate of leaf area proportion by owner and uses that
--ratio to compute the runoff per owner
--tab=RUNOFF_OWNER
SELECT ratio_est.popn_name,
       ratio_est.popn_version,
```

```
       ratio_est.owner,
       ratio_est.ratio_estimate * rain.avoided_runoff runoff_avoided,
       power(rain.avoided_runoff, 2) * ratio_est.var_of_ratio_estimate var_runoff_avoided,
       sqrt(power(rain.avoided_runoff, 2) * ratio_est.var_of_ratio_estimate) se_runoff_avoided,
       ratio_est.ratio_estimate * rain.avoided_runoff +
       sqrt(power(rain.avoided_runoff, 2) * ratio_est.var_of_ratio_estimate) one_se_upper_bound,
       ratio_est.ratio_estimate * rain.avoided_runoff -
       sqrt(power(rain.avoided_runoff, 2) * ratio_est.var_of_ratio_estimate) one_se_lower_bound,
       ratio_est.ratio_estimate prop_leaf_area,
       ratio_est.se_of_ratio_estimate se_prop_leaf_area,
       ratio_est.var_of_ratio_estimate var_prop_leaf_area,
       rain.avoided_runoff total_runoff_avoided
  FROM mod_rainfall rain,
       (ratio_estimate_query) ratio_est
 WHERE rain.popn_cn = ratio_est.popn_cn
 ORDER BY owner, runoff_avoided DESC;
```

The final estimate script (above) uses the output of the ratio estimation script as an input. It is joined to the model output in MOD_RAINFALL by joining through the population CN number. The total runoff avoided is allocated across the ownership domain using the code highlighted as light green. The only component of uncertainty that can be estimated for this model is sampling error. For the estimate of variance, the model output is treated as a constant and squared before it is multiplied by the variance of the ratio estimate. This is done in the code highlighted in dark blue. The sampling error is simply the square root of the variance estimate. It can easily be expressed as upper and lower bounds. The leaf area along with variance and sampling error estimates are also output.

The output from the final estimate script can easily be plotted. Note that the error bars show only sampling error (1 standard error) and do not account for model error. Thus, the total amount of error in the estimates is not known. The analyst should be cautious when making comparisons between domains or between populations.



Example 8.9.4: VOC Emissions by Crown Class:
The VOC emissions population model has the most complex output of four models populated in this Stage 1 design. The model outputs VOC estimates by tree genus. This allows the model to account

for important differences in the characteristics of each genus. It also requires that all allocations of the model output to other population domains include tree genus, at least in the intermediate steps.

In this example, the analyst is interested in VOC emissions (both isoprene and monoterpene) by crown class. The analyst begins by computing the proportion of leaf biomass by tree genus and crown class. Leaf biomass is chosen as the variable of interest because it correlates most strongly with the emission of VOCs by trees. Even though the analysis is focused on VOC emissions by crown class, the calculation must include tree genus to account for the different levels of emissions between genera.

The SQL script below is used to compute a ratio estimate of leaf biomass by genus and crown class to leaf biomass by genus. This is unique among the four models in that the denominator of the ratio estimate is not a straight population total. This calculation uses the standard script for ratio estimation except for a few minor modifications that adapt this technique to this application. These modifications will be discussed below.

```
--The following query produces a ratio estimate of proportion leaf biomass
       --by genus with variance.
( --This outer query summarizes the final estimates and computes
 --the sampling errors.
 SELECT popn_name,
         popn_version,
         popn_cn,
         genus,
         crown_class,
        estimate ratio_estimate,
         SUM(estimate_numerator) numerator_estimate,
         SUM(estimate_denominator) denominator_estimate,
         CASE
          WHEN SUM(estimate_sum.var_y_x) > 0 THEN
            round(sqrt(SUM(estimate_sum.var_y_x)) /
                 SUM(estimate_sum.estimate) * 100,
                  3)
           ELSE
            0
         END AS se_of_ratio_estimate_pct,
         CASE
           WHEN SUM(estimate_sum.var_numerator) > 0 THEN
            round(sqrt(SUM(estimate_sum.var_numerator)) /
                  SUM(estimate_sum.estimate_numerator) * 100,
                  3)
           ELSE
            0
         END AS se_of_numerator_estimate_pct,
         CASE
           WHEN SUM(estimate_sum.var_denominator) > 0 THEN
            round(sqrt(SUM(estimate_sum.var_denominator)) /
                  SUM(estimate_sum.estimate_denominator) * 100,
                  3)
           ELSE
            0
         END AS se_of_denominator_estimate_pct,
         SUM(estimate_sum.var_y_x) var_of_ratio_estimate,
         CASE
           WHEN SUM(estimate_sum.var_y_x) > 0 THEN
            sqrt(SUM(estimate_sum.var_y_x))
         END AS se_of_ratio_estimate,
         SUM(estimate_sum.var_numerator) var_of_numerator_estimate,
```

```
      sqrt(SUM(estimate_sum.var_numerator)) se_of_numerator_estimate,
      SUM(estimate_sum.var_denominator) var_of_denominator_estimate,
      sqrt(SUM(estimate_sum.var_denominator)) se_of_denominator_estimate,
      plt_cnt total_plots,
      SUM(non_zero_num_plt_cnt) tot_non_zero_numerator_plots,
      SUM(non_zero_den_plt_cnt) tot_non_zero_denominator_plots,
      total_acres total_acres
FROM ( --This subquery produces the population ratio estimate
       --and estimates of variance for the entire population.
       SELECT strat_sum_stat.popn_name,
              strat_sum_stat.popn_version,
              strat_sum_stat.popn_cn,
              genus,
              crown_class,
              CASE
               WHEN SUM(nvl(sum_x, 0)) = 0 THEN
                999999999999
              ELSE
                 SUM(sum_y / strat_sum_stat.n_h * (strat_sum_stat.total_acres) *
                     strat_sum_stat.w_h) /
                 SUM(sum_x / strat_sum_stat.n_h * (strat_sum_stat.total_acres) *
                     strat_sum_stat.w_h)
              END estimate,
              SUM(sum_y / strat_sum_stat.n_h * (strat_sum_stat.total_acres) *
                  strat_sum_stat.w_h) estimate_numerator,
              SUM(sum_x / strat_sum_stat.n_h * (strat_sum_stat.total_acres) *
                  strat_sum_stat.w_h) estimate_denominator,
              strat_sum_stat.n plt_cnt,
              SUM(strat_sum.non_zero_y_cnt) non_zero_num_plt_cnt,
              SUM(strat_sum.non_zero_x_cnt) non_zero_den_plt_cnt,
              strat_sum_stat.total_acres,

              (1 / power(SUM(sum_x / strat_sum_stat.n_h *
                             (strat_sum_stat.total_acres) * strat_sum_stat.w_h),
                         2)) *
              (((power(total_acres, 2) / strat_sum_stat.n) *
              ((SUM(strat_sum_stat.w_h * strat_sum_stat.n_h *
                      (((strat_sum.sum_y2 / strat_sum_stat.n_h) -
                      (strat_sum.sum_y / strat_sum_stat.n_h *
                       strat_sum.sum_y / strat_sum_stat.n_h)) /
                       (strat_sum_stat.n_h - 1)))) +
              1 / strat_sum_stat.n *
              (SUM((1 - strat_sum_stat.w_h) * strat_sum_stat.n_h *
                      (((strat_sum.sum_y2 / strat_sum_stat.n_h) -
                      (strat_sum.sum_y / strat_sum_stat.n_h *
                      strat_sum.sum_y / strat_sum_stat.n_h)) /
                      (strat_sum_stat.n_h - 1)))))) + --var(yhat)
              power(SUM(sum_y / strat_sum_stat.n_h * (strat_sum_stat.total_acres) *
                           strat_sum_stat.w_h) /
                     SUM(sum_x / strat_sum_stat.n_h * (strat_sum_stat.total_acres) *
                           strat_sum_stat.w_h),
                     2) * --Ratio^2
              ((power(total_acres, 2) / strat_sum_stat.n) *
              ((SUM(strat_sum_stat.w_h * strat_sum_stat.n_h *
                      (((strat_sum.sum_x2 / strat_sum_stat.n_h) -
                      (strat_sum.sum_x / strat_sum_stat.n_h *
                      strat_sum.sum_x / strat_sum_stat.n_h)) /
                      (strat_sum_stat.n_h - 1)))) +
              1 / strat_sum_stat.n *
              (SUM((1 - strat_sum_stat.w_h) * strat_sum_stat.n_h *
                      (((strat_sum.sum_x2 / strat_sum_stat.n_h) -
                      (strat_sum.sum_x / strat_sum_stat.n_h *
                      strat_sum.sum_x / strat_sum_stat.n_h)) /
```

```
          (strat_sum_stat.n_h - 1)))))) - --Var(xhat)
 2 * (SUM(sum_y / strat_sum_stat.n_h * (strat_sum_stat.total_acres) *
           strat_sum_stat.w_h) /
 SUM(sum_x / strat_sum_stat.n_h * (strat_sum_stat.total_acres) *
           strat_sum_stat.w_h)) * --2*Ratio
 (power(strat_sum_stat.total_acres, 2) / strat_sum_stat.n *
 (SUM(strat_sum_stat.w_h * strat_sum_stat.n_h *
        ((sum_xy - strat_sum_stat.n_h * (sum_x / strat_sum_stat.n_h) *
        (sum_y / strat_sum_stat.n_h)) /
        (strat_sum_stat.n_h * (strat_sum_stat.n_h - 1)))) +
                --Cov(ybar,xbar)
SUM((1 - strat_sum_stat.w_h) * (strat_sum_stat.n_h / strat_sum_stat.n) *
        ((sum_xy - strat_sum_stat.n_h * (sum_x / strat_sum_stat.n_h) *
        (sum_y / strat_sum_stat.n_h)) /
        (strat_sum_stat.n_h * (strat_sum_stat.n_h - 1))))
                --cov(ybar,xbar)
 ))) var_y_x,

 (power(total_acres, 2) / strat_sum_stat.n) * --A_T/n
 ((SUM(strat_sum_stat.w_h * strat_sum_stat.n_h * --Sum of W_h*n_h
       (((strat_sum.sum_y2 / strat_sum_stat.n_h) -
       (strat_sum.sum_y / strat_sum_stat.n_h * strat_sum.sum_y /
       strat_sum_stat.n_h)) / (strat_sum_stat.n_h - 1)))) + --v(x_h)
 1 / strat_sum_stat.n *
 (SUM((1 - strat_sum_stat.w_h) * strat_sum_stat.n_h *
       (((strat_sum.sum_y2 / strat_sum_stat.n_h) -
       (strat_sum.sum_y / strat_sum_stat.n_h * strat_sum.sum_y /
      strat_sum_stat.n_h)) / (strat_sum_stat.n_h - 1))))) var_numerator,
                 --v(x_h)

 (power(total_acres, 2) / strat_sum_stat.n) * --A_T/n
 ((SUM(strat_sum_stat.w_h * strat_sum_stat.n_h * --Sum of W_h*n_h
(((strat_sum.sum_x2 / strat_sum_stat.n_h) -
       (strat_sum.sum_x / strat_sum_stat.n_h * strat_sum.sum_x /
       strat_sum_stat.n_h)) / (strat_sum_stat.n_h - 1)))) + --v(x_h)
 1 / strat_sum_stat.n *
(SUM((1 - strat_sum_stat.w_h) * strat_sum_stat.n_h *
       (((strat_sum.sum_x2 / strat_sum_stat.n_h) -
       (strat_sum.sum_x / strat_sum_stat.n_h * strat_sum.sum_x /
     strat_sum_stat.n_h)) / (strat_sum_stat.n_h - 1))))) var_denominator
               --v(x_h)

FROM ( --This subquery returns the stratification summary statistics
       --used to support stratified estimation.
       SELECT pop.name popn_name,
               pop.version popn_version,
               pop.cn popn_cn,
               eu.cn estn_unit_cn,
               geo.name est_unit_name,
               strat.cn strat_cn,
               strat.name strat_name,
               strat.description,
               strat.area strat_acres,
               (SELECT SUM(area)
                  FROM pop_stratum strat2
                 WHERE strat2.estn_unit_cn = eu.cn) total_acres,
               strat.area /
               (SELECT SUM(area)
                   FROM pop_stratum strat2
                 WHERE strat2.estn_unit_cn = eu.cn) w_h,
               (SELECT COUNT(psa.plt_cn)
                  FROM plot_strat_assgn    psa,
                       plot_statsamp_assgn pssa,
                       pop_stat_samp       samp,
```

```
                        plot                p
                  WHERE psa.strat_cn = strat.cn
                    AND samp.eval_cn = eval.cn
                    AND pssa.pss_cn = samp.cn
                    AND pssa.plt_cn = p.cn
                    AND psa.plt_cn = p.cn) n_h,
                (SELECT COUNT(pssa.plt_cn)
                   FROM plot_statsamp_assgn pssa,
                        pop_stat_samp       samp
                  WHERE samp.eval_cn = eval.cn
                    AND pssa.pss_cn = samp.cn) n
          FROM pop_eval      eval,
               pop_estn_unit eu,
               pop_stratum   strat,
               geoarea       geo,
               population    pop
         WHERE eval.evalid = 'Austin2014Curr'
           AND eval.cn = eu.eval_cn
           AND eu.cn = strat.estn_unit_cn
           AND eu.geoarea_cn = geo.cn
           AND eu.popn_cn = pop.cn) strat_sum_stat,
( --This subquery computes sufficient statistics of the sum of y, y^2,
  --x, x^2, and xy (crossproduct)for each pop_stratum and domain of interest.
       SELECT all_plot_sum.strat_cn,
              all_plot_sum.strat_name,
              --domains would go here and in the group by
              all_plot_sum.genus,
              all_plot_sum.crown_class,
              SUM(y) sum_y,
              SUM(y * y) sum_y2,
              SUM(x) sum_x,
              SUM(x * x) sum_x2,
              SUM(x * y) sum_xy,
              SUM(all_plot_sum.plt_cnt) n_h,
              SUM(decode(nvl(y, 0), 0, 0, 1)) non_zero_y_cnt,
              SUM(decode(nvl(x, 0), 0, 0, 1)) non_zero_x_cnt
         FROM (SELECT DISTINCT a.strat_cn,
                               a.strat_name,
                               a.genus,
                               b.crown_class,
                               a.plt_cn,
                               a.plt_cnt
                 FROM (--This subquery computes the simple count of plots per each
                       --pop_stratum and domain of interest.
                       SELECT strat.cn   strat_cn,
                              strat.name strat_name,
                              r.genus,
                              p.cn        plt_cn,
                              1           plt_cnt
                         FROM pop_eval eval,
                              pop_stat_samp samp,
                              pop_estn_unit eu,
                              pop_stratum strat,
                              plot_statsamp_assgn sampassgn,
```

```
plot_strat_assgn stratassgn,
plot p,
(SELECT DISTINCT popn_cn,
                 geoarea_cn,
                 report_year
   FROM mod_voc_emissions) MOD,
--This subquery returns the distinct species
--associated with the current sample
(SELECT DISTINCT r.genus
   FROM pop_eval                eval,
        pop_stat_samp           samp,
        plot_statsamp_assgn sampassgn,
        plot                       p,
        tree                       t,
        ref_species                r
  WHERE eval.evalid = 'Austin2014Curr'
    AND eval.cn = samp.eval_cn
    AND sampassgn.pss_cn =
        samp.cn
    AND sampassgn.plt_cn = p.cn
    AND p.cn = t.plt_cn
    AND p.urban_manual >=
        r.manual_start
    AND (r.manual_end IS NULL OR
        p.urban_manual <=
        r.manual_end)
    AND t.spcd = r.spcd) r
WHERE eval.evalid = 'Austin2014Curr'
  AND eval.cn = samp.eval_cn
  AND samp.cn = sampassgn.pss_cn
  AND sampassgn.plt_cn = p.cn
  AND p.cn = stratassgn.plt_cn
  AND stratassgn.strat_cn = strat.cn
  AND strat.estn_unit_cn = eu.cn
  AND eu.eval_cn = eval.cn
  AND mod.popn_cn = eu.popn_cn
  AND mod.geoarea_cn = eu.geoarea_cn
  AND mod.report_year = eval.report_year
GROUP BY strat.estn_unit_cn,
         strat.cn,
         strat.name,
         p.cn,
```

```
                                r.genus,
                                1) a,
                  ( --This subquery computes the simple count of plots per each
                     --pop_stratum and domain of interest.
                      SELECT strat.cn       strat_cn,
                             strat.name     strat_name,
                             r.crown_class,
                             p.cn           plt_cn,
                             1              plt_cnt
                        FROM pop_eval eval,
                             pop_stat_samp samp,
                             pop_estn_unit eu,
                             pop_stratum strat,
                             plot_statsamp_assgn sampassgn,
                             plot_strat_assgn stratassgn,
                             plot p,
                             (SELECT DISTINCT popn_cn,
                                              geoarea_cn,
                                              report_year
                                FROM mod_voc_emissions) MOD,
                             --This subquery returns the distinct species
                             --associated with the current sample
                             (SELECT DISTINCT r.abbr crown_class
                                FROM pop_eval              eval,
                                     pop_stat_samp         samp,
                                     plot_statsamp_assgn sampassgn,
                                     plot                  p,
                                     tree                  t,
                                     ref_crown_class       r
                               WHERE eval.evalid = 'Austin2014Curr'
                                 AND eval.cn = samp.eval_cn
                                 AND sampassgn.pss_cn =
                                     samp.cn
                                 AND sampassgn.plt_cn = p.cn
                                 AND p.cn = t.plt_cn
                                 AND p.urban_manual >=
                                     r.manual_start
                                 AND (r.manual_end IS NULL OR
                                     p.urban_manual <=
                                     r.manual_end)
                                 AND t.crown_class_cd =
```

```
                              r.crown_class_cd) r
                      WHERE eval.evalid = 'Austin2014Curr'
                        AND eval.cn = samp.eval_cn
                        AND samp.cn = sampassgn.pss_cn
                        AND sampassgn.plt_cn = p.cn
                        AND p.cn = stratassgn.plt_cn
                        AND stratassgn.strat_cn = strat.cn
                        AND strat.estn_unit_cn = eu.cn
                       AND eu.eval_cn = eval.cn
                       AND mod.popn_cn = eu.popn_cn
                       AND mod.georarea_cn = eu.georarea_cn
                       AND mod.report_year = eval.report_year
                      GROUP BY strat.estn_unit_cn,
                               strat.cn,
                               strat.name,
                               p.cn,
                               r.crown_class,
                               1) b ) all_plot_sum,
--This subquery produces an adjusted, plot-level
--estimate of the variable of interest for each
--pop_stratum and domain of interest for the numerator
(SELECT strat.cn   strat_cn,
        strat.name strat_name,
        p.cn       plt_cn,
        --domains would go here and in the group by
        r.genus genus,
        lu.abbr crown_class,
        1 plt_cnt,
        SUM(nvl(t.tpa_unadj, 0) *
            nvl(t.leaf_biomass, 0) *
            decode(t.subp,
                   1,
                   strat.adj_factor_subp,
                   strat.adj_factor_micr)) y
   FROM pop_eval eval,
        pop_stat_samp samp,
        pop_estn_unit eu,
        pop_stratum strat,
        plot_statsamp_assgn sampassgn,
        plot_strat_assgn stratassgn,
        plot p,
        tree t,
        ref_species r,
        ref_crown_class lu,
        (SELECT DISTINCT popn_cn,
                         georarea_cn,
                         report_year
           FROM mod_voc_emissions) MOD
  WHERE eval.evalid = 'Austin2014Curr'
    AND eval.cn = samp.eval_cn
    AND samp.cn = sampassgn.pss_cn
    AND sampassgn.plt_cn = p.cn
    AND p.cn = stratassgn.plt_cn
    AND stratassgn.strat_cn = strat.cn
```

```
        AND strat.estn_unit_cn = eu.cn
        AND eu.eval_cn = eval.cn
        AND p.cn = t.plt_cn(+)
        AND p.urban_manual >= r.manual_start
        AND (r.manual_end IS NULL OR
            p.urban_manual <= r.manual_end)
        AND t.spcd = r.spcd
        AND p.urban_manual >= lu.manual_start
        AND (lu.manual_end IS NULL OR
            p.urban_manual <= lu.manual_end)
        AND t.crown_class_cd = lu.crown_class_cd
        AND mod.popn_cn = eu.popn_cn
        AND mod.geoarea_cn = eu.geoarea_cn
        AND mod.report_year = eval.report_year
      GROUP BY strat.estn_unit_cn,
               strat.cn,
               strat.name,
               p.cn,
               r.genus,
               lu.abbr,
               1) y_plot_sum,
    --This subquery produces an adjusted, plot-level
    --estimate of the variable of interest for each
    --pop_stratum and domain of interest for the denominator
    (SELECT strat.cn   strat_cn,
            strat.name strat_name,
            p.cn       plt_cn,
            --domains would go here and in the group by
            r.genus genus,
            1 plt_cnt,
            SUM(nvl(t.tpa_unadj, 0) *
                nvl(t.leaf_biomass, 0) *
                decode(t.subp,
                       1,
                       strat.adj_factor_subp,
                       strat.adj_factor_micr)) x
       FROM pop_eval eval,
            pop_stat_samp samp,
            pop_estn_unit eu,
            pop_stratum strat,
            plot_statsamp_assgn sampassgn,
            plot_strat_assgn stratassgn,
            plot p,
            tree t,
            ref_species r,
            (SELECT DISTINCT popn_cn,
                             geoarea_cn,
                             report_year
               FROM mod_voc_emissions) MOD
     WHERE eval.evalid = 'Austin2014Curr'
        AND eval.cn = samp.eval_cn
        AND samp.cn = sampassgn.pss_cn
        AND sampassgn.plt_cn = p.cn
        AND p.cn = stratassgn.plt_cn
        AND stratassgn.strat_cn = strat.cn
        AND strat.estn_unit_cn = eu.cn
        AND eu.eval_cn = eval.cn
        AND p.cn = t.plt_cn(+)
        AND p.urban_manual >= r.manual_start
        AND (r.manual_end IS NULL OR
```

```
                                                  p.urban_manual <= r.manual_end)
                                             AND t.spcd = r.spcd
                                             AND mod.popn_cn = eu.popn_cn
                                             AND mod.geoarea_cn = eu.geoarea_cn
                                             AND mod.report_year = eval.report_year
                                          GROUP BY strat.estn_unit_cn,
                                                   strat.cn,
                                                   strat.name,
                                                   p.cn,
                                                   r.genus,
                                                   1) x_plot_sum
                                  WHERE all_plot_sum.plt_cn = x_plot_sum.plt_cn(+)
                                    AND all_plot_sum.plt_cn = y_plot_sum.plt_cn(+)
                                    AND all_plot_sum.genus = x_plot_sum.genus(+)
                                    AND all_plot_sum.genus = y_plot_sum.genus(+)
                                    AND all_plot_sum.crown_class =
                                        y_plot_sum.crown_class(+)
                                  GROUP BY all_plot_sum.strat_cn,
                                           all_plot_sum.strat_name,
                                           all_plot_sum.genus,
                                           all_plot_sum.crown_class) strat_sum
                         WHERE strat_sum_stat.strat_cn = strat_sum.strat_cn(+)
                         GROUP BY strat_sum_stat.popn_name,
                                  strat_sum_stat.popn_version,
                                  strat_sum_stat.popn_cn,
                                  strat_sum_stat.total_acres,
                                  strat_sum_stat.n,
                                  genus,
                                  crown_class) estimate_sum
  WHERE non_zero_num_plt_cnt > 0
  GROUP BY popn_name,
           popn_version,
           popn_cn,
           estimate,
           total_acres,
           plt_cnt,
           genus,
           crown_class) ratio_est
```

Sections of the above code are highlighted to point out important differences between this script and the standard ratio estimate script described in the Ratio Estimates section above. Code highlighted in purple was added to support joining of the ratio estimate results to the population model output from MOD_VOC_EMISSIONS. Code highlighted in aqua was included to constrain the ratio estimate to only those areas and reporting years represented by the population model output. The `all_plot_sum` query uses a slightly different structure than previous examples in order to produce the superset of all genus and crown class combinations on every plot. It uses two subqueries; one for tree genus and the other for crown class. The code highlighted in light grey returns the list of all crown classes for each plot. The code outlined in black returns the list of all tree genera on every plot. These two subqueres are left unjoined on purpose. They are queried by the code highlighted in maroon, which returns the final superset used to join the numerator and denominator. Code highlighted in orange shows additions that add the genus domain partition to the denominator. This is not really a difference from the standard ratio script. It is unique, however, among the four population model outputs included in the Stage 1 design.

Abbreviated results from the ratio estimate are given in the table below. Note that both the Genus and Crown Class domains are presented. Note also that the denominator estimate is not constant across all domains of interest.

POPN_ NAME	POPN_ VERSION	POPN _CN	GENUS	CROWN _CLASS	RATIO_ ESTIMATE	NUMERATOR _ESTIMATE	DENOM-INATOR _ESTIMATE	SE_OF_ RATIO_ ESTIMATE _PCT
Austin, Texas Urban Area	1.0	146047152121573	Acacia	Co-dominant	1.00	111,880.00	111,880.00	-
Austin, Texas Urban Area	1.0	146047152121573	Acer	Intermediate	0.05	173,944.22	3,492,140.93	109.04
Austin, Texas Urban Area	1.0	146047152121573	Acer	Overtopped	0.19	671,067.55	3,492,140.93	93.87
Austin, Texas Urban Area	1.0	146047152121573	Acer	Co-dominant	0.76	2,647,129.15	3,492,140.93	26.69
Austin, Texas Urban Area	1.0	146047152121573	Albizia	Co-dominant	1.00	68,679.18	68,679.18	-
Austin, Texas Urban Area	1.0	146047152121573	Arbutus	Co-dominant	1.00	8,732.19	8,732.19	-
Austin, Texas Urban Area	1.0	146047152121573	Betula	Intermediate	1.00	205,945.85	205,945.85	-
Austin, Texas Urban Area	1.0	146047152121573	Broussonetia	Overtopped	0.06	79,817.71	1,302,212.89	57.02
Austin, Texas Urban Area	1.0	146047152121573	Broussonetia	Co-dominant	0.90	1,171,431.15	1,302,212.89	6.13
Austin, Texas Urban Area	1.0	146047152121573	Broussonetia	Intermediate	0.04	50,964.03	1,302,212.89	127.44
Austin, Texas Urban Area	1.0	146047152121573	Carya	Intermediate	0.08	287,900.02	3,523,514.93	74.33
Austin, Texas Urban Area	1.0	146047152121573	Carya	Open Grown	0.05	173,675.07	3,523,514.93	112.19
Austin, Texas Urban Area	1.0	146047152121573	Carya	Co-dominant	0.85	2,979,911.35	3,523,514.93	9.93
Austin, Texas Urban Area	1.0	146047152121573	Carya	Overtopped	0.02	82,028.49	3,523,514.93	112.05

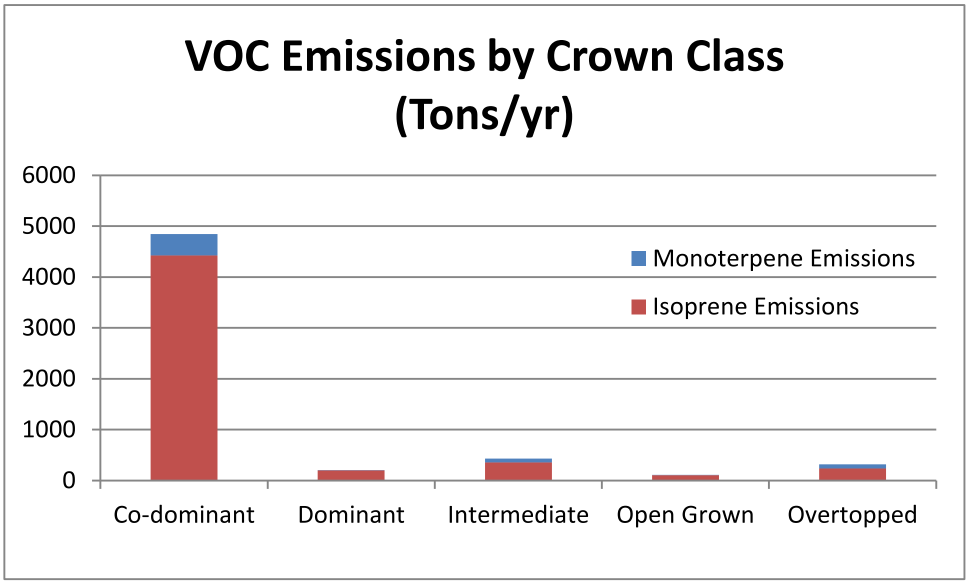
```
SELECT ratio_est.popn_name,
       ratio_est.popn_version,
       ratio_est.genus,
       ratio_est.crown_class,
       --ISOPRENE
       ratio_est.ratio_estimate * voc.isoprene_emitted isoprene,
       power(voc.isoprene_emitted, 2) * ratio_est.var_of_ratio_estimate var_isoprene,
       CASE
         WHEN ratio_est.var_of_ratio_estimate > 0 THEN
          sqrt(power(voc.isoprene_emitted, 2) *
               ratio_est.var_of_ratio_estimate)
       END AS se_isoprene,
```

```
       CASE
         WHEN ratio_est.var_of_ratio_estimate > 0 THEN
          ratio_est.ratio_estimate * voc.isoprene_emitted +
          sqrt(power(voc.isoprene_emitted, 2) *
               ratio_est.var_of_ratio_estimate)
       END AS one_se_upper_bound,
       CASE
         WHEN ratio_est.var_of_ratio_estimate > 0 THEN
          ratio_est.ratio_estimate * voc.isoprene_emitted -
          sqrt(power(voc.isoprene_emitted, 2) *
               ratio_est.var_of_ratio_estimate)
       END AS one_se_lower_bound,
       voc.isoprene_emitted total_isoprene,
       --MONOTERPENE
       ratio_est.ratio_estimate * voc.monoterpene_emitted monoterpene,
       power(voc.monoterpene_emitted, 2) * ratio_est.var_of_ratio_estimate var_monoterpene,
       CASE
         WHEN ratio_est.var_of_ratio_estimate > 0 THEN
          sqrt(power(voc.monoterpene_emitted, 2) *
               ratio_est.var_of_ratio_estimate)
       END AS se_monoterpene,
       CASE
         WHEN ratio_est.var_of_ratio_estimate > 0 THEN
          ratio_est.ratio_estimate * voc.monoterpene_emitted +
          sqrt(power(voc.monoterpene_emitted, 2) *
               ratio_est.var_of_ratio_estimate)
       END AS one_se_upper_bound,
       CASE
         WHEN ratio_est.var_of_ratio_estimate > 0 THEN
          ratio_est.ratio_estimate * voc.monoterpene_emitted -
          sqrt(power(voc.monoterpene_emitted, 2) *
               ratio_est.var_of_ratio_estimate)
       END AS one_se_lower_bound,
       voc.monoterpene_emitted total_monoterpene,
       ratio_est.ratio_estimate prop_leaf_biomass,
       ratio_est.se_of_ratio_estimate se_prop_leaf_biomass,
       ratio_est.var_of_ratio_estimate var_prop_leaf_biomass
  FROM mod_voc_emissions voc,
       (ratio_estimate_script) ratio_est
 WHERE voc.popn_cn = ratio_est.popn_cn
   AND ratio_est.genus = voc.genus
 ORDER BY genus, crown_class, isoprene DESC, monoterpene DESC;
```

The final estimate script shown above uses the ratio estimate script as an input. The ratio estimate script is shown as **ratio_estimate_script** in the FROM clause. The population model output from MOD_VOC_EMISSIONS is joined to the ratio estimate script by joining on both the population CN number as well as tree genus. This join is highlighted in blue-green. The output includes both genus as well as crown class so that the user can determine how they wish to summarize the results. The allocation across domains is done separately for isoprene and monoterpene. In both cases, the allocation is accomplished by the code highlighted in light green. The variance of the proportion is computed in the dark blue area. The variance calculation treats the population model output as a constant and squares this value (which is at the genus level) before multiplying it by the variance of the proportion. The code also employs the use of the CASE operator in the calculation of sampling errors. The purpose of this is to guard against error resulting from 0 variance. Note that some genera are rare. Within a given rare genus, there is sometimes only a single crown class. When this happens, the ratio is 1 and the variance of the ratio is 0.

Abbreviated output from the final estimate script is given below. The estimates of isoprene and monoterpene emissions can be summed across the various genera to arrive at totals for each crown class. The variances, however, cannot be similarly totaled without accounting for the covariance between genera. This is not addressed in this user guide except to point out the issue. Thus, only point estimates are possible at this time. Analysts should refrain from quantitative comparisons between domains or populations until a methodology to estimate uncertainty is developed for this analysis. The point estimates can easily be used to generate a plot of the results to support a general discussion.

POPN_ NAME	POPN _VERSION	GENUS	CROWN_CLASS	ISOPRENE	VAR _ISOPRENE	MONOTERPENE
Austin, Texas Urban Area	1.0	Acacia	Co-dominant	0.009487714	0	0.823639365
Austin, Texas Urban Area	1.0	Acer	Co-dominant	0.22464355	0.003593916	10.40083491
Austin, Texas Urban Area	1.0	Acer	Intermediate	0.014761443	0.000259085	0.683444215
Austin, Texas Urban Area	1.0	Acer	Overtopped	0.056948864	0.002857689	2.63669146
Austin, Texas Urban Area	1.0	Albizia	Co-dominant	0.005824162	0	0.033706816
Austin, Texas Urban Area	1.0	Arbutus	Co-dominant	0.000803814	0	0.002433796
Austin, Texas Urban Area	1.0	Betula	Intermediate	0.017555767	0	0.101602424
Austin, Texas Urban Area	1.0	Broussonetia	Co-dominant	11.42734194	0.490917693	0.383389658
Austin, Texas Urban Area	1.0	Broussonetia	Intermediate	0.497155504	0.401397159	0.016679669
Austin, Texas Urban Area	1.0	Broussonetia	Overtopped	0.778623845	0.197088926	0.026122989
Austin, Texas Urban Area	1.0	Carya	Co-dominant	0.252829061	0.000630529	11.70580373
Austin, Texas Urban Area	1.0	Carya	Intermediate	0.024426731	0.000329667	1.130940064
Austin, Texas Urban Area	1.0	Carya	Open Grown	0.014735373	0.000273306	0.682237177
Austin, Texas Urban Area	1.0	Carya	Overtopped	0.006959666	6.08088E-05	0.322227515


VOC Emissions by Crown Class
(Tons/yr)
6000
5000
4000
3000
2000
1000
0
Monoterpene Emissions
Isoprene Emissions
Co-dominant
Dominant
Intermediate
Open Grown
Overtopped

Literature Cited

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Appendix A. Index of Column Names

The following table lists column names used in the database tables, their location within the table, and a short description.

Column name with (field guide section)	Table name	Location in table	Description
ABBR	REF_BOLE_STUMP_REMOVED	5	Code abbreviation
ABBR	REF_CAUSE_OF_DEATH	5	Code abbreviation
ABBR	REF_CROWN_CLASS	5	Code abbreviation
ABBR	REF_CROWN_LIGHT_EXPOSURE	5	Code abbreviation
ABBR	REF_DIAHT	5	Code abbreviation
ABBR	REF_ENERGY_EFFECT	5	Code abbreviation
ABBR	REF_ENERGY_USE	5	Code abbreviation
ABBR	REF_FOREST_TYPE_GROUP	3	Abbreviation
ABBR	REF_LANDUSE	5	Code abbreviation
ABBR	REF_NONFOREST_LANDUSE	5	Code abbreviation
ABBR	REF_OWNER	5	Code abbreviation
ABBR	REF_OWNER_GROUP	5	Code abbreviation
ABBR	REF_PLANTED	5	Code abbreviation
ABBR	REF_SAMPLKIND	5	Code abbreviation
ABBR	REF_STANDING_DEAD	5	Code abbreviation
ABBR	REF_TREE_STATUS	5	Code abbreviation
ABBR	REF_URBAN_PLOT_NONSAMPLE_REASN	5	Code abbreviation
ABBR	REF_URBAN_PLOT_STATUS	5	Code abbreviation
ABBR	REF_URBAN_SUBP_NONSAMPLE_REASN	5	Code abbreviation
ABBR	REF_URBAN_SUBP_STATUS	5	Code abbreviation
ACTUALHT (5.15)	TREE	17	Actual height
ADJ_FACTOR_MICR	POP_STRATUM	8	Stratum microplot adjustment factor
ADJ_FACTOR_SUBP	POP_STRATUM	9	ADJUSTMENT
ADJUSTMENT	REF_POP_ATTRIBUTE	5	Adjustment
AREA	POP_ESTN_UNIT	5	Total area
AREA	POP_STRATUM	5	Stratum area
AREA_UNITS	POP_ESTN_UNIT	6	Area units
AREA_UNITS	POP_STRATUM	6	Stratum area units
ATTRIBUTE_NBR	REF_POP_ATTRIBUTE	1	Population attribute number
AVOIDED_RUNOFF	MOD_RAINFALL	7	Avoided runoff
AZIMUTH	BUILDING_INTERACTION	14	Azimuth
BASAL_AREA	TREE	21	Basal area
BEGIN_DATE	TIME_PERIOD	4	Time period begin date
BEGIN_PANEL70	SAMPLE_RULE	5	Beginning panel70
BLD_INTERACTION_ID	BUILDING_INTERACTION	12	Building interaction identifier
BOUNDARY	POPULATION_STRUCTURE	6	Boundary indicator
C_SPGRPCD	REF_SPECIES	26	Caribbean species group code
CALCULATION_NBR	REF_CALCULATION	1	Calculation number
CALCULATION_NBR	REF_POP_ATTRIBUTE	2	Calculation number
CARBON_AVOIDED	MOD_ENERGY_EFFECTS	9	Carbon emissions avoided

Column name with (field guide section)	Table name	Location in table	Description
CARBON_AVOIDED VALUE	MOD_ENERGY_EFFECTS	12	Carbon emissions avoided value
CARBON_STORAGE	TREE	23	Carbon storage
CARIBBEAN	REF_SPECIES	24	Caribbean
CAUSE_OF_DEATH (5.21)	REF_CAUSE_OF_DEATH	3	Cause of death
CAUSE_OF_DEATH (5.21)	TREE	62	Cause of death
CLASS	REF_SPECIES_GROUP	4	Class
CN	BUILDING_INTERACTION	1	Sequence number
CN	COVER	1	Sequence number
CN	FIELD_LANDUSE	1	Sequence number
CN	FIELD_SAMPLE	1	Sequence number
CN	GEOAREA	1	Sequence number
CN	MOD_ENERGY_EFFECTS	1	Sequence number
CN	MOD_POLLUTION_HEALTH_FACTOR	1	Sequence number
CN	MOD_POLLUTION_REMOVAL	1	Sequence number
CN	MOD_RAINFALL	1	Sequence number
CN	MOD_VOC_EMISSIONS	1	Sequence number
CN	PLOT	1	Sequence number
CN	POP_ESTN_UNIT	1	Sequence number
CN	POP_EVAL	1	Sequence number
CN	POP_STAT_SAMP	1	Sequence number
CN	POP_STRATUM	1	Sequence number
CN	POPULATION	1	Sequence number
CN	PROJECT	1	Sequence number
CN	SERIES	1	Sequence number
CN	SUBPLOT	1	Sequence number
CN	TIME_PERIOD	1	Sequence number
CN	TREE	1	Sequence number
COMMON_NAME	REF_DAMAGE_AGENT	5	Damage agent common name
COMMON_NAME	REF_SPECIES	2	Common name
COMP_CROWN_RATIO	TREE	45	Compacted crown ratio
COMPENSATORY_VALUE	TREE	28	Compensatory value
CORE	REF_SPECIES	23	Core
COUNTYCD (1.2)	BUILDING_INTERACTION	8	County code
COUNTYCD (1.2)	COVER	8	County code
COUNTYCD (1.2)	FIELD_LANDUSE	8	County code
COUNTYCD (1.2)	PLOT	6	County code
COUNTYCD (1.2)	REF_COUNTY	3	County code
COUNTYCD (1.2)	SUBPLOT	7	County code
COUNTYCD (1.2)	TREE	8	County code
COUNTYNM	REF_COUNTY	4	County name
CREATED_BY	BUILDING_INTERACTION	15	Created by
CREATED_BY	COVER	18	Created by
CREATED_BY	FIELD_LANDUSE	14	Created by
CREATED_BY	FIELD_SAMPLE	8	Created by
CREATED_BY	GEOAREA	4	
CREATED_BY	MOD_ENERGY_EFFECTS	14	Created by
CREATED_BY	MOD_POLLUTION_HEALTH_FACTOR	18	Created by

Column name with (field guide section)	Table name	Location in table	Description
CREATED_BY	MOD_POLLUTION_REMOVAL	16	Created by
CREATED_BY	MOD_RAINFALL	9	Created by
CREATED_BY	MOD_VOC_EMISSIONS	13	Created by
CREATED_BY	PLOT	19	Created by
CREATED_BY	PLOT_FLDSAMP_ASSGN	3	Created by
CREATED_BY	PLOT_STATSAMP_ASSGN	3	Created by
CREATED_BY	PLOT_STRAT_ASSGN	3	Created by
CREATED_BY	POP_ESTN_UNIT	8	Created by
CREATED_BY	POP_EVAL	7	Created by
CREATED_BY	POP_EVAL_TYPE_ASSGN	3	Created by
CREATED_BY	POP_STAT_SAMP	5	Created by
CREATED_BY	POP_STAT_SAMP_CONSTR_ASSGN	3	Created by
CREATED_BY	POP_STRATUM	12	Created by
CREATED_BY	POPULATION	5	Created by
CREATED_BY	POPULATION_STRUCTURE	8	Created by
CREATED_BY	PROJECT	5	Created by
CREATED_BY	PROJECT_POPN_ASSGN	4	Created by
CREATED_BY	REF_BOLE_STUMP_REMOVED	6	Created by
CREATED_BY	REF_CALCULATION	7	Created by
CREATED_BY	REF_CAUSE_OF_DEATH	6	Created by
CREATED_BY	REF_COUNTY	5	Created by
CREATED_BY	REF_CROWN_CLASS	6	Created by
CREATED_BY	REF_CROWN_LIGHT_EXPOSURE	6	Created by
CREATED_BY	REF_DAMAGE_AGENT	9	Created by
CREATED_BY	REF_DAMAGE_AGENT_GROUP	5	Created by
CREATED BY	REF_DB_VERSION	4	Created by
CREATED_BY	REF_DIAHT	6	Created by
CREATED_BY	REF_ENERGY_EFFECT	6	Created by
CREATED_BY	REF_ENERGY_USE	6	Created by
CREATED_BY	REF_LANDUSE	6	Created by
CREATED_BY	REF_NONFOREST_LANDUSE	6	Created by
CREATED_BY	REF_OWNER	6	Created by
CREATED_BY	REF_OWNER_GROUP	6	Created by
CREATED_BY	REF_PLANTED	6	Created by
CREATED_BY	REF_POP_ATTRIBUTE	8	Created by
CREATED_BY	REF_POP_DOMAIN	5	Created by
CREATED_BY	REF_POP_EVAL_TYPE	3	Created by
CREATED_BY	REF_SAMPLE_CONSTRAINT	4	Created by
CREATED_BY	REF_SAMPLKIND	6	Created by
CREATED_BY	REF_SPECIES	17	Created by
CREATED_BY	REF_SPECIES_GROUP	5	Created by
CREATED_BY	REF_STANDING_DEAD	6	Created by
CREATED_BY	REF_STATE	5	Created by
CREATED_BY	REF_TREE_STATUS	6	Created by
CREATED_BY	REF_URBAN_PLOT_NONSAMPLE_REASN	6	Created by
CREATED_BY	REF_URBAN_PLOT_STATUS	6	Created by
CREATED_BY	REF_URBAN_SUBP_NONSAMPLE_REASN	6	Created by

Column name with (field guide section)	Table name	Location in table	Description
CREATED_BY	REF_URBAN_SUBP_STATUS	6	Created by
CREATED_BY	REF_UNIT	4	Created by
CREATED_BY	SAMPLE_RULE	8	Created by
CREATED_BY	SERIES	4	Created by
CREATED_BY	SUBPLOT	20	Created by
CREATED_BY	TIME_PERIOD	7	Created by
CREATED_BY	TREE	63	Created by
CREATED_DATE	BUILDING_INTERACTION	16	Created date
CREATED_DATE	COVER	19	Created date
CREATED_DATE	FIELD_LANDUSE	15	Created date
CREATED_DATE	FIELD_SAMPLE	9	Created date
CREATED_DATE	GEOAREA	5	
CREATED_DATE	MOD_ENERGY_EFFECTS	15	Created date
CREATED_DATE	MOD_POLLUTION_HEALTH_FACTOR	19	Created date
CREATED_DATE	MOD_POLLUTION_REMOVAL	17	Created date
CREATED_DATE	MOD_RAINFALL	10	Created date
CREATED_DATE	MOD_VOC_EMISSIONS	14	Created date
CREATED_DATE	PLOT	20	Created date
CREATED_DATE	PLOT_FLDSAMP_ASSGN	4	Created date
CREATED_DATE	PLOT_STATSAMP_ASSGN	4	Created date
CREATED_DATE	PLOT_STRAT_ASSGN	4	Created date
CREATED_DATE	POP_ESTN_UNIT	9	Created date
CREATED_DATE	POP_EVAL	8	Created date
CREATED_DATE	POP_EVAL_TYPE_ASSGN	4	Created date
CREATED_DATE	POP_STAT_SAMP	6	Created date
CREATED_DATE	POP_STAT_SAMP_CONSTR_ASSGN	4	Created date
CREATED_DATE	POP_STRATUM	13	Created date
CREATED_DATE	POPULATION	6	Created date
CREATED_DATE	POPULATION_STRUCTURE	9	Created date
CREATED DATE	PROJECT	6	Created date
CREATED_DATE	PROJECT_POPN_ASSGN	5	Created date
CREATED_DATE	REF_BOLE_STUMP_REMOVED	7	Created date
CREATED_DATE	REF_CALCULATION	8	Created by
CREATED_DATE	REF_CAUSE_OF_DEATH	7	Created date
CREATED_DATE	REF_COUNTY	6	Created date
CREATED_DATE	REF_CROWN_CLASS	7	Created date
CREATED_DATE	REF_CROWN_LIGHT_EXPOSURE	7	Created date
CREATED_DATE	REF_DAMAGE_AGENT	10	Created date
CREATED_DATE	REF_DAMAGE_AGENT_GROUP	6	Created date
CREATED_DATE	REF_DB_VERSION	5	Created date
CREATED_DATE	REF_DIAHT	7	Created date
CREATED_DATE	REF_ENERGY_EFFECT	7	Created date
CREATED_DATE	REF_ENERGY_USE	7	Created date
CREATED_DATE	REF_LANDUSE	7	Created date
CREATED_DATE	REF_NONFOREST_LANDUSE	7	Created date
CREATED_DATE	REF_OWNER	7	Created date
CREATED_DATE	REF_OWNER_GROUP	7	Created date
CREATED_DATE	REF_PLANTED	7	Created date

Column name with (field guide section)	Table name	Location in table	Description
CREATED_DATE	REF_POP_ATTRIBUTE	9	Created date
CREATED_DATE	REF_POP_DOMAIN	6	Created date
CREATED_DATE	REF_POP_EVAL_TYPE	4	Created date
CREATED_DATE	REF_SAMPLE_CONSTRAINT	5	Created date
CREATED_DATE	REF_SAMPLKIND	7	Created date
CREATED_DATE	REF_SPECIES	18	Created date
CREATED_DATE	REF_SPECIES_GROUP	6	Created date
CREATED_DATE	REF_STANDING_DEAD	7	Created date
CREATED_DATE	REF_STATE	5	Created date
CREATED_DATE	REF_TREE_STATUS	7	Created date
CREATED_DATE	REF_URBAN_PLOT_NONSAMPLE_REASN	7	Created date
CREATED_DATE	REF_URBAN_PLOT_STATUS	7	Created date
CREATED_DATE	REF_URBAN_SUBP_NONSAMPLE_REASN	7	Created date
CREATED_DATE	REF_URBAN_SUBP_STATUS	7	Created date
CREATED_DATE	REF_UNIT	5	Created date
CREATED_DATE	SAMPLE_RULE	9	Created date
CREATED_DATE	SERIES	5	Created date
CREATED_DATE	SUBPLOT	21	Created date
CREATED_DATE	TIME_PERIOD	8	Created date
CREATED_DATE	TREE	64	Created date
CREATED_IN_INSTANCE	BUILDING_INTERACTION	17	Created in instance
CREATED_IN_INSTANCE	COVER	20	Created in instance
CREATED_IN_INSTANCE	FIELD_LANDUSE	16	Created in instance
CREATED_IN_INSTANCE	FIELD_SAMPLE	10	Created in instance
CREATED_IN_INSTANCE	GEOAREA	6	Created in instance
CREATED_IN_INSTANCE	MOD_ENERGY_EFFECTS	16	Created in instance
CREATED_IN_INSTANCE	MOD_POLLUTION_HEALTH_FACTOR	20	Created in instance
CREATED_IN_INSTANCE	MOD_POLLUTION_REMOVAL	18	Created in instance
CREATED_IN_INSTANCE	MOD_RAINFALL	11	Created in instance
CREATED_IN_INSTANCE	MOD_VOC_EMISSIONS	15	Created in instance
CREATED_IN_INSTANCE	PLOT	21	Created in instance
CREATED_IN_INSTANCE	PLOT_FLDSAMP_ASSGN	5	Created in instance
CREATED_IN_INSTANCE	PLOT_STATSAMP_ASSGN	5	Created in instance
CREATED_IN_INSTANCE	PLOT_STRAT_ASSGN	5	Created in instance
CREATED_IN_INSTANCE	POP_ESTN_UNIT	10	Created in instance
CREATED_IN_INSTANCE	POP_EVAL	9	Created in instance
CREATED_IN_INSTANCE	POP_EVAL_TYPE_ASSGN	5	Created in instance
CREATED_IN_INSTANCE	POP_STAT_SAMP	7	Created in instance
CREATED_IN_INSTANCE	POP_STAT_SAMP_CONSTR_ASSGN	5	Created in instance
CREATED_IN_INSTANCE	POP_STRATUM	14	Created in instance
CREATED_IN_INSTANCE	POPULATION	7	Created in instance
CREATED_IN_INSTANCE	POPULATION_STRUCTURE	10	Created in instance
CREATED_IN_INSTANCE	PROJECT	7	Created in instance
CREATED_IN_INSTANCE	PROJECT_POPN_ASSGN	6	Created in instance
CREATED_IN_INSTANCE	REF_BOLE_STUMP_REMOVED	8	Created in instance
CREATED_IN_INSTANCE	REF_CALCULATION	9	Created in instance
CREATED_IN_INSTANCE	REF_CAUSE_OF_DEATH	8	Created in instance

Column name with (field guide section)	Table name	Location in table	Description
CREATED_IN_INSTANCE	REF_COUNTY	7	Created in instance
CREATED_IN_INSTANCE	REF_CROWN_CLASS	8	Created in instance
CREATED_IN_INSTANCE	REF_CROWN_LIGHT_EXPOSURE	8	Created in instance
CREATED_IN_INSTANCE	REF_DAMAGE_AGENT	11	Created in instance
CREATED_IN_INSTANCE	REF_DAMAGE_AGENT_GROUP	7	Created in instance
CREATED_IN_INSTANCE	REF_DB_VERSION	6	Created in instance
CREATED_IN_INSTANCE	REF_DIAHT	8	Created in instance
CREATED_IN_INSTANCE	REF_ENERGY_EFFECT	8	Created in instance
CREATED_IN_INSTANCE	REF_ENERGY_USE	8	Created in instance
CREATED_IN_INSTANCE	REF_LANDUSE	8	Created in instance
CREATED_IN_INSTANCE	REF_NONFOREST_LANDUSE	8	Created in instance
CREATED_IN_INSTANCE	REF_OWNER	8	Created in instance
CREATED_IN_INSTANCE	REF_OWNER_GROUP	8	Created in instance
CREATED_IN_INSTANCE	REF_PLANTED	8	Created in instance
CREATED_IN_INSTANCE	REF_POP_ATTRIBUTE	10	Created in instance
CREATED_IN_INSTANCE	REF_POP_DOMAIN	7	Created in instance
CREATED_IN_INSTANCE	REF_POP_EVAL_TYPE	5	Created in instance
CREATED_IN_INSTANCE	REF_SAMPLE_CONSTRAINT	6	Created in instance
CREATED_IN_INSTANCE	REF_SAMPLKIND	8	Created in instance
CREATED_IN_INSTANCE	REF_SPECIES	19	Created in instance
CREATED_IN_INSTANCE	REF_SPECIES_GROUP	7	Created in instance
CREATED_IN_INSTANCE	REF_STANDING_DEAD	8	Created in instance
CREATED_IN_INSTANCE	REF_STATE	6	Created in instance
CREATED_IN_INSTANCE	REF_TREE_STATUS	8	Created in instance
CREATED_IN_INSTANCE	REF_URBAN_PLOT_NONSAMPLE_REASN	8	Created in instance
CREATED_IN_INSTANCE	REF_URBAN_PLOT_STATUS	8	Created in instance
CREATED_IN_INSTANCE	REF_URBAN_SUBP_NONSAMPLE_REASN	8	Created in instance
CREATED_IN_INSTANCE	REF_URBAN_SUBP_STATUS	8	Created in instance
CREATED_IN_INSTANCE	REF_UNIT	6	Created in instance
CREATED_IN_INSTANCE	SAMPLE_RULE	10	Created in instance
CREATED_IN_INSTANCE	SERIES	6	Created in instance
CREATED_IN_INSTANCE	SUBPLOT	22	Created in instance
CREATED_IN_INSTANCE	TIME_PERIOD	9	Created in instance
CREATED_IN_INSTANCE	TREE	65	Created in instance
CROWN_CLASS_CD	REF_CROWN_CLASS	3	Crown class code
CROWN_CLASS_CD (5.17)	TREE	51	Crown class code
CROWN_DIAM_90 (5.18.2)	TREE	20	Crown diameter at 90 degrees
CROWN_DIAM_WIDE (5.18.1)	TREE	19	Crown diameter at the widest point
CROWN_GROUND_AREA	TREE	29	Crown ground area
CROWN_HEIGHT	TREE	18	Crown height
CROWN_LIGHT_EXPOSURE (23.6)	REF_CROWN_LIGHT_EXPOSURE	3	Crown light exposure
CROWN_LIGHT_EXPOSURE (23.6)	TREE	33	Crown light exposure
CYCLE	FIELD_SAMPLE	5	Inventory cycle number
DAMAGE_AGENT_CD	REF_DAMAGE_AGENT	3	Damage agent code
DAMAGE_AGENT_CD1 (5.20.1)	TREE	59	Damage agent 1

Column name with (field guide section)	Table name	Location in table	Description
DAMAGE_AGENT_CD2 (5.20.2)	TREE	60	Damage agent 2
DAMAGE_AGENT_CD3 (5.20.3)	TREE	61	Damage agent 3
DAMAGE_AGENT_GROUP_CD	REF_DAMAGE_AGENT	4	Damage agent group code
DAMAGE_AGENT_GROUP_CD	REF_DAMAGE_AGENT_GROUP	3	Damage agent group code
DESCR	REF_DB_VERSION	2	Version description
DESCRIPTION	GEOAREA	3	Geographic area description
DESCRIPTION	POP_EVAL	6	Evaluation description
DESCRIPTION	POP_STAT_SAMP	4	Statistical sample description
DESCRIPTION	POP_STRATUM	11	Stratum description
DESCRIPTION	POPULATION	4	Population description
DESCRIPTION	PROJECT	4	Description
DESCRIPTION	REF_BOLE_STUMP_REMOVED	4	Code description
DESCRIPTION	REF_CALCULATION	3	Calculation description
DESCRIPTION	REF_CAUSE_OF_DEATH	4	Code description
DESCRIPTION	REF_CROWN_CLASS	4	Code description
DESCRIPTION	REF_CROWN_LIGHT_EXPOSURE	4	Code description
DESCRIPTION	REF_DAMAGE_AGENT_GROUP	4	Code description
DESCRIPTION	REF_DIAHT	4	Code description
DESCRIPTION	REF_ENERGY_EFFECT	4	Code description
DESCRIPTION	REF_ENERGY_USE	4	Code description
DESCRIPTION	REF_LANDUSE	4	Code description
DESCRIPTION	REF_NONFOREST_LANDUSE	4	Code description
DESCRIPTION	REF_OWNER	4	Code description
DESCRIPTION	REF_OWNER_GROUP	4	Code description
DESCRIPTION	REF_PLANTED	4	Code description
DESCRIPTION	REF_POP_ATTRIBUTE	4	Population attribute description
DESCRIPTION	REF_POP_DOMAIN	2	Population domain description
DESCRIPTION	REF_POP_EVAL_TYPE	2	Evaluation type description
DESCRIPTION	REF_SAMPLE_CONSTRAINT	2	Sample constraint description
DESCRIPTION	REF_SAMPLKIND	4	Code description
DESCRIPTION	REF_STANDING_DEAD	4	Code description
DESCRIPTION	REF_TREE_STATUS	4	Code description
DESCRIPTION	REF_URBAN_PLOT_NONSAMPLE_REASN	4	Code description
DESCRIPTION	REF_URBAN_PLOT_STATUS	4	Code description
DESCRIPTION	REF_URBAN_SUBP_NONSAMPLE_REASN	4	Code description
DESCRIPTION	REF_URBAN_SUBP_STATUS	4	Code description
DESCRIPTION	SERIES	3	Series description
DESCRIPTION	TIME_PERIOD	6	Time period description
DIA (5.9.2)	TREE	15	Current diameter
DIAHTCD (5.24)	REF_DIAHT	3	Diameter height code
DIAHTCD (5.24)	TREE	35	Diameter height code
DISTANCE (5.28)	BUILDING_INTERACTION	13	Distance

Column name with (field guide section)	Table name	Location in table	Description
DMG_EXCESS_MULCH (5.20.7)	TREE	55	Excessive mulch damage
DMG_IMPROPER_PLANTING (5.20.10)	TREE	58	Improper planting damage
DMG_OVERHEAD_WIRES (5.20.9)	TREE	57	Overhead wire conflict damage
DMG_ROOT_STEM_GIRDLING (5.20.4)	TREE	52	Root/stem girdling damage
DMG_SIDEWALK_ROOT CONFLICT (5.20.8)	TREE	56	Sidewalk/root conflict damage
DMG_TOPPING_PRUNING (5.20.6)	TREE	54	Topping/pruning damage
DMG_TRUNK_BARK_INCLUSION (5.20.5)	TREE	53	Trunk/bark inclusion damage
DOMAIN_TYPE	REF_CALCULATION	6	Domain type
DOMAIN_TYPE	REF_POP_ATTRIBUTE	7	Domain type
DOMAIN_TYPE	REF_POP_DOMAIN	4	Domain type
E_SPGRPCD	REF_SPECIES	8	Eastern species group code
EAST	REF_SPECIES	12	East
ELECTRICITY_AVOIDED	MOD_ENERGY_EFFECTS	8	Electricity use avoided
ELECTRICITY_AVOIDED_VALUE	MOD_ENERGY_EFFECTS	11	Electricity use avoided value
END_DATE	TIME_PERIOD	5	Time period end date
END_PANEL70	SAMPLE_RULE	6	End panel70
ENERGY_EFFECT	REF_ENERGY_EFFECT	3	Energy type
ENERGY_EFFECT	MOD_ENERGY_EFFECTS	6	Energy effect
ENERY_USE	MOD_ENERGY_EFFECTS	5	Energy use
ENERGY_USE	REF_ENERGY_USE	3	Energy use
ESTN_UNIT_CN	POP_STRATUM	2	Estimation unit sequence number
EVAL_CN	POP_ESTN_UNIT	2	Evaluation sequence number
EVAL_CN	POP_EVAL_TYPE_ASSGN	1	Evaluation sequence number
EVAL_CN	POP_STAT_SAMP	2	Evaluation sequence number
EVAL_TYPE	REF_POP_ATTRIBUTE	6	Evaluation type
EVAL_TYPE_NAME	POP_EVAL_TYPE_ASSGN	2	Evaluation type name
EVALID	POP_EVAL	2	Evaluation identifier
EXPNS	POP_STRATUM	7	Stratum expansion factor
EXPRESSION	REF_CALCULATION	4	Expression
EXPRESSION	REF_POP_DOMAIN	3	Population domain expression
EXPRESSION	REF_SAMPLE_CONSTRAINT	3	Expression
FLDSAMP_CN	PLOT_FLDSAMP_ASSGN	2	Field sample sequence number
FLDSAMP_CN	SAMPLE_RULE	1	Field sample sequence number
FOLIAGE_MISSING	TREE	43	Foliage missing
FUEL_AVOIDED	MOD_ENERGY_EFFECTS	7	Fuel use avoided
FUEL_AVOIDED_VALUE	MOD_ENERGY_EFFECTS	10	Fuel use avoided value
GENUS	MOD_VOC_EMISSIONS	5	Genus
GENUS	REF_SPECIES	3	Genus

Column name with (field guide section)	Table name	Location in table	Description
GEOAREA_CN	MOD_ENERGY_EFFECTS	3	Geographic area sequence number
GEOAREA_CN	MOD_POLLUTION_HEALTH_FACTOR	3	Geographic area sequence number
GEOAREA_CN	MOD_POLLUTION_REMOVAL	3	Geographic area sequence number
GEOAREA_CN	MOD_RAINFALL	3	Geographic area sequence number
GEOAREA_CN	MOD_VOC_EMISSIONS	3	Geographic area sequence number
GEOAREA_CN	POP_ESTN_UNIT	4	Geographic area sequence number
GEOAREA_CN	POPULATION_STRUCTURE	2	Geographic area sequence number
GEOAREA_CN	SAMPLE_RULE	3	Geographic area sequence number
GR_COV_PCT_BLDG	COVER	13	Ground cover – percent building
GR_COV_PCT_HERBACEOUS	COVER	16	Ground cover – percent herbaceous
GR_COV_PCT_IMPERVIOUS	COVER	14	Ground cover – percent impervious
GR_COV_PCT_PERMEABLE	COVER	15	Ground cover – percent permeable
GR_COV_PCT_WATER	COVER	17	Ground cover – percent water
GROSS_C_SEQ	TREE	24	Gross carbon sequestration
HEALTH_FACTOR	MOD_POLLUTION_HEALTH_FACTOR	5	Health factor
HT (5.14)	TREE	16	Total height
HTDMP	TREE	36	Height to diameter measurement point
INSTALL_TYPE	REF_DB_VERSION	3	Installation type
INTENSITY	SAMPLE_RULE	4	Sample intensity
INVENTORY_TYPE	PROJECT	3	Inventory type
INVYR	TIME_PERIOD	13	Time period inventory year
IS_BOLE_STUMP_REMOVED (5.7.4)	REF_BOLE_STUMP_REMOVED	3	Is bole/stump removed
IS_BOLE_STUMP_REMOVED (5.7.4)	TREE	50	Is bole/stump removed
IS_MAINTAINED_AREA (5.29)	TREE	46	Is tree in maintained area
IS_PLANTED (5.32)	REF_PLANTED	3	Is tree planted
IS_PLANTED (5.32)	TREE	49	Is tree planted
IS_RIPARIAN (5.30)	TREE	47	Is tree in riparian area
IS_STREET_TREE (5.31)	TREE	48	Is tree a street tree
ISOPRENE_EMITTED	MOD_VOC_EMISSIONS	6	Isoprene emitted
KINDCD	REF_SAMPLKIND	3	Sample kind code
LABEL	POP_EVAL	4	Evaluation label
LABEL	POP_STRATUM	4	Stratum label
LANDUSE	FIELD_LANDUSE	11	Land use
LANDUSE	REF_LANDUSE	3	Land use

Column name with (field guide section)	Table name	Location in table	Description
LANDUSE	TREE	40	Land use
LANDUSE_AREA	FIELD_LANDUSE	13	Land use area
LANDUSE_AT_SUBP_CENTER	SUBPLOT	13	Land use at subplot center
LAT	PLOT	16	Latitude
LEAF_AREA	TREE	26	Leaf area
LEAF_AREA_INDEX	TREE	30	Leaf area index
LEAF_BIOMASS	TREE	27	Leaf biomass
LEAF_BIOMASS_INDEX	TREE	31	Leaf biomass index
LON	PLOT	17	Longitude
MAJOR_SPGRPCD	REF_SPECIES	10	Major species group code
MANUAL_END	REF_BOLE_STUMP_REMOVED	2	Ending manual version
MANUAL_END	REF_CAUSE_OF_DEATH	2	Ending manual version
MANUAL_END	REF_CROWN_CLASS	2	Ending manual version
MANUAL_END	REF_CROWN_LIGHT_EXPOSURE	2	Ending manual version
MANUAL_END	REF_DAMAGE_AGENT	2	Ending manual version
MANUAL_END	REF_DAMAGE_AGENT_GROUP	2	Ending manual version
MAUNAL_END	REF_DIAHT	2	Ending manual version
MANUAL_END	REF_ENERGY_EFFECT	2	Ending manual version
MANUAL_END	REF_ENERGY_USE	2	Ending manual version
MANUAL_END	REF_LANDUSE	2	Ending manual version
MANUAL_END	REF_NONFOREST_LANDUSE	2	Ending manual version
MANUAL_END	REF_OWNER	2	Ending manual version
MANUAL_END	REF_OWNER_GROUP	2	Ending manual version
MANUAL_END	REF_PLANTED	2	Ending manual version
MANUAL_END	REF_SAMPLKIND	2	Ending manual version
MANUAL_END	REF_SPECIES	16	Manual end
MANUAL_END	REF_STANDING_DEAD	2	Ending manual version
MANUAL_END	REF_TREE_STATUS	2	Ending manual version
MANUAL_END	REF_URBAN_PLOT_NONSAMPLE_REASN	2	Ending manual version
MANUAL_END	REF_URBAN_PLOT_STATUS	2	Ending manual version
MANUAL_END	REF_URBAN_SUBP_NONSAMPLE_REASN	2	Ending manual version
MANUAL_END	REF_URBAN_SUBP_STATUS	3	Ending manual version
MANUAL_START	REF_BOLE_STUMP_REMOVED	1	Starting manual version
MANUAL_START	REF_CAUSE_OF_DEATH	1	Starting manual version
MANUAL_START	REF_CROWN_CLASS	1	Starting manual version
MANUAL_START	REF_CROWN_LIGHT_EXPOSURE	1	Starting manual version
MANUAL_START	REF_DAMAGE_AGENT	1	Starting manual version
MANUAL_START	REF_DAMAGE_AGENT_GROUP	1	Starting manual version
MANUAL_START	REF_DIAHT	1	Starting manual version
MANUAL_START	REF_ENERGY_EFFECT	1	Starting manual version
MANUAL_START	REF_ENERGY_USE	1	Starting manual version
MANUAL_START	REF_LANDUSE	1	Starting manual version
MANUAL_START	REF_NONFOREST_LANDUSE	1	Starting manual version
MANUAL_START	REF_OWNER	1	Starting manual version
MANUAL_START	REF_OWNER_GROUP	1	Starting manual version
MANUAL_START	REF_PLANTED	1	Starting manual version
MANUAL_START	REF_SAMPLKIND	1	Starting manual version

Column name with (field guide section)	Table name	Location in table	Description
MANUAL_START	REF_SPECIES	15	Manual start
MANUAL_START	REF_STANDING_DEAD	1	Starting manual version
MANUAL_START	REF_TREE_STATUS	1	Starting manual version
MANUAL_START	REF_URBAN_PLOT_NONSAMPLE_REASN	1	Starting manual version
MANUAL_START	REF_URBAN_PLOT_STATUS	1	Starting manual version
MANUAL_START	REF_URBAN_SUBP_NONSAMPLE_REASN	1	Starting manual version
MANUAL_START	REF_URBAN_SUBP_STATUS	1	Starting manual version
MAX_POLLUTION_REMOVAL	MOD_POLLUTION_REMOVAL	11	Maximum pollution removal
MAX_REMOVAL_VALUE	MOD_POLLUTION_REMOVAL	8	Maximum pollution removal value
MEASDAY (1.13.3)	PLOT	10	Measurement day
MEASMON (1.13.2)	PLOT	9	Measurement month
MEASYEAR (1.13.1)	PLOT	8	Measurement year
MIN_POLLUTION_REMOVAL	MOD_POLLUTION_REMOVAL	10	Minimum pollution removal
MIN_REMOVAL_VALUE	MOD_POLLUTION_REMOVAL	7	Minimum pollution removal value
MODIFIED_BY	BUILDING_INTERACTION	18	Modified by
MODIFIED_BY	COVER	21	Modified by
MODIFIED_BY	FIELD_LANDUSE	17	Modified by
MODIFIED_BY	FIELD_SAMPLE	11	Modified by
MODIFIED_BY	GEOAREA	7	Modified by
MODIFIED_BY	MOD_ENERGY_EFFECTS	17	Modified by
MODIFIED_BY	MOD_POLLUTION_HEALTH_FACTOR	15	Modified by
MODIFIED_BY	MOD_POLLUTION_REMOVAL	13	Modified by
MODIFIED_BY	MOD_RAINFALL	12	Modified by
MODIFIED_BY	MOD_VOC_EMISSIONS	10	Modified by
MODIFIED_BY	PLOT	22	Modified by
MODIFIED_BY	PLOT_FLDSAMP_ASSGN	6	Modified by
MODIFIED_BY	PLOT_STATSAMP_ASSGN	6	Modified by
MODIFIED_BY	PLOT_STRAT_ASSGN	6	Modified by
MODIFIED_BY	POP_ESTN_UNIT	11	Modified by
MODIFIED_BY	POP_EVAL	10	Modified by
MODIFIED_BY	POP_EVAL_TYPE_ASSGN	6	Modified by
MODIFIED BY	POP_STAT_SAMP	8	Modified by
MODIFIED_BY	POP_STAT_SAMP_CONSTR_ASSGN	6	Modified by
MODIFIED_BY	POP_STRATUM	15	Modified by
MODIFIED_BY	POPULATION	8	Modified by
MODIFIED_BY	POPULATION_STRUCTURE	11	Modified by
MODIFIED_BY	PROJECT	8	Modified by
MODIFIED_BY	PROJECT_POPN_ASSGN	7	Modified by
MODIFIED_BY	REF_BOLE_STUMP_REMOVED	9	Modified by
MODIFIED_BY	REF_CALCULATION	10	Modified by
MODIFIED_BY	REF_CAUSE_OF_DEATH	9	Modified by
MODIFIED_BY	REF_COUNTY	8	Modified by
MODIFIED_BY	REF_CROWN_CLASS	9	Modified by

Column name with (field guide section)	Table name	Location in table	Description
MODIFIED_BY	REF_CROWN_LIGHT_EXPOSURE	9	Modified by
MODIFIED_BY	REF_DAMAGE_AGENT	12	Modified by
MODIFIED_BY	REF_DAMAGE_AGENT_GROUP	8	Modified by
MODIFIED_BY	REF_DB_VERSION	7	Modified by
MODIFIED_BY	REF_DIAHT	9	Modified by
MODIFIED_BY	REF_ENERGY_EFFECT	9	Modified by
MODIFIED_BY	REF_ENERGY_USE	9	Modified by
MODIFIED_BY	REF_LANDUSE	9	Modified by
MODIFIED_BY	REF_NONFOREST_LANDUSE	9	Modified by
MODIFIED_BY	REF_OWNER	9	Modified by
MODIFIED_BY	REF_OWNER_GROUP	9	Modified by
MODIFIED_BY	REF_PLANTED	9	Modified by
MODIFIED_BY	REF_POP_ATTRIBUTE	11	Modified by
MODIFIED_BY	REF_POP_DOMAIN	8	Modified by
MODIFIED_BY	REF_POP_EVAL_TYPE	6	Modified by
MODIFIED_BY	REF_SAMPLE_CONSTRAINT	7	Modified by
MODIFIED_BY	REF_SAMPLKIND	9	Modified by
MODIFIED_BY	REF_SPECIES	20	Modified by
MODIFIED_BY	REF_SPECIES_GROUP	8	Modified by
MODIFIED_BY	REF_STANDING_DEAD	9	Modified by
MODIFIED_BY	REF_STATE	7	Modified by
MODIFIED_BY	REF_TREE_STATUS	9	Modified by
MODIFIED_BY	REF_URBAN_PLOT_NONSAMPLE_REASN	9	Modified by
MODIFIED_BY	REF_URBAN_PLOT_STATUS	9	Modified by
MODIFIED_BY	REF_URBAN_SUBP_NONSAMPLE_REASN	9	Modified by
MODIFIED_BY	REF_URBAN_SUBP_STATUS	9	Modified by
MODIFIED_BY	REF_UNIT	7	Modified by
MODIFIED_BY	SAMPLE_RULE	11	Modified by
MODIFIED_BY	SERIES	7	Modified by
MODIFIED_BY	SUBPLOT	23	Modified by
MODIFIED_BY	TIME_PERIOD	10	Modified by
MODIFIED_BY	TREE	66	Modified by
MODIFIED_DATE	BUILDING_INTERACTION	20	Modified date
MODIFIED_DATE	COVER	23	Modified date
MODIFIED_DATE	FIELD_LANDUSE	19	Modified date
MODIFIED_DATE	FIELD_SAMPLE	13	Modified date
MODIFIED_DATE	GEOAREA	8	Modified date
MODIDIED_DATE	MOD_ENERGY_EFFECTS	19	Modified date
MODIFIED_DATE	MOD_POLLUTION_HEALTH_FACTOR	16	Modified date
MODIFIED_DATE	MOD_POLLUTION_REMOVAL	14	Modified date
MODIFIED_DATE	MOD_RAINFALL	14	Modified date
MODIFIED_DATE	MOD_VOC_EMISSIONS	11	Modified date
MODIFIED_DATE	PLOT	24	Modified date
MODIFIED_DATE	PLOT_FLDSAMP_ASSGN	8	Modified date
MODIFIED_DATE	PLOT_STATSAMP_ASSGN	8	Modified date
MODIFIED_DATE	PLOT_STRAT_ASSGN	8	Modified date
MODIFIED_DATE	POP_ESTN_UNIT	13	Modified date

Column name with (field guide section)	Table name	Location in table	Description
MODIFIED_DATE	POP_EVAL	11	Modified date
MODIFIED_DATE	POP_EVAL_TYPE_ASSGN	8	Modified date
MODIFIED_DATE	POP_STAT_SAMP	9	Modified date
MODIFIED_DATE	POP_STAT_SAMP_CONSTR_ASSGN	8	Modified date
MODIFIED_DATE	POP_STRATUM	16	Modified date
MODIFIED_DATE	POPULATION	9	Modified date
MODIFIED_DATE	PROJECT	9	Modified date
MODIFIED_DATE	POPULATION_STRUCTURE	13	Modified date
MODIFIED_DATE	PROJECT_POPN_ASSGN	9	Modified date
MODIFIED_DATE	REF_BOLE_STUMP_REMOVED	11	Modified date
MODIFIED_DATE	REF_CALCULATION	12	Modified date
MODIFIED_DATE	REF_CAUSE_OF_DEATH	11	Modified date
MODIFIED_DATE	REF_COUNTY	9	Modified date
MODIFIED_DATE	REF_CROWN_CLASS	11	Modified date
MODIFIED_DATE	REF_CROWN_LIGHT_EXPOSURE	11	Modified date
MODIFIED_DATE	REF_DAMAGE_AGENT	14	Modified date
MODIFIED_DATE	REF_DAMAGE_AGENT_GROUP	10	Modified date
MODIFIED_DATE	REF_DB_VERSION	8	Modified date
MODIFIED_DATE	REF_DIAHT	11	Modified date
MODIFIED_DATE	REF_ENERGY_EFFECT	11	Modified date
MODIFIED_DATE	REF_ENERGY_USE	11	Modified date
MODIFIED_DATE	REF_LANDUSE	11	Modified date
MODIFIED_DATE	REF_NONFOREST_LANDUSE	11	Modified date
MODIFIED_DATE	REF_OWNER	11	Modified date
MODIFIED_DATE	REF_OWNER_GROUP	11	Modified date
MODIFIED_DATE	REF_PLANTED	11	Modified date
MODIFIED_DATE	REF_POP_ATTRIBUTE	13	Modified date
MODIFIED_DATE	REF_POP_DOMAIN	10	Modified date
MODIFIED_DATE	REF_POP_EVAL_TYPE	8	Modified date
MODIFIED_DATE	REF_SAMPLE_CONSTRAINT	9	Modified date
MODIFIED_DATE	REF_SAMPLKIND	11	Modified date
MODIFIED_DATE	REF_SPECIES	21	Modified date
MODIFIED_DATE	REF_SPECIES_GROUP	9	Modified date
MODIFIED_DATE	REF_STANDING_DEAD	11	Modified date
MODIFIED_DATE	REF_STATE	8	Modified date
MODIFIED_DATE	REF_TREE_STATUS	11	Modified date
MODIFIED_DATE	REF_URBAN_PLOT_NONSAMPLE_REASN	11	Modified date
MODIFIED_DATE	REF_URBAN_PLOT_STATUS	11	Modified date
MODIFIED_DATE	REF_URBAN_SUBP_NONSAMPLE_REASN	11	Modified date
MODIFIED_DATE	REF_URBAN_SUBP_STATUS	11	Modified date
MODIFIED_DATE	REF_UNIT	8	Modified date
MODIFIED_DATE	SAMPLE_RULE	13	Modified date
MODIFIED_DATE	SERIES	8	Modified date
MODIFIED_DATE	SUBPLOT	25	Modified date
MODIFIED_DATE	TIME_PERIOD	11	Modified date
MODIFIED_DATE	TREE	68	Modified date
MODIFIED_IN_INSTANCE	BUILDING_INTERACTION	19	Modified in instance

Column name with (field guide section)	Table name	Location in table	Description
MODIFIED_IN_INSTANCE	COVER	22	Modified in instance
MODIFIED_IN_INSTANCE	FIELD_LANDUSE	18	Modified in instance
MODIFIED_IN_INSTANCE	FIELD_SAMPLE	12	Modified in instance
MODIFIED_IN_INSTANCE	GEOAREA	9	Modified in instance
MODIFIED_IN_INSTANCE	MOD_ENERGY_EFFECTS	18	Modified in instance
MODIFIED_IN_INSTANCE	MOD_POLLUTION_HEALTH_FACTOR	17	Modified in instance
MODIFIED_IN_INSTANCE	MOD_POLLUTION_REMOVAL	15	Modified in instance
MODIFIED_IN_INSTANCE	MOD_RAINFALL	13	Modified in instance
MODIFIED_IN_INSTANCE	MOD_VOC_EMISSIONS	12	Modified in instance
MODIFIED_IN_INSTANCE	PLOT	23	Modified in instance
MODIFIED_IN_INSTANCE	PLOT_FLDSAMP_ASSGN	7	Modified in instance
MODIFIED_IN_INSTANCE	PLOT_STATSAMP_ASSGN	7	Modified in instance
MODIFIED_IN_INSTANCE	PLOT_STRAT_ASSGN	7	Modified in instance
MODIFIED_IN_INSTANCE	POP_ESTN_UNIT	12	Modified in instance
MODIFIED_IN_INSTANCE	POP_EVAL	12	Modified in instance
MODIFIED_IN_INSTANCE	POP_EVAL_TYPE_ASSGN	7	Modified in instance
MODIFIED_IN_INSTANCE	POP_STAT_SAMP	10	Modified in instance
MODIFIED_IN_INSTANCE	POP_STAT_SAMP_CONSTR_ASSGN	7	Modified in instance
MODIFIED_IN_INSTANCE	POP_STRATUM	17	Modified in instance
MODIFIED_IN INSTANCE	POPULATION	10	Modified in instance
MODIFIED_IN_INSTANCE	POPULATION_STRUCTURE	12	Modified in instance
MODIFIED_IN_INSTANCE	PROJECT	10	Modified in instance
MODIFIED_IN_INSTANCE	PROJECT_POPN_ASSGN	8	Modified in instance
MODIFIED_IN_INSTANCE	REF_BOLE_STUMP_REMOVED	10	Modified in instance
MODIFIED_IN_INSTANCE	REF_CALCULATION	11	Modified in instance
MODIFIED_IN_INSTANCE	REF_CAUSE_OF_DEATH	10	Modified in instance
MODIFIED_IN_INSTANCE	REF_COUNTY	10	Modified in instance
MODIFIED_IN_INSTANCE	REF_CROWN_CLASS	10	Modified in instnace
MODIFIED_IN_INSTANCE	REF_CROWN_LIGHT_EXPOSURE	10	Modified in instance
MODIFIED_IN_INSTANCE	REF_DAMAGE_AGENT	13	Modified in instance
MODIFIED_IN_INSTANCE	REF_DAMAGE_AGENT_GROUP	9	Modified in instance
MODIFIED_IN_INSTANCE	REF_DB_VERSION	9	Modified in instance
MODIFIED_IN_INSTANCE	REF_DIAHT	10	Modified in instance
MODIFIED_IN_INSTANCE	REF_ENERGY_EFFECT	10	Modified in instance
MODIFIED_IN_INSTANCE	REF_ENERGY_USE	10	Modified in instance
MODIFIED_IN_INSTANCE	REF_LANDUSE	10	Modified in instance
MODIFIED_IN_INSTANCE	REF_NONFOREST_LANDUSE	10	Modified in instance
MODIFIED_IN_INSTANCE	REF_OWNER	10	Modified in instance
MODIFIED_IN_INSTANCE	REF_OWNER_GROUP	10	Modified in instance
MODIFIED_IN_INSTANCE	REF_PLANTED	10	Modified in instance
MODIFIED_IN_INSTANCE	REF_POP_ATTRIBUTE	12	Modified in instance
MODIFIED_IN_INSTANCE	REF_POP_DOMAIN	9	Modified in instance
MODIFIED_IN_INSTANCE	REF_POP_EVAL_TYPE	7	Modified in instance
MODIFIED_IN_INSTNACE	REF_SAMPLE_CONSTRAINT	8	Modified in instance
MODIFIED_IN_INSTANCE	REF_SAMPLKIND	10	Modified in instance
MODIFIED_IN_INSTANCE	REF_SPECIES	22	Modified in instance
MODIFIED_IN_INSTANCE	REF_SPECIES_GROUP	10	Modified in instance
MODIFIED_IN_INSTANCE	REF_STANDING_DEAD	10	Modified in instance

Column name with (field guide section)	Table name	Location in table	Description
MODIFIED_IN_INSTANCE	REF_STATE	9	Modified in instance
MODIFIED_IN_INSTANCE	REF_TREE_STATUS	10	Modified in instance
MODIFIED_IN_INSTANCE	REF_URBAN_PLOT_NONSAMPLE_REASN	10	Modified in instance
MODIFIED_IN_INSTANCE	REF_URBAN_PLOT_STATUS	10	Modified in instance
MODIFIED_IN_INSTANCE	REF_URBAN_SUBP_NONSAMPLE_REASN	10	Modified in instance
MODIFIED_IN_INSTANCE	REF_URBAN_SUBP_STATUS	10	Modified in instance
MODIFIED_IN_INSTANCE	REF_UNIT	9	Modified in instance
MODIFIED_IN_INSTANCE	SAMPLE_RULE	12	Modified in instance
MODIFIED_IN_INSTANCE	SERIES	9	Modified in instance
MODIFIED_IN_INSTANCE	SUBPLOT	24	Modified in instance
MODIFIED_IN_INSTANCE	TIME_PERIOD	12	Modified in instance
MODIFIED_IN_INSTANCE	TREE	67	Modified in instance
MONOTERPENE_EMITTED	MOD_VOC_EMISSIONS	7	Monoterpene emitted
NAME	GEOAREA	2	Geographic area name
NAME	POP_EVAL	3	Evaluation name
NAME	POP_STAT_SAMP	3	Statistical sample name
NAME	POP_STRATUM	3	Stratum name
NAME	POPULATION	2	Population name
NAME	PROJECT	2	Project name
NAME	REF_CALCULATION	2	Calculation name
NAME	REF_POP_ATTRIBUTE	3	Population attribute name
NAME	REF_POP_DOMAIN	1	Population domain name
NAME	REF_POP_EVAL_TYPE	1	Evaluation type name
NAME	REF_SAMPLE_CONSTRAINT	1	Sample constraint name
NAME	REF_SPECIES_GROUP	2	Name
NAME	SERIES	2	Series name
NAME	TIME_PERIOD	2	Time period name
NBR_STEMS (6.4)	TREE	37	Number of stems
NET_C_SEQ	TREE	25	Net carbon sequestration
NO2_INCIDENCE	MOD_POLLUTION_HEALTH_FACTOR	6	Nitrogen dioxide incidence
NO2_VALUE	MOD_POLLUTION_HEALTH_FACTOR	7	Nitrogen dioxide value
NONFOREST_LANDUSE	REF_NONFOREST_LANDUSE	3	Nonforest land use
NOTES	FIELD_SAMPLE	7	Field sample notes
NOTES	MOD_ENERGY_EFFECTS	13	Plot notes
NOTES	MOD_POLLUTION_HEALTH_FACTOR	14	Notes
NOTES	MOD_POLLUTION_REMOVAL	12	Notes
NOTES	MOD_RAINFALL	8	Notes
NOTES	MOD_VOC_EMISSIONS	9	VOC emission notes
NOTES	PLOT	18	Plot notes
NOTES	POP_ESTN_UNIT	7	Estimation unit notes
NOTES	POPULATION_STRUCTURE	7	Population structure notes
NOTES	PROJECT_POPN_ASSGN	3	Notes
NOTES	SAMPLE_RULE	7	Sample rule notes
OTHER_VOCS_EMITTED	MOD_VOC_EMISSIONS	8	Other VOCs emitted
OWNCD (2.5.8)	REF_OWNER	3	Owner code
OWNCD (2.5.8)	TREE	39	Owner code

Column name with (field guide section)	Table name	Location in table	Description
OWNGRPCD (2.5.2)	REF_OWNER_GROUP	3	Owner group code
OWNGRPCD (2.5.2)	TREE	38	Owner group code
O3_INCIDENCE	MOD_POLLUTION_HEALTH_FACTOR	10	Ozone incidence
O3_VALUE	MOD_POLLUTION_HEALTH_FACTOR	11	Ozone value
P_SPGRPCD	REF_SPECIES	27	Pacific species group code
PCT_CENSUS_WATER	SUBPLOT	19	Percent census water
PCT_FOREST	SUBPLOT	16	Percent forest
PCT_LANDUSE	FIELD_LANDUSE	12	Percent land use
PCT_NONCENSUS_WATER	SUBPLOT	18	Percent noncensus water
PCT_NONFOREST	SUBPLOT	17	Percent nonforest
PCT_NONSAMPLED	SUBPLOT	15	Percent nonsampled
PCT_SAMPLED	SUBPLOT	14	Percent sampled
PCT_SHRUB_SEED_COVER	COVER	12	Percent shrub & seedling cover
PCT_TREE_COVER	COVER	11	Percent tree cover
PERCENT_CROWN_DIEBACK	TREE	32	Percent crown dieback
PLOT (1.3)	BUILDING_INTERACTION	9	Plot number
PLOT (1.3)	COVER	9	Plot number
PLOT (1.3)	FIELD_LANDUSE	9	Plot number
PLOT (1.3)	PLOT	7	Plot number
PLOT (1.3)	SUBPLOT	8	Plot number
PLOT (1.3)	TREE	9	Plot number
PLOTID	BUILDING_INTERACTION	4	Plot identifier
PLOTID	COVER	4	Plot identifier
PLOTID	FIELD_LANDUSE	4	Plot identifier
PLOTID	PLOT	2	Plot identifier
PLOTID	SUBPLOT	3	Plot identifier
PLOTID	TREE	4	Plot identifier
PLT_CN	BUILDING_INTERACTION	2	Plot sequence number
PLT_CN	COVER	2	Plot sequence number
PLT_CN	FIELD_LANDUSE	2	Plot sequence number
PLT_CN	PLOT_FLDSAMP_ASSGN	1	Plot sequence number
PLT_CN	PLOT_STATSAMP_ASSGN	1	Plot sequence number
PLT_CN	PLOT_STRAT_ASSGN	1	Plot sequence number
PLT_CN	SUBPLOT	2	Plot sequence number
PLT_CN	TREE	2	Plot sequence number
PM25_INCIDENCE	MOD_POLLUTION_HEALTH_FACTOR	12	Particulate matter incidence
PM25_VALUE	MOD_POLLUTION_HEALTH_FACTOR	13	Particulate matter value
POLLUTANT	MOD_POLLUTION_REMOVAL	5	Pollutant
POLLUTION_REMOVAL	MOD_POLLUTION_REMOVAL	9	Pollution removal
POPN_CN	MOD_ENERGY_EFFECTS	2	Population sequence number
POPN_CN	MOD_POLLUTION_HEALTH_FACTOR	2	Population sequence number
POPN_CN	MOD_POLLUTION_REMOVAL	2	Population sequence number
POPN_CN	MOD_RAINFALL	2	Population sequence number

Column name with (field guide section)	Table name	Location in table	Description
POPN_CN	MOD_VOC_EMISSIONS	2	Population sequence number
POPN_CN	POP_ESTN_UNIT	3	Population sequence number
POPN_CN	POPULATION_STRUCTURE	1	Population sequence number
POPN_CN	PROJECT_POPN_ASSGN	2	Population sequence number
POPN_CN	SAMPLE-RULE	2	Population sequence number
PRECEDENCE_RANK	POPULATION_STRUCTURE	3	Precedence rank
PRESENT_NONFOREST_LAND USE	TREE	41	Present nonforest land use
PROJ_CN	FIELD_SAMPLE	2	Project sequence number
PROJ_CN	PROJECT_POPN_ASSGN	1	Project sequence number
PSS_CN	POP_STAT_SAMP_CONSTR_AS SGN	1	Statistical sample sequence number
RAINFALL	MOD_RAINFALL	5	Rainfall
REGION	REF_DAMAGE_AGENT	8	Region
REGION	REF_SPECIES_GROUP	3	Region
REPORT_YEAR	MOD_ENERGY_EFFECTS	4	Reporting year
REPORT_YEAR	MOD_POLLUTION_HEALTH_F ACTOR	4	Reporting year
REPORT_YEAR	MOD_POLLUTION_REMOVAL	4	Reporting year
REPORT_YEAR	MOD_RAINFALL	4	Reporting year
REPORT_YEAR	MOD_VOC_EMISSIONS	4	Reporting year
REPORT_YEAR	POP_EVAL	5	Reporting year
REMOVAL_VALUE	MOD_POLLUTION_REMOVAL	6	Pollutant removal value
SAMP_CONSTR_NAME	POP_STAT_SAMP_CONSTR_AS SGN	2	Sample constraint name
SAMPLE_FILLS_AREA	POPULATION_STRUCTURE	5	Sample-fills-area-indicator
SBP_CN	COVER	3	Subplot sequence number
SBP_CN	FIELD_LANDUSE	3	Subplot sequence number
SBP_CN	TREE	3	Subplot sequence number
SCIENTIFIC_NAME	REF_DAMAGE_AGENT	6	Damage agent scientific name
SERIES_CN	FIELD_SAMPLE	3	Series sequence number
SFTWD_HRDWD	REF_SPECIES	11	Softwood/hardwood
SO2_INCIDENCE	MOD_POLLUTION_HEALTH_F ACTOR	8	Sulfur dioxide incidence
SO2_VALUE	MOD_POLLUTION_HEALTH_F ACTOR	9	Sulfur dioxide value
SPCD (5.8)	REF_SPECIES	1	Species code
SPCD (5.8)	TREE	13	Species code
SPECIES	REF_SPECIES	4	Species
SPECIES_SYMBOL	REF_SPECIES	7	Species symbol
SPGRPCD	REF_SPECIES_GROUP	1	Species group code
SPGRPCD	TREE	14	Species group code
STAND_ALONE	POPULATION_STRUCTURE	4	Stand-alone indicator
STANDING_DEAD_CD (5.7.2)	REF_STANDING_DEAD	3	Standing dead code
STANDING_DEAD_CD (7.7.2)	TREE	42	Standing dead code
STRAT_CN	PLOT_STRAT_ASSGN	2	Stratum sequence number

Column name with (field guide section)	Table name	Location in table	Description
STATSAMP_CN	POP_STAT_SAMP_CONSTR_ASSGN	1	Statistical sample sequence number
STATSAMP_CN	PLOT_STATSAMP_ASSGN	2	Statistical sample sequence number
STATEABBR	REF_STATE	3	State abbreviation
STATECD (1.1)	BUILDING_INTERACTION	6	State code
STATECD (1.1)	COVER	6	State code
STATECD (1.1)	FIELD_LANDUSE	6	State code
STATECD (1.1)	PLOT	4	State code
STATECD (1.1)	REF_COUNTY	1	State code
STATECD (1.1)	REF_STATE	1	State code
STATECD (1.1)	REF_UNIT	1	State code
STATECD (1.1)	SUBPLOT	5	State code
STATECD (1.1)	TREE	6	State code
STATENM	REF_STATE	2	State name
STATUSCD (5.7)	REF_TREE_STATUS	3	Tree status code
STATUSCD (5.7)	TREE	12	Tree status code
STRATUM_SOURCE	POP_STRATUM	10	
SUBCYCLE	FIELD_SAMPLE	6	Inventory subcycle number
SUBP (3.1)	BUILDING_INTERACTION	10	Subplot number
SUBP (3.1)	COVER	10	Subplot number
SUBP (3.1)	FIELD_LANDUSE	10	Subplot number
SUBP (3.1)	SUBPLOT	9	Subplot number
SUBP (3.1)	TREE	10	Subplot number
SUBPLOT_SIZE	SUBPLOT	10	Subplot size
SUBSPECIES	REF_SPECIES	6	Subspecies
THRESHOLD	REF_DAMAGE_AGENT	7	Damage agent threshold
TIME_PERIOD_CN	FIELD_SAMPLE	4	Time period sequence number
TIME_PERIOD_TYPE	TIME_PERIOD	3	Time period type
TPA_UNADJ	TREE	34	Trees per acre unadjusted
TRE_CN	BUILDING_INTERACTION	3	Tree sequence number
TREE (5.2)	BUILDING_INTERACTION	11	Tree number
TREE 5.2)	TREE	11	Tree number
TREE_BIOMASS	TREE	22	Tree total biomass
TREE_INTERCEPTION	MOD_RAINFALL	6	Tree interception
URBAN_KINDCD (1.10)	PLOT	11	Urban sample kind code
URBAN_MANUAL	PLOT	14	Urban manual version
URBAN_MANUAL_REGIONAL	PLOT	15	Urban regional manual version
URBAN_PLOT_NONSAMPLE_REASN_CD (1.7)	PLOT	13	Urban plot nonsampled reason code
URBAN_PLOT_NONSAMPLE_REASN_CD (1.7)	REF_URBAN_PLOT_NONSAMPLE_REASN	3	Urban plot nonsampled reason code
URBAN_PLOT_STATUS_CD (1.4)	PLOT	12	Urban plot status code
URBAN_PLOT_STATUS_CD (1.4)	REF_URBAN_PLOT_STATUS	3	Urban plot status code
URBAN_SUBP_NONSAMPLE_REASN_CD (3.3)	REF_URBAN_SUBP_NONSAMPLE_REASN	3	Urban subplot nonsampled reason code

Column name with (field guide section)	Table name	Location in table	Description
URBAN_SUBP_NONSAMPLE_REASN_CD (3.3)	SUBPLOT	12	Urban subplot nonsampled reason code
URBAN_SUBP_STATUSCD (3.2)	REF_URBAN_SUBP_STATUS	3	Urban subplot status code
URBAN_SUBP_STATUSCD (3.2)	SUBPLOT	11	Urban subplot status code
UNCOMP_CROWN_RATIO	TREE	44	Uncompacted live crown ratio
UNITCD	BUILDING_INTERACTION	7	Unit code
UNITCD	COVER	7	Unit code
UNITCD	FIELD_LANDUSE	7	Unit code
UNITCD	PLOT	5	Unit code
UNITCD	REF_COUNTY	2	Unit code
UNITCD	REF_UNIT	2	Unit code
UNITCD	SUBPLOT	6	Unit code
UNITCD	TREE	7	Unit code
UNITNM	REF_UNIT	3	Unit name
VARIETY	REF_SPECIES	5	Variety
VERSION	POPULATION	3	Population version
VERSION	REF_DB_VERSION	1	Version number
VISIT_NBR	BUILDING_INTERACTION	5	Visit number
VISIT_NBR	COVER	5	Visit number
VISIT_NBR	FIELD_LANDUSE	5	Visit number
VISIT_NBR	PLOT	3	Visit number
VISIT_NBR	SUBPLOT	4	Visit number
VISIT_NBR	TREE	5	Visit number
W_SPGRPCD	REF_SPECIES	9	Western species group
WEST	REF_SPECIES	13	West
WHERE_CLAUSE	REF_CALCULATION	5	Where clause
WOODLAND	REF_SPECIES	14	Woodland

Appendix B. State, Survey Unit, and County Codes

State Code: 1 **State Name:** Alabama **State Abbreviation:** AL **Region/Station Code:** 33

Survey Unit Code: 1 **Survey Unit Name**: Southwest-South

County code and county name							
3	Baldwin	53	Escambia	129	Washington		
39	Covington	97	Mobile				

Survey Unit Code: 2 **Survey Unit Name**: Southwest-North

County code and county name							
23	Choctaw	35	Conecuh	99	Monroe	131	Wilcox
25	Clarke	91	Marengo	119	Sumter		

Survey Unit Code: 3 **Survey Unit Name**: Southeast

County code and county name							
1	Autauga	31	Coffee	67	Henry	109	Pike
5	Barbour	41	Crenshaw	69	Houston	113	Russell
11	Bullock	45	Dale	81	Lee	123	Tallapoosa
13	Butler	47	Dallas	85	Lowndes		
17	Chambers	51	Elmore	87	Macon		
21	Chilton	61	Geneva	101	Montgomery		

Survey Unit Code: 4 **Survey Unit Name**: West Central

County code and county name					
7	Bibb	65	Hale	105	Perry
57	Fayette	75	Lamar	107	Pickens
63	Greene	93	Marion	125	Tuscaloosa

Survey Unit Code: 5 **Survey Unit Name**: North Central

County code and county name							
9	Blount	29	Cleburne	73	Jefferson	121	Talladega
15	Calhoun	37	Coosa	111	Randolph	127	Walker
19	Cherokee	43	Cullman	115	St. Clair	133	Winston
27	Clay	55	Etowah	117	Shelby		

Survey Unit Code: 6 **Survey Unit Name**: North

County code and county name							
33	Colbert	71	Jackson	83	Limestone	103	Morgan
49	DeKalb	77	Lauderdale	89	Madison		
59	Franklin	79	Lawrence	95	Marshall		

State Code: 2 **State Name:** Alaska **State Abbreviation:** AK **Region/Station Code:** 27

Survey Unit Code: 1 **Survey Unit Name**: Alaska

County code and county name

13	Aleutians East Borough	170	Matanuska-Susitna Borough
16	Aleutians West Census Area	180	Nome Census Area
20	Anchorage Borough	185	North Slope Borough
50	Bethel Census Area	188	Northwest Arctic Borough
60	Bristol Bay Borough	201	Prince of Wales-Outer Ketchikan Census Area
68	Denali Borough	220	Sitka Borough
70	Dillingham Census Area	232	Skagway-Hoonah-Angoon Census Area
90	Fairbanks North Star Borough	240	Southeast Fairbanks Census Area
100	Haines Borough	261	Valdez-Cordova Census Area
110	Juneau Borough	270	Wade Hampton Census Area
122	Kenai Peninsula Borough	280	Wrangell-Petersburg Census Area
130	Ketchikan Gateway Borough	282	Yakutat Borough
150	Kodiak Island Borough	290	Yukon-Koyukuk Census Area
164	Lake and Peninsula Borough		

State Code: 4 **State Name:** Arizona **State Abbreviation:** AZ **Region/Station Code:** 22

Survey Unit Code: 1 **Survey Unit Name**: Southern

County code and county name

3	Cochise	12	La Paz	21	Pinal
9	Graham	13	Maricopa	23	Santa Cruz
11	Greenlee	19	Pima	27	Yuma

Survey Unit Code: 2 **Survey Unit Name**: Northern

County code and county name

1	Apache	7	Gila	17	Navajo
5	Coconino	15	Mohave	25	Yavapai

State Code: 5 **State Name:** Arkansas **State Abbreviation:** AR **Region/Station Code:** 33

Survey Unit Code: 1 **Survey Unit Name**: South Delta

County code and county name							
1	Arkansas	69	Jefferson	85	Lonoke	117	Prairie
17	Chicot	77	Lee	95	Monroe		
41	Desha	79	Lincoln	107	Phillips		

Survey Unit Code: 2 **Survey Unit Name**: North Delta

County code and county name							
21	Clay	37	Cross	75	Lawrence	123	St. Francis
31	Craighead	55	Greene	93	Mississippi	147	Woodruff
35	Crittenden	67	Jackson	111	Poinsett		

Survey Unit Code: 3 **Survey Unit Name**: Southwest

County code and county name							
3	Ashley	27	Columbia	59	Hot Spring	99	Nevada
11	Bradley	39	Dallas	61	Howard	103	Ouachita
13	Calhoun	43	Drew	73	Lafayette	109	Pike
19	Clark	53	Grant	81	Little River	133	Sevier
25	Cleveland	57	Hempstead	91	Miller	139	Union

Survey Unit Code: 4 **Survey Unit Name**: Ouachita

County code and county name							
51	Garland	105	Perry	125	Saline	149	Yell
83	Logan	113	Polk	127	Scott		
97	Montgomery	119	Pulaski	131	Sebastian		

Survey Unit Code: 5 **Survey Unit Name**: Ozark

County code and county name							
5	Baxter	33	Crawford	71	Johnson	129	Searcy
7	Benton	45	Faulkner	87	Madison	135	Sharp
9	Boone	47	Franklin	89	Marion	137	Stone
15	Carroll	49	Fulton	101	Newton	141	Van Buren
23	Cleburne	63	Independence	115	Pope	143	Washington
29	Conway	65	Izard	121	Randolph	145	White

State Code: 6 **State Name:** California **State Abbreviation:** CA **Region/Station Code:** 26

Survey Unit Code: 1 **Survey Unit Name**: North Coast

County code and county name							
15	Del Norte	23	Humboldt	45	Mendocino	97	Sonoma

Survey Unit Code: 2 **Survey Unit Name**: North Interior

County code and county name					
35	Lassen	89	Shasta	105	Trinity
49	Modoc	93	Siskiyou		

Survey Unit Code: 3 **Survey Unit Name**: Sacramento

County code and county name							
7	Butte	33	Lake	63	Plumas	103	Tehama
11	Colusa	55	Napa	67	Sacramento	113	Yolo
17	El Dorado	57	Nevada	91	Sierra	115	Yuba
21	Glenn	61	Placer	101	Sutter		

Survey Unit Code: 4 **Survey Unit Name**: Central Coast

County code and county name							
1	Alameda	69	San Benito	83	Santa Barbara	111	Ventura
13	Contra Costa	75	San Francisco	85	Santa Clara		
41	Marin	79	San Luis Obispo	87	Santa Cruz		
53	Monterey	81	San Mateo	95	Solano		

Survey Unit Code: 5 **Survey Unit Name**: San Joaquin

County code and county name							
3	Alpine	29	Kern	47	Merced	107	Tulare
5	Amador	31	Kings	51	Mono	109	Tuolumne
9	Calaveras	39	Madera	77	San Joaquin		
19	Fresno	43	Mariposa	99	Stanislaus		

Survey Unit Code: 6 **Survey Unit Name**: Southern

County code and county name							
25	Imperial	37	Los Angeles	65	Riverside	73	San Diego
27	Inyo	59	Orange	71	San Bernardino		

State Code: 8 **State Name:** Colorado **State Abbreviation:** CO **Region/Station Code:** 22

Survey Unit Code: 1 **Survey Unit Name**: Northern Front Range

County code and county name							
13	Boulder	35	Douglas	47	Gilpin	69	Larimer
14	Broomfield[a]	39	Elbert	59	Jefferson	93	Park
19	Clear Creek	41	El Paso	65	Lake	119	Teller

Survey Unit Code: 2 **Survey Unit Name**: Southern Front Range

County code and county name							
15	Chaffee	27	Custer	55	Huerfano	101	Pueblo
23	Costilla	43	Fremont	71	Las Animas		

Survey Unit Code: 3 **Survey Unit Name**: West Central

County code and county name							
3	Alamosa	51	Gunnison	97	Pitkin	111	San Juan
21	Conejos	53	Hinsdale	105	Rio Grande	117	Summit
37	Eagle	57	Jackson	107	Routt		
49	Grand	79	Mineral	109	Saguache		

Survey Unit Code: 4 **Survey Unit Name**: Western

County code and county name							
7	Archuleta	45	Garfield	81	Moffat	91	Ouray
29	Delta	67	La Plata	83	Montezuma	103	Rio Blanco
33	Dolores	77	Mesa	85	Montrose	113	San Miguel

Survey Unit Code: 5 **Survey Unit Name**: Eastern

County code and county name							
1	Adams	25	Crowley	75	Logan	115	Sedgwick
5	Arapahoe	31	Denver	87	Morgan	121	Washington
9	Baca	61	Kiowa	89	Otero	123	Weld
11	Bent	63	Kit Carson	95	Phillips	125	Yuma
17	Cheyenne	73	Lincoln	99	Prowers		

[a] This is a new county in the 2010 census, but is not currently added to the COUNTY table.

State Code: 9 **State Name:** Connecticut **State Abbreviation:** CT **Region/Station Code:** 24

Survey Unit Code: 1 **Survey Unit Name**: Connecticut

County code and county name							
1	Fairfield	5	Litchfield	9	New Haven	13	Tolland
3	Hartford	7	Middlesex	11	New London	15	Windham

State Code: 10 **State Name:** Delaware **State Abbreviation:** DE **Region/Station Code:** 24

Survey Unit Code: 1 **Survey Unit Name**: Delaware

County code and county name					
1	Kent	3	New Castle	5	Sussex

State Code: 11 **State Name:** District of Columbia **State Abbrev.:** DC **Region/Station Code:** 24

Survey Unit Code: 1 **Survey Unit Name**: District of Columbia

State Code: 12 **State Name:** Florida **State Abbreviation:** FL **Region/Station Code:** 33

Survey Unit Code: 1 **Survey Unit Name**: Northeastern

County code and county name							
1	Alachua	31	Duval	79	Madison	123	Taylor
3	Baker	35	Flagler	83	Marion	125	Union
7	Bradford	41	Gilchrist	89	Nassau	127	Volusia
19	Clay	47	Hamilton	107	Putnam		
23	Columbia	67	Lafayette	109	St. Johns		
29	Dixie	75	Levy	121	Suwannee		

Survey Unit Code: 2 **Survey Unit Name**: Northwestern

County code and county name							
5	Bay	39	Gadsden	65	Jefferson	113	Santa Rosa
13	Calhoun	45	Gulf	73	Leon	129	Wakulla
33	Escambia	59	Holmes	77	Liberty	131	Walton
37	Franklin	63	Jackson	91	Okaloosa	133	Washington

Survey Unit Code: 3 **Survey Unit Name**: Central

County code and county name							
9	Brevard	55	Highlands	93	Okeechobee	105	Polk
17	Citrus	57	Hillsborough	95	Orange	111	St. Lucie
27	DeSoto	61	Indian River	97	Osceola	115	Sarasota
49	Hardee	69	Lake	101	Pasco	117	Seminole
53	Hernando	81	Manatee	103	Pinellas	119	Sumter

Survey Unit Code: 4 **Survey Unit Name**: Southern

County code and county name							
11	Broward	25	Dade	71	Lee	99	Palm Beach
15	Charlotte	43	Glades	85	Martin		
21	Collier	51	Hendry	87	Monroe		

State Code: 13 **State Name:** Georgia **State Abbreviation:** GA **Region/Station Code:** 33

Survey Unit Code: 1 **Survey Unit Name**: Southeastern

County code and county name							
1	Appling	51	Chatham	161	Jeff Davis	251	Screven
3	Atkinson	65	Clinch	165	Jenkins	267	Tattnall
5	Bacon	69	Coffee	167	Johnson	271	Telfair
25	Brantley	91	Dodge	175	Laurens	279	Toombs
29	Bryan	101	Echols	179	Liberty	283	Treutlen
31	Bulloch	103	Effingham	183	Long	299	Ware
39	Camden	107	Emanuel	191	McIntosh	305	Wayne
43	Candler	109	Evans	209	Montgomery	309	Wheeler
49	Charlton	127	Glynn	229	Pierce		

Survey Unit Code: 2 **Survey Unit Name**: Southwestern

County code and county name							
7	Baker	81	Crisp	173	Lanier	277	Tift
17	Ben Hill	87	Decatur	185	Lowndes	287	Turner
19	Berrien	93	Dooly	201	Miller	315	Wilcox
27	Brooks	99	Early	205	Mitchell	321	Worth
71	Colquitt	131	Grady	253	Seminole		
75	Cook	155	Irwin	275	Thomas		

Survey Unit Code: 3 **Survey Unit Name**: Central

County code and county name							
9	Baldwin	141	Hancock	211	Morgan	265	Taliaferro
21	Bibb	145	Harris	215	Muscogee	269	Taylor
23	Bleckley	153	Houston	225	Peach	273	Terrell
33	Burke	159	Jasper	231	Pike	289	Twiggs
35	Butts	163	Jefferson	235	Pulaski	293	Upson
37	Calhoun	169	Jones	237	Putnam	301	Warren
53	Chattahoochee	171	Lamar	239	Quitman	303	Washington
61	Clay	177	Lee	243	Randolph	307	Webster
73	Columbia	181	Lincoln	245	Richmond	317	Wilkes
79	Crawford	189	McDuffie	249	Schley	319	Wilkinson
95	Dougherty	193	Macon	259	Stewart		
125	Glascock	197	Marion	261	Sumter		
133	Greene	207	Monroe	263	Talbot		

Survey Unit Code: 4 **Survey Unit Name**: North Central

County code and county name							
11	Banks	97	Douglas	143	Haralson	219	Oconee
13	Barrow	105	Elbert	147	Hart	221	Oglethorpe
45	Carroll	113	Fayette	149	Heard	223	Paulding
59	Clarke	117	Forsyth	151	Henry	233	Polk
63	Clayton	119	Franklin	157	Jackson	247	Rockdale
67	Cobb	121	Fulton	195	Madison	255	Spalding
77	Coweta	135	Gwinnett	199	Meriwether	285	Troup
89	DeKalb	139	Hall	217	Newton	297	Walton

Georgia cont.

Georgia cont.

Survey Unit Code: 5 **Survey Unit Name**: Northern

County code and county name

15	Bartow	111	Fannin	213	Murray	295	Walker
47	Catoosa	115	Floyd	227	Pickens	311	White
55	Chattooga	123	Gilmer	241	Rabun	313	Whitfield
57	Cherokee	129	Gordon	257	Stephens		
83	Dade	137	Habersham	281	Towns		
85	Dawson	187	Lumpkin	291	Union		

State Code: 15 **State Name:** Hawaii **State Abbreviation:** HI **Region/Station Code: 26**

Survey Unit Code: 1 **Survey Unit Name**: Hawaii

County code and county name

1	Hawaii	5	Kalawao	9	Maui
3	Honolulu	7	Kauai		

State Code: 16 **State Name:** Idaho **State Abbreviation:** ID **Region/Station Code:** 22

Survey Unit Code: 1 **Survey Unit Name**: Northern

County code and county name

9	Benewah	35	Clearwater	57	Latah	79	Shoshone
17	Bonner	49	Idaho	61	Lewis		
21	Boundary	55	Kootenai	69	Nez Perce		

Survey Unit Code: 2 **Survey Unit Name**: Southwestern

County code and county name

1	Ada	27	Canyon	73	Owyhee	87	Washington
3	Adams	39	Elmore	75	Payette		
15	Boise	45	Gem	85	Valley		

Survey Unit Code: 3 **Survey Unit Name**: Southeastern

County code and county name

5	Bannock	25	Camas	43	Fremont	65	Madison
7	Bear Lake	29	Caribou	47	Gooding	67	Minidoka
11	Bingham	31	Cassia	51	Jefferson	71	Oneida
13	Blaine	33	Clark	53	Jerome	77	Power
19	Bonneville	37	Custer	59	Lemhi	81	Teton
23	Butte	41	Franklin	63	Lincoln	83	Twin Falls

State Code: 17 **State Name:** Illinois **State Abbreviation:** IL **Region/Station Code:** 23

Survey Unit Code: 1 **Survey Unit Name**: Southern

County code and county name							
3	Alexander	69	Hardin	145	Perry	165	Saline
55	Franklin	77	Jackson	151	Pope	181	Union
59	Gallatin	87	Johnson	153	Pulaski	193	White
65	Hamilton	127	Massac	157	Randolph	199	Williamson

Survey Unit Code: 2 **Survey Unit Name**: Claypan

County code and county name							
5	Bond	47	Edwards	101	Lawrence	163	St. Clair
13	Calhoun	49	Effingham	117	Macoupin	173	Shelby
23	Clark	51	Fayette	119	Madison	185	Wabash
25	Clay	61	Greene	121	Marion	189	Washington
27	Clinton	79	Jasper	133	Monroe	191	Wayne
33	Crawford	81	Jefferson	135	Montgomery		
35	Cumberland	83	Jersey	159	Richland		

Survey Unit Code: 3 **Survey Unit Name**: Prairie

County code and county name							
1	Adams	53	Ford	105	Livingston	149	Pike
7	Boone	57	Fulton	107	Logan	155	Putnam
9	Brown	63	Grundy	109	McDonough	161	Rock Island
11	Bureau	67	Hancock	111	McHenry	167	Sangamon
15	Carroll	71	Henderson	113	McLean	169	Schuyler
17	Cass	73	Henry	115	Macon	171	Scott
19	Champaign	75	Iroquois	123	Marshall	175	Stark
21	Christian	85	Jo Daviess	125	Mason	177	Stephenson
29	Coles	89	Kane	129	Menard	179	Tazewell
31	Cook	91	Kankakee	131	Mercer	183	Vermilion
37	DeKalb	93	Kendall	137	Morgan	187	Warren
39	De Witt	95	Knox	139	Moultrie	195	Whiteside
41	Douglas	97	Lake	141	Ogle	197	Will
43	DuPage	99	La Salle	143	Peoria	201	Winnebago
45	Edgar	103	Lee	147	Piatt	203	Woodford

State Code: 18 **State Name:** Indiana **State Abbreviation:** IN **Region/Station Code:** 23

Survey Unit Code: 1 **Survey Unit Name**: Lower Wabash

County code and county name							
21	Clay	83	Knox	129	Posey	165	Vermillion
27	Daviess	101	Martin	133	Putnam	167	Vigo
51	Gibson	121	Parke	153	Sullivan		
55	Greene	125	Pike	163	Vanderburgh		

Survey Unit Code: 2 **Survey Unit Name**: Knobs

County code and county name							
13	Brown	61	Harrison	117	Orange	173	Warrick
19	Clark	71	Jackson	119	Owen	175	Washington
25	Crawford	93	Lawrence	123	Perry		
37	Dubois	105	Monroe	143	Scott		
43	Floyd	109	Morgan	147	Spencer		

Survey Unit Code: 3 **Survey Unit Name**: Upland Flats

County code and county name					
29	Dearborn	77	Jefferson	137	Ripley
41	Fayette	79	Jennings	155	Switzerland
47	Franklin	115	Ohio	161	Union

Survey Unit Code: 4 **Survey Unit Name**: Northern

County code and county name							
1	Adams	45	Fountain	87	Lagrange	139	Rush
3	Allen	49	Fulton	89	Lake	141	St. Joseph
5	Bartholomew	53	Grant	91	La Porte	145	Shelby
7	Benton	57	Hamilton	95	Madison	149	Starke
9	Blackford	59	Hancock	97	Marion	151	Steuben
11	Boone	63	Hendricks	99	Marshall	157	Tippecanoe
15	Carroll	65	Henry	103	Miami	159	Tipton
17	Cass	67	Howard	107	Montgomery	169	Wabash
23	Clinton	69	Huntington	111	Newton	171	Warren
31	Decatur	73	Jasper	113	Noble	177	Wayne
33	De Kalb	75	Jay	127	Porter	179	Wells
35	Delaware	81	Johnson	131	Pulaski	181	White
39	Elkhart	85	Kosciusko	135	Randolph	183	Whitley

State Code: 19 **State Name:** Iowa **State Abbreviation:** IA **Region/Station Code:** 23

Survey Unit Code: 1 **Survey Unit Name**: Northeastern

County code and county name							
5	Allamakee	31	Cedar	65	Fayette	105	Jones
11	Benton	37	Chickasaw	67	Floyd	113	Linn
13	Black Hawk	43	Clayton	75	Grundy	131	Mitchell
17	Bremer	45	Clinton	89	Howard	163	Scott
19	Buchanan	55	Delaware	97	Jackson	171	Tama
23	Butler	61	Dubuque	103	Johnson	191	Winneshiek

Survey Unit Code: 2 **Survey Unit Name**: Southeastern

County code and county name							
7	Appanoose	83	Hardin	121	Madison	177	Van Buren
15	Boone	87	Henry	123	Mahaska	179	Wapello
39	Clarke	95	Iowa	125	Marion	181	Warren
49	Dallas	99	Jasper	127	Marshall	183	Washington
51	Davis	101	Jefferson	135	Monroe	185	Wayne
53	Decatur	107	Keokuk	139	Muscatine	187	Webster
57	Des Moines	111	Lee	153	Polk		
77	Guthrie	115	Louisa	157	Poweshiek		
79	Hamilton	117	Lucas	169	Story		

Survey Unit Code: 3 **Survey Unit Name**: Southwestern

County code and county name							
1	Adair	47	Crawford	133	Monona	165	Shelby
3	Adams	71	Fremont	137	Montgomery	173	Taylor
9	Audubon	73	Greene	145	Page	175	Union
27	Carroll	85	Harrison	155	Pottawattamie	193	Woodbury
29	Cass	129	Mills	159	Ringgold		

Survey Unit Code: 4 **Survey Unit Name**: Northwestern

County code and county name							
21	Buena Vista	63	Emmet	119	Lyon	161	Sac
25	Calhoun	69	Franklin	141	O'Brien	167	Sioux
33	Cerro Gordo	81	Hancock	143	Osceola	189	Winnebago
35	Cherokee	91	Humboldt	147	Palo Alto	195	Worth
41	Clay	93	Ida	149	Plymouth	197	Wright
59	Dickinson	109	Kossuth	151	Pocahontas		

State Code: 20 **State Name:** Kansas **State Abbreviation:** KS **Region/Station Code:** 23

Survey Unit Code: 1 **Survey Unit Name**: Northeastern

County code and county name							
5	Atchison	59	Franklin	117	Marshall	177	Shawnee
13	Brown	61	Geary	121	Miami	197	Wabaunsee
27	Clay	85	Jackson	131	Nemaha	201	Washington
41	Dickinson	87	Jefferson	139	Osage	209	Wyandotte
43	Doniphan	91	Johnson	149	Pottawatomie		
45	Douglas	103	Leavenworth	161	Riley		

Survey Unit Code: 2 **Survey Unit Name**: Southeastern

County code and county name							
1	Allen	21	Cherokee	99	Labette	133	Neosho
3	Anderson	31	Coffey	107	Linn	205	Wilson
11	Bourbon	35	Cowley	111	Lyon	207	Woodson
15	Butler	37	Crawford	115	Marion		
17	Chase	49	Elk	125	Montgomery		
19	Chautauqua	73	Greenwood	127	Morris		

Survey Unit Code: 3 **Survey Unit Name**: Western

County code and county name							
7	Barber	71	Greeley	129	Morton	171	Scott
9	Barton	75	Hamilton	135	Ness	173	Sedgwick
23	Cheyenne	77	Harper	137	Norton	175	Seward
25	Clark	79	Harvey	141	Osborne	179	Sheridan
29	Cloud	81	Haskell	143	Ottawa	181	Sherman
33	Comanche	83	Hodgeman	145	Pawnee	183	Smith
39	Decatur	89	Jewell	147	Phillips	185	Stafford
47	Edwards	93	Kearny	151	Pratt	187	Stanton
51	Ellis	95	Kingman	153	Rawlins	189	Stevens
53	Ellsworth	97	Kiowa	155	Reno	191	Sumner
55	Finney	101	Lane	157	Republic	193	Thomas
57	Ford	105	Lincoln	159	Rice	195	Trego
63	Gove	109	Logan	163	Rooks	199	Wallace
65	Graham	113	McPherson	165	Rush	203	Wichita
67	Grant	119	Meade	167	Russell		
69	Gray	123	Mitchell	169	Saline		

State Code: 21 **State Name:** Kentucky **State Abbreviation:** KY **Region/Station Code:** 33

Survey Unit Code: 1 **Survey Unit Name**: Eastern

County code and county name							
71	Floyd	119	Knott	133	Letcher	193	Perry
95	Harlan	131	Leslie	159	Martin	195	Pike

Survey Unit Code: 2 **Survey Unit Name**: Northern Cumberland

County code and county name							
19	Boyd	115	Johnson	165	Menifee	237	Wolfe
43	Carter	127	Lawrence	175	Morgan		
63	Elliott	135	Lewis	197	Powell		
89	Greenup	153	Magoffin	205	Rowan		

Survey Unit Code: 3 **Survey Unit Name**: Southern Cumberland

County code and county name							
13	Bell	65	Estill	125	Laurel	189	Owsley
25	Breathitt	109	Jackson	129	Lee	203	Rockcastle
51	Clay	121	Knox	147	McCreary	235	Whitley

Survey Unit Code: 4 **Survey Unit Name**: Bluegrass

County code and county name							
5	Anderson	67	Fayette	113	Jessamine	187	Owen
11	Bath	69	Fleming	117	Kenton	191	Pendleton
15	Boone	73	Franklin	137	Lincoln	201	Robertson
17	Bourbon	77	Gallatin	151	Madison	209	Scott
21	Boyle	79	Garrard	161	Mason	211	Shelby
23	Bracken	81	Grant	167	Mercer	215	Spencer
37	Campbell	97	Harrison	173	Montgomery	223	Trimble
41	Carroll	103	Henry	181	Nicholas	229	Washington
49	Clark	111	Jefferson	185	Oldham	239	Woodford

Survey Unit Code: 5 **Survey Unit Name**: Pennyroyal

County code and county name							
1	Adair	57	Cumberland	99	Hart	179	Nelson
27	Breckinridge	85	Grayson	123	Larue	199	Pulaski
29	Bullitt	87	Green	155	Marion	207	Russell
45	Casey	91	Hancock	163	Meade	217	Taylor
53	Clinton	93	Hardin	169	Metcalfe	231	Wayne

Survey Unit Code: 6 **Survey Unit Name**: Western Coalfield

County code and county name							
3	Allen	55	Crittenden	141	Logan	213	Simpson
9	Barren	59	Daviess	149	McLean	219	Todd
31	Butler	61	Edmonson	171	Monroe	225	Union
33	Caldwell	101	Henderson	177	Muhlenberg	227	Warren
47	Christian	107	Hopkins	183	Ohio	233	Webster

Survey Unit Code: 7 **Survey Unit Name**: Western

County code and county name							
7	Ballard	75	Fulton	139	Livingston	157	Marshall
35	Calloway	83	Graves	143	Lyon	221	Trigg
39	Carlisle	105	Hickman	145	McCracken		

State Code: 22 **State Name:** Louisiana **State Abbreviation:** LA **Region/Station Code:** 33

Survey Unit Code: 1 **Survey Unit Name**: North Delta

County code and county name					
25	Catahoula	41	Franklin	83	Richland
29	Concordia	65	Madison	107	Tensas
35	East Carroll	67	Morehouse	123	West Carroll

Survey Unit Code: 2 **Survey Unit Name**: South Delta

County code and county name							
1	Acadia	47	Iberville	77	Pointe Coupee	99	St. Martin
5	Ascension	51	Jefferson	87	St. Bernard	101	St. Mary
7	Assumption	55	Lafayette	89	St. Charles	109	Terrebonne
9	Avoyelles	57	Lafourche	93	St. James	113	Vermilion
23	Cameron	71	Orleans	95	St. John the Baptist	121	West Baton Rouge
45	Iberia	75	Plaquemines	97	St. Landry	125	West Feliciana

Survey Unit Code: 3 **Survey Unit Name**: Southwest

County code and county name							
3	Allen	39	Evangeline	59	La Salle	85	Sabine
11	Beauregard	43	Grant	69	Natchitoches	115	Vernon
19	Calcasieu	53	Jefferson Davis	79	Rapides		

Survey Unit Code: 4 **Survey Unit Name**: Southeast

County code and county name							
33	East Baton Rouge	63	Livingston	103	St. Tammany	117	Washington
37	East Feliciana	91	St. Helena	105	Tangipahoa		

Survey Unit Code: 5 **Survey Unit Name**: Northwest

County code and county name							
13	Bienville	27	Claiborne	73	Ouachita	127	Winn
15	Bossier	31	De Soto	81	Red River		
17	Caddo	49	Jackson	111	Union		
21	Caldwell	61	Lincoln	119	Webster		

State Code: 23 **State Name:** Maine **State Abbreviation:** ME **Region/Station Code:** 24

Survey Unit Code: 1 **Survey Unit Name**: Washington

County code and county name	
29	Washington

Survey Unit Code: 2 **Survey Unit Name**: Aroostook

County code and county name	
3	Aroostook

Survey Unit Code: 3 **Survey Unit Name**: Penobscot

County code and county name	
19	Penobscot

Survey Unit Code: 4 **Survey Unit Name**: Hancock

County code and county name	
9	Hancock

Survey Unit Code: 5 **Survey Unit Name**: Piscataquis

County code and county name	
21	Piscataquis

Survey Unit Code: 6 **Survey Unit Name**: Capitol Region

County code and county name							
11	Kennebec	13	Knox	15	Lincoln	27	Waldo

Survey Unit Code: 7 **Survey Unit Name**: Somerset

County code and county name	
25	Somerset

Survey Unit Code: 8 **Survey Unit Name**: Casco Bay

County code and county name							
1	Androscoggin	5	Cumberland	23	Sagadahoc	31	York

Survey Unit Code: 9 **Survey Unit Name**: Western Maine

County code and county name			
7	Franklin	17	Oxford

State Code: 24 **State Name:** Maryland **State Abbreviation:** MD **Region/Station Code:** 24

Survey Unit Code: 2 **Survey Unit Name**: Central

County code and county name							
3	Anne Arundel	15	Cecil	29	Kent	41	Talbot
5	Baltimore	21	Frederick	31	Montgomery	43	Washington
11	Caroline	25	Harford	33	Prince George's	510	Baltimore city
13	Carroll	27	Howard	35	Queen Anne's		

Survey Unit Code: 3 **Survey Unit Name**: Southern

County code and county name					
09	Calvert	17	Charles	37	St. Mary's

Survey Unit Code: 4 **Survey Unit Name**: Lower Eastern Shore

County code and county name							
19	Dorchester	39	Somerset	45	Wicomico	47	Worcester

Survey Unit Code: 5 **Survey Unit Name**: Western

County code and county name			
1	Allegany	23	Garrett

State Code: 25 **State Name:** Massachusetts **State Abbreviation:** MA **Region/Station Code:** 24

Survey Unit Code: 1 **Survey Unit Name**: Massachusetts

County code and county name							
1	Barnstable	9	Essex	17	Middlesex	25	Suffolk
3	Berkshire	11	Franklin	19	Nantucket	27	Worcester
5	Bristol	13	Hampden	21	Norfolk		
7	Dukes	15	Hampshire	23	Plymouth		

State Code: 26 **State Name:** Michigan **State Abbreviation:** MI **Region/Station Code:** 23

Survey Unit Code: 1 **Survey Unit Name**: Eastern Upper Peninsula

County code and county name							
3	Alger	41	Delta	97	Mackinac	153	Schoolcraft
33	Chippewa	95	Luce	109	Menominee		

Survey Unit Code: 2 **Survey Unit Name**: Western Upper Peninsula

County code and county name							
13	Baraga	53	Gogebic	71	Iron	103	Marquette
43	Dickinson	61	Houghton	83	Keweenaw	131	Ontonagon

Survey Unit Code: 3 **Survey Unit Name**: Northern Lower Peninsula

County code and county name							
1	Alcona	39	Crawford	101	Manistee	133	Osceola
7	Alpena	47	Emmet	105	Mason	135	Oscoda
9	Antrim	51	Gladwin	107	Mecosta	137	Otsego
11	Arenac	55	Grand Traverse	111	Midland	141	Presque Isle
17	Bay	69	Iosco	113	Missaukee	143	Roscommon
19	Benzie	73	Isabella	119	Montmorency	165	Wexford
29	Charlevoix	79	Kalkaska	123	Newaygo		
31	Cheboygan	85	Lake	127	Oceana		
35	Clare	89	Leelanau	129	Ogemaw		

Survey Unit Code: 4 **Survey Unit Name**: Southern Lower Peninsula

County code and county name							
5	Allegan	57	Gratiot	91	Lenawee	147	St. Clair
15	Barry	59	Hillsdale	93	Livingston	149	St. Joseph
21	Berrien	63	Huron	99	Macomb	151	Sanilac
23	Branch	65	Ingham	115	Monroe	155	Shiawassee
25	Calhoun	67	Ionia	117	Montcalm	157	Tuscola
27	Cass	75	Jackson	121	Muskegon	159	Van Buren
37	Clinton	77	Kalamazoo	125	Oakland	161	Washtenaw
45	Eaton	81	Kent	139	Ottawa	163	Wayne
49	Genesee	87	Lapeer	145	Saginaw		

State Code: 27 **State Name:** Minnesota **State Abbreviation:** MN **Region/Station Code:** 23

Survey Unit Code: 1 **Survey Unit Name**: Aspen-Birch

County code and county name					
17	Carlton	71	Koochiching	137	St. Louis
31	Cook	75	Lake		

Survey Unit Code: 2 **Survey Unit Name**: Northern Pine

County code and county name							
1	Aitkin	21	Cass	57	Hubbard	87	Mahnomen
5	Becker	29	Clearwater	61	Itasca	135	Roseau
7	Beltrami	35	Crow Wing	77	Lake of the Woods	159	Wadena

Survey Unit Code: 3 **Survey Unit Name**: Central Hardwood

County code and county name							
3	Anoka	49	Goodhue	97	Morrison	141	Sherburne
9	Benton	53	Hennepin	109	Olmsted	145	Stearns
19	Carver	55	Houston	111	Otter Tail	153	Todd
25	Chisago	59	Isanti	115	Pine	157	Wabasha
37	Dakota	65	Kanabec	123	Ramsey	163	Washington
41	Douglas	79	Le Sueur	131	Rice	169	Winona
45	Fillmore	95	Mille Lacs	139	Scott	171	Wright

Survey Unit Code: 4 **Survey Unit Name**: Prairie

County code and county name							
11	Big Stone	67	Kandiyohi	103	Nicollet	143	Sibley
13	Blue Earth	69	Kittson	105	Nobles	147	Steele
15	Brown	73	Lac qui Parle	107	Norman	149	Stevens
23	Chippewa	81	Lincoln	113	Pennington	151	Swift
27	Clay	83	Lyon	117	Pipestone	155	Traverse
33	Cottonwood	85	McLeod	119	Polk	161	Waseca
39	Dodge	89	Marshall	121	Pope	165	Watonwan
43	Faribault	91	Martin	125	Red Lake	167	Wilkin
47	Freeborn	93	Meeker	127	Redwood	173	Yellow Medicine
51	Grant	99	Mower	129	Renville		
63	Jackson	101	Murray	133	Rock		

State Code: 28 **State Name:** Mississippi **State Abbreviation:** MS **Region/Station Code:** 33

Survey Unit Code: 1 **Survey Unit Name**: Delta

County code and county name							
11	Bolivar	55	Issaquena	133	Sunflower	151	Washington
27	Coahoma	83	Leflore	135	Tallahatchie	163	Yazoo
51	Holmes	119	Quitman	143	Tunica		
53	Humphreys	125	Sharkey	149	Warren		

Survey Unit Code: 2 **Survey Unit Name**: North

County code and county name							
3	Alcorn	33	DeSoto	95	Monroe	139	Tippah
9	Benton	43	Grenada	97	Montgomery	141	Tishomingo
13	Calhoun	57	Itawamba	105	Oktibbeha	145	Union
15	Carroll	71	Lafayette	107	Panola	155	Webster
17	Chickasaw	81	Lee	115	Pontotoc	161	Yalobusha
19	Choctaw	87	Lowndes	117	Prentiss		
25	Clay	93	Marshall	137	Tate		

Survey Unit Code: 3 **Survey Unit Name**: Central

County code and county name							
7	Attala	75	Lauderdale	103	Noxubee	129	Smith
23	Clarke	79	Leake	121	Rankin	159	Winston
61	Jasper	99	Neshoba	123	Scott		
69	Kemper	101	Newton	127	Simpson		

Survey Unit Code: 4 **Survey Unit Name**: South

County code and county name							
31	Covington	47	Harrison	77	Lawrence	147	Walthall
35	Forrest	59	Jackson	91	Marion	153	Wayne
39	George	65	Jefferson Davis	109	Pearl River		
41	Greene	67	Jones	111	Perry		
45	Hancock	73	Lamar	131	Stone		

Survey Unit Code: 5 **Survey Unit Name**: Southwest

County code and county name							
1	Adams	29	Copiah	63	Jefferson	113	Pike
5	Amite	37	Franklin	85	Lincoln	157	Wilkinson
21	Claiborne	49	Hinds	89	Madison		

State Code: 29 **State Name:** Missouri **State Abbreviation:** MO **Region/Station Code:** 23

Survey Unit Code: 1 **Survey Unit Name**: Eastern Ozarks

County code and county name							
17	Bollinger	65	Dent	179	Reynolds	221	Washington
23	Butler	93	Iron	181	Ripley	223	Wayne
35	Carter	123	Madison	187	St. Francois		
55	Crawford	149	Oregon	203	Shannon		

Survey Unit Code: 2 **Survey Unit Name**: Southwestern Ozarks

County code and county name							
9	Barry	91	Howell	153	Ozark	215	Texas
43	Christian	119	McDonald	209	Stone	225	Webster
67	Douglas	145	Newton	213	Taney	229	Wright

Survey Unit Code: 3 **Survey Unit Name**: Northwestern Ozarks

County code and county name							
15	Benton	85	Hickory	141	Morgan	185	St. Clair
29	Camden	105	Laclede	161	Phelps		
39	Cedar	125	Maries	167	Polk		
59	Dallas	131	Miller	169	Pulaski		

Survey Unit Code: 4 **Survey Unit Name**: Prairie

County code and county name							
1	Adair	53	Cooper	107	Lafayette	171	Putnam
3	Andrew	57	Dade	109	Lawrence	173	Ralls
5	Atchison	61	Daviess	111	Lewis	175	Randolph
7	Audrain	63	DeKalb	113	Lincoln	177	Ray
11	Barton	75	Gentry	115	Linn	195	Saline
13	Bates	77	Greene	117	Livingston	197	Schuyler
21	Buchanan	79	Grundy	121	Macon	199	Scotland
25	Caldwell	81	Harrison	127	Marion	205	Shelby
33	Carroll	83	Henry	129	Mercer	211	Sullivan
37	Cass	87	Holt	137	Monroe	217	Vernon
41	Chariton	95	Jackson	147	Nodaway	227	Worth
45	Clark	97	Jasper	159	Pettis		
47	Clay	101	Johnson	163	Pike		
49	Clinton	103	Knox	165	Platte		

Survey Unit Code: 5 **Survey Unit Name**: Riverborder

County code and county name							
19	Boone	73	Gasconade	143	New Madrid	189	St. Louis
27	Callaway	89	Howard	151	Osage	201	Scott
31	Cape Girardeau	99	Jefferson	155	Pemiscot	207	Stoddard
51	Cole	133	Mississippi	157	Perry	219	Warren
69	Dunklin	135	Moniteau	183	St. Charles	510	St. Louis city
71	Franklin	139	Montgomery	186	Ste. Genevieve		

State Code: 30 **State Name:** Montana **State Abbreviation:** MT **Region/Station Code:** 22

Survey Unit Code: 1 **Survey Unit Name**: Northwestern

County code and county name							
29	Flathead	47	Lake	53	Lincoln	89	Sanders

Survey Unit Code: 2 **Survey Unit Name**: Eastern

County code and county name							
3	Big Horn	27	Fergus	71	Phillips	95	Stillwater
5	Blaine	33	Garfield	73	Pondera	97	Sweet Grass
9	Carbon	35	Glacier	75	Powder River	99	Teton
11	Carter	37	Golden Valley	79	Prairie	101	Toole
15	Chouteau	41	Hill	83	Richland	103	Treasure
17	Custer	51	Liberty	85	Roosevelt	105	Valley
19	Daniels	55	McCone	87	Rosebud	109	Wibaux
21	Dawson	65	Musselshell	91	Sheridan	111	Yellowstone
25	Fallon	69	Petroleum				

Survey Unit Code: 3 **Survey Unit Name**: Western

County code and county name							
39	Granite	61	Mineral	63	Missoula	81	Ravalli

Survey Unit Code: 4 **Survey Unit Name**: West Central

County code and county name							
7	Broadwater	43	Jefferson	49	Lewis and Clark	77	Powell
13	Cascade	45	Judith Basin	59	Meagher	107	Wheatland

Survey Unit Code: 5 **Survey Unit Name**: Southwestern

County code and county name					
1	Beaverhead	31	Gallatin	67	Park
23	Deer Lodge	57	Madison	93	Silver Bow

State Code: 31 **State Name:** Nebraska **State Abbreviation:** NE **Region/Station Code:** 23

Survey Unit Code: 1 **Survey Unit Name**: Eastern

County code and county name							
1	Adams	55	Douglas	99	Kearney	151	Saline
11	Boone	59	Fillmore	109	Lancaster	153	Sarpy
19	Buffalo	61	Franklin	119	Madison	155	Saunders
21	Burt	63	Frontier	121	Merrick	159	Seward
23	Butler	65	Furnas	125	Nance	163	Sherman
25	Cass	67	Gage	127	Nemaha	167	Stanton
27	Cedar	73	Gosper	129	Nuckolls	169	Thayer
35	Clay	77	Greeley	131	Otoe	173	Thurston
37	Colfax	79	Hall	133	Pawnee	175	Valley
39	Cuming	81	Hamilton	137	Phelps	177	Washington
41	Custer	83	Harlan	139	Pierce	179	Wayne
43	Dakota	87	Hitchcock	141	Platte	181	Webster
47	Dawson	93	Howard	143	Polk	185	York
51	Dixon	95	Jefferson	145	Red Willow		
53	Dodge	97	Johnson	147	Richardson		

Survey Unit Code: 2 **Survey Unit Name**: Western

County code and county name							
3	Antelope	33	Cheyenne	91	Hooker	123	Morrill
5	Arthur	45	Dawes	101	Keith	135	Perkins
7	Banner	49	Deuel	103	Keya Paha	149	Rock
9	Blaine	57	Dundy	105	Kimball	157	Scotts Bluff
13	Box Butte	69	Garden	107	Knox	161	Sheridan
15	Boyd	71	Garfield	111	Lincoln	165	Sioux
17	Brown	75	Grant	113	Logan	171	Thomas
29	Chase	85	Hayes	115	Loup	183	Wheeler
31	Cherry	89	Holt	117	McPherson		

State Code: 32 **State Name:** Nevada **State Abbreviation:** NV **Region/Station Code:** 22

Survey Unit Code: 1 **Survey Unit Name**: Nevada

County code and county name							
1	Churchill	11	Eureka	21	Mineral	33	White Pine
3	Clark	13	Humboldt	23	Nye	510	Carson City
5	Douglas	15	Lander	27	Pershing		
7	Elko	17	Lincoln	29	Storey		
9	Esmeralda	19	Lyon	31	Washoe		

State Code: 33 **State Name:** New Hampshire **State Abbreviation:** NH **Region/Station Code:** 24

Survey Unit Code: 2 **Survey Unit Name**: Northern

County code and county name					
3	Carroll	7	Coos	9	Grafton

Survey Unit Code: 3 **Survey Unit Name**: Southern

County code and county name							
1	Belknap	11	Hillsborough	15	Rockingham	19	Sullivan
5	Cheshire	13	Merrimack	17	Strafford		

State Code: 34 **State Name:** New Jersey **State Abbreviation:** NJ **Region/Station Code:** 24

Survey Unit Code: 1 **Survey Unit Name**: New Jersey

County code and county name							
1	Atlantic	13	Essex	25	Monmouth	37	Sussex
3	Bergen	15	Gloucester	27	Morris	39	Union
5	Burlington	17	Hudson	29	Ocean	41	Warren
7	Camden	19	Hunterdon	31	Passaic		
9	Cape May	21	Mercer	33	Salem		
11	Cumberland	23	Middlesex	35	Somerset		

State Code: 35 **State Name:** New Mexico **State Abbreviation:** NM **Region/Station Code:** 22

Survey Unit Code: 1 **Survey Unit Name**: Northwestern

County code and county name							
1	Bernalillo	31	McKinley	45	San Juan	61	Valencia
6	Cibola	39	Rio Arriba	49	Santa Fe		
28	Los Alamos	43	Sandoval	55	Taos		

Survey Unit Code: 2 **Survey Unit Name**: Northeastern

County code and county name							
7	Colfax	21	Harding	37	Quay	57	Torrance
19	Guadalupe	33	Mora	47	San Miguel	59	Union

Survey Unit Code: 3 **Survey Unit Name**: Southwestern

County code and county name							
3	Catron	17	Grant	29	Luna	53	Socorro
13	Dona Ana	23	Hidalgo	51	Sierra		

Survey Unit Code: 4 **Survey Unit Name**: Southeastern

County code and county name							
5	Chaves	11	De Baca	25	Lea	35	Otero
9	Curry	15	Eddy	27	Lincoln	41	Roosevelt

State Code: 36 **State Name:** New York **State Abbreviation:** NY **Region/Station Code:** 24

Survey Unit Code: 1 **Survey Unit Name**: Adirondack

County code and county name							
19	Clinton	33	Franklin	45	Jefferson	89	St. Lawrence

Survey Unit Code: 2 **Survey Unit Name**: Lake Plain

County code and county name							
11	Cayuga	53	Madison	69	Ontario	117	Wayne
29	Erie	55	Monroe	73	Orleans	121	Wyoming
37	Genesee	63	Niagara	75	Oswego	123	Yates
51	Livingston	67	Onondaga	99	Seneca		

Survey Unit Code: 3 **Survey Unit Name**: Western Adirondack

County code and county name							
35	Fulton	43	Herkimer	49	Lewis	65	Oneida

Survey Unit Code: 4 **Survey Unit Name**: Eastern Adirondack

County code and county name					
31	Essex	41	Hamilton	113	Warren

Survey Unit Code: 5 **Survey Unit Name**: Southwest Highlands

County code and county name							
3	Allegany	9	Cattaraugus	13	Chautauqua	101	Steuben

Survey Unit Code: 6 **Survey Unit Name**: South-Central Highlands

County code and county name					
7	Broome	23	Cortland	97	Schuyler
15	Chemung	25	Delaware	107	Tioga
17	Chenango	77	Otsego	109	Tompkins

Survey Unit Code: 7 **Survey Unit Name**: Capitol District

County code and county name							
1	Albany	57	Montgomery	91	Saratoga	115	Washington
21	Columbia	83	Rensselaer	93	Schenectady		

Survey Unit Code: 8 **Survey Unit Name**: Catskill-Lower Hudson

County code and county name							
5	Bronx	59	Nassau	81	Queens	103	Suffolk
27	Dutchess	61	New York	85	Richmond	105	Sullivan
39	Greene	71	Orange	87	Rockland	111	Ulster
47	Kings	79	Putnam	95	Schoharie	119	Westchester

State Code: 37 **State Name:** North Carolina **State Abbreviation:** NC **Region/Station Code:** 33

Survey Unit Code: 1 **Survey Unit Name**: Southern Coastal Plain

County code and county name							
17	Bladen	85	Harnett	125	Moore	163	Sampson
19	Brunswick	93	Hoke	129	New Hanover	165	Scotland
47	Columbus	101	Johnston	133	Onslow	191	Wayne
51	Cumberland	103	Jones	141	Pender		
61	Duplin	105	Lee	153	Richmond		
79	Greene	107	Lenoir	155	Robeson		

Survey Unit Code: 2 **Survey Unit Name**: Northern Coastal Plain

County code and county name							
13	Beaufort	53	Currituck	95	Hyde	143	Perquimans
15	Bertie	55	Dare	117	Martin	147	Pitt
29	Camden	65	Edgecombe	127	Nash	177	Tyrrell
31	Carteret	73	Gates	131	Northampton	187	Washington
41	Chowan	83	Halifax	137	Pamlico	195	Wilson
49	Craven	91	Hertford	139	Pasquotank		

Survey Unit Code: 3 **Survey Unit Name**: Piedmont

County code and county name							
1	Alamance	59	Davie	119	Mecklenburg	167	Stanly
3	Alexander	63	Durham	123	Montgomery	169	Stokes
7	Anson	67	Forsyth	135	Orange	171	Surry
25	Cabarrus	69	Franklin	145	Person	179	Union
33	Caswell	71	Gaston	149	Polk	181	Vance
35	Catawba	77	Granville	151	Randolph	183	Wake
37	Chatham	81	Guilford	157	Rockingham	185	Warren
45	Cleveland	97	Iredell	159	Rowan	197	Yadkin
57	Davidson	109	Lincoln	161	Rutherford		

Survey Unit Code: 4 **Survey Unit Name**: Mountains

County code and county name							
5	Alleghany	39	Cherokee	111	McDowell	189	Watauga
9	Ashe	43	Clay	113	Macon	193	Wilkes
11	Avery	75	Graham	115	Madison	199	Yancey
21	Buncombe	87	Haywood	121	Mitchell		
23	Burke	89	Henderson	173	Swain		
27	Caldwell	99	Jackson	175	Transylvania		

State Code: 38 **State Name:** North Dakota **State Abbreviation:** ND **Region/Station Code:** 23

Survey Unit Code: 1 **Survey Unit Name**: Eastern

County code and county name

1	Adams	29	Emmons	57	Mercer	85	Sioux
3	Barnes	31	Foster	59	Morton	87	Slope
5	Benson	33	Golden Valley	61	Mountrail	89	Stark
7	Billings	35	Grand Forks	63	Nelson	91	Steele
9	Bottineau	37	Grant	65	Oliver	93	Stutsman
11	Bowman	39	Griggs	67	Pembina	95	Towner
13	Burke	41	Hettinger	69	Pierce	97	Traill
15	Burleigh	43	Kidder	71	Ramsey	99	Walsh
17	Cass	45	LaMoure	73	Ransom	101	Ward
19	Cavalier	47	Logan	75	Renville	103	Wells
21	Dickey	49	McHenry	77	Richland	105	Williams
23	Divide	51	McIntosh	79	Rolette		
25	Dunn	53	McKenzie	81	Sargent		
27	Eddy	55	McLean	83	Sheridan		

State Code: 39 **State Name:** Ohio **State Abbreviation:** OH **Region/Station Code:** 24

Survey Unit Code: 1 **Survey Unit Name**: South-Central

County code and county name							
1	Adams	53	Gallia	87	Lawrence	145	Scioto
15	Brown	71	Highland	131	Pike		
25	Clermont	79	Jackson	141	Ross		

Survey Unit Code: 2 **Survey Unit Name**: Southeastern

County code and county name							
9	Athens	105	Meigs	127	Perry	167	Washington
73	Hocking	115	Morgan	163	Vinton		

Survey Unit Code: 3 **Survey Unit Name**: East-Central

County code and county name							
13	Belmont	59	Guernsey	81	Jefferson	121	Noble
19	Carroll	67	Harrison	111	Monroe	157	Tuscarawas
31	Coshocton	75	Holmes	119	Muskingum		

Survey Unit Code: 4 **Survey Unit Name**: Northeastern

County code and county name							
5	Ashland	55	Geauga	103	Medina	155	Trumbull
7	Ashtabula	77	Huron	133	Portage	169	Wayne
29	Columbiana	85	Lake	139	Richland		
35	Cuyahoga	93	Lorain	151	Stark		
43	Erie	99	Mahoning	153	Summit		

Survey Unit Code: 5 **Survey Unit Name**: Southwestern

County code and county name							
17	Butler	45	Fairfield	61	Hamilton	113	Montgomery
23	Clark	47	Fayette	89	Licking	129	Pickaway
27	Clinton	49	Franklin	97	Madison	135	Preble
37	Darke	57	Greene	109	Miami	165	Warren

Survey Unit Code: 6 **Survey Unit Name**: Northwestern

County code and county name							
3	Allen	63	Hancock	107	Mercer	149	Shelby
11	Auglaize	65	Hardin	117	Morrow	159	Union
21	Champaign	69	Henry	123	Ottawa	161	Van Wert
33	Crawford	83	Knox	125	Paulding	171	Williams
39	Defiance	91	Logan	137	Putnam	173	Wood
41	Delaware	95	Lucas	143	Sandusky	175	Wyandot
51	Fulton	101	Marion	147	Seneca		

State Code: 40 **State Name:** Oklahoma **State Abbreviation:** OK **Region/Station Code:** 33

Survey Unit Code: 1 **Survey Unit Name**: Southeast

County code and county name							
5	Atoka	29	Coal	79	Le Flore	127	Pushmataha
13	Bryan	61	Haskell	89	McCurtain		
23	Choctaw	77	Latimer	121	Pittsburg		

Survey Unit Code: 2 **Survey Unit Name**: Northeast

County code and county name							
1	Adair	41	Delaware	97	Mayes	115	Ottawa
21	Cherokee	91	McIntosh	101	Muskogee	135	Sequoyah

Survey Unit Code: 3 **Survey Unit Name**: North Central

County code and county name							
35	Craig	113	Osage	131	Rogers	145	Wagoner
37	Creek	117	Pawnee	143	Tulsa	147	Washington
105	Nowata	119	Payne				

Survey Unit Code: 4 **Survey Unit Name**: South Central

County code and county name							
19	Carter	81	Lincoln	95	Marshall	111	Okmulgee
27	Cleveland	83	Logan	99	Murray	123	Pontotoc
49	Garvin	85	Love	107	Okfuskee	125	Pottawatomie
63	Hughes	87	McClain	109	Oklahoma	133	Seminole
69	Johnston						

Survey Unit Code: 5 **Survey Unit Name**: Southwest

County code and county name							
9	Beckham	33	Cotton	57	Harmon	129	Roger Mills
11	Blaine	39	Custer	65	Jackson	137	Stephens
15	Caddo	43	Dewey	67	Jefferson	141	Tillman
17	Canadian	51	Grady	73	Kingfisher	149	Washita
31	Comanche	55	Greer	75	Kiowa		

Survey Unit Code: 6 **Survey Unit Name**: High Plains

County code and county name							
7	Beaver	45	Ellis	59	Harper	139	Texas
25	Cimarron						

Survey Unit Code: 7 **Survey Unit Name**: Great Plains

County code and county name							
3	Alfalfa	53	Grant	93	Major	151	Woods
47	Garfield	71	Kay	103	Noble	153	Woodward

State Code: 41 **State Name:** Oregon **State Abbreviation:** OR **Region/Station Code:** 26

Survey Unit Code: 0 **Survey Unit Name**: Northwest

County code and county name							
5	Clackamas	27	Hood River	53	Polk	71	Yamhill
7	Clatsop	47	Marion	57	Tillamook		
9	Columbia	51	Multnomah	67	Washington		

Survey Unit Code: 1 **Survey Unit Name**: West Central

County code and county name							
3	Benton	39	Lane	41	Lincoln	43	Linn

Survey Unit Code: 2 **Survey Unit Name**: Southwest

County code and county name					
11	Coos	19	Douglas	33	Josephine
15	Curry	29	Jackson		

Survey Unit Code: 3 **Survey Unit Name**: Central

County code and county name					
13	Crook	31	Jefferson	55	Sherman
17	Deschutes	35	Klamath	65	Wasco
21	Gilliam	37	Lake	69	Wheeler

Survey Unit Code: 4 **Survey Unit Name**: Blue Mountains

County code and county name							
1	Baker	25	Harney	49	Morrow	61	Union
23	Grant	45	Malheur	59	Umatilla	63	Wallowa

State Code: 42 **State Name:** Pennsylvania **State Abbreviation:** PA **Region/Station Code:** 24

Survey Unit Code: 0 **Survey Unit Name**: South Central

County code and county name					
43	Dauphin	61	Huntingdon	99	Perry
55	Franklin	67	Juniata	109	Snyder
57	Fulton	87	Mifflin	119	Union

Survey Unit Code: 5 **Survey Unit Name**: Western

County code and county name							
3	Allegheny	19	Butler	59	Greene	85	Mercer
5	Armstrong	39	Crawford	63	Indiana	125	Washington
7	Beaver	49	Erie	73	Lawrence	129	Westmoreland

Survey Unit Code: 6 **Survey Unit Name**: North Central/Allegheny

County code and county name							
23	Cameron	35	Clinton	81	Lycoming	117	Tioga
27	Centre	47	Elk	83	McKean	121	Venango
31	Clarion	53	Forest	105	Potter	123	Warren
33	Clearfield	65	Jefferson	113	Sullivan		

Survey Unit Code: 7 **Survey Unit Name**: Southwestern

County code and county name					
9	Bedford	21	Cambria	111	Somerset
13	Blair	51	Fayette		

Survey Unit Code: 8 **Survey Unit Name**: Northeastern/Pocono

County code and county name							
15	Bradford	79	Luzerne	103	Pike	131	Wyoming
25	Carbon	89	Monroe	107	Schuylkill		
37	Columbia	93	Montour	115	Susquehanna		
69	Lackawanna	97	Northumberland	127	Wayne		

Survey Unit Code: 9 **Survey Unit Name**: Southeastern

County code and county name							
1	Adams	41	Cumberland	77	Lehigh	133	York
11	Berks	45	Delaware	91	Montgomery		
17	Bucks	71	Lancaster	95	Northampton		
29	Chester	75	Lebanon	101	Philadelphia		

State Code: 44 **State Name:** Rhode Island **State Abbreviation:** RI **Region/Station Code:** 24

Survey Unit Code: 1 **Survey Unit Name**: Rhode Island

County code and county name					
1	Bristol	5	Newport	9	Washington
3	Kent	7	Providence		

State Code: 45 **State Name:** South Carolina **State Abbreviation:** SC **Region/Station Code:** 33

Survey Unit Code: 1 **Survey Unit Name**: Southern Coastal Plain

County code and county name							
3	Aiken	11	Barnwell	29	Colleton	53	Jasper
5	Allendale	13	Beaufort	35	Dorchester	63	Lexington
9	Bamberg	17	Calhoun	49	Hampton	75	Orangeburg

Survey Unit Code: 2 **Survey Unit Name**: Northern Coastal Plain

County code and county name							
15	Berkeley	31	Darlington	51	Horry	69	Marlboro
19	Charleston	33	Dillon	55	Kershaw	79	Richland
25	Chesterfield	41	Florence	61	Lee	85	Sumter
27	Clarendon	43	Georgetown	67	Marion	89	Williamsburg

Survey Unit Code: 3 **Survey Unit Name**: Piedmont

County code and county name							
1	Abbeville	39	Fairfield	65	McCormick	83	Spartanburg
7	Anderson	45	Greenville	71	Newberry	87	Union
21	Cherokee	47	Greenwood	73	Oconee	91	York
23	Chester	57	Lancaster	77	Pickens		
37	Edgefield	59	Laurens	81	Saluda		

State Code: 46 **State Name:** South Dakota **State Abbreviation:** SD **Region/Station Code:** 23

Survey Unit Code: 1 **Survey Unit Name**: Eastern

County code and county name							
3	Aurora	37	Day	71	Jackson	107	Potter
5	Beadle	39	Deuel	73	Jerauld	109	Roberts
7	Bennett	41	Dewey	75	Jones	111	Sanborn
9	Bon Homme	43	Douglas	77	Kingsbury	115	Spink
11	Brookings	45	Edmunds	79	Lake	117	Stanley
13	Brown	49	Faulk	83	Lincoln	119	Sully
15	Brule	51	Grant	85	Lyman	121	Todd
17	Buffalo	53	Gregory	87	McCook	123	Tripp
21	Campbell	55	Haakon	89	McPherson	125	Turner
23	Charles Mix	57	Hamlin	91	Marshall	127	Union
25	Clark	59	Hand	95	Mellette	129	Walworth
27	Clay	61	Hanson	97	Miner	135	Yankton
29	Codington	65	Hughes	99	Minnehaha	137	Ziebach
31	Corson	67	Hutchinson	101	Moody		
35	Davison	69	Hyde	105	Perkins		

Survey Unit Code: 2 **Survey Unit Name**: Western

County code and county name							
19	Butte	47	Fall River	81	Lawrence	103	Pennington
33	Custer	63	Harding	93	Meade	113	Shannon

State Code: 47 **State Name:** Tennessee **State Abbreviation:** TN **Region/Station Code:** 33

Survey Unit Code: 1 **Survey Unit Name**: West

County code and county name							
17	Carroll	53	Gibson	95	Lake	157	Shelby
23	Chester	69	Hardeman	97	Lauderdale	167	Tipton
33	Crockett	75	Haywood	109	McNairy	183	Weakley
45	Dyer	77	Henderson	113	Madison		
47	Fayette	79	Henry	131	Obion		

Survey Unit Code: 2 **Survey Unit Name**: West Central

County code and county name							
5	Benton	81	Hickman	99	Lawrence	161	Stewart
39	Decatur	83	Houston	101	Lewis	181	Wayne
71	Hardin	85	Humphreys	135	Perry		

Survey Unit Code: 3 **Survey Unit Name**: Central

County code and county name							
3	Bedford	41	DeKalb	117	Marshall	159	Smith
15	Cannon	43	Dickson	119	Maury	165	Sumner
21	Cheatham	55	Giles	125	Montgomery	169	Trousdale
27	Clay	87	Jackson	127	Moore	187	Williamson
31	Coffee	103	Lincoln	147	Robertson	189	Wilson
37	Davidson	111	Macon	149	Rutherford		

Survey Unit Code: 4 **Survey Unit Name**: Plateau

County code and county name							
7	Bledsoe	51	Franklin	133	Overton	153	Sequatchie
13	Campbell	61	Grundy	137	Pickett	175	Van Buren
35	Cumberland	115	Marion	141	Putnam	177	Warren
49	Fentress	129	Morgan	151	Scott	185	White

Survey Unit Code: 5 **Survey Unit Name**: East

County code and county name							
1	Anderson	59	Greene	93	Knox	145	Roane
9	Blount	63	Hamblen	105	Loudon	155	Sevier
11	Bradley	65	Hamilton	107	McMinn	163	Sullivan
19	Carter	67	Hancock	121	Meigs	171	Unicoi
25	Claiborne	73	Hawkins	123	Monroe	173	Union
29	Cocke	89	Jefferson	139	Polk	179	Washington
57	Grainger	91	Johnson	143	Rhea		

State Code: 48 **State Name:** Texas **State Abbreviation:** TX **Region/Station Code:** 33

Survey Unit Code: 1 **Survey Unit Name**: Southeast

County code and county name							
5	Angelina	241	Jasper	351	Newton	455	Trinity
71	Chambers	245	Jefferson	361	Orange	457	Tyler
185	Grimes	289	Leon	373	Polk	471	Walker
199	Hardin	291	Liberty	403	Sabine	473	Waller
201	Harris	313	Madison	405	San Augustine		
225	Houston	339	Montgomery	407	San Jacinto		

Survey Unit Code: 2 **Survey Unit Name**: Northeast

County code and county name							
1	Anderson	183	Gregg	365	Panola	459	Upshur
37	Bowie	203	Harrison	387	Red River	467	Van Zandt
63	Camp	213	Henderson	401	Rusk	499	Wood
67	Cass	315	Marion	419	Shelby		
73	Cherokee	343	Morris	423	Smith		
159	Franklin	347	Nacogdoches	449	Titus		

Survey Unit Code: 3 **Survey Unit Name**: North Central

County code and county name							
15	Austin	121	Denton	217	Hill	337	Montague
21	Bastrop	123	De Witt	223	Hopkins	349	Navarro
41	Brazos	139	Ellis	231	Hunt	367	Parker
51	Burleson	145	Falls	237	Jack	379	Rains
55	Caldwell	147	Fannin	251	Johnson	395	Robertson
77	Clay	149	Fayette	257	Kaufman	397	Rockwall
85	Collin	161	Freestone	277	Lamar	439	Tarrant
89	Colorado	175	Goliad	285	Lavaca	477	Washington
97	Cooke	177	Gonzales	287	Lee	497	Wise
113	Dallas	181	Grayson	293	Limestone	503	Young
119	Delta	187	Guadalupe	331	Milam		

Survey Unit Code: 4 **Survey Unit Name**: South

County code and county name							
7	Aransas	157	Fort Bend	273	Kleberg	427	Starr
13	Atascosa	163	Frio	283	La Salle	469	Victoria
25	Bee	167	Galveston	297	Live Oak	479	Webb
39	Brazoria	215	Hidalgo	311	McMullen	481	Wharton
47	Brooks	239	Jackson	321	Matagorda	489	Willacy
57	Calhoun	247	Jim Hogg	323	Maverick	493	Wilson
61	Cameron	249	Jim Wells	355	Nueces	505	Zapata
127	Dimmit	255	Karnes	391	Refugio	507	Zavala
131	Duval	261	Kenedy	409	San Patricio		

Texas cont.

Texas cont.

Survey Unit Code: 5 **Survey Unit Name**: West Central

County code and county name							
19	Bandera	99	Coryell	267	Kimble	385	Real
27	Bell	105	Crockett	271	Kinney	399	Runnels
29	Bexar	133	Eastland	281	Lampasas	411	San Saba
31	Blanco	137	Edwards	299	Llano	413	Schleicher
35	Bosque	143	Erath	307	McCulloch	425	Somervell
49	Brown	171	Gillespie	309	McLennan	429	Stephens
53	Burnet	193	Hamilton	319	Mason	435	Sutton
59	Callahan	209	Hays	325	Medina	453	Travis
83	Coleman	221	Hood	327	Menard	463	Uvalde
91	Comal	259	Kendall	333	Mills	465	Val Verde
93	Comanche	265	Kerr	363	Palo Pinto	491	Williamson
95	Concho						

Survey Unit Code: 6 **Survey Unit Name**: Northwest

County code and county name							
3	Andrews	129	Donley	235	Irion	375	Potter
9	Archer	151	Fisher	253	Jones	381	Randall
11	Armstrong	153	Floyd	263	Kent	383	Reagan
17	Bailey	155	Foard	269	King	393	Roberts
23	Baylor	165	Gaines	275	Knox	415	Scurry
33	Borden	169	Garza	279	Lamb	417	Shackelford
45	Briscoe	173	Glasscock	295	Lipscomb	421	Sherman
65	Carson	179	Gray	303	Lubbock	431	Sterling
69	Castro	189	Hale	305	Lynn	433	Stonewall
75	Childress	191	Hall	317	Martin	437	Swisher
79	Cochran	195	Hansford	329	Midland	441	Taylor
81	Coke	197	Hardeman	335	Mitchell	445	Terry
87	Collingsworth	205	Hartley	341	Moore	447	Throckmorton
101	Cottle	207	Haskell	345	Motley	451	Tom Green
107	Crosby	211	Hemphill	353	Nolan	483	Wheeler
111	Dallam	219	Hockley	357	Ochiltree	485	Wichita
115	Dawson	227	Howard	359	Oldham	487	Wilbarger
117	Deaf Smith	233	Hutchinson	369	Parmer	501	Yoakum
125	Dickens						

Survey Unit Code: 7 **Survey Unit Name**: West

County code and county name							
43	Brewster	141	El Paso	371	Pecos	461	Upton
103	Crane	229	Hudsbeth	377	Presidio	475	Ward
109	Culberson	243	Jeff Davis	389	Reeves	495	Winkler
135	Ector	301	Loving	443	Terrell		

State Code: 49 **State Name:** Utah **State Abbreviation:** UT **Region/Station Code:** 22

Survey Unit Code: 1 **Survey Unit Name**: Northern

County code and county name							
3	Box Elder	29	Morgan	43	Summit	51	Wasatch
5	Cache	33	Rich	45	Tooele	57	Weber
11	Davis	35	Salt Lake	49	Utah		

Survey Unit Code: 2 **Survey Unit Name**: Uinta

County code and county name					
9	Daggett	13	Duchesne	47	Uintah

Survey Unit Code: 3 **Survey Unit Name**: Central

County code and county name					
23	Juab	31	Piute	41	Sevier
27	Millard	39	Sanpete	55	Wayne

Survey Unit Code: 4 **Survey Unit Name**: Eastern

County code and county name							
7	Carbon	15	Emery	19	Grand	37	San Juan

Survey Unit Code: 5 **Survey Unit Name**: Southwestern

County code and county name					
1	Beaver	21	Iron	53	Washington
17	Garfield	25	Kane		

State Code: 50 **State Name:** Vermont **State Abbreviation:** VT **Region/Station Code:** 24

Survey Unit Code: 2 **Survey Unit Name**: Northern

County code and county name							
5	Caledonia	11	Franklin	15	Lamoille	19	Orleans
9	Essex	13	Grand Isle	17	Orange	23	Washington

Survey Unit Code: 3 **Survey Unit Name**: Southern

County code and county name					
1	Addison	7	Chittenden	25	Windham
3	Bennington	21	Rutland	27	Windsor

State Code: 51 **State Name:** Virginia **State Abbreviation:** VA **Region/Station Code:** 33

Survey Unit Code: 1 **Survey Unit Name**: Coastal Plain

County code and county name							
1	Accomack	85	Hanover	119	Middlesex	193	Westmoreland
25	Brunswick	87	Henrico	127	New Kent	199	York
33	Caroline	93	Isle Of Wight	131	Northampton	550	Chesapeake city
36	Charles City	95	James City	133	Northumberland	650	Hampton city
41	Chesterfield	97	King And Queen	149	Prince George	700	Newport News city
53	Dinwiddie	99	King George	159	Richmond	800	Suffolk city
57	Essex	101	King William	175	Southampton	810	Virginia Beach city
73	Gloucester	103	Lancaster	181	Surry		
81	Greensville	115	Mathews	183	Sussex		

Survey Unit Code: 2 **Survey Unit Name**: Southern Piedmont

County code and county name							
7	Amelia	37	Charlotte	111	Lunenburg	145	Powhatan
11	Appomattox	49	Cumberland	117	Mecklenburg	147	Prince Edward
19	Bedford	67	Franklin	135	Nottoway		
29	Buckingham	83	Halifax	141	Patrick		
31	Campbell	89	Henry	143	Pittsylvania		

Survey Unit Code: 3 **Survey Unit Name**: Northern Piedmont

County code and county name							
3	Albemarle	61	Fauquier	109	Louisa	157	Rappahannock
9	Amherst	65	Fluvanna	113	Madison	177	Spotsylvania
13	Arlington	75	Goochland	125	Nelson	179	Stafford
47	Culpeper	79	Greene	137	Orange		
59	Fairfax	107	Loudoun	153	Prince William		

Survey Unit Code: 4 **Survey Unit Name**: Northern Mountains

County code and county name							
5	Alleghany	43	Clarke	139	Page	171	Shenandoah
15	Augusta	45	Craig	161	Roanoke	187	Warren
17	Bath	69	Frederick	163	Rockbridge		
23	Botetourt	91	Highland	165	Rockingham		

Survey Unit Code: 5 **Survey Unit Name**: Southern Mountains

County code and county name							
21	Bland	71	Giles	167	Russell	195	Wise
27	Buchanan	77	Grayson	169	Scott	197	Wythe
35	Carroll	105	Lee	173	Smyth		
51	Dickenson	121	Montgomery	185	Tazewell		
63	Floyd	155	Pulaski	191	Washington		

Virginia cont.

Virginia cont.

Cities aggregated into other counties

City code and city name		Associated county code and county name		City code and city name		Associated county code and county name	
510	Alexandria city	59	Fairfax	683	Manassas city	153	Prince William
515	Bedford city	19	Bedford	685	Manassas Park city	153	Prince William
520	Bristol city	191	Washington	690	Martinsville city	89	Henry
530	Buena Vista city	163	Rockbridge	710	Norfolk city	550	Chesapeake City
540	Charlottesville city	3	Albemarle	720	Norton city	195	Wise
560	Clifton Forge city	5	Allegheny	730	Petersburg city	53	Dinwiddie
570	Colonial Heights city	41	Chesterfield	730	Petersburg city	149	Prince George
580	Covington city	5	Allegheny	735	Poquoson city	199	York
590	Danville city	143	Pittsylvania	740	Portsmouth city	550	Chesapeake City
595	Emporia city	81	Greensville	750	Radford city	121	Montgomery
600	Fairfax city	59	Fairfax	760	Richmond city	41	Chesterfield
610	Falls Church city	59	Fairfax	760	Richmond city	87	Henrico
620	Franklin city	175	Southampton	770	Roanoke city	161	Roanoke
630	Fredericksburg city	177	Spotsylvania	775	Salem city	161	Roanoke
640	Galax city	35	Carroll	780	South Boston city	83	Halifax
640	Galax city	77	Grayson	790	Staunton city	15	Augusta
660	Harrisonburg city	165	Rockingham	820	Waynesboro city	15	Augusta
670	Hopewell city	149	Prince George	830	Williamsburg city	95	County of James City
678	Lexington city	163	Rockbridge	840	Winchester city	69	Frederick
680	Lynchburg city	31	Campbell				

State Code: 53 **State Name:** Washington **State Abbreviation:** WA **Region/Station Code:** 26

Survey Unit Code: 5 **Survey Unit Name**: Puget Sound

County code and county name							
29	Island	35	Kitsap	55	San Juan	61	Snohomish
33	King	53	Pierce	57	Skagit	73	Whatcom

Survey Unit Code: 6 **Survey Unit Name**: Olympic Peninsula

County code and county name					
9	Clallam	31	Jefferson	67	Thurston
27	Grays Harbor	45	Mason		

Survey Unit Code: 7 **Survey Unit Name**: Southwest

County code and county name					
11	Clark	41	Lewis	59	Skamania
15	Cowlitz	49	Pacific	69	Wahkiakum

Survey Unit Code: 8 **Survey Unit Name**: Central

County code and county name					
7	Chelan	37	Kittitas	47	Okanogan
17	Douglas	39	Klickitat	77	Yakima

Survey Unit Code: 9 **Survey Unit Name**: Inland Empire

County code and county name							
1	Adams	19	Ferry	43	Lincoln	71	Walla Walla
3	Asotin	21	Franklin	51	Pend Oreille	75	Whitman
5	Benton	23	Garfield	63	Spokane		
13	Columbia	25	Grant	65	Stevens		

State Code: 54 **State Name:** West Virginia **State Abbreviation:** WV **Region/Station Code:** 24

Survey Unit Code: 2 **Survey Unit Name**: Northeastern

County code and county name

1	Barbour	31	Hardy	65	Morgan	91	Taylor
3	Berkeley	33	Harrison	71	Pendleton	93	Tucker
7	Braxton	37	Jefferson	75	Pocahontas	97	Upshur
23	Grant	41	Lewis	77	Preston	101	Webster
27	Hampshire	57	Mineral	83	Randolph		

Survey Unit Code: 3 **Survey Unit Name**: Southern

County code and county name

5	Boone	39	Kanawha	59	Mingo	89	Summers
15	Clay	45	Logan	63	Monroe	109	Wyoming
19	Fayette	47	McDowell	67	Nicholas		
25	Greenbrier	55	Mercer	81	Raleigh		

Survey Unit Code: 4 **Survey Unit Name**: Northwestern

County code and county name

9	Brooke	35	Jackson	69	Ohio	99	Wayne
11	Cabell	43	Lincoln	73	Pleasants	103	Wetzel
13	Calhoun	49	Marion	79	Putnam	105	Wirt
17	Doddridge	51	Marshall	85	Ritchie	107	Wood
21	Gilmer	53	Mason	87	Roane		
29	Hancock	61	Monongalia	95	Tyler		

State Code: 55 **State Name:** Wisconsin **State Abbreviation:** WI **Region/Station Code:** 23

Survey Unit Code: 1 **Survey Unit Name**: Northeastern

County code and county name							
37	Florence	69	Lincoln	83	Oconto	125	Vilas
41	Forest	75	Marinette	85	Oneida		
67	Langlade	78	Menominee	115	Shawano		

Survey Unit Code: 2 **Survey Unit Name**: Northwestern

County code and county name							
3	Ashland	13	Burnett	95	Polk	113	Sawyer
5	Barron	31	Douglas	99	Price	119	Taylor
7	Bayfield	51	Iron	107	Rusk	129	Washburn

Survey Unit Code: 3 **Survey Unit Name**: Central

County code and county name							
1	Adams	53	Jackson	81	Monroe	141	Wood
17	Chippewa	57	Juneau	97	Portage		
19	Clark	73	Marathon	135	Waupaca		
35	Eau Claire	77	Marquette	137	Waushara		

Survey Unit Code: 4 **Survey Unit Name**: Southwestern

County code and county name							
11	Buffalo	49	Iowa	93	Pierce	121	Trempealeau
23	Crawford	63	La Crosse	103	Richland	123	Vernon
33	Dunn	65	Lafayette	109	St. Croix		
43	Grant	91	Pepin	111	Sauk		

Survey Unit Code: 5 **Survey Unit Name**: Southeastern

County code and county name							
9	Brown	39	Fond du Lac	71	Manitowoc	117	Sheboygan
15	Calumet	45	Green	79	Milwaukee	127	Walworth
21	Columbia	47	Green Lake	87	Outagamie	131	Washington
25	Dane	55	Jefferson	89	Ozaukee	133	Waukesha
27	Dodge	59	Kenosha	101	Racine	139	Winnebago
29	Door	61	Kewaunee	105	Rock		

State Code: 56 **State Name:** Wyoming **State Abbreviation:** WY **Region/Station Code:** 22

Survey Unit Code: 1 **Survey Unit Name**: Western

County code and county name							
13	Fremont	23	Lincoln	35	Sublette	39	Teton
17	Hot Springs	29	Park	37	Sweetwater	41	Uinta

Survey Unit Code: 2 **Survey Unit Name**: Central and Southeastern

County code and county name							
1	Albany	9	Converse	21	Laramie	31	Platte
3	Big Horn	15	Goshen	25	Natrona	33	Sheridan
7	Carbon	19	Johnson	27	Niobrara	43	Washakie

Survey Unit Code: 3 **Survey Unit Name**: Northeastern

County code and county name					
5	Campbell	11	Crook	45	Weston

State Code: 60 **State Name:** American Samoa **State Abbreviation:** AS **Region/Station Code:** 26

Survey Unit Code: 1 **Survey Unit Name**: American Samoa

County code and county name					
10	Tutuila East	30	Rose	50	Tutuila West
20	Manu'a	40	Swains		

State Code: 64 **State Name:** Federated States of Micronesia **State Abbreviation:** FM **Region/Station Code:** 26

Survey Unit Code: 1 **Survey Unit Name**: Federated States of Micronesia

County code and county name							
2	Chuuk	5	Kosrae	40	Pohnpei	60	Yap

State Code: 66 **State Name:** Guam **State Abbreviation:** GU **Region/Station Code:** 26

Survey Unit Code: 1 **Survey Unit Name**: Guam

County code and county name	
10	Guam

State Code: 68 **State Name:** Marshall Islands **State Abbreviation:** MH **Region/Station Code:** 26

Survey Unit Code: 1 **Survey Unit Name**: Marshall Islands

County code and county name							
7	Ailinginae	90	Enewetak	170	Lib	350	Rongelap
10	Ailinglaplap	100	Erikub	180	Likiep	360	Rongrik
30	Ailuk	110	Jabat	190	Majuro	385	Toke
40	Arno	120	Jaluit	300	Maloelap	390	Ujae
50	Aur	130	Jemo	310	Mejit	400	Ujelang
60	Bikar	140	Kili	320	Mili	410	Utrik
70	Bikini	150	Kwajalein	330	Namorik	420	Wotho
73	Bokak	160	Lae	340	Namu	430	Wotje
80	Ebon						

State Code: 69 **State Name:** Northern Mariana Islands **State Abbreviation:** MP **Region/Station Code:** 26

Survey Unit Code: 1 **Survey Unit Name**: Northern Mariana Islands

County code and county name							
85	Northern Islands	100	Rota	110	Saipan	120	Tinian

State Code: 70 **State Name:** Palau **State Abbreviation:** PW **Region/Station Code:** 26

Survey Unit Code: 1 **Survey Unit Name**: Palau

County code and county name							
2	Aimeliik	100	Kayangel	218	Ngarchelong	227	Ngernmlengui
4	Airai	150	Koror	222	Ngardmau	228	Ngiwal
10	Angaur	212	Melekeok	224	Ngatpang	350	Peleliu
50	Hatoboheit	214	Ngaraard	226	Ngchesar	370	Sonsorol

State Code: 72[a] **State Name:** Puerto Rico **State Abbreviation:** PR **Region/Station Code:** 33

Survey Unit Code: 1 **Survey Unit Name**: Mainland Puerto Rico

County code and county name							
1	Adjuntas	39	Ciales	77	Juncos	115	Quebradillas
3	Aguada	41	Cidra	79	Lajas	117	Rincón
5	Aguadilla	43	Coamo	81	Lares	119	Río Grande
7	Aguas Buenas	45	Comerío	83	Las Marías	121	Sabana Grande
9	Aibonito	47	Corozal	85	Las Piedras	123	Salinas
11	Añasco	51	Dorado	87	Loiza	125	San Germán
13	Arecibo	53	Fajardo	89	Luquillo	127	San Juan
15	Arroyo	54	Florida	91	Manatí	129	San Lorenzo
17	Barceloneta	55	Guánica	93	Maricao	131	San Sebastián
19	Barranquitas	57	Guayama	95	Maunabo	133	Santa Isabel
21	Bayamón	59	Guayanilla	97	Mayagüez[b]	135	Toa Alta
23	Cabo Rojo	61	Guaynabo	99	Moca	137	Toa Baja
25	Caguas	63	Gurabo	101	Morovis	139	Trujillo Alto
27	Camuy	65	Hatillo	103	Naguabo	141	Utuado
29	Canóvanas	67	Hormigueros	105	Naranjito	143	Vega Alta
31	Carolina	69	Humacao	107	Orocovis	145	Vega Baja
33	Cataño	71	Isabela Municipio	109	Patillas	149	Villalba
35	Cayey	73	Jayuya	111	Peñuelas	151	Yabucoa
37	Ceiba	75	Juana Díaz	113	Ponce	153	Yauco

Survey Unit Code: 2 **Survey Unit Name**: Vieques

County code and county name	
147	Vieques

Survey Unit Code: 3 **Survey Unit Name**: Culebra

County code and county name	
49	Culebra

[a]FIA estimates of Puerto Rico do not include the small outlying islands such as Desecheo, Caja de Muertos, etc.
[b]Mona Island is split from Mayagüez County (97) as a separate estimation unit for stratification. However, Mona Island is not a separate FIA survey unit because it is not a separate county (municipio); it is part of Mayagüez County.

State Code: 78 **State Name:** U.S. Virgin Islands **State Abbreviation:** VI **Region/Station Code:** 33

Survey Unit Code: 1 **Survey Unit Name**: St. Croix Island

County code and county name
10 St. Croix Island

Survey Unit Code: 2 **Survey Unit Name**: St. John Island

County code and county name
20 St. John Island

Survey Unit Code: 3 **Survey Unit Name**: St. Thomas Island

County code and county name
30 St. Thomas Island

Appendix C. Tree Species Group Codes

Region and class	Species group name	Code
Eastern softwood	Longleaf and slash pines	1
Eastern softwood	Loblolly and shortleaf pines	2
Eastern softwood	Other yellow pines	3
Eastern softwood	Eastern white and red pines	4
Eastern softwood	Jack pine	5
Eastern softwood	Spruce and balsam fir	6
Eastern softwood	Eastern hemlock	7
Eastern softwood	Cypress	8
Eastern softwood	Other eastern softwoods	9
Western softwood	Douglas-fir	10
Western softwood	Ponderosa and Jeffrey pines	11
Western softwood	True fir	12
Western softwood	Western hemlock	13
Western softwood	Sugar pine	14
Western softwood	Western white pine	15
Western softwood	Redwood	16
Western softwood	Sitka spruce	17
Western softwood	Engelmann and other spruces	18
Western softwood	Western larch	19
Western softwood	Incense-cedar	20
Western softwood	Lodgepole pine	21
Western softwood	Western redcedar	22
Western softwood	Woodland softwoods	23
Western softwood	Other western softwoods	24
Eastern hardwoods	Select white oaks	25
Eastern hardwoods	Select red oaks	26
Eastern hardwoods	Other white oaks	27
Eastern hardwoods	Other red oaks	28
Eastern hardwoods	Hickory	29
Eastern hardwoods	Yellow birch	30
Eastern hardwoods	Hard maple	31
Eastern hardwoods	Soft maple	32
Eastern hardwoods	Beech	33
Eastern hardwoods	Sweetgum	34
Eastern hardwoods	Tupelo and blackgum	35
Eastern hardwoods	Ash	36
Eastern hardwoods	Cottonwood and aspen	37
Eastern hardwoods	Basswood	38
Eastern hardwoods	Yellow-poplar	39
Eastern hardwoods	Black walnut	40
Eastern hardwoods	Other eastern soft hardwoods	41
Eastern hardwoods	Other eastern hard hardwoods	42
Eastern hardwoods	Eastern noncommercial hardwoods	43
Western hardwoods	Cottonwood and aspen	44
Western hardwoods	Red alder	45
Western hardwoods	Oak	46
Western hardwoods	Other western hardwoods	47
Western hardwoods	Woodland hardwoods	48

Region and class	Species group name	Code
Tropical and subtropical species	Tropical and subtropical pines	51
Tropical and subtropical species	Other tropical and subtropical softwoods	52
Tropical and subtropical species	Tropical and subtropical palms	53
Tropical and subtropical species	Tropical and subtropical hardwoods	54
All hardwoods	Urban-specific hardwoods	55
All softwoods	Urban-specific softwoods	56

Appendix D. Tree Species Codes and Names

Major groups (MAJOR_SPGRPCD) are (1) pines, (2) other softwoods, (3) soft hardwoods, and (4) hard hardwoods. The 48 species groups (E_SPGRPD and W_SPGRPCD) can be found in appendix C.

SPCD	Common name	Scientific name	Species Symbol	E_SPGRCD	W_SPGRPCD	MAJOR_ SPGRPCD
10	fir spp.	Abies spp.	ABIES	6	12	2
11	Pacific silver fir	Abies amabilis	ABAM	9	12	2
12	balsam fir	Abies balsamea	ABBA	6	12	2
14	Santa Lucia or bristlecone fir	Abies bracteata	ABBR	9	12	2
15	white fir	Abies concolor	ABCO	9	12	2
16	Fraser fir	Abies fraseri	ABFR	9	12	2
17	grand fir	Abies grandis	ABGR	9	12	2
18	corkbark fir	Abies lasiocarpa var. arizonica	ABLAA	9	12	2
19	subalpine fir	Abies lasiocarpa	ABLA	9	12	2
20	California red fir	Abies magnifica	ABMA	9	12	2
21	Shasta red fir	Abies shastensis	ABSH	9	12	2
22	noble fir	Abies procera	ABPR	9	12	2
40	white-cedar spp.	Chamaecyparis spp.	CHAMA4	9	24	2
41	Port-Orford-cedar	Chamaecyparis lawsoniana	CHLA	9	24	2
42	Alaska yellow-cedar	Chamaecyparis nootkatensis	CHNO	9	24	2
43	Atlantic white-cedar	Chamaecyparis thyoides	CHTH2	9	24	2
50	cypress	Cupressus spp.	CUPRE	9	24	2
51	Arizona cypress	Cupressus arizonica	CUAR	9	24	2
52	Baker or Modoc cypress	Cupressus bakeri	CUBA	9	24	2
53	Tecate cypress	Cupressus forbesii	CUFO2	9	24	2
54	Monterey cypress	Cupressus macrocarpa	CUMA2	9	24	2
55	Sargent's cypress	Cupressus sargentii	CUSA3	9	24	2
56	MacNab's cypress	Cupressus macnabiana	CUMA	9	24	2
57	redcedar/juniper spp.	Juniperus spp.	JUNIP	9	23	2
58	Pinchot juniper	Juniperus pinchotii	JUPI	23	23	2
59	redberry juniper	Juniperus coahuilensis	JUCO11	23	23	2
60	Drooping juniper	Juniperus flaccida	JUFL	23	23	2
61	Ashe juniper	Juniperus ashei	JUAS	23	23	2
62	California juniper	Juniperus californica	JUCA7	23	23	2
63	alligator juniper	Juniperus deppeana	JUDE2	23	23	2
64	western juniper	Juniperus occidentalis	JUOC	9	24	2
65	Utah juniper	Juniperus osteosperma	JUOS	23	23	2
66	Rocky Mountain juniper	Juniperus scopulorum	JUSC2	23	23	2
67	southern redcedar	Juniperus virginiana var. silicicola	JUVIS	9	24	2
68	eastern redcedar	Juniperus virginiana	JUVI	9	24	2
69	oneseed juniper	Juniperus monosperma	JUMO	23	23	2
70	larch spp.	Larix spp.	LARIX	9	24	2
71	tamarack (native)	Larix laricina	LALA	9	24	2
72	subalpine larch	Larix lyallii	LALY	9	24	2
73	western larch	Larix occidentalis	LAOC	9	19	2
81	incense-cedar	Calocedrus decurrens	CADE27	9	20	2
90	spruce spp.	Picea spp.	PICEA	6	18	2
91	Norway spruce	Picea abies	PIAB	9	18	2
92	Brewer spruce	Picea breweriana	PIBR	9	18	2
93	Engelmann spruce	Picea engelmannii	PIEN	9	18	2
94	white spruce	Picea glauca	PIGL	6	18	2
95	black spruce	Picea mariana	PIMA	6	18	2
96	blue spruce	Picea pungens	PIPU	9	18	2
97	red spruce	Picea rubens	PIRU	6	18	2
98	Sitka spruce	Picea sitchensis	PISI	9	17	2
100	pine spp.	Pinus spp.	PINUS	9	24	1

SPCD	Common name	Scientific name	Species Symbol	E_SPGRCD	W_SPGRPCD	MAJOR_ SPGRPCD
101	whitebark pine	Pinus albicaulis	PIAL	9	24	1
102	Rocky Mountain bristlecone pine	Pinus aristata	PIAR	9	24	1
103	knobcone pine	Pinus attenuata	PIAT	9	24	1
104	foxtail pine	Pinus balfouriana	PIBA	9	24	1
105	jack pine	Pinus banksiana	PIBA2	5	24	1
106	common or two-needle pinyon	Pinus edulis	PIED	23	23	1
107	sand pine	Pinus clausa	PICL	3	24	1
108	lodgepole pine	Pinus contorta	PICO	9	21	1
109	Coulter pine	Pinus coulteri	PICO3	9	24	1
110	shortleaf pine	Pinus echinata	PIEC2	2	24	1
111	slash pine	Pinus elliottii	PIEL	1	24	1
112	Apache pine	Pinus engelmannii	PIEN2	9	24	1
113	limber pine	Pinus flexilis	PIFL2	9	24	1
114	southwestern white pine	Pinus strobiformis	PIST3	9	24	1
115	spruce pine	Pinus glabra	PIGL2	3	24	1
116	Jeffrey pine	Pinus jeffreyi	PIJE	9	11	1
117	sugar pine	Pinus lambertiana	PILA	9	14	1
118	Chihuahuan pine	Pinus leiophylla	PILE	9	24	1
119	western white pine	Pinus monticola	PIMO3	9	15	1
120	bishop pine	Pinus muricata	PIMU	9	24	1
121	longleaf pine	Pinus palustris	PIPA2	1	24	1
122	ponderosa pine	Pinus ponderosa	PIPO	9	11	1
123	Table Mountain pine	Pinus pungens	PIPU5	3	24	1
124	Monterey pine	Pinus radiata	PIRA2	9	24	1
125	red pine	Pinus resinosa	PIRE	4	24	1
126	pitch pine	Pinus rigida	PIRI	3	24	1
127	gray or California foothill pine	Pinus sabiniana	PISA2	9	24	1
128	pond pine	Pinus serotina	PISE	3	24	1
129	eastern white pine	Pinus strobus	PIST	4	24	1
130	Scotch pine	Pinus sylvestris	PISY	3	24	1
131	loblolly pine	Pinus taeda	PITA	2	24	1
132	Virginia pine	Pinus virginiana	PIVI2	3	24	1
133	singleleaf pinyon	Pinus monophylla	PIMO	23	23	1
134	border pinyon	Pinus discolor	PIDI3	23	23	1
135	Arizona pine	Pinus arizonica	PIAR5	9	11	1
136	Austrian pine	Pinus nigra	PINI	9	24	1
137	Washoe pine	Pinus washoensis	PIWA	9	24	1
138	four-leaf or Parry pinyon pine	Pinus quadrifolia	PIQU	23	23	1
139	Torrey pine	Pinus torreyana	PITO	9	24	1
140	Mexican pinyon pine	Pinus cembroides	PICE	23	23	1
141	Papershell pinyon pine	Pinus remota	PIRE5	23	23	1
142	Great Basin bristlecone pine	Pinus longaeva	PILO	9	24	1
143	Arizona pinyon pine	Pinus monophylla var. fallax	PIMOF	23	23	1
144	Honduras pine	Pinus elliottii var. elliottii	PIELE2	9	24	1
200	Douglas-fir spp.	Pseudotsuga spp.	PSEUD7	9	10	2
201	bigcone Douglas-fir	Pseudotsuga macrocarpa	PSMA	9	10	2
202	Douglas-fir	Pseudotsuga menziesii	PSME	9	10	2
211	redwood	Sequoia sempervirens	SESE3	9	16	2
212	giant sequoia	Sequoiadendron giganteum	SEGI2	9	24	2
220	baldcypress spp.	Taxodium spp.	TAXOD	9	24	2
221	baldcypress	Taxodium distichum	TADI2	8	24	2
222	pondcypress	Taxodium ascendens	TAAS	8	24	2
223	Montezuma baldcypress	Taxodium mucronatum	TAMU	8	24	2
230	yew spp.	Taxus spp.	TAXUS	9	24	2

SPCD	Common name	Scientific name	Species Symbol	E_SPGRCD	W_SPGRPCD	MAJOR_ SPGRPCD
231	Pacific yew	Taxus brevifolia	TABR2	9	24	2
232	Florida yew	Taxus floridana	TAFL	9	24	2
240	thuja spp.	Thuja spp.	THUJA	9	24	2
241	northern white-cedar	Thuja occidentalis	THOC2	9	24	2
242	western redcedar	Thuja plicata	THPL	9	22	2
250	torreya (nutmeg) spp.	Torreya spp.	TORRE	9	24	2
251	California torreya (nutmeg)	Torreya californica	TOCA	9	24	2
252	Florida torreya (nutmeg)	Torreya taxifolia	TOTA	9	24	2
260	hemlock spp.	Tsuga spp.	TSUGA	7	24	2
261	eastern hemlock	Tsuga canadensis	TSCA	7	24	2
262	Carolina hemlock	Tsuga caroliniana	TSCA2	7	24	2
263	western hemlock	Tsuga heterophylla	TSHE	9	13	2
264	mountain hemlock	Tsuga mertensiana	TSME	9	24	2
299	Unknown dead conifer	Tree evergreen	2TE	9	24	2
300	acacia spp.	Acacia spp.	ACACI	48	48	3
303	sweet acacia	Acacia farnesiana	ACFA	48	48	3
304	catclaw acacia	Acacia greggii	ACGR	48	48	3
310	maple spp.	Acer spp.	ACER	31	47	4
311	Florida maple	Acer barbatum	ACBA3	31	47	4
312	bigleaf maple	Acer macrophyllum	ACMA3	43	47	3
313	boxelder	Acer negundo	ACNE2	41	47	3
314	black maple	Acer nigrum	ACNI5	31	47	4
315	striped maple	Acer pensylvanicum	ACPE	43	47	3
316	red maple	Acer rubrum	ACRU	32	47	3
317	silver maple	Acer saccharinum	ACSA2	32	47	3
318	sugar maple	Acer saccharum	ACSA3	31	47	4
319	mountain maple	Acer spicatum	ACSP2	43	47	4
320	Norway maple	Acer platanoides	ACPL	31	47	4
321	Rocky Mountain maple	Acer glabrum	ACGL	48	48	4
322	bigtooth maple	Acer grandidentatum	ACGR3	48	48	4
323	chalk maple	Acer leucoderme	ACLE	31	47	4
330	buckeye, horsechestnut spp.	Aesculus spp.	AESCU	41	47	3
331	Ohio buckeye	Aesculus glabra	AEGL	41	47	3
332	yellow buckeye	Aesculus flava	AEFL	43	47	3
333	California buckeye	Aesculus californica	AECA	41	47	3
334	Texas buckeye	Aesculus glabra var. arguta	AEGLA	41	47	3
336	red buckeye	Aesculus pavia	AEPA	43	47	3
337	painted buckeye	Aesculus sylvatica	AESY	41	47	3
341	ailanthus	Ailanthus altissima	AIAL	43	47	4
345	mimosa, silktree	Albizia julibrissin	ALJU	43	47	3
350	alder spp.	Alnus spp.	ALNUS	41	47	3
351	red alder	Alnus rubra	ALRU2	43	45	3
352	white alder	Alnus rhombifolia	ALRH2	43	47	3
353	Arizona alder	Alnus oblongifolia	ALOB2	43	47	3
355	European alder	Alnus glutinosa	ALGL2	43	47	3
356	serviceberry spp.	Amelanchier spp.	AMELA	43	47	4
357	common serviceberry	Amelanchier arborea	AMAR3	43	47	4
358	roundleaf serviceberry	Amelanchier sanguinea	AMSA	43	47	4
360	madrone spp.	Arbutus spp.	ARBUT	43	47	4
361	Pacific madrone	Arbutus menziesii	ARME	43	47	4
362	Arizona madrone	Arbutus arizonica	ARAR2	43	47	4
363	Texas madrone	Arbutus xalapensis	ARXA80	48	48	4
367	pawpaw	Asimina triloba	ASTR	43	47	3
370	birch spp.	Betula spp.	BETUL	41	47	4
371	yellow birch	Betula alleghaniensis	BEAL2	30	47	4
372	sweet birch	Betula lenta	BELE	42	47	4

SPCD	Common name	Scientific name	Species Symbol	E_SPGRCD	W_SPGRPCD	MAJOR_ SPGRPCD
373	river birch	Betula nigra	BENI	41	47	3
374	water birch	Betula occidentalis	BEOC2	41	47	3
375	paper birch	Betula papyrifera	BEPA	41	47	3
377	Virginia roundleaf birch	Betula uber	BEUB	41	47	3
378	northwestern paper birch	Betula x utahensis	BEUT	43	47	3
379	gray birch	Betula populifolia	BEPO	41	47	3
381	chittamwood, gum bumelia	Sideroxylon lanuginosum ssp. lanuginosum	SILAL3	43	47	4
391	American hornbeam, musclewood	Carpinus caroliniana	CACA18	43	47	4
400	hickory spp.	Carya spp.	CARYA	29	47	4
401	water hickory	Carya aquatica	CAAQ2	29	47	4
402	bitternut hickory	Carya cordiformis	CACO15	29	47	4
403	pignut hickory	Carya glabra	CAGL8	29	47	4
404	pecan	Carya illinoinensis	CAIL2	29	47	4
405	shellbark hickory	Carya laciniosa	CALA21	29	47	4
406	nutmeg hickory	Carya myristiciformis	CAMY	29	47	4
407	shagbark hickory	Carya ovata	CAOV2	29	47	4
408	black hickory	Carya texana	CATE9	29	47	4
409	mockernut hickory	Carya alba	CAAL27	29	47	4
410	sand hickory	Carya pallida	CAPA24	29	47	4
411	scrub hickory	Carya floridana	CAFL6	29	47	4
412	red hickory	Carya ovalis	CAOV3	29	47	4
413	southern shagbark hickory	Carya carolinae-septentrionalis	CACA38	29	47	4
420	chestnut spp.	Castanea spp.	CASTA	43	47	3
421	American chestnut	Castanea dentata	CADE12	43	47	3
422	Allegheny chinkapin	Castanea pumila	CAPU9	43	47	3
423	Ozark chinkapin	Castanea pumila var. ozarkensis	CAPUO	43	47	3
424	Chinese chestnut	Castanea mollissima	CAMO83	43	47	3
431	giant chinkapin, golden chinkapin	Chrysolepis chrysophylla var. chrysophylla	CHCHC4	43	47	3
450	catalpa spp.	Catalpa spp.	CATAL	42	47	4
451	southern catalpa	Catalpa bignonioides	CABI8	43	47	4
452	northern catalpa	Catalpa speciosa	CASP8	41	47	3
460	hackberry spp.	Celtis spp.	CELTI	41	47	3
461	sugarberry	Celtis laevigata	CELA	41	47	3
462	hackberry	Celtis occidentalis	CEOC	41	47	3
463	netleaf hackberry	Celtis laevigata var. reticulata	CELAR	41	47	3
471	eastern redbud	Cercis canadensis	CECA4	43	47	3
475	curlleaf mountain-mahogany	Cercocarpus ledifolius	CELE3	48	48	4
481	yellowwood	Cladrastis kentukea	CLKE	43	47	4
490	dogwood spp.	Cornus spp.	CORNU	43	47	4
491	flowering dogwood	Cornus florida	COFL2	42	47	4
492	Pacific dogwood	Cornus nuttallii	CONU4	43	47	4
500	hawthorn spp.	Crataegus spp.	CRATA	43	47	4
501	cockspur hawthorn	Crataegus crus-galli	CRCR2	43	47	4
502	downy hawthorn	Crataegus mollis	CRMO2	43	47	4
503	Brainerd's hawthorn	Crataegus brainerdii	CRBR3	43	47	4
504	pear hawthorn	Crataegus calpodendron	CRCA	43	47	4
505	fireberry hawthorn	Crataegus chrysocarpa	CRCH	43	47	4
506	broadleaf hawthorn	Crataegus dilatata	CRDI	43	47	4
507	fanleaf hawthorn	Crataegus flabellata	CRFL	43	47	4
508	oneseed hawthorn	Crataegus monogyna	CRMO3	43	47	4
509	scarlet hawthorn	Crataegus pedicellata	CRPE	43	47	4
510	eucalyptus spp.	Eucalyptus spp.	EUCAL	42	47	4
511	Tasmanian bluegum	Eucalyptus globulus	EUGL	43	47	4

SPCD	Common name	Scientific name	Species Symbol	E_SPGRCD	W_SPGRPCD	MAJOR_ SPGRPCD
512	river redgum	Eucalyptus camaldulensis	EUCA2	43	47	4
513	grand eucalyptus	Eucalyptus grandis	EUGR12	43	47	4
514	swampmahogany	Eucalyptus robusta	EURO2	43	47	4
520	persimmon spp.	Diospyros spp.	DIOSP	43	47	4
521	common persimmon	Diospyros virginiana	DIVI5	42	47	4
522	Texas persimmon	Diospyros texana	DITE3	43	47	4
523	Anacua knockaway	Ehretia anacua	EHAN	48	48	3
531	American beech	Fagus grandifolia	FAGR	33	47	4
540	ash spp.	Fraxinus spp.	FRAXI	36	47	3
541	white ash	Fraxinus americana	FRAM2	36	47	4
542	Oregon ash	Fraxinus latifolia	FRLA	43	47	4
543	black ash	Fraxinus nigra	FRNI	36	47	3
544	green ash	Fraxinus pennsylvanica	FRPE	36	47	4
545	pumpkin ash	Fraxinus profunda	FRPR	36	47	3
546	blue ash	Fraxinus quadrangulata	FRQU	36	47	4
547	velvet ash	Fraxinus velutina	FRVE2	43	47	4
548	Carolina ash	Fraxinus caroliniana	FRCA3	36	47	4
549	Texas ash	Fraxinus texensis	FRTE	36	47	3
550	honeylocust spp.	Gleditsia spp.	GLEDI	42	47	4
551	waterlocust	Gleditsia aquatica	GLAQ	42	47	4
552	honeylocust	Gleditsia triacanthos	GLTR	42	47	4
555	loblolly-bay	Gordonia lasianthus	GOLA	41	47	3
561	ginkgo, maidenhair tree	Ginkgo biloba	GIBI2	43	47	3
571	Kentucky coffeetree	Gymnocladus dioicus	GYDI	42	47	4
580	silverbell spp.	Halesia spp.	HALES	43	47	3
581	Carolina silverbell	Halesia carolina	HACA3	41	47	3
582	two-wing silverbell	Halesia diptera	HADI3	41	47	3
583	little silverbell	Halesia parviflora	HAPA2	41	47	3
591	American holly	Ilex opaca	ILOP	42	47	4
600	walnut spp.	Juglans spp.	JUGLA	41	47	4
601	butternut	Juglans cinerea	JUCI	41	47	3
602	black walnut	Juglans nigra	JUNI	40	47	4
603	northern California black walnut	Juglans hindsii	JUHI	43	47	4
604	southern California black walnut	Juglans californica	JUCA	43	47	4
605	Texas walnut	Juglans microcarpa	JUMI	41	47	4
606	Arizona walnut	Juglans major	JUMA	43	47	4
611	sweetgum	Liquidambar styraciflua	LIST2	34	47	3
621	yellow-poplar	Liriodendron tulipifera	LITU	39	47	3
631	tanoak	Lithocarpus densiflorus	LIDE3	43	47	4
641	Osage-orange	Maclura pomifera	MAPO	43	47	4
650	magnolia spp.	Magnolia spp.	MAGNO	41	47	3
651	cucumbertree	Magnolia acuminata	MAAC	41	47	3
652	southern magnolia	Magnolia grandiflora	MAGR4	41	47	3
653	sweetbay	Magnolia virginiana	MAVI2	43	47	3
654	bigleaf magnolia	Magnolia macrophylla	MAMA2	43	47	4
655	mountain or Fraser magnolia	Magnolia fraseri	MAFR	41	47	3
657	pyramid magnolia	Magnolia pyramidata	MAPY	41	47	3
658	umbrella magnolia	Magnolia tripetala	MATR	41	47	3
660	apple spp.	Malus spp.	MALUS	43	47	4
661	Oregon crab apple	Malus fusca	MAFU	43	47	4
662	southern crab apple	Malus angustifolia	MAAN3	43	47	4
663	sweet crab apple	Malus coronaria	MACO5	43	47	4
664	prairie crab apple	Malus ioensis	MAIO	43	47	4
680	mulberry spp.	Morus spp.	MORUS	42	47	4

SPCD	Common name	Scientific name	Species Symbol	E_SPGRCD	W_SPGRPCD	MAJOR_ SPGRPCD
681	white mulberry	Morus alba	MOAL	42	47	4
682	red mulberry	Morus rubra	MORU2	42	47	4
683	Texas mulberry	Morus microphylla	MOMI	42	47	4
684	black mulberry	Morus nigra	MONI	43	47	4
690	tupelo spp.	Nyssa spp.	NYSSA	35	47	3
691	water tupelo	Nyssa aquatica	NYAQ2	35	47	3
692	Ogeechee tupelo	Nyssa ogeche	NYOG	43	47	4
693	blackgum	Nyssa sylvatica	NYSY	35	47	3
694	swamp tupelo	Nyssa biflora	NYBI	35	47	3
701	eastern hophornbeam	Ostrya virginiana	OSVI	43	47	4
711	sourwood	Oxydendrum arboreum	OXAR	43	47	4
712	paulownia, empress-tree	Paulownia tomentosa	PATO2	41	47	3
715	Maytenus palauica	Maytenus palauica	MAPA28	54	54	3
718	kesiamel	Osmoxylon truncatum	OSTR	54	54	3
720	bay spp.	Persea spp.	PERSE	43	47	3
721	redbay	Persea borbonia	PEBO	41	47	3
722	water-elm, planertree	Planera aquatica	PLAQ	43	47	3
729	sycamore spp.	Platanus spp.	PLATA	41	47	3
730	California sycamore	Platanus racemosa	PLRA	43	47	3
731	American sycamore	Platanus occidentalis	PLOC	41	47	3
732	Arizona sycamore	Platanus wrightii	PLWR2	41	47	3
740	cottonwood and poplar spp.	Populus spp.	POPUL	37	44	3
741	balsam poplar	Populus balsamifera	POBA2	37	44	3
742	eastern cottonwood	Populus deltoides	PODE3	37	44	3
743	bigtooth aspen	Populus grandidentata	POGR4	37	44	3
744	swamp cottonwood	Populus heterophylla	POHE4	37	44	3
745	plains cottonwood	Populus deltoides ssp. monilifera	PODEM	37	44	3
746	quaking aspen	Populus tremuloides	POTR5	37	44	3
747	black cottonwood	Populus balsamifera spp. trichocarpa	POBAT	37	44	4
748	Fremont cottonwood	Populus fremontii	POFR2	37	44	4
749	narrowleaf cottonwood	Populus angustifolia	POAN3	37	44	3
752	silver poplar	Populus alba	POAL7	37	44	3
753	Lombardy poplar	Populus nigra	PONI	37	44	3
755	mesquite spp.	Prosopis spp.	PROSO	48	48	4
756	honey mesquite	Prosopis glandulosa	PRGL2	48	48	4
757	velvet mesquite	Prosopis velutina	PRVE	48	48	4
758	screwbean mesquite	Prosopis pubescens	PRPU	48	48	4
760	cherry and plum spp.	Prunus spp.	PRUNU	43	47	4
761	pin cherry	Prunus pensylvanica	PRPE2	43	47	3
762	black cherry	Prunus serotina	PRSE2	41	47	3
763	chokecherry	Prunus virginiana	PRVI	43	47	4
764	peach	Prunus persica	PRPE3	43	47	3
765	Canada plum	Prunus nigra	PRNI	43	47	4
766	American plum	Prunus americana	PRAM	43	47	4
768	bitter cherry	Prunus emarginata	PREM	43	47	4
769	Allegheny plum	Prunus alleghaniensis	PRAL5	43	47	3
770	Chickasaw plum	Prunus angustifolia	PRAN3	43	47	3
771	sweet cherry, domesticated	Prunus avium	PRAV	43	47	3
772	sour cherry, domesticated	Prunus cerasus	PRCE	43	47	3
773	European plum, domesticated	Prunus domestica	PRDO	43	47	3
774	Mahaleb cherry, domesticated	Prunus mahaleb	PRMA	43	47	3
800	oak spp.	Quercus spp.	QUERC	42	48	4
801	California live oak	Quercus agrifolia	QUAG	43	46	4
802	white oak	Quercus alba	QUAL	25	47	4

SPCD	Common name	Scientific name	Species Symbol	E_SPGRCD	W_SPGRPCD	MAJOR_ SPGRPCD
803	Arizona white oak	Quercus arizonica	QUAR	48	48	4
804	swamp white oak	Quercus bicolor	QUBI	25	47	4
805	canyon live oak	Quercus chrysolepis	QUCH2	43	46	4
806	scarlet oak	Quercus coccinea	QUCO2	28	47	4
807	blue oak	Quercus douglasii	QUDO	43	46	4
808	Durand oak	Quercus sinuata var. sinuata	QUSIS	25	47	4
809	northern pin oak	Quercus ellipsoidalis	QUEL	28	47	4
810	Emory oak	Quercus emoryi	QUEM	48	48	4
811	Engelmann oak	Quercus engelmannii	QUEN	43	46	4
812	southern red oak	Quercus falcata	QUFA	28	47	4
813	cherrybark oak	Quercus pagoda	QUPA5	26	47	4
814	Gambel oak	Quercus gambelii	QUGA	48	48	4
815	Oregon white oak	Quercus garryana	QUGA4	43	46	4
816	scrub oak	Quercus ilicifolia	QUIL	43	47	4
817	shingle oak	Quercus imbricaria	QUIM	28	47	4
818	California black oak	Quercus kelloggii	QUKE	43	46	4
819	turkey oak	Quercus laevis	QULA2	43	47	4
820	laurel oak	Quercus laurifolia	QULA3	28	47	4
821	California white oak	Quercus lobata	QULO	43	46	4
822	overcup oak	Quercus lyrata	QULY	27	47	4
823	bur oak	Quercus macrocarpa	QUMA2	25	47	4
824	blackjack oak	Quercus marilandica	QUMA3	28	47	4
825	swamp chestnut oak	Quercus michauxii	QUMI	25	47	4
826	chinkapin oak	Quercus muehlenbergii	QUMU	25	47	4
827	water oak	Quercus nigra	QUNI	28	47	4
828	Texas red oak	Quercus texana	QUTE	28	47	4
829	Mexican blue oak	Quercus oblongifolia	QUOB	48	48	4
830	pin oak	Quercus palustris	QUPA2	28	47	4
831	willow oak	Quercus phellos	QUPH	28	47	4
832	chestnut oak	Quercus prinus	QUPR2	27	47	4
833	northern red oak	Quercus rubra	QURU	26	47	4
834	Shumard oak	Quercus shumardii	QUSH	26	47	4
835	post oak	Quercus stellata	QUST	27	47	4
836	Delta post oak	Quercus similis	QUSI2	27	47	4
837	black oak	Quercus velutina	QUVE	28	47	4
838	live oak	Quercus virginiana	QUVI	27	47	4
839	interior live oak	Quercus wislizeni	QUWI2	43	46	4
840	dwarf post oak	Quercus margarettiae	QUMA6	27	47	4
841	dwarf live oak	Quercus minima	QUMI2	27	47	4
842	bluejack oak	Quercus incana	QUIN	43	47	4
843	silverleaf oak	Quercus hypoleucoides	QUHY	48	48	4
844	Oglethorpe oak	Quercus oglethorpensis	QUOG	27	47	4
845	dwarf chinkapin oak	Quercus prinoides	QUPR	43	47	4
846	gray oak	Quercus grisea	QUGR3	48	48	4
847	netleaf oak	Quercus rugosa	QURU4	48	48	4
851	Chisos oak	Quercus graciliformis	QUGR	26	47	4
852	sea torchwood	Amyris elemifera	AMEL	43	47	3
853	pond-apple	Annona glabra	ANGL4	43	47	3
854	gumbo limbo	Bursera simaruba	BUSI	43	47	3
855	sheoak spp.	Casuarina spp.	CASUA	43	47	3
856	gray sheoak	Casuarina glauca	CAGL11	43	47	3
857	belah	Casuarina lepidophloia	CALE28	43	47	3
858	camphortree	Cinnamomum camphora	CICA	43	47	3
859	Florida fiddlewood	Citharexylum fruticosum	CIFR	43	47	3
860	citrus spp.	Citrus spp.	CITRU2	43	47	3
863	tietongue, pigeon-plum	Coccoloba diversifolia	CODI8	43	47	3

SPCD	Common name	Scientific name	Species Symbol	E_SPGRCD	W_SPGRPCD	MAJOR_ SPGRPCD
864	soldierwood	Colubrina elliptica	COEL2	43	47	3
865	largeleaf geigertree	Cordia sebestena	COSE2	43	47	3
866	carrotwood	Cupaniopsis anacardioides	CUAN4	43	47	3
867	Bluewood	Condalia hookeri	COHO	48	48	4
868	Blackbead ebony	Ebenopsis ebano	EBEB	42	47	4
869	Great leucaene	Leucaena pulverulenta	LEPU3	43	47	3
870	Texas sophora	Sophora affinis	SOAF	42	47	4
873	red stopper	Eugenia rhombea	EURH	43	47	3
874	butterbough, inkwood	Exothea paniculata	EXPA	43	47	3
876	Florida strangler fig	Ficus aurea	FIAU	43	47	3
877	wild banyantree, shortleaf fig	Ficus citrifolia	FICI	43	47	3
882	beeftree, longleaf blolly	Guapira discolor	GUDI	43	47	3
883	manchineel	Hippomane mancinella	HIMA2	43	47	3
884	false tamarind	Lysiloma latisiliquum	LYLA3	43	47	3
885	mango	Mangifera indica	MAIN3	43	47	3
886	Florida poisontree	Metopium toxiferum	METO3	43	47	3
887	fishpoison tree	Piscidia piscipula	PIPI3	43	47	3
888	octopus tree, schefflera	Schefflera actinophylla	SCAC2	43	47	3
890	false mastic	Sideroxylon foetidissimum	SIFO	43	47	3
891	white bully, willow bustic	Sideroxylon salicifolium	SISA6	43	47	3
895	paradisetree	Simarouba glauca	SIGL3	43	47	3
896	Java plum	Syzygium cumini	SYCU	43	47	3
897	tamarind	Tamarindus indica	TAIN2	43	47	3
901	black locust	Robinia pseudoacacia	ROPS	42	47	4
902	New Mexico locust	Robinia neomexicana	RONE	48	48	4
906	Everglades palm, paurotis-palm	Acoelorraphe wrightii	ACWR4	43	47	3
907	Florida silver palm	Coccothrinax argentata	COAR	43	47	3
908	coconut palm	Cocos nucifera	CONU	43	47	3
909	royal palm spp.	Roystonea spp.	ROYST	43	47	3
911	Mexican palmetto	Sabal mexicana	SAME8	41	47	3
912	cabbage palmetto	Sabal palmetto	SAPA	43	47	3
913	key thatch palm	Thrinax morrisii	THMO4	43	47	3
914	Florida thatch palm	Thrinax radiata	THRA2	43	47	3
915	other palms	Family Arecaceae not listed above	ARECA	43	47	3
919	western soapberry	Sapindus saponaria var. drummondii	SASAD	43	47	4
920	willow spp.	Salix spp.	SALIX	43	47	3
921	peachleaf willow	Salix amygdaloides	SAAM2	43	47	3
922	black willow	Salix nigra	SANI	41	47	3
923	Bebb willow	Salix bebbiana	SABE2	43	47	3
924	Bonpland willow	Salix bonplandiana	SABO	41	47	3
925	coastal plain willow	Salix caroliniana	SACA5	43	47	3
926	balsam willow	Salix pyrifolia	SAPY	43	47	3
927	white willow	Salix alba	SAAL2	41	47	3
928	Scouler's willow	Salix scouleriana	SASC	41	47	3
929	weeping willow	Salix sepulcralis	SASE10	41	47	3
931	sassafras	Sassafras albidum	SAAL5	41	47	3
934	mountain-ash spp.	Sorbus spp.	SORBU	43	47	4
935	American mountain-ash	Sorbus americana	SOAM3	43	47	4
936	European mountain-ash	Sorbus aucuparia	SOAU	43	47	4
937	northern mountain-ash	Sorbus decora	SODE3	43	47	4
940	West Indian mahogany	Swietenia mahagoni	SWMA2	43	47	4
950	basswood spp.	Tilia spp.	TILIA	38	47	3
951	American basswood	Tilia americana	TIAM	38	47	3
952	white basswood	Tilia americana var.	TIAMH	38	47	3

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		heterophylla				
953	Carolina basswood	Tilia americana var. caroliniana	TIAMC	38	47	3
970	elm spp.	Ulmus spp.	ULMUS	41	47	3
971	winged elm	Ulmus alata	ULAL	41	47	4
972	American elm	Ulmus americana	ULAM	41	47	3
973	cedar elm	Ulmus crassifolia	ULCR	41	47	3
974	Siberian elm	Ulmus pumila	ULPU	41	47	3
975	slippery elm	Ulmus rubra	ULRU	41	47	3
976	September elm	Ulmus serotina	ULSE	41	47	3
977	rock elm	Ulmus thomasii	ULTH	42	47	4
981	California-laurel	Umbellularia californica	UMCA	43	47	4
982	Joshua tree	Yucca brevifolia	YUBR	43	47	3
986	black-mangrove	Avicennia germinans	AVGE	43	47	4
987	buttonwood-mangrove	Conocarpus erectus	COER2	43	47	4
988	white-mangrove	Laguncularia racemosa	LARA2	43	47	4
989	American mangrove	Rhizophora mangle	RHMA2	43	47	4
990	desert ironwood	Olneya tesota	OLTE	48	48	4
991	saltcedar	Tamarix spp.	TAMAR2	43	47	3
992	melaleuca	Melaleuca quinquenervia	MEQU	41	47	3
993	chinaberry	Melia azedarach	MEAZ	43	47	4
994	Chinese tallowtree	Triadica sebifera	TRSE6	43	47	4
995	tungoil tree	Vernicia fordii	VEFO	43	47	4
996	smoketree	Cotinus obovatus	COOB2	43	47	4
997	Russian-olive	Elaeagnus angustifolia	ELAN	43	47	3
998	Unknown dead hardwood	Tree broadleaf	2TB	43	47	3
999	Other or unknown live tree	Tree unknown	2TREE	43	47	3
5091	Washington hawthorn	Crataegus phaenopyrum	CRPH	43	47	4
5092	fleshy hawthorn	Crataegus succulenta	CRSU5	43	47	4
5093	dwarf hawthorn	Crataegus uniflora	CRUN	43	47	4
5145	hedge maple	Acer campestre	ACCA5	55	55	3
5146	vine maple	Acer circinatum	ACCI	55	55	3
5147	Amur maple	Acer ginnala	ACGI	55	55	3
5148	paperbark maple	Acer griseum	ACGR14	55	55	3
5149	Painted maple	Acer mono	ACMO10	55	55	3
5150	Japanese maple	Acer palmatum	ACPA2	55	55	3
5151	sycamore maple	Acer pseudoplatanus	ACPS	55	55	3
5152	tatarian maple	Acer tataricum	ACTA80	55	55	3
5154	Freeman maple	Acer x freemanii	ACFR	55	55	3
5163	horse chestnut	Aesculus hippocastanum	AEHI	55	55	3
5164	bottlebrush buckeye	Aesculus parviflora	AEPA2	55	55	3
5188	gray alder	Alnus incana	ALIN2	55	55	3
5190	hazel alder	Alnus serrulata	ALSE2	55	55	3
5192	green alder	Alnus viridis	ALVI5	55	55	3
5203	Allegheny serviceberry	Amelanchier laevis	AMLA	55	55	3
5232	Japanese angelica tree	Aralia elata	AREL8	55	55	3
5233	devil's walkingstick	Aralia spinosa	ARSP2	55	55	3
5256	smallflower pawpaw	Asimina parviflora	ASPA18	55	55	3
5259	silverling	Baccharis glomeruliflora	BAGL	55	55	3
5260	eastern baccharis	Baccharis halimifolia	BAHA	55	55	3
5279	European white birch	Betula pendula	BEPE3	55	55	3
5280	Asian white birch	Betula platyphylla	BEPL2	55	55	3
5281	downy birch	Betula pubescens	BEPU5	55	55	3
5322	fountain butterflybush	Buddleja alternifolia	BUAL	55	55	3
5329	common box	Buxus sempervirens	BUSE2	55	55	3
5363	camellia	Camellia japonica	CAJA9	55	55	3

SPCD	Common name	Scientific name	Species Symbol	E_SPGRCD	W_SPGRPCD	MAJOR_ SPGRPCD
5364	tea	Camellia sinensis	CASI16	55	55	3
5375	Siberian peashrub	Caragana arborescens	CAAR18	55	55	3
5378	European hornbeam	Carpinus betulus	CABE8	55	55	3
5401	Japanese chestnut	Castanea crenata	CACR27	55	55	3
5402	European chestnut	Castanea sativa	CASA27	55	55	3
5411	Chinese catalpa	Catalpa ovata	CAOV5	55	55	3
5415	snowbrush ceanothus	Ceanothus velutinus	CEVE	55	55	3
5423	Deodar cedar	Cedrus deodara	CEDE2	56	56	3
5432	common buttonbush	Cephalanthus occidentalis	CEOC2	55	55	3
5435	katsura tree	Cercidiphyllum japonicum	CEJA2	55	55	3
5436	California redbud	Cercis orbiculata	CEOR9	55	55	3
5443	hinoki false cypress	Chamaecyparis obtusa	CHOB8	56	56	2
5462	desert willow	Chilopsis linearis	CHLI2	55	55	3
5491	Berlandier ash	Fraxinus berlandieriana	FRBE	36	47	3
5492	European ash	Fraxinus excelsior	FREX80	55	55	3
5493	Caucasian ash	Fraxinus oxycarpa	FROX	55	55	3
5523	rose glorybower	Clerodendrum bungei	CLBU	55	55	3
5529	mountain sweetpepperbush	Clethra acuminata	CLAC3	55	55	3
5559	bladder senna	Colutea arborescens	COAR6	55	55	3
5591	kousa dogwood	Cornus kousa	COKO2	55	55	3
5599	American hazelnut	Corylus americana	COAM3	55	55	3
5600	Turkish hazelnut	Corylus colurna	COCO30	55	55	3
5603	European smoketree	Cotinus coggygria	COCO10	55	55	3
5776	storehousebush	Cudrania tricuspidata	CUTR2	55	55	3
5800	Leyland cypress	Cupressocyparis leylandii	CULE2	56	56	2
5818	quince	Cydonia oblonga	CYOB2	55	55	3
5965	burningbush	Euonymus alatus	EUAL13	55	55	3
5983	European beech	Fagus sylvatica	FASY	55	55	3
6001	blackbrush wattle	Acacia anegadensis	ACAN4	54	54	3
6002	mulga	Acacia aneura	ACAN10	54	54	3
6003	auri	Acacia auriculiformis	ACAU	54	54	3
6004	small Philippine acacia	Acacia confusa	ACCO	54	54	3
6006	koa	Acacia koa	ACKO	54	54	3
6007	koaoha	Acacia koaia	ACKO2	54	54	3
6008	porknut	Acacia macracantha	ACMA	54	54	3
6009	black wattle	Acacia mangium	ACMA12	54	54	3
6010	black wattle	Acacia mearnsii	ACME80	54	54	3
6011	blackwood	Acacia melanoxylon	ACME	54	54	3
6012	spineless wattle	Acacia muricata	ACMU	54	54	3
6013	gum arabic tree	Acacia nilotica	ACNI2	54	54	3
6014	South Wales wattle	Acacia parramattensis	ACPA81	54	54	3
6015	Acacia polyacantha	Acacia polyacantha	ACPO3	54	54	3
6018	poponax	Acacia tortuosa	ACTO	54	54	3
6021	hollowheart	Acnistus arborescens	ACAR	54	54	3
6023	grugru palm	Acrocomia media	ACME2	53	53	3
6025	baobab	Adansonia digitata	ADDI3	54	54	3
6026	wild lime	Adelia ricinella	ADRI	54	54	3
6028	red beadtree	Adenanthera pavonina	ADPA	54	54	3
6029	beadtree	Adenanthera spp.	ADENA	54	54	3
6032	Caribbean spiritweed	Aegiphila martinicensis	AEMA	54	54	3
6036	kauri	Agathis australis	AGAU4	54	54	3
6037	Queensland kauri	Agathis robusta	AGRO6	54	54	3
6042	Titimel	Aglaia mariannensis	AGMA14	54	54	3
6043	mesecheues	Aglaia palauensis	AGPA19	54	54	3
6044	karasyu, marasau	Aglaia ponapensis	AGPO4	54	54	3
6046	laga ali	Aglaia samoensis	AGSA9	54	54	3

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6047	Aglaia	Aglaia spp.	AGLAI	54	54	3
6048	Olomea	Aidia cochinchinensis	AICO2	54	54	3
6049	Aidia racemosa	Aidia racemosa	AIRA2	54	54	3
6051	ailanthus	Ailanthus spp.	AILAN	54	54	3
6053	Aiphanes minima	Aiphanes minima	AIMI	54	54	3
6055	cream albizia	Albizia adinocephala	ALAD	54	54	3
6056	naked albizia	Albizia carbonaria	ALCA8	54	54	3
6057	Chinese albizia	Albizia chinensis	ALCH2	54	54	3
6058	ukall ra ngebard	Albizia falcataria	ALFA5	54	54	3
6059	woman's tongue	Albizia lebbeck	ALLE	54	54	3
6060	tall albizia	Albizia procera	ALPR	54	54	3
6061	ukall ra ngebard	Albizia retusa	ALRE	54	54	3
6062	whiteflower albizia	Albizia saponaria	ALSA10	54	54	3
6063	albizia	Albizia spp.	ALBIZ	54	54	3
6064	achiotillo	Alchornea latifolia	ALLA	54	54	3
6066	palo de gallina	Alchorneopsis floribunda	ALFL3	54	54	3
6069	Hawaii alectryon	Alectryon macrococcus	ALMA	54	54	3
6073	alectryon	Alectryon spp.	ALECT	54	54	3
6075	Indian walnut	Aleurites moluccana	ALMO2	54	54	3
6077	aleurites	Aleurites spp.	ALEUR	54	54	3
6078	lumbang	Aleurites trisperma	ALTR11	54	54	3
6080	palo blanco	Allophylus crassinervis	ALCR9	54	54	3
6082	palo de caja	Allophylus racemosus	ALRA	54	54	3
6083	Allophylus	Allophylus spp.	ALLOP	54	54	3
6084	chebeludes	Allophylus ternatus	ALTE13	54	54	3
6085	ebeludes, chebeludes	Allophylus timorensis	ALTI2	54	54	3
6086	Nepal alder	Alnus nepalensis	ALNE2	54	54	3
6088	chelebiob, elebiong	Alphitonia carolinensis	ALCA21	54	54	3
6089	Hawaii kauilatree	Alphitonia ponderosa	ALPO3	54	54	3
6090	Alphitonia	Alphitonia spp.	ALPHI	54	54	3
6091	toi	Alphitonia zizyphoides	ALZI	54	54	3
6092	helecho gigante de la sierra	Alsophila bryophila	ALBR4	54	54	3
6093	Alsophila portoricensis	Alsophila portoricensis	ALPO7	54	54	3
6095	deviltree	Alstonia macrophylla	ALMA16	54	54	3
6096	Alstonia pacifica	Alstonia pacifica	ALPA22	54	54	3
6097	alstonia	Alstonia spp.	ALSTO	54	54	3
6101	black calabash	Amphitecna latifolia	AMLA4	54	54	3
6103	balsam torchwood	Amyris balsamifera	AMBA2	54	54	3
6106	anacardium	Anacardium spp.	ANACA	54	54	3
6107	cashew	Anacardium occidentale	ANOC	54	54	3
6108	Anacolosa glochidiiformis	Anacolosa glochidiiformis	ANGL5	54	54	3
6109	Anacolosa insularis	Anacolosa insularis	ANIN13	54	54	3
6111	Anadenanthera peregrina	Anadenanthera peregrina	ANPE13	54	54	3
6114	cabbagebark tree	Andira inermis	ANIN	54	54	3
6118	dermarm	Angiopteris evecta	ANEV	54	54	3
6120	canelillo	Aniba bracteata	ANBR7	54	54	3
6124	Annona cherimola	Annona cherimola	ANCH9	54	54	3
6125	ilama	Annona diversifolia	ANDI11	54	54	3
6127	mountain soursop	Annona montana	ANMO	54	54	3
6128	soursop	Annona muricata	ANMU2	54	54	3
6129	custard apple	Annona reticulata	ANRE	54	54	3
6130	Annona	Annona spp.	ANNON	54	54	3
6131	sugar apple	Annona squamosa	ANSQ	54	54	3
6135	Kapua china laurel	Antidesma kapuae	ANKA	54	54	3
6137	Antidesma bunius	Antidesma bunius	ANBU3	54	54	3
6138	Antidesma kusaiense	Antidesma kusaiense	ANKU3	54	54	3

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6139	ha a	Antidesma platyphyllum	ANPL2	54	54	3
6142	Antidesma ponapense	Antidesma ponapense	ANPO8	54	54	3
6143	hame	Antidesma pulvinatum	ANPU2	54	54	3
6144	Antidesma sphaerocarpum	Antidesma sphaerocarpum	ANSP14	54	54	3
6145	chinalaurel	Antidesma spp.	ANTID	54	54	3
6146	placa chiquitu	Antirhea acutata	ANAC4	54	54	3
6147	pegwood	Antirhea coriacea	ANCO3	54	54	3
6148	Antirhea inconspicua	Antirhea inconspicua	ANIN2	54	54	3
6149	palo iloron	Antirhea lucida	ANLU3	54	54	3
6150	quina roja	Antirhea obtusifolia	ANOB2	54	54	3
6151	Puerto Rico quina	Antirhea portoricensis	ANPO3	54	54	3
6152	Sintenis' quina	Antirhea sintenisii	ANSI	54	54	3
6154	parana pine	Araucaria angustifolia	ARAN15	54	54	3
6155	New Caledonia pine	Araucaria columnaris	ARCO32	51	51	1
6156	Norfolk Island Pine	Araucaria excelsa	AREX4	51	51	1
6157	Norfolk Island pine	Araucaria heterophylla	ARHE12	54	54	3
6158	Araucaria	Araucaria spp.	ARAUC2	54	54	3
6159	Alexandra palm	Archontophoenix alexandrae	ARAL	53	53	3
6161	shoebutton	Ardisia elliptica	AREL4	54	54	3
6162	ausubon	Ardisia glauciflora	ARGL11	54	54	3
6163	mountain marlberry	Ardisia luquillensis	ARLU3	54	54	3
6164	Guadeloupe marlberry	Ardisia obovata	AROB2	54	54	3
6165	China-shrub	Ardisia solanacea	ARSO	54	54	3
6166	marlberry	Ardisia spp.	ARDIS	54	54	3
6167	betelnut	Areca catechu	ARCA41	54	54	3
6169	cabo-negro	Arenga pinnata	ARPI6	54	54	3
6171	breadfruit	Artocarpus altilis	ARAL7	54	54	3
6173	Artocarpus heterophyllus	Artocarpus heterophyllus	ARHE2	54	54	3
6175	dugdug, Marianas breadfruit	Artocarpus mariannensis	ARMA28	54	54	3
6176	Artocarpus nobilis	Artocarpus nobilis	ARNO	54	54	3
6177	Marang	Artocarpus odoratissimus	AROD2	54	54	3
6178	meduu	Artocarpus spp.	ARTOC	54	54	3
6179	taputoi	Arytera brackenridgei	ARBR11	54	54	3
6181	afia	Ascarina diffusa	ASDI14	54	54	3
6185	Astronidium navigatorum	Astronidium navigatorum	ASNA10	54	54	3
6186	meskui	Astronidium palauense	ASPA37	54	54	3
6187	Astronidium pickeringii	Astronidium pickeringii	ASPI11	54	54	3
6188	Astronidium samoense	Astronidium samoense	ASSA23	54	54	3
6189	Astronidium	Astronidium spp.	ASTRO4	54	54	3
6190	Astronidium subcordata	Astronidium subcordata	ASSU31	54	54	3
6193	ifi ifi	Atuna racemosa	ATRA2	54	54	3
6197	Bilimbi	Averrhoa bilimbi	AVBI	54	54	3
6198	carambola	Averrhoa carambola	AVCA	54	54	3
6199	Averrhoa	Averrhoa spp.	AVERR	54	54	3
6200	biut	Avicennia alba	AVAL	54	54	3
6203	Avicennia marina	Avicennia marina	AVMA3	54	54	3
6205	Avicennia	Avicennia spp.	AVICE	54	54	3
6206	neem	Azadirachta indica	AZIN2	54	54	3
6208	Saitamu	Baccaurea taitensis	BATA	54	54	3
6212	European larch	Larix decidua	LADE2	56	56	2
6213	ralm	Badusa palauensis	BAPA8	54	54	3
6215	bamboo	Bambusa spp.	BAMBU	54	54	3
6216	common bamboo	Bambusa vulgaris	BAVU2	54	54	3
6217	Puerto Rico palo de ramon	Banara portoricensis	BAPO	54	54	3
6219	Vanderbilt's palo de ramon	Banara vanderbiltii	BAVA2	54	54	3
6220	sea putat	Barringtonia asiatica	BAAS3	54	54	3

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6221	langaasag	Barringtonia racemosa	BARA5	54	54	3
6222	falaga	Barringtonia samoensis	BASA9	54	54	3
6223	Barringtonia	Barringtonia spp.	BARRI	54	54	3
6224	Bastardiopsis eggersii	Bastardiopsis eggersii	BAEG6	54	54	3
6225	Bauhinia binata	Bauhinia binata	BABI6	54	54	3
6226	Napoleon's plume	Bauhinia monandra	BAMO2	54	54	3
6227	petite flamboyant bauhinia	Bauhinia multinervia	BAMU3	54	54	3
6228	railroadfence	Bauhinia pauletia	BAPA3	54	54	3
6229	butterfly tree	Bauhinia purpurea	BAPU	54	54	3
6230	bauhinia	Bauhinia spp.	BAUHI	54	54	3
6231	St. Thomas tree	Bauhinia tomentosa	BATO	54	54	3
6232	mountain ebony	Bauhinia variegata	BAVA	54	54	3
6233	slugwood	Beilschmiedia pendula	BEPE	54	54	3
6234	bog spicebush	Lindera subcoriacea	LISU8	55	55	3
6235	Caribbean myrtlecroton	Bernardia dichotoma	BEDI2	54	54	3
6236	Javanese bishopwood	Bischofia javanica	BIJA	54	54	3
6237	bishopwood	Bischofia spp.	BISCH	54	54	3
6238	lipsticktree	Bixa orellana	BIOR	54	54	3
6239	bixa	Bixa spp.	BIXA	54	54	3
6240	akee	Blighia sapida	BLSA2	54	54	3
6241	Texasplume	Bauhinia lunarioides	BALU	55	55	3
6242	akupa	Bobea brevipes	BOBR3	54	54	3
6243	ahakea lau nui	Bobea elatior	BOEL3	54	54	3
6244	Hawaii dogweed	Bobea sandwicensis	BOSA2	54	54	3
6245	ahakea	Bobea spp.	BOBEA	54	54	3
6246	ahakea	Bobea timonioides	BOTI	54	54	3
6247	parrotweed	Bocconia frutescens	BOFR2	54	54	3
6248	bocconia	Bocconia spp.	BOCCO	54	54	3
6250	virgata	Boehmeria virgata	BOVI7	54	54	3
6251	white alling	Bontia daphnoides	BODA	54	54	3
6253	Bourreria radula	Bourreria radula	BORA2	54	54	3
6255	bodywood	Bourreria succulenta	BOSU2	54	54	3
6257	roble de guayo	Bourreria virgata	BOVI2	54	54	3
6260	kanawao	Broussaisia arguta	BRAR6	54	54	3
6262	paper mulberry	Broussonetia papyrifera	BRPA4	54	54	3
6264	angels-trumpet	Brugmansia candida	BRCA12	54	54	3
6267	smallflower bruguiera	Bruguiera parviflora	BRPA15	54	54	3
6268	Oriental mangrove	Bruguiera sexangula	BRSE11	54	54	3
6269	bruguiera	Bruguiera spp.	BRUGU	54	54	3
6270	West Indian sumac	Brunellia comocladiifolia	BRCO6	54	54	3
6272	American brunfelsia	Brunfelsia americana	BRAM4	54	54	3
6273	Serpentine Hill raintree	Brunfelsia densifolia	BRDE4	54	54	3
6274	vega blanca	Brunfelsia lactea	BRLA5	54	54	3
6275	Puerto Rico raintree	Brunfelsia portoricensis	BRPO3	54	54	3
6277	omail	Buchanania engleriana	BUEN	54	54	3
6278	gasu	Buchanania merrillii	BUME4	54	54	3
6279	omail, deuachel	Buchanania palawensis	BUPA16	54	54	3
6280	Buchanania	Buchanania spp.	BUCHA	54	54	3
6283	fourleaf buchenavia	Buchenavia tetraphylla	BUTE4	54	54	3
6284	gregorywood	Bucida buceras	BUBU	54	54	3
6286	dogtail	Buddleja asiatica	BUAS	54	54	3
6294	cafe falso	Bunchosia glandulifera	BUGL2	54	54	3
6295	cafe forastero	Bunchosia glandulosa	BUGL	54	54	3
6297	Bunchosia polystachia	Bunchosia polystachia	BUPO5	54	54	3
6299	Burckella richii	Burckella richii	BURI3	54	54	3
6303	Buxus laevigata	Buxus laevigata	BULA10	54	54	3

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6304	Puerto Rico box	Buxus portoricensis	BUPO	54	54	3
6306	Vahl's box	Buxus vahlii	BUVA	54	54	3
6308	maricao cimun	Byrsonima crassifolia	BYCR	54	54	3
6311	Long Key locustberry	Byrsonima lucida	BYLU	54	54	3
6313	doncella	Byrsonima spicata	BYSP	54	54	3
6315	almendrillo	Byrsonima wadsworthii	BYWA	54	54	3
6316	nicker	Caesalpinia spp.	CAESA	54	54	3
6317	divi divi	Caesalpinia coriaria	CACO28	54	54	3
6318	uhiuhi	Caesalpinia kavaiensis	CAKA5	54	54	3
6319	pride-of-Barbados	Caesalpinia pulcherrima	CAPU13	54	54	3
6320	sappanwood	Caesalpinia sappan	CASA28	54	54	3
6325	Surinamese stickpea	Calliandra surinamensis	CASU33	54	54	3
6326	caparosa	Callicarpa ampla	CAAM14	54	54	3
6328	crimson bottlebrush	Callistemon citrinus	CACI15	54	54	3
6331	Callitris columellaris	Callitris columellaris	CACO2	52	52	2
6337	Caloncoba echinata	Caloncoba echinata	CAEC2	54	54	3
6338	Antilles calophyllum	Calophyllum antillanum	CAAN22	54	54	3
6341	Alexandrian laurel	Calophyllum inophyllum	CAIN4	54	54	3
6342	tamanu	Calophyllum neo-ebudicum	CANE31	54	54	3
6343	chesemolech	Calophyllum pelewense	CAPE15	54	54	3
6344	olebtaches, chesemolech	Calophyllum soulattri	CASO12	54	54	3
6345	calophyllum	Calophyllum spp.	CALOP	54	54	3
6346	roostertree	Calotropis procera	CAPR	54	54	3
6347	calotropis	Calotropis spp.	CALOT	54	54	3
6350	degame	Calycophyllum candidissimum	CACA73	54	54	3
6351	Kiaerskov's lidflower	Calyptranthes kiaerskovii	CAKI	54	54	3
6352	limoncillo	Calyptranthes krugii	CAKR	54	54	3
6353	Luquillo forest lidflower	Calyptranthes luquillensis	CALU12	54	54	3
6354	pale lidflower	Calyptranthes pallens	CAPA8	54	54	3
6355	Puerto Rico lidflower	Calyptranthes portoricensis	CAPO9	54	54	3
6356	limoncillo de monte	Calyptranthes sintenisii	CASI8	54	54	3
6358	Thomas' lidflower	Calyptranthes thomasiana	CATH3	54	54	3
6359	myrtle of the river	Calyptranthes zuzygium	CAZU	53	53	3
6360	Puerto Rico manac	Calyptronoma rivalis	CARI3	54	54	3
6366	kelela charm, kiu	Campnosperma brevipetiolatum	CABR18	54	54	3
6370	ilang-ilang	Cananga odorata	CAOD	54	54	3
6372	mafoa	Canarium mafoa	CAHA39	54	54	3
6373	mesecheues	Canarium hirsutum	CAHI14	54	54	3
6374	lukerr	Canarium indicum	CAIN42	54	54	3
6375	Pili Nut	Canarium ovatum	CAOV7	54	54	3
6377	Canarium	Canarium spp.	CANAR2	54	54	3
6378	maali	Canarium vitiense	CAVI26	54	54	3
6379	Canarium vulgare	Canarium vulgare	CAVU9	54	54	3
6380	wild cinnamon	Canella winteriana	CAWI	54	54	3
6381	Olasina	Psydrax merrillii	CAME35	54	54	3
6383	burro blanco	Capparis amplissima	CAAM13	54	54	3
6384	caper	Capparis baducca	CABA2	54	54	3
6386	Jamaican caper	Capparis cynophallophora	CACY	54	54	3
6387	falseteeth	Capparis flexuosa	CAFL2	54	54	3
6389	broadleaf caper	Capparis hastata	CAHA9	54	54	3
6390	linguam	Capparis indica	CAIN5	54	54	3
6393	crabwood	Carapa guianensis	CAGU6	54	54	3
6395	papaya	Carica papaya	CAPA23	54	54	3
6396	papaya	Carica spp.	CARIC	54	54	3
6397	scorpionbush	Carmona retusa	CARE22	54	54	3

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6398	scorpionbush	Carmona spp.	CARMO	54	54	3
6399	fish tail palm	Caryota mitis	CAMI36	53	53	3
6400	Caryota	Caryota spp.	CARYO	54	54	3
6401	fishtail palm	Caryota urens	CAUR3	53	53	3
6402	rabo de ranton	Casearia aculeata	CAAC3	54	54	3
6403	gia verde	Casearia arborea	CAAR8	54	54	3
6405	keuert	Casearia cauliflora	CACA28	54	54	3
6406	wild honeytree	Casearia decandra	CADE11	54	54	3
6407	Guyanese wild coffee	Casearia guianensis	CAGU2	54	54	3
6408	Casearia	Casearia spp.	CASEA	54	54	3
6410	crackopen	Casearia sylvestris	CASY2	54	54	3
6415	golden shower	Cassia fistula	CAFI3	54	54	3
6417	pink shower	Cassia grandis	CAGR11	54	54	3
6418	apple blossom	Cassia javanica	CAJA3	54	54	3
6420	kassod tree	Cassia siamea	CASI4	54	54	3
6422	Cassia	Cassia spp.	CASSI	54	54	3
6425	marbletree	Cassine xylocarpa	CAXY	54	54	3
6427	goatwood	Cassipourea guianensis	CAGU3	54	54	3
6429	goatbush	Castela erecta	CAER3	54	54	3
6430	Panama rubbertree	Castilla elastica	CAEL5	54	54	3
6433	river sheoak	Casuarina cunninghamiana	CACU8	54	54	3
6434	beach sheoak	Casuarina equisetifolia	CAEQ	54	54	3
6437	gagu,australian pine	Casuarina litorea	CALI8	51	51	1
6438	catberry	Ilex mucronata	ILMU	55	55	3
6439	Haitian catalpa	Catalpa longissima	CALO8	54	54	3
6441	trumpet tree	Cecropia obtusifolia	CEOB	54	54	3
6443	pumpwood	Cecropia schreberiana	CESC9	54	54	3
6444	pumpwood	Cecropia spp.	CECRO	54	54	3
6445	Spanish cedar	Cedrela odorata	CEOD	54	54	3
6447	pochote	Ceiba acuminata	CEAC4	54	54	3
6448	pochote	Ceiba aesculifolia	CEAE2	54	54	3
6449	kapoktree	Ceiba pentandra	CEPE2	54	54	3
6452	Celtis paniculata	Celtis paniculata	CEPA6	54	54	3
6454	almex	Celtis trinervia	CETR3	54	54	3
6457	St. John's bread	Ceratonia siliqua	CESI3	54	54	3
6459	chuti	Cerbera dilatata	CEDI12	54	54	3
6460	emeridech	Cerbera floribunda	CEFL2	54	54	3
6461	leva	Cerbera manghas	CEMA20	54	54	3
6462	chiute	Cerbera odollam	CEOD2	54	54	3
6463	Cerbera spp	Cerbera spp	CERBE	54	54	3
6468	lady of the night cactus	Cereus hexagonus	CEHE3	54	54	3
6469	Cereus hildmannianus	Cereus hildmannianus	CEHI3	54	54	3
6470	sweetpotato cactus	Cereus spp.	CEREU	54	54	3
6472	biut	Ceriops tagal	CETA2	54	54	3
6473	orange jessamine	Cestrum aurantiacum	CEAU2	54	54	3
6474	day jessamine	Cestrum diurnum	CEDI6	54	54	3
6475	galen del monte	Cestrum laurifolium	CELA2	54	54	3
6477	night jessamine	Cestrum nocturnum	CENO	54	54	3
6478	jessamine	Cestrum spp.	CESTR	54	54	3
6479	Knowlton's hophornbeam	Ostrya knowltonii	OSKN	55	55	3
6481	jointed sandmat	Chamaesyce articulata	CHAR8	54	54	3
6482	koko	Chamaesyce atrococca	CHAT2	54	54	3
6483	ekoko	Chamaesyce celastroides	CHCE	54	54	3
6492	Herbsts sandmat	Chamaesyce herbstii	CHHE3	54	54	3
6493	kokomalei	Chamaesyce kuwaleana	CHKU	54	54	3
6494	alpine sandmat	Chamaesyce olowaluana	CHOL3	54	54	3

SPCD	Common name	Scientific name	Species Symbol	E_SPGRCD	W_SPGRPCD	MAJOR_ SPGRPCD
6495	Koolau Range sandmat	Chamaesyce rockii	CHRO2	54	54	3
6496	sandmat	Chamaesyce spp.	CHAMA15	54	54	3
6497	Napali coast papala	Charpentiera densiflora	CHDE3	54	54	3
6498	ellipticleaf papala	Charpentiera elliptica	CHEL	54	54	3
6499	broadleaf papala	Charpentiera obovata	CHOB2	54	54	3
6500	Koolau Range papala	Charpentiera ovata	CHOV2	54	54	3
6503	papala	Charpentiera spp.	CHARP	54	54	3
6504	Waianae Range papala	Charpentiera tomentosa	CHTO3	54	54	3
6507	Domins club	Cheirodendron dominii	CHDO3	54	54	3
6508	Fauries club	Cheirodendron fauriei	CHFA	54	54	3
6509	olapa	Cheirodendron forbesii	CHFO4	54	54	3
6510	lapalapa	Cheirodendron platyphyllum	CHPL	54	54	3
6511	swamp bay	Persea palustris	PEPA37	55	55	3
6513	cheirodendron	Cheirodendron spp.	CHEIR	54	54	3
6514	olapalapa	Cheirodendron trigynum	CHTR2	54	54	3
6516	Amur corktree	Phellodendron amurense	PHAM2	55	55	3
6517	alaweo	Chenopodium oahuense	CHOA	54	54	3
6518	goosefoot	Chenopodium spp.	CHENO	54	54	3
6519	hueso	Chionanthus axilliflorus	CHAX2	54	54	3
6520	bridgotree	Chionanthus compactus	CHCO12	54	54	3
6521	white rosewood	Chionanthus domingensis	CHDO4	54	54	3
6522	hueso prieto	Chionanthus holdridgei	CHHO4	54	54	3
6523	cabra blanca	Chionanthus ligustrinus	CHLI6	54	54	3
6525	vitiensis	Chionanthus vitiensis	CHVI22	54	54	3
6526	puntaj jayuya	Chione seminervis	CHSE5	54	54	3
6528	fatpork	Chione venosa	CHVE4	54	54	3
6529	african teak	Chlorophora excelsa	CHEX5	54	54	3
6532	silk-floss tree	Chorisia speciosa	CHSP13	54	54	3
6533	Sakhalin spruce	Picea glehnii	PIGL7	56	56	2
6535	icaco coco plum	Chrysobalanus icaco	CHIC	54	54	3
6538	Serbian spruce	Picea omorika	PIOM2	56	56	2
6539	bastard redwood	Chrysophyllum argenteum	CHAR6	54	54	3
6541	star apple	Chrysophyllum cainito	CHCA10	54	54	3
6542	satinleaf	Chrysophyllum oliviforme	CHOL	54	54	3
6543	camito de perro	Chrysophyllum pauciflorum	CHPA31	54	54	3
6545	Hawaiian tree fern	Cibotium heleniae	CIHE7	54	54	3
6546	Chamissos manfern	Cibotium chamissoi	CICH	54	54	3
6547	hapuu	Cibotium glaucum	CIGL	54	54	3
6548	hapuu li	Cibotium menziesii	CIME8	54	54	3
6549	manfern	Cibotium spp.	CIBOT	54	54	3
6552	quinine	Cinchona pubescens	CIPU	54	54	3
6553	cinchona	Cinchona spp.	CINCH	54	54	3
6554	cassia	Cinnamomum aromaticum	CIAR8	54	54	3
6555	Padang cassia	Cinnamomum burmannii	CIBU2	54	54	3
6557	ochod	Cinnamomum carolinense	CICA2	54	54	3
6559	laurel avispillo	Cinnamomum elongatum	CIEL2	54	54	3
6560	avispillo	Cinnamomum montanum	CIMO3	54	54	3
6561	ochod	Cinnamomum pedatinervium	CIPE6	54	54	3
6562	matieu	Cinnamomum sessilifolium	CISE2	54	54	3
6563	cinnamon	Cinnamomum spp.	CINNA2	54	54	3
6564	cinnamon	Cinnamomum verum	CIVE2	54	54	3
6565	juniper berry	Citharexylum caudatum	CICA8	54	54	3
6567	spiny fiddlewood	Citharexylum spinosum	CISP3	54	54	3
6568	fiddlewood	Citharexylum spp.	CITHA	54	54	3
6569	threespike fiddlewood	Citharexylum tristachyum	CITR7	54	54	3
6570	samoensis	Citronella samoensis	CISA2	54	54	3

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6572	Lime (Tipolo)	Citrus aurantifolia	CIAU	54	54	3
6573	key lime	Citrus xaurantiifolia	CIAU7	54	54	3
6574	sour orange	Citrus xaurantium	CIAU8	54	54	3
6575	lemon	Citrus xlimon	CILI5	54	54	3
6576	grapefruit	Citrus xparadisi	CIPA3	54	54	3
6577	sweet orange	Citrus xsinensis	CISI3	54	54	3
6578	grapefruit, kahet magas	Citrus grandis	CIGR	54	54	3
6579	limon china	Citrus hystrix	CIHY2	54	54	3
6580	kahet, wild orange	Citrus macroptera	CIMA10	54	54	3
6581	Citrus maxima	Citrus maxima	CIMA5	54	54	3
6582	Citrus medica	Citrus medica	CIME3	54	54	3
6583	calamondin, kingkang	Citrus mitis	CIMI3	54	54	3
6584	Citrus reticulata	Citrus reticulata	CIRE3	54	54	3
6586	koee	Claoxylon carolinianum	CLCA15	54	54	3
6588	Claoxylon fallax	Claoxylon fallax	CLFA6	54	54	3
6589	Claoxylon longiracemosum	Claoxylon longiracemosum	CLLO5	54	54	3
6590	katteknau, katot	Claoxylon marianum	CLMA25	54	54	3
6591	poola	Claoxylon sandwicense	CLSA	54	54	3
6592	claoxylon	Claoxylon spp.	CLAOX	54	54	3
6593	Cleistanthus carolinianus	Cleistanthus carolinianus	CLCA18	54	54	3
6594	Cleistanthus insularis	Cleistanthus insularis	CLIN8	54	54	3
6595	Cleistanthus	Cleistanthus spp.	CLEIS5	54	54	3
6596	oha wai nui Clermontia	Clermontia leptoclada	CLLE3	54	54	3
6597	oha wai nui	Clermontia arborescens	CLAR4	54	54	3
6601	Kauai clermontia	Clermontia clermontioides	CLCL	54	54	3
6604	Kohala Mountain clermontia	Clermontia drepanomorpha	CLDR2	54	54	3
6605	haha aiakamanu	Clermontia fauriei	CLFA	54	54	3
6606	bog clermontia	Clermontia grandiflora	CLGR3	54	54	3
6610	oha kepau	Clermontia hawaiiensis	CLHA4	54	54	3
6611	forest clermontia	Clermontia kakeana	CLKA	54	54	3
6612	Waipio Valley clermontia	Clermontia kohalae	CLKO	54	54	3
6613	hillside clermontia	Clermontia lindseyana	CLLI3	54	54	3
6614	Maui clermontia	Clermontia micrantha	CLMI3	54	54	3
6615	Mauna Loa clermontia	Clermontia montis-loa	CLMO5	54	54	3
6616	Oahu clermontia	Clermontia oblongifolia	CLOB2	54	54	3
6620	Wailai Pali clermontia	Clermontia pallida	CLPA6	54	54	3
6621	smallflower clermontia	Clermontia parviflora	CLPA8	54	54	3
6622	pele clermontia	Clermontia peleana	CLPE2	54	54	3
6625	Waioiani clermontia	Clermontia persicifolia	CLPE3	54	54	3
6626	Hamakua clermontia	Clermontia pyrularia	CLPY2	54	54	3
6627	Clermontia singuliflora	Clermontia singuliflora	CLSI3	54	54	3
6628	clermontia	Clermontia spp.	CLERM	54	54	3
6629	Haleakala clermontia	Clermontia tuberculata	CLTU2	54	54	3
6630	swampforest clermontia	Clermontia waimeae	CLWA2	54	54	3
6631	haggarbush	Clerodendrum aculeatum	CLAC2	54	54	3
6632	stickbush	Clerodendrum chinense	CLCH4	54	54	3
6633	Natal glorybower	Clerodendrum glabrum	CLGL2	54	54	3
6634	turks turbin	Clerodendrum indicum	CLIN	54	54	3
6635	velvetleaf glorybower	Clerodendrum macrostegium	CLMA24	54	54	3
6636	glorybower	Clerodendrum spp.	CLERO2	54	54	3
6637	teta prieta	Cleyera albopunctata	CLAL4	54	54	3
6639	jackass breadnut	Clibadium erosum	CLER	54	54	3
6641	Clidemia cymosa	Clidemia cymosa	CLCY5	54	54	3
6642	soapbush	Clidemia hirta	CLHI3	54	54	3
6644	Philippine pigeonwings	Clitoria fairchildiana	CLFA5	54	54	3
6646	cupeillo	Clusia clusioides	CLCL2	54	54	3

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6648	Grundlach's attorney	Clusia gundlachii	CLGU	54	54	3
6650	cupey de monte	Clusia minor	CLMI2	54	54	3
6651	Scotch attorney	Clusia rosea	CLRO	54	54	3
6652	attorney	Clusia spp.	CLUSI	54	54	3
6653	deepwoods fern	Cnemidaria horrida	CNHO	54	54	3
6655	treadsoftly	Cnidoscolus aconitifolius	CNAC	54	54	3
6658	uvilla	Coccoloba costata	COCO8	54	54	3
6660	whitewood	Coccoloba krugii	COKR	54	54	3
6661	puckhout	Coccoloba microstachya	COMI	54	54	3
6662	pale seagrape	Coccoloba pallida	COPA24	54	54	3
6663	grandleaf seagrape	Coccoloba pubescens	COPU	54	54	3
6664	uvera	Coccoloba pyrifolia	COPY	54	54	3
6665	ortegon	Coccoloba rugosa	CORU4	54	54	3
6666	uvero de monte	Coccoloba sintenisii	COSI2	54	54	3
6668	Swartz's pigeonplum	Coccoloba swartzii	COSW	54	54	3
6669	Bahama pigeonplum	Coccoloba tenuifolia	COTE9	54	54	3
6670	seagrape	Coccoloba uvifera	COUV	54	54	3
6671	false chiggergrape	Coccoloba venosa	COVE	54	54	3
6673	Coccothrinax barbadensis	Coccothrinax barbadensis	COBA3	54	54	3
6679	silk cottontree	Cochlospermum vitifolium	COVI	53	53	3
6681	coconut palm	Cocos spp.	COCOS	53	53	3
6683	garden croton	Codiaeum variegatum	COVA3	54	54	3
6684	Arabian coffee	Coffea arabica	COAR2	54	54	3
6686	Coffea liberica	Coffea liberica	COLI8	54	54	3
6687	coffee	Coffea spp.	COFFE	54	54	3
6688	Cojoba arborea	Cojoba arborea	COAR9	54	54	3
6689	abata cola	Cola acuminata	COAC4	54	54	3
6691	uab, chuchab	Colona scabra	COSC13	54	54	3
6693	common snakebark	Colubrina arborescens	COAR3	54	54	3
6694	Asian nakedwood	Colubrina asiatica	COAS3	54	54	3
6696	cherry laurel	Prunus laurocerasus	PRLA5	55	55	3
6697	kauila	Colubrina oppositifolia	COOP	54	54	3
6699	nakedwood	Colubrina spp.	COLUB	54	54	3
6700	Urban's nakedwood	Colubrina verrucosa	COVE6	54	54	3
6702	ochaol	Combretum tetralophum	COTE15	54	54	3
6703	Mao	Commersonia bartramia	COBA17	54	54	3
6705	poison ash	Comocladia dodonaea	CODO	54	54	3
6706	carrasco	Comocladia glabra	COGL4	54	54	3
6707	Japanese flowering cherry	Prunus serrulata	PRSE3	55	55	3
6709	mangrove	Conocarpus spp.	CONOC	54	54	3
6710	Luquillo Mountain snailwood	Conostegia rufescens	CORU17	54	54	3
6711	Consolea moniliformis	Consolea moniliformis	COMO8	54	54	3
6712	Consolea rubescens	Consolea rubescens	CORU8	54	54	3
6714	copaiba	Copaifera officinalis	COOF2	54	54	3
6716	forest mirrorplant	Coprosma foliosa	COFO2	54	54	3
6717	koi	Coprosma kauensis	COKA	54	54	3
6718	Oahu mirrorplant	Coprosma longifolia	COLO4	54	54	3
6719	alpine mirrorplant	Coprosma montana	COMO3	54	54	3
6720	Maui mirrorplant	Coprosma ochracea	COOC3	54	54	3
6721	pubescent mirrorplant	Coprosma pubens	COPU8	54	54	3
6722	woodland mirrorplant	Coprosma rhynchocarpa	CORH	54	54	3
6724	mirrorplant	Coprosma spp.	COPRO	54	54	3
6726	olena	Coprosma waimeae	COWA4	54	54	3
6728	Spanish elm	Cordia alliodora	COAL	54	54	3
6729	Tou	Cordia aspera	COAS6	54	54	3
6730	muneco	Cordia borinquensis	COBO3	54	54	3

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6731	red manjack	Cordia collococca	COCO5	54	54	3
6733	fragrant manjack	Cordia dichotoma	CODI18	54	54	3
6735	smooth manjack	Cordia laevigata	COLA12	54	54	3
6736	Cordia micronesica	Cordia micronesica	COMI6	54	54	3
6737	clammy cherry	Cordia obliqua	COOB3	54	54	3
6738	San Bartolome	Cordia rickseckeri	CORI	54	54	3
6739	Puerto Rico manjack	Cordia rupicola	CORU5	54	54	3
6741	cordia	Cordia spp.	CORDI	54	54	3
6742	kou	Cordia subcordata	COSU2	54	54	3
6743	mucilage manjack	Cordia sulcata	COSU3	54	54	3
6744	tiplant	Cordyline fruticosa	COFR2	54	54	3
6745	cordyline	Cordyline spp.	CORDY2	54	54	3
6746	nigua	Cornutia obovata	COOB4	54	54	3
6747	azulejo	Cornutia pyramidata	COPY2	54	54	3
6748	roughleaf dogwood	Cornus drummondii	CODR	55	55	3
6749	redgum	Corymbia calophylla	COCA48	54	54	3
6750	Corymbia citriodora	Corymbia citriodora	COCI4	54	54	3
6751	redflower gum	Corymbia ficifolia	COFI7	54	54	3
6752	red bloodwood	Corymbia gummifera	COGU4	54	54	3
6754	karaka nut	Corynocarpus laevigatus	COLA6	54	54	3
6755	corynocarpus	Corynocarpus spp.	CORYN2	54	54	3
6756	cannonball tree	Couroupita guianensis	COGU3	54	54	3
6758	sacred garlic pear	Crateva religiosa	CRRE12	54	54	3
6759	Stansbury cliffrose	Purshia stansburiana	PUST	55	55	3
6760	houka, calabash	Crescentia alata	CRAL11	54	54	3
6761	common calabash tree	Crescentia cujete	CRCU	54	54	3
6762	higuerito	Crescentia linearifolia	CRLI5	54	54	3
6763	higuero de sierra	Crescentia portoricensis	CRPO6	54	54	3
6765	Critonia portoricensis	Critonia portoricensis	CRPO7	54	54	3
6767	maidenberry	Crossopetalum rhacoma	CRRH	54	54	3
6768	Arkansas oak	Quercus arkansana	QUAR2	55	55	3
6769	Saitamu	Crossostylis biflora	CRBI9	54	54	3
6771	longbeak rattlebox	Crotalaria longirostrata	CRLO3	54	54	3
6773	wild marrow	Croton astroites	CRAS3	54	54	3
6774	Croton flavens	Croton flavens	CRFL23	54	54	3
6775	sabinon	Croton poecilanthus	CRPO4	54	54	3
6778	Cryptocarya oreophila	Cryptocarya oreophila	CROR5	54	54	3
6779	laulilii	Cryptocarya elegans	CREL8	54	54	3
6781	holio	Cryptocarya mannii	CRMA8	54	54	3
6782	Georgia oak	Quercus georgiana	QUGE	55	55	3
6783	cryptocarya	Cryptocarya spp.	CRYPT2	54	54	3
6784	laulilii	Cryptocarya turbinata	CRTU4	54	54	3
6785	Havard oak	Quercus havardii	QUHA3	55	55	3
6786	Japanese cedar	Cryptomeria japonica	CRJA3	52	52	2
6787	Japanese cedar	Cryptomeria spp.	CRYPT4	54	54	3
6788	Chinese fir	Cunninghamia lanceolata	CULA	52	52	2
6790	wild ackee	Cupania americana	CUAM	54	54	3
6791	myrtle oak	Quercus myrtifolia	QUMY	55	55	3
6792	guara blanca	Cupania triquetra	CUTR	54	54	3
6794	durmast oak	Quercus petraea	QUPE2	55	55	3
6795	cedar-of-Goa	Cupressus lusitanica	CULU2	52	52	2
6796	Italian cypress	Cupressus sempervirens	CUSE2	52	52	2
6797	English oak	Quercus robur	QURO2	55	55	3
6799	bastard oak	Quercus sinuata	QUSI	55	55	3
6800	Haleakala cyanea	Cyanea aculeatiflora	CYAC4	54	54	3
6801	palmtree cyanea	Cyanea arborea	CYAR10	53	53	3

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6802	Kauai cyanea	Cyanea fissa	CYFI6	54	54	3
6805	Degeners cyanea	Cyanea floribunda	CYFL4	54	54	3
6806	Kilauea Mauna cyanea	Cyanea giffardii	CYGI5	54	54	3
6807	wetforest cyanea	Cyanea hamatiflora	CYHA6	54	54	3
6810	Oahu cyanea	Cyanea hardyi	CYHA7	54	54	3
6811	prickly cyanea	Cyanea horrida	CYHO6	54	54	3
6812	Limahuli Valley cyanea	Cyanea kuhihewa	CYKU3	54	54	3
6813	Kunths cyanea	Cyanea kunthiana	CYKU	54	54	3
6814	giant kokee cyanea	Cyanea leptostegia	CYLE5	54	54	3
6815	purple cyanea	Cyanea macrostegia	CYMA10	54	54	3
6818	Marks cyanea	Cyanea marksii	CYMA14	54	54	3
6819	hairy cyanea	Cyanea pilosa	CYPI4	54	54	3
6822	pohaku cyanea	Cyanea pohaku	CYPO5	54	54	3
6823	Molokai cyanea	Cyanea procera	CYPR8	54	54	3
6824	manyfruit cyanea	Cyanea pycnocarpa	CYPY	54	54	3
6825	oakleaf cyanea	Cyanea quercifolia	CYQU	54	54	3
6826	plateau delissea	Cyanea rivularis	CYRI4	54	54	3
6827	pua kala	Cyanea solenocalyx	CYSO2	54	54	3
6828	cyanea	Cyanea spp.	CYANE	54	54	3
6829	Kaiholena cyanea	Cyanea stictophylla	CYST5	54	54	3
6830	Mt. Kaala cyanea	Cyanea superba	CYSU8	54	54	3
6833	aku aku	Cyanea tritomantha	CYTR6	54	54	3
6834	parrotfeather treefern	Cyathea andina	CYAN	54	54	3
6835	West Indian treefern	Cyathea arborea	CYAR	54	54	3
6837	Coopers cyathea	Cyathea cooperi	CYCO18	54	54	3
6838	olioli	Cyathea decurrens	CYDE16	54	54	3
6839	Jamaican treefern	Cyathea furfuracea	CYFU	54	54	3
6840	olioli	Cyathea lunulata	CYLU5	54	54	3
6841	olioli	Cyathea medullaris	CYME12	54	54	3
6842	kattar	Cyathea nigricans	CYNI7	54	54	3
6843	small treefern	Cyathea parvula	CYPA7	54	54	3
6844	kattar	Cyathea ponapeana	CYPO11	54	54	3
6847	treefern	Cyathea spp.	CYATH	54	54	3
6848	helecho gigante	Cyathea tenera	CYTE10	54	54	3
6849	olioli	Cyathea truncata	CYTR11	54	54	3
6850	Cybianthus sintenisii	Cybianthus sintenisii	CYSI	54	54	3
6852	queen sago	Cycas circinalis	CYCI3	54	54	3
6853	remiang	Cycas revoluta	CYRE11	54	54	3
6854	Cycas	Cycas spp.	CYCAS	54	54	3
6855	ola	Cyclophyllum barbatum	CYBA7	54	54	3
6857	oreganillo falso	Cynometra portoricensis	CYPO2	54	54	3
6858	gulos	Cynometra ramiflora	CYRA8	54	54	3
6860	tree-tomato	Cyphomandra betacea	CYBE3	54	54	3
6862	swamp titi	Cyrilla racemiflora	CYRA	54	54	3
6863	cyrtandra	Cyrtandra pulchella	CYPU13	54	54	4
6864	Cyrtandra	Cyrtandra ramosissima	CYRA3	54	54	3
6865	forest cyrtandra	Cyrtandra giffardii	CYGI3	54	54	3
6866	cyrtandra	Cyrtandra spp.	CYRTA	54	54	3
6867	candletree	Dacryodes excelsa	DAEX	54	54	3
6869	Indian rosewood	Dalbergia sissoo	DASI	54	54	3
6871	burn nose	Daphnopsis americana	DAAM2	54	54	3
6872	Heller's cieneguillo	Daphnopsis helleriana	DAHE2	54	54	3
6873	emajagua de sierra	Daphnopsis philippiana	DAPH	54	54	3
6875	Hawaii delissea	Delissea fallax	DEFA	54	54	3
6876	cutleaf delissea	Delissea laciniata	DELA4	54	54	3
6877	Niihau delissea	Delissea niihauensis	DENI	54	54	3

SPCD	Common name	Scientific name	Species Symbol	E_SPGRCD	W_SPGRPCD	MAJOR_ SPGRPCD
6880	smallflower delissea	Delissea parviflora	DEPA9	54	54	3
6881	delissea	Delissea spp.	DELIS	54	54	3
6882	leechleaf delissea	Delissea undulata	DEUN2	54	54	3
6883	royal poinciana	Delonix regia	DERE	54	54	3
6884	delonix	Delonix spp.	DELON	54	54	3
6885	salato	Dendrocnide harveyi	DEHA5	54	54	3
6886	kahtat	Dendrocnide latifolia	DELA13	54	54	3
6887	Dendrocnide	Dendrocnide spp.	DENDR16	54	54	3
6888	angelica tree	Dendropanax arboreus	DEAR	54	54	3
6889	palo de vaca	Dendropanax laurifolius	DELA3	54	54	3
6891	redpalm	Dictyosperma album	DIAL13	53	53	3
6896	chulta	Dillenia indica	DIIN6	54	54	3
6898	shrubby dillenia	Dillenia suffruticosa	DISU11	54	54	3
6899	Dimocarpus longan	Dimocarpus longan	DILO7	54	54	3
6900	mabolo	Diospyros blancoi	DIBL3	54	54	3
6902	Mabolo	Diospyros discolor	DIDI9	54	54	3
6903	Black sapote	Diospyros ebenaster	DIEB	54	54	3
6904	anume	Diospyros elliptica	DIEL3	54	54	3
6905	Diospyros ferrea	Diospyros ferrea	DIFE5	54	54	3
6906	elama	Diospyros hillebrandii	DIHI4	54	54	3
6907	persimmon	Diospyros kaki	DIKA2	54	54	3
6909	black apple	Diospyros revoluta	DIRE6	54	54	3
6910	auauli	Diospyros samoensis	DISA16	54	54	3
6911	lama	Diospyros sandwicensis	DISA10	54	54	3
6912	Chinese persimmon	Diospyros sintenisii	DISI3	54	54	3
6918	common buckthorn	Rhamnus cathartica	RHCA3	55	55	3
6921	otot	Discocalyx ponapensis	DIPO	54	54	3
6923	jaboncillo	Ditta myricoides	DIMY	54	54	3
6924	staghorn sumac	Rhus typhina	RHTY	55	55	3
6927	Florida hopbush	Dodonaea viscosa	DOVI	54	54	3
6928	rru	Dolichandrone spathacea	DOSP3	54	54	3
6930	Ceylon gooseberry	Dovyalis hebecarpa	DOHE2	54	54	3
6932	fragrant dracaena	Dracaena fragrans	DRFR2	54	54	3
6933	Dracaena multiflora	Dracaena multiflora	DRMU2	54	54	3
6937	cafeillo	Drypetes alba	DRAL5	54	54	3
6938	varital	Drypetes glauca	DRGL2	54	54	3
6939	rosewood	Drypetes ilicifolia	DRIL	54	54	3
6940	guiana plum	Drypetes lateriflora	DRLA3	54	54	3
6941	kevert	Drypetes nitida	DRNI3	54	54	3
6942	Drypetes	Drypetes spp.	DRYPE	54	54	3
6943	none	Drypetes vitiensis	DRVI5	54	54	3
6944	Dubautia	Dubautia demissifolia	DUDE	54	54	3
6945	Dubautia	Dubautia fallax	DUFA2	54	54	3
6946	Dubautia	Dubautia montana	DUMO2	54	54	3
6947	Mauna Kea dubautia	Dubautia arborea	DUAR	54	54	3
6948	forest dubautia	Dubautia knudsenii	DUKN	54	54	3
6952	Kauai dubautia	Dubautia microcephala	DUMI	54	54	3
6953	plantainleaf dubautia	Dubautia plantaginea	DUPL	54	54	3
6954	Elaeagnus willow	Salix elaeagnos	SAEL	55	55	3
6957	netvein dubautia	Dubautia reticulata	DURE2	54	54	3
6958	dubautia	Dubautia spp.	DUBAU	54	54	3
6959	Geyer willow	Salix geyeriana	SAGE2	55	55	3
6961	golden dewdrops	Duranta erecta	DUER	54	54	3
6963	red willow	Salix laevigata	SALA3	55	55	3
6965	Durian	Durio zibethinus	DUZI	54	54	3
6966	Dypsis lutescens	Dypsis lutescens	DYLU	54	54	3

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6967	corkscrew willow	Salix matsudana	SAMA13	55	55	3
6968	maota mea	Dysoxylum huntii	DYHU2	54	54	3
6969	maota	Dysoxylum maota	DYMA	54	54	3
6970	mamala	Dysoxylum samoense	DYSA	54	54	3
6971	Dysoxylum	Dysoxylum spp.	DYSOX	54	54	3
6973	oil nut palm	Elaeis guineensis	ELGU	53	53	3
6975	kalia	Elaeocarpus bifidus	ELBI	54	54	3
6976	syatak	Elaeocarpus carolinensis	ELCA20	54	54	3
6977	\`a\`mati\`e	Elaeocarpus floridanus	ELFL6	54	54	3
6978	Elaeocarpus graeffei	Elaeocarpus graeffei	ELGR	54	54	3
6979	sapatua	Elaeocarpus grandis	ELGR6	54	54	3
6980	joga	Elaeocarpus joga	ELJO	54	54	3
6981	Elaeocarpus kerstingianus	Elaeocarpus kerstingianus	ELKE	54	54	3
6982	maratte, opop	Elaeocarpus kusanoi	ELKU	54	54	3
6983	Elaeocarpus	Elaeocarpus spp.	ELAEO	54	54	3
6984	aamatie	Elaeocarpus tonganus	ELTO4	54	54	3
6985	Elaeocarpus	Elaeocarpus ulianus	ELUL	54	54	3
6990	taputoi	Elattostachys falcata	ELFA3	54	54	3
6991	red elderberry	Sambucus racemosa	SARA2	55	55	3
6992	utuutu	Eleocharis dulcis	ELDU3	54	54	3
6994	elaeocarpa	Endiandra elaeocarpa	ENEL	54	54	3
6996	monkeysoap	Enterolobium cyclocarpum	ENCY	54	54	3
6998	loquat	Eriobotrya japonica	ERJA3	54	54	3
6999	loquat	Eriobotrya spp.	ERIOB	54	54	3
7000	blacktorch	Erithalis fruticosa	ERFR4	54	54	3
7004	machete	Erythrina berteriana	ERBE3	54	54	3
7005	coral erythrina	Erythrina corallodendron	ERCO22	54	54	3
7006	crybabytree	Erythrina crista-galli	ERCR6	54	54	3
7007	cock's spur	Erythrina eggersii	EREG	54	54	3
7008	bucayo	Erythrina fusca	ERFU2	54	54	3
7011	mountain immortelle	Erythrina poeppigiana	ERPO5	54	54	3
7012	wili wili	Erythrina sandwicensis	ERSA11	54	54	3
7013	erythrina	Erythrina spp.	ERYTH	54	54	3
7014	gatae palagi	Erythrina subumbrans	ERSU15	54	54	3
7015	tiger's claw	Erythrina variegata	ERVA7	54	54	3
7016	tiger's claw	Erythrina variegata orientalis	ERVAO	54	54	3
7017	acuminatissimum	Erythrospermum acuminatissimum	ERAC10	54	54	3
7019	swamp-redwood	Erythroxylum areolatum	ERAR17	54	54	3
7021	ratwood	Erythroxylum rotundifolium	ERRO3	54	54	3
7022	rufous false cocaine	Erythroxylum rufum	ERRU4	54	54	3
7023	Argentine senna	Senna corymbosa	SECO9	55	55	3
7024	Urban's false cocaine	Erythroxylum urbanii	ERUR4	54	54	3
7025	southern mahogany	Eucalyptus botryoides	EUBO2	54	54	3
7026	applebox	Eucalyptus bridgesiana	EUBR2	54	54	3
7028	argyle apple	Eucalyptus cinerea	EUCI80	54	54	3
7030	sugargum	Eucalyptus cladocalyx	EUCL	54	54	3
7031	yate	Eucalyptus cornuta	EUCO3	54	54	3
7032	narrowleaf red ironbark	Eucalyptus crebra	EUCR	54	54	3
7033	roundleaf gum	Eucalyptus deanei	EUDE	54	54	3
7034	Indonesian gum	Eucalyptus deglupta	EUDE2	54	54	3
7038	tuart	Eucalyptus gomphocephala	EUGO	54	54	3
7039	mountain graygum	Eucalyptus goniocalyx	EUGO2	54	54	3
7041	white box	Eucalyptus hemiphloia	EUHE12	54	54	3
7043	spotted gum	Eucalyptus maculata	EUMA23	54	54	3
7044	jarrah	Eucalyptus marginata	EUMA4	54	54	3

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7045	Australian tallowwood	Eucalyptus microcorys	EUMI	54	54	3
7046	gray ironbark	Eucalyptus paniculata	EUPA	54	54	3
7047	blackbutt	Eucalyptus pilularis	EUPI	54	54	3
7048	black ironbox	Eucalyptus raveretiana	EURA4	54	54	3
7049	redmahogany	Eucalyptus resinifera	EURE2	54	54	3
7051	Western Australian floodedgum	Eucalyptus rudis	EURU2	54	54	3
7052	black peppermint	Eucalyptus salicifolia	EUSA17	54	54	3
7053	Sydney bluegum	Eucalyptus saligna	EUSA	54	54	3
7054	red ironbark	Eucalyptus sideroxylon	EUSI2	54	54	3
7056	forest redgum	Eucalyptus tereticornis	EUTE	54	54	3
7057	manna gum	Eucalyptus viminalis	EUVI	54	54	3
7059	edebsachel, chedebsachel	Eugenia aquea	EUAQ	54	54	3
7060	white stopper	Eugenia axillaris	EUAX	54	54	3
7061	blackrodwood	Eugenia biflora	EUBI	54	54	3
7062	Sierra de Cayey stopper	Eugenia boqueronensis	EUBO3	54	54	3
7063	guayabota de sierra	Eugenia borinquensis	EUBO4	54	54	3
7065	cloves	Eugenia caryophyllus	EUCA16	54	54	3
7066	redberry stopper	Eugenia confusa	EUCO4	54	54	3
7067	lathberry	Eugenia cordata	EUCO5	54	54	3
7068	lathberry	Eugenia cordata var. sintenisii	EUCOS	54	54	3
7069	sperry guava	Eugenia corozalensis	EUCO13	54	54	3
7071	serrette guave	Eugenia domingensis	EUDO	54	54	3
7072	guasabara	Eugenia eggersii	EUEG	54	54	3
7075	smooth rodwood	Eugenia glabrata	EUGL6	54	54	3
7076	Luquillo Mountain stopper	Eugenia haematocarpa	EUHA4	54	54	3
7078	macupa, wax apple	Eugenia javanica	EUJA4	54	54	3
7079	nioi	Eugenia koolauensis	EUKO	54	54	3
7081	privet stopper	Eugenia ligustrina	EULI	54	54	3
7082	makupa, malay apple	Eugenia malaccensis	EUMA5	54	54	3
7083	bigleaf snowbell	Styrax grandifolius	STGR4	55	55	3
7084	birdcherry	Eugenia monticola	EUMO	54	54	3
7086	Eugenia nitida	Eugenia nitida	EUNI2	54	54	3
7087	orenged	Eugenia palauensis	EUPA3	54	54	3
7088	agatelang	Eugenia palumbis	EUPA28	54	54	3
7089	rockmyrtle	Eugenia procera	EUPR4	54	54	3
7090	Christmas cherry	Eugenia pseudopsidium	EUPS	54	54	3
7091	mountain stopper	Eugenia reinwardtiana	EURE7	54	54	3
7092	Japanese tree lilac	Syringa reticulata	SYRE2	55	55	3
7093	serrasuela	Eugenia serrasuela	EUSE9	54	54	3
7094	sessileleaf stopper	Eugenia sessiliflora	EUSE10	54	54	3
7096	stopper	Eugenia spp.	EUGEN	54	54	3
7098	Stahl's stopper	Eugenia stahlii	EUST3	54	54	3
7099	luluhut	Eugenia stelechantha	EUST24	54	54	3
7100	Stewardson's stopper	Eugenia stewardsonii	EUST6	54	54	3
7101	rebotel	Eugenia suzukii	EUSU9	54	54	3
7102	atoto	Eugenia thompsonii	EUTH4	54	54	3
7103	Underwood's stopper	Eugenia underwoodii	EUUN	54	54	3
7104	Surinam cherry	Eugenia uniflora	EUUN2	54	54	3
7105	aridland stopper	Eugenia xerophytica	EUXE	54	54	3
7109	Mexican shrubby spurge	Euphorbia cotinifolia	EUCO24	54	54	3
7110	Kauai spurge	Euphorbia haeleeleana	EUHA2	54	54	3
7111	mottled spurge	Euphorbia lactea	EULA8	54	54	3
7112	Indian spurgetree	Euphorbia neriifolia	EUNE4	54	54	3
7113	manchineel berry	Euphorbia petiolaris	EUPE8	54	54	3
7114	poinsettia	Euphorbia pulcherrima	EUPU9	54	54	3

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7115	spurge	Euphorbia spp.	EUPHO	54	54	3
7116	Indiantree spurge	Euphorbia tirucalli	EUTI	54	54	3
7117	Longan	Euphoria longana	EULO7	54	54	3
7119	anini	Eurya sandwicensis	EUSA6	54	54	3
7120	eurya	Eurya spp.	EURYA	54	54	3
7123	Euodia hortensis	Euodia hortensis	EUHO5	54	54	3
7124	kertub	Euodia nitida	EUNI8	54	54	3
7125	beror	Euodia palawensis	EUPA29	54	54	3
7126	Euodia ponapensis	Euodia ponapensis	EUPO15	54	54	3
7127	Euodia	Euodia spp.	EUODI	54	54	3
7128	Euodia trichantha	Euodia trichantha	EUTR13	54	54	3
7129	blinding tree	Excoecaria agallocha	EXAG	54	54	3
7131	hulumoa	Exocarpos gaudichaudii	EXGA	54	54	3
7132	exocarpos	Exocarpos spp.	EXOCA	54	54	3
7133	kotop	Exorrhiza ponapensis	EXPO2	54	54	3
7135	Caribbean princewood	Exostema caribaeum	EXCA	54	54	3
7136	plateado	Exostema ellipticum	EXEL	54	54	3
7137	Exostema sanctae-luciae	Exostema sanctae-luciae	EXSA2	54	54	3
7141	pualulu	Fagraea berteroana	FABE	54	54	3
7142	ksid	Fagraea ksid	FAKS	54	54	3
7143	Fagraea	Fagraea spp.	FAGRA	54	54	3
7144	peacocksplume	Falcataria moluccana	FAMO	54	54	3
7145	peacocksplume	Falcataria spp.	FALCA2	54	54	3
7146	false coffee	Faramea occidentalis	FAOC	54	54	3
7148	Jamaican cherry fig	Ficus americana	FIAM	54	54	3
7149	Indian banyan	Ficus benghalensis	FIBE2	54	54	3
7150	weeping fig	Ficus benjamina	FIBE	54	54	3
7151	edible fig	Ficus carica	FICA	54	54	3
7152	Ficus copiosa	Ficus copiosa	FICO2	54	54	3
7154	brown-woolly fig	Ficus drupacea	FIDR3	54	54	3
7155	Indian rubberplant	Ficus elastica	FIEL	54	54	3
7156	mati	Ficus godeffroyi	FIGO	54	54	3
7158	Ficus lutea	Ficus lutea	FILU	54	54	3
7159	fiddleleaf fig	Ficus lyrata	FILY	54	54	3
7160	Chinese banyan	Ficus microcarpa	FIMI2	54	54	3
7162	tibig	Ficus nota	FINO3	54	54	3
7163	aoa	Ficus obliqua	FIOB3	54	54	3
7164	amate	Ficus obtusifolia	FIOB	54	54	3
7165	aoa	Ficus prolixa	FIPR2	54	54	3
7166	peepul tree	Ficus religiosa	FIRE3	54	54	3
7167	Port Jackson fig	Ficus rubiginosa	FIRU4	54	54	3
7168	lulk, banyan	Ficus saffordii	FISA	54	54	3
7169	mati vao	Ficus scabra	FISC3	54	54	3
7171	fig	Ficus spp.	FICUS	54	54	3
7173	jaguey	Ficus stahlii	FIST	54	54	3
7174	sycamore fig	Ficus sycomorus	FISY2	54	54	3
7175	Chinese banyan	Ficus thonningii	FITH2	54	54	3
7176	mati	Ficus tinctoria	FITI2	54	54	3
7177	jaguey blanco	Ficus trigonata	FITR	54	54	3
7178	mati	Ficus uniauriculata	FIUN	54	54	3
7179	higo	Ficus virens	FIVI3	54	54	3
7180	Finschia chloroxantha	Finschia chloroxantha	FICH	54	54	3
7181	Chinese parasoltree	Firmiana simplex	FISI2	55	55	3
7182	burrdaisytree	Fitchia speciosa	FISP3	54	54	3
7184	governor's plum	Flacourtia indica	FLIN	54	54	3
7185	batoko plum	Flacourtia inermis	FLIN3	54	54	3

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7186	filimoto	Flacourtia rukam	FLRU2	54	54	3
7188	Queensland maple	Flindersia brayleyana	FLBR	54	54	3
7190	Flueggea acidoton	Flueggea acidoton	FLAC	54	54	3
7191	poumuli	Flueggea flexuosa	FLFL4	54	54	3
7192	mehamehame	Flueggea neowawraea	FLNE	54	54	3
7193	bushweed	Flueggea spp.	FLUEG	54	54	3
7194	inkbush	Forestiera eggersiana	FOEG	54	54	3
7195	caca ravet	Forestiera rhamnifolia	FORH	54	54	3
7196	Florida swampprivet	Forestiera segregata	FOSE	54	54	3
7198	oval kumquat	Fortunella margarita	FOMA2	54	54	3
7199	Chinese chastetree	Vitex negundo	VINE2	55	55	3
7200	California buckthorn	Frangula californica	FRCA12	54	54	3
7202	West Indian buckthorn	Frangula sphaerosperma	FRSPL	54	54	3
7203	Franklin tree	Franklinia alatamaha	FRAL	55	55	3
7206	shamel ash	Fraxinus uhdei	FRUH	54	54	3
7207	Bolivian fuchsia	Fuchsia boliviana	FUBO	54	54	3
7208	shrubby fuchsia	Fuchsia paniculata	FUPA2	54	54	3
7209	fuchsia	Fuchsia spp.	FUCHS	54	54	3
7210	silkrubber	Funtumia elastica	FUEL	54	54	3
7211	avocado	Persea americana	PEAM3	43	47	3
7212	Gourka	Garcinia dulcis	GADU3	53	53	3
7213	lemon saptree	Garcinia hessii	GAHE5	54	54	3
7214	mangosteen	Garcinia mangostana	GAMA10	54	54	3
7215	tilol	Garcinia matsudai	GAMA8	54	54	3
7216	none	Garcinia myrtifolia	GAMY	54	54	3
7217	konpuil	Garcinia ponapensis	GAPO4	54	54	3
7218	palo de cruz	Garcinia portoricensis	GAPO2	54	54	3
7219	tilol	Garcinia rumiyo	GARU3	54	54	3
7221	Garcinia	Garcinia spp.	GARCI	54	54	3
7223	Garcinia xanthochymus	Garcinia xanthochymus	GAXA	54	54	3
7224	forest gardenia	Gardenia brighamii	GABR	54	54	3
7225	Oahu gardenia	Gardenia mannii	GAMA6	54	54	3
7226	Remys gardenia	Gardenia remyi	GARE	54	54	3
7227	gardenia	Gardenia spp.	GARDE	54	54	3
7228	Tahitian gardenia	Gardenia taitensis	GATA	54	54	3
7229	manuai vivao	Garuga floribunda	GAFL8	54	54	3
7231	llume	Gaussia attenuata	GAAT	54	54	3
7233	taipoipo	Geniostoma rupestre	GERU3	54	54	3
7235	jagua	Genipa americana	GEAM	54	54	3
7237	arbol de Navidad	Gesneria pedunculosa	GEPE4	54	54	3
7239	bastard gregre	Ginoria rohrii	GIRO	54	54	3
7241	Gironniera celtidifolia	Gironniera celtidifolia	GICE2	54	54	3
7243	Japanese zelkova	Zelkova serrata	ZESE80	55	55	3
7245	quickstick	Gliricidia sepium	GLSE2	54	54	3
7246	lotebush	Ziziphus obtusifolia	ZIOB	55	55	3
7247	masame	Glochidion cuspidatum	GLCU	54	54	3
7248	Glochidion marianum	Glochidion marianum	GLMA9	54	54	3
7249	masame	Glochidion ramiflorum	GLRA4	54	54	3
7250	Glochidion	Glochidion spp.	GLOCH	54	54	3
7251	belau	Gmelina elliptica	GMEL	54	54	3
7252	blacheos	Gmelina palawensis	GMPA	54	54	3
7253	Gmelina	Gmelina spp.	GMELI	54	54	3
7254	Gnetum gnemon	Gnetum gnemon	GNGN	54	54	3
7255	flower axistree	Glycosmis parviflora	GLPA4	55	55	3
7256	mata buey	Goetzea elegans	GOEL	54	54	3
7257	Glochidion kanehirae	Glochidion kanehirae	GLKA	54	54	3

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7258	grand merisier	Gomidesia lindeniana	GOLI	54	54	3
7260	Goniothalamus carolinensis	Goniothalamus carolinensis	GOCA2	54	54	3
7262	Creole cotton	Gossypium barbadense	GOBA	54	54	3
7264	Gossypium hirsutum	Gossypium hirsutum	GOHIH2	54	54	3
7268	Graffenrieda ottoschulzii	Graffenrieda ottoschulzii	GROT	54	54	3
7272	kahiliflower	Grevillea banksii	GRBA	54	54	3
7273	silkoak	Grevillea robusta	GRRO	54	54	3
7274	grevillea	Grevillea spp.	GREVI	54	54	3
7275	fau ui	Grewia crenata	GRCR4	54	54	3
7279	lignum-vitae	Guaiacum officinale	GUOF	54	54	3
7280	holywood	Guaiacum sanctum	GUSA	54	54	3
7282	paipai	Guamia mariannae	GUMA4	54	54	3
7285	black mampoo	Guapira fragrans	GUFR	54	54	3
7286	corcho prieto	Guapira obtusata	GUOB	54	54	3
7288	alligatorwood	Guarea glabra	GUGL3	54	54	3
7290	American muskwood	Guarea guidonia	GUGU	54	54	3
7294	haya minga	Guatteria blainii	GUBL	54	54	3
7295	haya blanca	Guatteria caribaea	GUCA2	54	54	3
7298	bastardcedar	Guazuma ulmifolia	GUUL	54	54	3
7299	hammock velvetseed	Guettarda elliptica	GUEL	54	54	3
7300	frogwood	Guettarda krugii	GUKR	54	54	3
7302	cucubano de vieques	Guettarda odorata	GUOD	54	54	3
7303	cucubano	Guettarda ovalifolia	GUOV	54	54	3
7305	roseta	Guettarda pungens	GUPU	54	54	3
7306	wild guave	Guettarda scabra	GUSC	54	54	3
7307	puapua	Guettarda speciosa	GUSP3	54	54	3
7309	cucubano de monte	Guettarda valenzuelana	GUVA	54	54	3
7311	rhoifolia	Guioa rhoifolia	GURH	54	54	3
7312	Guioa	Guioa spp.	GUIOA	54	54	3
7313	bochela uchererak, uch	Gulubia palauensis	GUPA	54	54	3
7315	West Indian false box	Gyminda latifolia	GYLA	54	54	3
7317	oysterwood	Gymnanthes lucida	GYLU	54	54	3
7319	vilivili	Gyrocarpus americanus	GYAM2	54	54	3
7321	bloodwoodtree	Haematoxylum campechianum	HACA2	54	54	3
7327	palo de hueso	Haenianthus salicifolius	HASAO	54	54	3
7328	mountain silverbell	Halesia tetraptera	HATE3	55	55	3
7329	Ozark witchhazel	Hamamelis vernalis	HAVE2	55	55	3
7330	scarletbush	Hamelia patens	HAPA3	54	54	3
7331	American witchhazel	Hamamelis virginiana	HAVI4	55	55	3
7332	Haplolobus floribundus	Haplolobus floribundus	HAFL	54	54	3
7334	fa`aili	Harpullia arborea	HAAR4	54	54	3
7335	haujillo	Havardia pallens	HAPA10	55	55	3
7336	false locust	Hebestigma cubense	HECU10	54	54	3
7338	denticulata	Hedycarya denticulata	HEDE14	54	54	3
7340	Hedycarya	Hedycarya spp.	HEDYC2	54	54	3
7341	cigarbush	Hedyosmum arborescens	HEAR	54	54	3
7343	Fosbergs starviolet	Hedyotis fosbergii	HEFO5	54	54	3
7344	manono	Hedyotis hillebrandii	HEHI8	54	54	3
7345	starviolet	Hedyotis spp.	HEDYO2	54	54	3
7346	variable starviolet	Hedyotis terminalis	HETE21	54	54	3
7347	screwtree	Helicteres jamaicensis	HEJA	54	54	3
7349	white moho	Heliocarpus popayanensis	HEPO4	54	54	3
7350	heliocarpus	Heliocarpus spp.	HELIO	54	54	3
7353	camasey peludo	Henriettea fascicularis	HEFA5	54	54	3
7354	MacFadyen's camasey	Henriettea macfadyenii	HEMA11	54	54	3
7355	thinleaf camasey	Henriettea membranifolia	HEME5	54	54	3

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7357	jusillo	Henriettea squamulosum	HESQ	54	54	3
7359	ufa	Heritiera littoralis	HELI9	54	54	3
7360	ufa halemtano	Heritiera longipetiolata	HELO12	54	54	3
7362	Heritiera	Heritiera spp.	HERIT2	54	54	3
7363	pipi	Hernandia moerenhoutiana	HEMO13	54	54	3
7364	pua, Chinese lantern tree	Hernandia nymphaeifolia	HENY	54	54	3
7365	Hernandia ovigera	Hernandia ovigera	HEOV4	54	54	3
7366	mago	Hernandia sonora	HESO	54	54	3
7367	Hernandia	Hernandia spp.	HERNA	54	54	3
7368	Hernandia labyrinthica	Hernandia labyrinthica	HELA27	54	54	3
7370	Lanai island-aster	Hesperomannia arborescens	HEAR9	54	54	3
7371	Maui island-aster	Hesperomannia arbuscula	HEAR10	54	54	3
7372	Kauai island-aster	Hesperomannia lydgatei	HELY	54	54	3
7373	island-aster	Hesperomannia spp.	HESPE8	54	54	3
7374	toyon	Heteromeles arbutifolia	HEAR5	54	54	3
7376	toyon	Heteromeles spp.	HETER5	54	54	3
7377	palma brava	Heterospathe elata	HEEL9	53	53	3
7381	para rubber tree	Hevea brasiliensis	HEBR8	54	54	3
7384	hau kuahiwi	Hibiscadelphus bombycinus	HIBO2	54	54	3
7385	lava hau kuahiwi	Hibiscadelphus crucibracteatus	HICR	54	54	3
7386	Kauai hau kuahiwi	Hibiscadelphus distans	HIDI	54	54	3
7387	Kilauea hau kuahiwi	Hibiscadelphus giffardianus	HIGI	54	54	3
7388	Hualalai hau kuahiwi	Hibiscadelphus hualalaiensis	HIHU	54	54	3
7389	hau kuahiwi	Hibiscadelphus puakuahiwi	HIPU2	54	54	3
7390	hibiscadelphus	Hibiscadelphus spp.	HIBIS	54	54	3
7391	Maui hau kuahiwi	Hibiscadelphus wilderianus	HIWI	54	54	3
7392	Woods hau kuahiwi	Hibiscadelphus woodii	HIWO	54	54	3
7393	white rosemallow	Hibiscus arnottianus	HIAR	54	54	3
7397	Brackenridges rosemallow	Hibiscus brackenridgei	HIBR	54	54	3
7401	lemonyellow rosemallow	Hibiscus calyphyllus	HICA6	54	54	3
7402	red Kauai rosemallow	Hibiscus clayi	HICL	54	54	3
7403	mahoe	Hibiscus elatus	HIEL	54	54	3
7404	red rosemallow	Hibiscus kokio	HIKO	54	54	3
7407	largeleaf rosemallow	Hibiscus macrophyllus	HIMA5	54	54	3
7408	Dixie rosemallow	Hibiscus mutabilis	HIMU3	54	54	3
7409	seaside mahoe	Hibiscus pernambucensis	HIPE3	54	54	3
7410	shoeblackplant	Hibiscus rosa-sinensis	HIRO3	54	54	3
7411	rosemallow	Hibiscus spp.	HIBIS2	54	54	3
7412	sea hibiscus	Hibiscus tiliaceus	HITI	54	54	3
7413	white Kauai rosemallow	Hibiscus waimeae	HIWA	54	54	3
7418	teta de burra cinarron	Hirtella rugosa	HIRU2	54	54	3
7420	pigeonberry	Hirtella triandra	HITR3	54	54	3
7422	white cogwood	Homalium racemosum	HORA	54	54	3
7424	Homalium whitmeeanum	Homalium whitmeeanum	HOWH	54	54	3
7427	chemeklachel, eumail	Horsfieldia amklaal	HOAM2	54	54	3
7428	ersachel	Horsfieldia novoguineensis	HONO2	54	54	3
7429	Horsfieldia nunu	Horsfieldia nunu	HONU2	54	54	3
7430	chersachel	Horsfieldia palauensis	HOPA10	54	54	3
7431	Horsfieldia	Horsfieldia spp.	HORSF2	54	54	3
7432	Japanese raisintree	Hovenia dulcis	HODU2	55	55	3
7434	sandbox tree	Hura crepitans	HUCR	54	54	3
7438	cedro macho	Hyeronima clusioides	HYCL	54	54	3
7440	nightblooming cactus	Hylocereus spp.	HYLOC	54	54	3
7441	nightblooming cactus	Hylocereus undatus	HYUN3	54	54	3
7442	stinkingtoe	Hymenaea courbaril	HYCO	54	54	3
7445	inkwood	Hypelate trifoliata	HYTR	54	54	3

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7446	limestone snakevine	Hyperbaena laurifolia	HYLA8	54	54	3
7448	Canary Island St. Johnswort	Hypericum canariense	HYCA11	54	54	3
7453	Hawaii holly	Ilex anomala	ILAN	54	54	3
7454	English holly	Ilex aquifolium	ILAQ80	54	54	3
7455	dahoon	Ilex cassine	ILCA	54	54	3
7456	te	Ilex cookii	ILCO3	54	54	3
7457	maconcona	Ilex guianensis	ILGU	54	54	3
7458	Caribbean holly	Ilex macfadyenii	ILMA	54	54	3
7459	Puerto Rico holly	Ilex nitida	ILNI	54	54	3
7460	mate	Ilex paraguariensis	ILPA3	54	54	3
7462	gongolin	Ilex sideroxyloides	ILSI	54	54	3
7463	Sintenis' holly	Ilex sintenisii	ILSI2	54	54	3
7464	holly	Ilex spp.	ILEX	54	54	3
7465	Urban's holly	Ilex urbaniana	ILUR	54	54	3
7466	Ilex urbaniana	Ilex urbaniana var. riedlaei	ILURR	54	54	3
7467	inga	Inga spp.	INGA	54	54	3
7469	yaupon	Ilex vomitoria	ILVO	55	55	3
7470	sacky sac bean	Inga laurina	INLA	54	54	3
7471	Inga nobilis	Inga nobilis	INNOQ	54	54	3
7474	river koko	Inga vera	INVE	54	54	3
7475	ifi	Inocarpus fagifer	INFA3	54	54	3
7477	ifilele	Intsia bijuga	INBI	54	54	3
7479	palo de hierro	Ixora ferrea	IXFE	54	54	3
7481	white jungleflame	Ixora thwaitesii	IXTH	54	54	3
7482	black poui	Jacaranda mimosifolia	JAMI	54	54	3
7483	jacaranda	Jacaranda spp.	JACAR	54	54	3
7485	braceletwood	Jacquinia armillaris	JAAR2	54	54	3
7487	bois bande	Jacquinia berteroi	JABE	54	54	3
7490	chirriador	Jacquinia umbellata	JAUM	54	54	3
7491	Barbados nut	Jatropha curcas	JACU2	54	54	3
7492	wild oilnut	Jatropha hernandiifolia	JAHE	54	54	3
7493	coralbush	Jatropha multifida	JAMU	54	54	3
7494	nettlespurge	Jatropha spp.	JATRO	54	54	3
7495	West Indian walnut	Juglans jamaicensis	JUJA	54	54	3
7496	English walnut	Juglans regia	JURE80	55	55	3
7497	ketoguit	Kayea pacifica	KAPA4	54	54	3
7499	Khaya anthotheca	Khaya anthotheca	KHAN	54	54	3
7501	Senegal mahogany	Khaya senegalensis	KHSE2	54	54	3
7503	Kigelia africana	Kigelia africana	KIAF	54	54	3
7506	guest tree	Kleinhovia hospita	KLHO	54	54	3
7508	Koanophyllon polyodon	Koanophyllon polyodon	KOPO	54	54	3
7509	Molokai treecotton	Kokia cookei	KOCO2	54	54	3
7510	Hawaii treecotton	Kokia drynarioides	KODR	54	54	3
7511	Kauai treecotton	Kokia kauaiensis	KOKA	54	54	3
7512	Wailupe Valley treecotton	Kokia lanceolata	KOLA2	54	54	3
7513	treecotton	Kokia spp.	KOKIA	54	54	3
7514	leadwood	Krugiodendron ferreum	KRFE	54	54	3
7515	goldenrain tree	Koelreuteria paniculata	KOPA	55	55	3
7516	burgan	Kunzea ericoides	KUER	54	54	3
7517	Kunzea	Kunzea spp.	KUNZE	54	54	3
7518	summit labordia	Labordia fagraeoidea	LAFA2	54	54	3
7519	bog labordia	Labordia hedyosmifolia	LAHE2	54	54	3
7520	mountain labordia	Labordia hirtella	LAHI5	54	54	3
7521	Waianae Range labordia	Labordia kaalae	LAKA	54	54	3
7522	Wahiawa Mountain labordia	Labordia lydgatei	LALY2	54	54	3
7523	labordia	Labordia spp.	LABOR	54	54	3

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7524	paleflower labordia	Labordia tinifolia	LATI2	54	54	3
7528	Lanai labordia	Labordia triflora	LATR4	54	54	3
7529	Nevada peavine	Labordia waiolani	LAWA3	54	54	3
7530	cuero de rana	Laetia procera	LAPR2	54	54	3
7531	golden chain tree	Laburnum anagyroides	LAAN2	55	55	3
7532	crapemyrtle	Lagerstroemia indica	LAIN	54	54	3
7533	pride of India	Lagerstroemia speciosa	LASP	54	54	3
7539	Langsat	Lansium domesticum	LADO2	54	54	3
7541	nino de cota	Laplacea portoricensis	LAPO	54	54	3
7543	bluelatan	Latania loddigesii	LALO	54	54	3
7550	henna	Lawsonia inermis	LAIN5	54	54	3
7552	Krug's roughleaf	Leandra krugiana	LEKR	54	54	3
7556	pitahaya	Leptocereus quadricostatus	LEQU	54	54	3
7558	large-leaf yellow teatree	Leptospermum morrisonii	LEMO20	54	54	3
7559	common teatree	Leptospermum petersonii	LEPE23	54	54	3
7560	common teatree	Leptospermum polygalifolim	LEPO22	54	54	3
7561	broom teatree	Leptospermum scoparium	LESC2	54	54	3
7562	teatree	Leptospermum spp.	LEPTO4	54	54	3
7564	Leucaena insularum	Leucaena insularum	LEIN31	54	54	3
7565	white leadtree	Leucaena leucocephala	LELE10	54	54	3
7566	leadtree	Leucaena spp.	LEUCA	54	54	3
7567	littleleaf leadtree	Leucaena retusa	LERE5	55	55	3
7569	Maria laurel	Licaria brittoniana	LIBR5	54	54	3
7570	Puerto Rico cinnamon	Licaria parvifolia	LIPA9	54	54	3
7573	pepperleaf sweetwood	Licaria triandra	LITR	54	54	3
7574	Amur privet	Ligustrum amurense	LIAM	54	54	3
7575	Chinese privet	Ligustrum sinense	LISI	54	54	3
7576	privet	Ligustrum spp.	LIGUS2	54	54	3
7577	Japanese privet	Ligustrum japonicum	LIJA	55	55	3
7578	glossy privet	Ligustrum lucidum	LILU2	55	55	3
7579	California privet	Ligustrum ovalifolium	LIOV	55	55	3
7580	southern spicebush	Lindera melissifolia	LIME7	55	55	3
7583	Lychee	Litchi chinensis	LICH4	54	54	3
7586	papaono	Litsea samoensis	LISA8	54	54	3
7587	Litsea	Litsea spp.	LITSE	54	54	3
7588	fountain palm	Livistona chinensis	LICH3	53	53	3
7590	geno geno	Lonchocarpus domingensis	LODO5	54	54	3
7591	geno	Lonchocarpus glaucifolius	LOGL2	54	54	3
7592	broadleaf lancepod	Lonchocarpus heptaphyllus	LOHE7	54	54	3
7593	Amur honeysuckle	Lonicera maackii	LOMA6	55	55	3
7595	vinegartree	Lophostemon confertus	LOCO9	54	54	3
7598	Egg Fruit / Canistel	Lucuma nervosa	LUNE4	54	54	3
7600	luehea	Luehea speciosa	LUSP11	54	54	3
7602	bakauaine, nana	Lumnitzera littorea	LULI8	54	54	3
7604	lunania	Lunania spp.	LUNAN	54	54	3
7606	Lunania ekmanii	Lunania ekmanii	LUEK	54	54	3
7608	St. Thomas staggerbush	Lyonia rubiginosa	LYRU2	54	54	3
7614	macadamia nut tree, pengua	Macadamia integrifolia	MAIN8	54	54	3
7616	Macadamia	Macadamia spp.	MACAD	54	54	3
7617	Macadamia Nut	Macadamia tetraphylla	MATE16	54	54	3
7618	bedel	Macaranga carolinensis	MACA25	54	54	3
7619	Macaranga grayana	Macaranga grayana	MAGR	54	54	3
7620	lau pata	Macaranga harveyana	MAHA9	54	54	3
7621	pengua	Macaranga mappa	MAMA28	54	54	3
7623	macaranga	Macaranga spp.	MACAR	54	54	3
7625	lau fatu	Macaranga stipulosa	MAST7	54	54	3

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7626	parasol leaf tree	Macaranga tanarius	MATA3	54	54	3
7627	Macaranga thompsonii	Macaranga thompsonii	MATH3	54	54	3
7628	palo de hoz	Machaerium lunatum	MALU2	54	54	3
7630	Puerto Rico alfilerillo	Machaonia portoricensis	MAPO6	54	54	3
7632	Maclura tinctoria	Maclura tinctoria	MATI3	54	54	3
7633	umbrella-tree	Maesopsis eminii	MAEM2	54	54	3
7635	Puerto Rico magnolia	Magnolia portoricensis	MAPO2	54	54	3
7636	laurel magnolia	Magnolia splendens	MASP	54	54	3
7638	Mallotus palauensis	Mallotus palauensis	MAPA6	54	54	3
7639	kamala tree	Mallotus philippensis	MAPH4	54	54	3
7641	mallotus	Mallotus spp.	MALLO	54	54	3
7642	Mallotus tiliifolius	Mallotus tiliifolius	MATI4	54	54	3
7643	Singapore holly	Malpighia coccigera	MACO11	54	54	3
7644	Barbados cherry	Malpighia emarginata	MAEM	54	54	3
7645	palo bronco	Malpighia fucata	MAFU2	54	54	3
7646	wild crapemyrtle	Malpighia glabra	MAGL6	54	54	3
7647	cowhage cherry	Malpighia infestissima	MAIN5	54	54	3
7648	bastard cherry	Malpighia linearis	MALI2	54	54	3
7649	Siberian crab apple	Malus baccata	MABA	55	55	3
7650	Japanese flowering crab apple	Malus floribunda	MAFL80	55	55	3
7651	paradise apple	Malus pumila	MAPU	55	55	3
7652	mammee apple	Mammea americana	MAAM2	54	54	3
7653	manapau	Mammea glauca	MAGL12	54	54	3
7654	chopak	Mammea odorata	MAOD2	54	54	3
7655	Mammea	Mammea spp.	MAMME	54	54	3
7657	kanit	Mangifera minor	MAMI3	54	54	3
7658	saipan mango	Mangifera odorata	MAOD	54	54	3
7659	mango	Mangifera spp.	MANGI	54	54	3
7660	ceara rubbertree	Manihot glaziovii	MAGL5	54	54	3
7661	manihot	Manihot spp.	MANIH	54	54	3
7662	bulletwood	Manilkara bidentata	MABI5	54	54	3
7663	Surinam bulletwood	Manilkara bidentata ssp. surinamensis	MABIS	54	54	3
7664	pani	Manilkara dissecta	MADI14	54	54	3
7666	kohle	Manilkara hoshinoi	MAHO5	54	54	3
7667	wild dilly	Manilkara jaimiqui	MAJA2	54	54	3
7669	zapote de costa	Manilkara pleeana	MAPL2	54	54	3
7671	Manilkara	Manilkara spp.	MANIL	54	54	3
7672	udeuid	Manilkara udoido	MAUD	54	54	3
7673	nisperillo	Manilkara valenzuela	MAVA3	54	54	3
7674	sapodilla	Manilkara zapota	MAZA	54	54	3
7677	palo de cana	Mappia racemosa	MARA3	54	54	3
7679	bkau, apgau	Maranthes corymbosa	MACO	54	54	3
7680	dermarm	Marattia fraxinea	MAFR11	54	54	3
7682	bastard hogberry	Margaritaria nobilis	MANO	54	54	3
7684	beruquillo	Marlierea sintenisii	MASI3	54	54	3
7688	Matayba apetala	Matayba apetala	MAAP5	54	54	3
7689	negra lora	Matayba domingensis	MADO2	54	54	3
7695	Caribbean mayten	Maytenus cymosa	MACY2	54	54	3
7697	Puerto Rico mayten	Maytenus elongata	MAEL3	54	54	3
7698	white cinnamon	Maytenus laevigata	MALA8	54	54	3
7699	ponce mayten	Maytenus ponceana	MAPO5	54	54	3
7700	luluhut	Maytenus thompsonii	MATH4	54	54	3
7702	Mecranium latifolium	Mecranium latifolium	MELA7	54	54	3
7704	Medusanthera carolinensis	Medusanthera carolinensis	MECA21	54	54	3

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7705	matamo	Medusanthera samoensis	MESA11	54	54	3
7706	Medusanthera	Medusanthera spp.	MEDUS2	54	54	3
7709	melaleuca	Melaleuca spp.	MELAL	54	54	3
7710	alom	Melanolepis multiglandulosa	MEMU10	54	54	3
7712	Melastoma candidum	Melastoma candidum	MECA9	54	54	3
7713	Melastoma sanguineum	Melastoma sanguineum	MESA3	54	54	3
7716	melia	Melia spp.	MELIA	54	54	3
7717	Spanish lime	Melicoccus bijugatus	MEBI	54	54	3
7719	mokihana	Melicope anisata	MEAN3	54	54	3
7720	Ballous melicope	Melicope balloui	MEBA2	54	54	3
7721	uahiapele	Melicope barbigera	MEBA3	54	54	3
7722	Waianae Range melicope	Melicope christophersenii	MECH2	54	54	3
7723	manena	Melicope cinerea	MECI6	54	54	3
7724	kukaemoa	Melicope clusiifolia	MECL	54	54	3
7725	piloula	Melicope cruciata	MECR5	54	54	3
7726	leiohiiaka	Melicope elliptica	MEEL2	54	54	3
7727	Haleakala melicope	Melicope haleakalae	MEHA7	54	54	3
7728	Haupa Mountain melicope	Melicope haupuensis	MEHA3	54	54	3
7729	mokihana kukae moa	Melicope hawaiensis	MEHA4	54	54	3
7730	Monoa melicope	Melicope hiiakae	MEHI6	54	54	3
7731	Honolulu melicope	Melicope hosakae	MEHO2	54	54	3
7732	Kaala melicope	Melicope kaalaensis	MEKA2	54	54	3
7733	Olokele Valley melicope	Melicope knudsenii	MEKN	54	54	3
7734	Kaholuamanu melicope	Melicope macropus	MEMA6	54	54	3
7735	Makaha Valley melicope	Melicope makahae	MEMA7	54	54	3
7736	Molokai melicope	Melicope molokaiensis	MEMO6	54	54	3
7737	alani	Melicope mucronulata	MEMU4	54	54	3
7738	Oahu melicope	Melicope oahuensis	MEOA	54	54	3
7739	Makawao melicope	Melicope obovata	MEOB4	54	54	3
7740	Honokahua melicope	Melicope orbicularis	MEOR4	54	54	3
7741	Hana melicope	Melicope ovalis	MEOV	54	54	3
7742	eggshape melicope	Melicope ovata	MEOV2	54	54	3
7743	pale melicope	Melicope pallida	MEPA6	54	54	3
7744	Lihue melicope	Melicope paniculata	MEPA7	54	54	3
7745	boxfruit alani	Melicope peduncularis	MEPE9	54	54	3
7746	Kohala Summit melicope	Melicope pseudoanisata	MEPS	54	54	3
7747	hairy melicope	Melicope puberula	MEPU4	54	54	3
7748	fourangle melicope	Melicope quadrangularis	MEQU3	54	54	3
7749	kapu melicope	Melicope radiata	MERA2	54	54	3
7750	soopini	Melicope latifolia	MERE8	54	54	3
7751	roundleaf melicope	Melicope rotundifolia	MERO3	54	54	3
7752	St. Johns melicope	Melicope saint-johnii	MESA4	54	54	3
7753	Mt. Kaala melicope	Melicope sandwicensis	MESA5	54	54	3
7754	melicope	Melicope spp.	MELIC3	54	54	3
7755	volcanic melicope	Melicope volcanica	MEVO	54	54	3
7756	alani wai	Melicope waialealae	MEWA2	54	54	3
7757	Monoa melicope	Melicope wawraeana	MEWA4	54	54	3
7758	kipuka piaula	Melicope zahlbruckneri	MEZA	54	54	3
7759	samoensis	Melicytus samoensis	MESA9	54	54	3
7763	aguacatillo	Meliosma herbertii	MEHE	54	54	3
7764	cacaillo	Meliosma obtusifolia	MEOB2	54	54	3
7766	mao	Melochia aristata	MEAR16	54	54	3
7767	melochia	Melochia spp.	MELOC	54	54	3
7768	teabush	Melochia tomentosa	METO4	54	54	3
7769	hierba del soldado	Melochia umbellata	MEUM3	54	54	3
7770	sayafe	Melochia villosissima var.	MEVIC4	54	54	3

SPCD	Common name	Scientific name	Species Symbol	E_SPGRCD	W_SPGRPCD	MAJOR_ SPGRPCD
		compacta				
7771	sayafe	Melochia villosissima var. villosissima	MEVIV	54	54	3
7774	faniok	Merrilliodendron megacarpum	MEME12	54	54	3
7776	fagufagu	Meryta macrophylla	MEMA16	54	54	3
7777	omechidel	Meryta senfftiana	MESE11	54	54	3
7778	Meryta	Meryta spp.	MERYT	54	54	3
7779	dawn redwood	Metasequoia glyptostroboides	MEGL8	56	56	2
7781	collina	Metrosideros collina	MEPOP2	54	54	3
7782	ohia	Metrosideros macropus	MEMA4	54	54	3
7783	ohia lehua	Metrosideros polymorpha	MEPO5	54	54	3
7792	lehua papa	Metrosideros rugosa	MERU2	54	54	3
7793	lehua	Metrosideros spp.	METRO	54	54	3
7794	lehua ahihi	Metrosideros tremuloides	METR5	54	54	3
7795	Kauai bottlebrush	Metrosideros waialealae	MEWA	54	54	3
7798	ivory-nut palm	Metroxylon amicarum	MEAM4	53	53	3
7799	sago palm	Metroxylon sagu	MESA7	53	53	3
7800	Metroxylon	Metroxylon spp.	METRO2	54	54	3
7801	Orange Champak	Michelia champaca	MICH4	54	54	3
7803	hairy johnnyberry	Miconia lanata	MILA10	54	54	3
7804	saquiyac	Miconia affinis	MIAF	54	54	3
7805	velvet tree	Miconia calvescens	MICA20	54	54	3
7806	Puerto Rico johnnyberry	Miconia foveolata	MIFO	54	54	3
7807	camasey de costilla	Miconia impetiolaris	MIIM	54	54	3
7808	smooth johnnyberry	Miconia laevigata	MILA8	54	54	3
7810	camasey cuatrocanales	Miconia mirabilis	MIMI3	54	54	3
7812	camasey racimoso	Miconia pachyphylla	MIPA7	54	54	3
7813	granadillo bobo	Miconia prasina	MIPR3	54	54	3
7814	auquey	Miconia punctata	MIPU9	54	54	3
7815	ridge johnnyberry	Miconia pycnoneura	MIPY2	54	54	3
7816	camasey felpa	Miconia racemosa	MIRA2	54	54	3
7817	peralejo	Miconia rubiginosa	MIRU4	54	54	3
7818	jau jau	Miconia serrulata	MISE2	54	54	3
7819	mountain johnnyberry	Miconia sintenisii	MISI2	54	54	3
7821	forest johnnyberry	Miconia subcorymbosa	MISU3	54	54	3
7822	rajador	Miconia tetrandra	MITE4	54	54	3
7823	camasey tomaso	Miconia thomasiana	MITH	54	54	3
7824	talafulu	Micromelum minutum	MIMI23	54	54	3
7828	caimitillo verde	Micropholis garciniifolia	MIGA	54	54	3
7829	Micropholis guyanensis	Micropholis guyanensis	MIGU2	54	54	3
7831	pinnata	Millettia pinnata	MIPI9	54	54	3
7833	elegant mimosa	Mimosa arenosa	MIAR4	54	54	3
7835	bulletwood, elengi	Mimusops elengi	MIEL4	54	54	3
7839	monodora	Monodora spp.	MONOD	54	54	3
7841	treedaisy	Montanoa hibiscifolia	MOHI	54	54	3
7842	montanoa	Montanoa spp.	MONTA	54	54	3
7845	Morella cerifera	Morella cerifera	MOCE2	54	54	3
7846	firetree	Morella faya	MOFA	54	54	3
7847	Morella holdridgeana	Morella holdridgeana	MOHO3	54	54	3
7848	bayberry	Morella spp.	MOREL2	54	54	3
7849	Indian mulberry	Morinda citrifolia	MOCI3	54	54	3
7850	ngel	Morinda latibractea	MOLA12	54	54	3
7851	Morinda pedunculata	Morinda pedunculata	MOPE2	54	54	3
7852	morinda	Morinda spp.	MORIN	54	54	3
7853	noni kuahiwi	Morinda trimera	MOTR	54	54	3
7855	horseradishtree	Moringa oleifera	MOOL	54	54	3

SPCD	Common name	Scientific name	Species Symbol	E_SPGRCD	W_SPGRPCD	MAJOR_ SPGRPCD
7857	ratapple	Morisonia americana	MOAM	54	54	3
7862	murta	Mouriri domingensis	MODO2	54	54	3
7863	mameyuelo	Mouriri helleri	MOHE	54	54	3
7865	falseohe	Munroidendron racemosum	MURA3	54	54	3
7867	strawberrytree	Muntingia calabura	MUCA4	54	54	3
7868	muntingia	Muntingia spp.	MUNTI	54	54	3
7869	Murraya exotica	Murraya exotica	MUEX2	54	54	3
7872	French plantain	Musa paradisiaca	MUPA3	54	54	3
7873	bungeltuu	Musa coccinea	MUCO8	54	54	3
7874	tama	Musa nana	MUNA	54	54	3
7875	tuu banana	Musa sapientum	MUSA	54	54	3
7876	meia	Musa spp.	MUSA2	54	54	3
7877	blantalos	Musa textilis	MUTE6	54	54	3
7878	tikap	Musa tikap	MUTI	54	54	3
7879	fei banana	Musa troglodytarum	MUTR2	54	54	3
7880	Mussaenda frondosa	Mussaenda frondosa	MUFR3	54	54	3
7881	aloalo vao	Mussaenda raiateensis	MURA5	54	54	3
7882	Mussaenda	Mussaenda spp.	MUSSA	54	54	3
7883	naio	Myoporum sandwicense	MYSA	54	54	3
7884	myoporum	Myoporum spp.	MYOPO	54	54	3
7886	red rodwood	Myrcia citrifolia	MYCI	54	54	3
7887	cieneguillo	Myrcia deflexa	MYDE	54	54	3
7888	curame	Myrcia fallax	MYFA3	54	54	3
7889	guayabacon	Myrcia leptoclada	MYLE	54	54	3
7890	ausu	Myrcia paganii	MYPA	54	54	3
7891	punchberry	Myrcia splendens	MYSP	54	54	3
7892	rodwood	Myrcia spp.	MYRCI	54	54	3
7893	twinberry	Myrcianthes fragrans	MYFR	54	54	3
7895	guavaberry	Myrciaria floribunda	MYFL	54	54	3
7899	yamamomo, strawberry tree	Myrica rubra	MYRU3	54	54	3
7900	sweetgale	Myrica spp.	MYRIC	54	54	3
7902	atoneulu	Myristica hypargyraea	MYHY2	54	54	3
7903	adepurot	Myristica insularis	MYIN3	54	54	3
7904	Myristica	Myristica spp.	MYRIS	54	54	3
7905	cercipo	Myrospermum frutescens	MYFR2	54	54	3
7906	Myristica inutilis	Myristica inutilis	MYIN4	54	54	3
7907	balsam of Tolu	Myroxylon balsamum	MYBA3	54	54	3
7910	forest colicwood	Myrsine alyxifolia	MYAL4	54	54	3
7911	leathery colicwood	Myrsine coriacea	MYCO2	54	54	3
7912	Myrsine cubana	Myrsine cubana	MYCU2	54	54	3
7913	summit colicwood	Myrsine degeneri	MYDE2	54	54	3
7914	mountain colicwood	Myrsine emarginata	MYEM	54	54	3
7915	streambank colicwood	Myrsine fernseei	MYFE	54	54	3
7916	Koolau Range colicwood	Myrsine fosbergii	MYFO	54	54	3
7918	Wahiawa Bog colicwood	Myrsine helleri	MYHE3	54	54	3
7919	Kauai colicwood	Myrsine kauaiensis	MYKA	54	54	3
7920	Kokee colicwood	Myrsine knudsenii	MYKN	54	54	3
7921	Lanai colicwood	Myrsine lanaiensis	MYLA3	54	54	3
7922	kolea lau nui	Myrsine lessertiana	MYLE2	54	54	3
7923	Hanapepe River colicwood	Myrsine mezii	MYME2	54	54	3
7924	swamp colicwood	Myrsine petiolata	MYPE3	54	54	3
7925	Molokai colicwood	Myrsine pukooensis	MYPU2	54	54	3
7926	kokea lau lii	Myrsine sandwicensis	MYSA2	54	54	3
7927	colicwood	Myrsine spp.	MYRSI	54	54	3
7928	Mt. Kahili colicwood	Myrsine wawraea	MYWA	54	54	3
7929	Myrsine palauensis	Myrsine palauensis	MYPA7	54	54	3

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7932	Nectandra coriacea	Nectandra coriacea	NECO	54	54	3
7933	shinglewood	Nectandra hihua	NEHI2	54	54	3
7934	Nectandra krugii	Nectandra krugii	NEKR	54	54	3
7935	Nectandra membranacea	Nectandra membranacea	NEME3	54	54	3
7936	Nectandra patens	Nectandra patens	NEPA4	54	54	3
7939	Nectandra turbacensis	Nectandra turbacensis	NETU	54	54	3
7940	saltwood	Neea buxifolia	NEBU	54	54	3
7942	fao	Neisosperma oppositifolia	NEOP	54	54	3
7944	kadam	Neolamarckia cadamba	NECA7	54	54	3
7946	aquilon	Neolaugeria resinosa	NERE2	54	54	3
7948	afa	Neonauclea forsteri	NEFO2	54	54	3
7952	Rambutan	Nephelium lappaceum	NELA7	54	54	3
7954	maaloa	Neraudia melastomifolia	NEME5	54	54	3
7956	oleander	Nerium oleander	NEOL	54	54	3
7958	keahi	Nesoluma polynesicum	NEPO	54	54	3
7960	Hawaii olive	Nestegis sandwicensis	NESA2	54	54	3
7961	nestegis	Nestegis spp.	NESTE	54	54	3
7962	kalm, aralm	Neuburgia celebica	NECE	54	54	3
7964	tree tobacco	Nicotiana glauca	NIGL	54	54	3
7965	tobacco	Nicotiana spp.	NICOT	54	54	3
7966	smallflower aiea	Nothocestrum breviflorum	NOBR2	54	54	3
7967	broadleaf aiea	Nothocestrum latifolium	NOLA	54	54	3
7968	longleaf aiea	Nothocestrum longifolium	NOLO	54	54	3
7969	Oahu aiea	Nothocestrum peltatum	NOPE	54	54	3
7970	aiea	Nothocestrum spp.	NOTHO3	54	54	3
7971	kaala rockwort	Nototrichium humile	NOHU	54	54	3
7972	Hawaii rockwort	Nototrichium sandwicense	NOSA	54	54	3
7974	toechel, teuechel	Nypa fruticans	NYFR2	54	54	3
7976	African bird's-eye bush	Ochna mossambicensis	OCMO4	54	54	3
7977	ochna	Ochna spp.	OCHNA	54	54	3
7978	Thomas birds-eye bush	Ochna thomasiana	OCTH	54	54	3
7980	Ochroma pyramidale	Ochroma pyramidale	OCPY	54	54	3
7982	holei	Ochrosia compta	OCCO	54	54	3
7983	island yellowwood	Ochrosia haleakalae	OCHA	54	54	3
7984	Kauai yellowwood	Ochrosia kauaiensis	OCKA	54	54	3
7985	Hawaii yellowwood	Ochrosia kilaueaensis	OCKI	54	54	3
7986	yellowwood	Ochrosia spp.	OCHRO2	54	54	3
7987	langiti	Ochrosia mariannensis	OCMA2	54	54	3
7990	laurel espada	Ocotea floribunda	OCFL	54	54	3
7991	black sweetwood	Ocotea foeniculacea	OCFO	54	54	3
7994	loblolly sweetwood	Ocotea leucoxylon	OCLE	54	54	3
7996	nemoca	Ocotea moschata	OCMO	54	54	3
7997	laurel sassafras	Ocotea nemodaphne	OCNE	54	54	3
7999	laurel de paloma	Ocotea portoricensis	OCPO	54	54	3
8000	oleandra fern	Oleandra neriiformis	OLNE	54	54	4
8001	nemoca cimarrona	Ocotea spathulata	OCSP	54	54	3
8003	Wright's laurel canelon	Ocotea wrightii	OCWR	54	54	3
8004	olive	Olea europaea	OLEU	54	54	3
8007	olive	Olea spp.	OLEA	54	54	3
8008	fanuamamala	Homalanthus acuminatus	HOAC4	54	54	3
8009	fanuamamala	Homalanthus nutans	HONU3	54	54	3
8010	Homalanthus	Homalanthus spp.	HOMAL6	54	54	3
8011	Ophiorrhiza palauensis	Ophiorrhiza palauensis	OPPA4	54	54	3
8013	cochineal nopal cactus	Opuntia cochenillifera	OPCO4	54	54	3
8014	tuna cactus	Opuntia ficus-indica	OPFI	54	54	3
8015	common pricklypear	Opuntia monacantha	OPMO5	54	54	3

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8018	pricklypear	Opuntia spp.	OPUNT	54	54	3
8019	amansis, edebsungelked, necklace bead tree	Ormosia calavensis	ORCA12	54	54	3
8020	peronia	Ormosia krugii	ORKR	54	54	3
8022	kesiamel	Osmoxylon oliveri	OSOL	54	54	3
8023	kesiamel	Osmoxylon pachyphyllum	OSPA	54	54	3
8024	Osmoxylon	Osmoxylon spp.	OSMOX	54	54	3
8027	pincho palo de rosa	Ottoschulzia rhodoxylon	OTRH	54	54	3
8029	chicharron amarillo	Ouratea ilicifolia	OUIL	54	54	3
8030	abey amarillo	Ouratea littoralis	OULI	54	54	3
8032	guanabanilla	Ouratea striata	OUST	54	54	3
8033	blacklancewood	Oxandra lanceolata	OXLA4	54	54	3
8034	haya	Oxandra laurifolia	OXLA5	54	54	3
8036	miich era ngebard, guiana chestnut	Pachira aquatica	PAAQ2	54	54	3
8037	wild chestnut	Pachira insignis	PAIN7	53	53	3
8044	gasu	Palaquium stehlinii	PAST24	54	54	3
8045	tafetan	Palicourea alpina	PAAL9	54	54	3
8047	red cappel	Palicourea crocea	PACR3	54	54	3
8049	Palicourea croceoides	Palicourea croceoides	PACR18	54	54	3
8051	showy cappel	Palicourea guianensis	PAGU	54	54	3
8054	chertochet	Pandanus aimiriikensis	PAAI	54	54	3
8055	matal	Pandanus cominsii	PACO51	54	54	3
8056	ongor	Pandanus compressus	PACO3	54	54	3
8057	silaue	Pandanus cylindricus	PACY10	54	54	3
8058	kienpel	Pandanus dilatatus	PADI2	54	54	3
8059	ongor	Pandanus divergens	PADI29	54	54	3
8060	pahong	Pandanus dubius	PADU3	54	54	3
8061	ongor	Pandanus duriocarpus	PADU4	54	54	3
8062	moak	Pandanus enchabiensis	PAEN	54	54	3
8063	hara	Pandanus fischerianus	PAFI	54	54	3
8064	aggag	Pandanus fragrans	PAFR7	54	54	3
8065	nenketak	Pandanus hosinoi	PAHO6	54	54	3
8066	pacheren	Pandanus jaluitensis	PAJA3	54	54	3
8067	buuk	Pandanus kanehirae	PAKA2	54	54	3
8068	siu	Pandanus korrensis	PAKO2	54	54	3
8069	lakatwa	Pandanus lakatwa	PALA3	54	54	3
8070	erwan, jonmouia	Pandanus laticanaliculatus	PALA4	54	54	3
8071	intekul, pasyure	Pandanus macrocephalus	PAMA3	54	54	3
8072	ongor, ertochet	Pandanus macrojeanneretia	PAMA32	54	54	3
8073	menne	Pandanus menne	PAME18	54	54	3
8074	Palaquium karrak	Palaquium karrak	PAKA	54	54	3
8075	Pandanus odontoides	Pandanus odontoides	PAOD2	54	54	3
8076	ongor, ertochet	Pandanus palawensis	PAPA38	54	54	3
8077	peet	Pandanus patina	PAPA39	54	54	3
8078	ongor	Pandanus peliliuensis	PAPE	54	54	3
8079	alwan, kipal, taip	Pandanus ponapensis	PAPO2	54	54	3
8080	deipw, jomineia	Pandanus pulposus	PAPU18	54	54	3
8081	pathaplip	Pandanus rectangulatus	PARE2	54	54	3
8082	fasa	Pandanus reineckei	PARE19	54	54	3
8083	magojokojok	Pandanus rotundatus	PARO2	54	54	3
8084	screwpine	Pandanus spp.	PANDA	54	54	3
8085	Tahitian screwpine	Pandanus tectorius	PATE2	54	54	3
8086	kiparenwel	Pandanus tolotomensis	PATO6	54	54	3
8087	mojel	Pandanus trukensis	PATR	54	54	3
8088	common screwpine	Pandanus utilis	PAUT	54	54	3

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8090	berrakelongor	Pandanus variegatus	PAVA4	54	54	3
8091	rauel	Pangium edule	PAED4	54	54	3
8092	lonlin, lajokorer	Pandanus obliquus	PAOB7	54	54	3
8099	scratchthroat	Parathesis crenulata	PACR2	54	54	3
8103	sea	Parinari insularum	PAIN20	54	54	3
8104	ais	Parinari laurina	PALA5	54	54	3
8105	Parinari	Parinari spp.	PARIN	54	54	3
8106	parkia	Parkia spp.	PARKI3	54	54	3
8107	Parkia korom	Parkia korom	PAKO5	54	54	3
8108	kmekumer	Parkia parvifoliola	PAPA2	54	54	3
8110	Parkia timoriana	Parkia timoriana	PATI5	54	54	3
8111	Jerusalem thorn	Parkinsonia aculeata	PAAC3	54	54	3
8112	paloverde	Parkinsonia spp.	PARKI2	54	54	3
8113	cuachilote	Parmentiera aculeata	PAAC13	54	54	3
8114	candle tree	Parmentiera cereifera	PACE8	54	54	3
8115	Texas paloverde	Parkinsonia texana	PATE10	55	55	3
8121	Peltophorum pterocarpum	Peltophorum pterocarpum	PEPT3	54	54	3
8123	ngis	Pemphis acidula	PEAC6	54	54	3
8125	butter tree	Pentadesma butyracea	PEBU4	54	54	3
8127	jiqi	Pera bumeliifolia	PEBU2	54	54	3
8129	Pericopsis mooniana	Pericopsis mooniana	PEMO13	54	54	3
8131	olomea	Perrottetia sandwicensis	PESA3	54	54	3
8134	canela	Persea krugii	PEKR	54	54	3
8138	aquacatillo	Persea urbaniana	PEUR2	54	54	3
8141	bastard stopper	Petitia domingensis	PEDO	54	54	3
8143	aquilon prieto	Phialanthus grandifolius	PHGR11	54	54	3
8144	candlewood	Phialanthus myrtilloides	PHMY	54	54	3
8146	Phaleria nisidai	Phaleria nisidai	PHNI11	54	54	3
8151	Canary Island date palm	Phoenix canariensis	PHCA13	53	53	3
8152	date palm	Phoenix dactylifera	PHDA4	53	53	3
8153	date palm	Phoenix spp.	PHOEN2	53	53	3
8154	date palm	Phoenix sylvestris	PHSY3	53	53	3
8155	Chinese photinia	Photinia davidiana	PHDA5	53	53	3
8157	Tahitian gooseberry tree	Phyllanthus acidus	PHAC3	54	54	3
8159	pamakani mahu	Phyllanthus distichus	PHDI10	54	54	3
8160	gamo de costa	Phyllanthus juglandifolius	PHJU2	54	54	3
8162	Phyllanthus orbicularis	Phyllanthus orbicularis	PHOR10	54	54	3
8164	Florida bitterbush	Picramnia pentandra	PIPE	54	54	3
8167	bitterwood	Picrasma excelsa	PIEX	54	54	3
8169	fustic	Pictetia aculeata	PIAC	54	54	3
8171	aceitillo	Pilocarpus racemosus	PIRA3	54	54	3
8173	Royen's tree cactus	Pilosocereus royenii	PIRO6	54	54	3
8175	allspice	Pimenta dioica	PIDI2	54	54	3
8177	bayrumtree	Pimenta racemosa	PIRA	54	54	3
8178	bayrumtree	Pimenta racemosa grisea	PIRAG	54	54	3
8180	Pimenta	Pimenta spp.	PIMEN	54	54	3
8181	chebouch, demailei	Pinanga insignis	PIIN5	54	54	3
8183	Caribbean pine	Pinus caribaea	PICA18	51	51	1
8184	Chinese red pine	Pinus massoniana	PIMA11	51	51	1
8185	Merkus pine	Pinus merkusii	PIME2	51	51	1
8186	ocote chino	Pinus oocarpa	PIOO2	51	51	1
8187	Mexican weeping pine	Pinus patula	PIPA13	51	51	1
8188	maritime pine	Pinus pinaster	PIPI6	51	51	1
8189	Japanese red pine	Pinus densiflora	PIDE5	56	56	1
8190	higuillo de hoja menuda	Piper aduncum	PIAD	54	54	3
8191	higuillo de limon	Piper amalago	PIAM2	54	54	3

SPCD	Common name	Scientific name	Species Symbol	E_SPGRCD	W_SPGRPCD	MAJOR_ SPGRPCD
8192	moth pepper	Piper blattarum	PIBL	54	54	3
8193	Guyanese pepper	Piper glabrescens	PIGL3	54	54	3
8194	Jamaican pepper	Piper hispidum	PIHI2	54	54	3
8195	Caracas pepper	Piper jacquemontianum	PIJA	54	54	3
8196	marigold pepper	Piper marginatum	PIMA4	54	54	3
8197	five-needle pine	Pinus parviflora	PIPA12	56	56	1
8198	Japansese Black pine	Pinus thunbergii	PITH2	56	56	1
8199	spanish elder	Piper swartzianum	PISW	54	54	3
8205	Waimea pipturus	Pipturus albidus	PIAL2	54	54	3
8206	soga	Pipturus argenteus	PIAR8	54	54	3
8207	pipturus	Pipturus spp.	PIPTU	54	54	3
8208	stinkwood	Piscidia carthagenensis	PICA5	54	54	3
8210	piscidia	Piscidia spp.	PISCI	54	54	3
8211	corcho bobo	Pisonia albida	PIAL3	54	54	3
8212	Australasian catchbirdtree	Pisonia brunoniana	PIBR3	54	54	3
8213	grand devils-claws	Pisonia grandis	PIGR6	54	54	3
8214	aulu	Pisonia sandwicensis	PISA5	54	54	3
8215	catchbirdtree	Pisonia spp.	PISON	54	54	3
8216	water mampoo	Pisonia subcordata	PISU	54	54	3
8217	umbrella catchbirdtree	Pisonia umbellifera	PIUM2	54	54	3
8218	Kauai catchbirdtree	Pisonia wagneriana	PIWA2	54	54	3
8219	Chinese pistache	Pistacia chinensis	PICH4	55	55	3
8220	monkeypod	Pithecellobium dulce	PIDU	54	54	3
8223	catclaw blackbead	Pithecellobium unguis-cati	PIUN	54	54	3
8224	Mona cheesewood, Pittosporum	Pittosporum monae	PIMO4	54	54	3
8226	Hawaii poisonberry tree	Pittosporum argentifolium	PIAR4	54	54	3
8227	hoawa	Pittosporum confertiflorum	PICO4	54	54	3
8228	Waianae Range cheesewood	Pittosporum flocculosum	PIFL4	54	54	3
8229	Waialeale cheesewood	Pittosporum gayanum	PIGA2	54	54	3
8230	Koolau Range cheesewood	Pittosporum glabrum	PIGL4	54	54	3
8231	hoawa	Pittosporum halophilum	PIHA3	54	54	3
8232	Hawaii cheesewood	Pittosporum hawaiiense	PIHA4	54	54	3
8233	Kona cheesewood	Pittosporum hosmeri	PIHO	54	54	3
8234	Kauai cheesewood	Pittosporum kauaiense	PIKA3	54	54	3
8235	royal cheesewood	Pittosporum napaliense	PINA	54	54	3
8236	Taiwanese cheesewood	Pittosporum pentandrum	PIPE8	54	54	3
8238	cheesewood	Pittosporum spp.	PITTO	54	54	3
8239	cream cheesewood	Pittosporum terminalioides	PITE5	54	54	3
8240	Australian cheesewood	Pittosporum undulatum	PIUN2	54	54	3
8241	cape cheesewood	Pittosporum viridiflorum	PIVI5	54	54	3
8242	alaa	Planchonella garberi	PLGA2	54	54	3
8243	alaa	Planchonella grayana	PLGR11	54	54	3
8244	alaa	Planchonella linggensis	PLLI6	54	54	3
8246	mamalava	Planchonella samoensis	PLSA9	54	54	3
8247	Planchonella	Planchonella spp.	PLANC	54	54	3
8248	mamalava	Planchonella torricellensis	PLTO2	54	54	3
8249	Oriental arborvitae	Platycladus orientalis	PLOR80	52	52	2
8250	Hawaii pilo kea	Platydesma remyi	PLRE4	54	54	3
8251	Maui pilo kea	Platydesma spathulata	PLSP3	54	54	3
8252	platydesma	Platydesma spp.	PLATY	54	54	3
8253	London planetree	Platanus hybrida	PLHY3	55	55	3
8254	Oriental planetree	Platanus orientalis	PLOR6	55	55	3
8255	chupa gallo	Pleodendron macranthum	PLMA6	54	54	3
8256	Mexican sycamore	Platanus mexicana	PLME9	55	55	3
8257	golden hala pepe	Pleomele aurea	PLAU2	54	54	3

SPCD	Common name	Scientific name	Species Symbol	E_SPGRCD	W_SPGRPCD	MAJOR_ SPGRPCD
8258	Maui hala pepe	Pleomele auwahiensis	PLAU5	54	54	3
8259	Lanai hala pepe	Pleomele fernaldii	PLFE	54	54	3
8260	Waianae Range hala pepe	Pleomele forbesii	PLFO2	54	54	3
8261	royal hala pepe	Pleomele halapepe	PLHA3	54	54	3
8262	Hawaii hala pepe	Pleomele hawaiiensis	PLHA4	54	54	3
8263	hala pepe	Pleomele spp.	PLEOM	54	54	3
8266	nosegaytree	Plumeria alba	PLAL	54	54	3
8268	Singapore graveyard flower	Plumeria obtusa	PLOB2	54	54	3
8269	Plumeria obtusa	Plumeria obtusa var. obtusa	PLOBO	54	54	3
8271	templetree	Plumeria rubra	PLRU2	54	54	3
8272	Plumeria	Plumeria spp.	PLUME	54	54	3
8273	yucca plum pine	Podocarpus coriaceus	POCO3	54	54	3
8274	yew plum pine	Podocarpus macrophyllus	POMA32	56	56	3
8275	Poitea florida	Poitea florida	POFL20	54	54	3
8276	Poitea punicea	Poitea punicea	POPU19	54	54	3
8279	violet tree	Polygala cowellii	POCO5	54	54	3
8280	crevajosa	Polygala penaea	POPE13	54	54	3
8283	bungaruau	Polyscias grandifolia	POGR28	54	54	3
8284	geranium aralia	Polyscias guilfoylei	POGU	54	54	3
8285	Polyscias macgillivrayi	Polyscias macgillivrayi	POMA	54	54	3
8286	bngei	Polyscias nodosa	PONO10	54	54	3
8287	tagitagi	Polyscias samoensis	POSA27	54	54	3
8288	shield aralia	Polyscias scutellaria	POSC10	54	54	3
8289	Polyscias	Polyscias spp.	POLYS4	54	54	3
8290	tava	Pometia pinnata	POPI12	54	54	3
8292	kattai	Ponapea hosinoi	POHO	54	54	3
8293	Ponapea ledermanniana	Ponapea ledermanniana	POLE21	54	54	3
8294	Ponapea	Ponapea spp.	PONAP	54	54	3
8295	kisaks	Pongamia pinnata	POPI4	54	54	3
8296	hardy orange	Poncirus trifoliata	POTR4	55	55	3
8297	Abiu	Pouteria caimito	POCA43	54	54	3
8298	elangel, chelangel	Pouteria calcarea	POCA6	54	54	3
8299	eggfruit	Pouteria campechiana	POCA23	54	54	3
8300	cocuyo	Pouteria dictyoneura	PODI5	54	54	3
8301	redmammee	Pouteria hotteana	POHO4	53	53	3
8302	bullytree	Pouteria multiflora	POMU6	54	54	3
8303	lalahag	Pouteria obovata	POOB8	54	54	3
8304	alaa	Pouteria sandwicensis	POSA11	54	54	3
8305	mammee sapote	Pouteria sapota	POSA13	54	54	3
8306	pouteria	Pouteria spp.	POUTE	54	54	3
8307	ahgao	Premna obtusifolia	PROB	54	54	3
8308	Premna pubescens	Premna pubescens	PRPU5	54	54	3
8309	aloalo	Premna serratifolia	PRSE6	54	54	3
8310	Premna	Premna spp.	PREMN	54	54	3
8311	Prestoea acuminata	Prestoea acuminata	PRACM	54	54	3
8313	Carolina poplar	Populus x canadensis	POCA19	55	55	3
8314	gray poplar	Populus x canescens	POCA14	55	55	3
8315	Hawaii pritchardia	Pritchardia affinis	PRAF	54	54	3
8316	Maui pritchardia	Pritchardia arecina	PRAR2	54	54	3
8317	Kilauea pritchardia	Pritchardia beccariana	PRBE	54	54	3
8318	Mt. Eke pritchardia	Pritchardia forbesiana	PRFO	54	54	3
8319	Makaleha pritchardia	Pritchardia hardyi	PRHA2	54	54	3
8320	loulu lelo	Pritchardia hillebrandii	PRHI	54	54	3
8321	Waianae Range pritchardia	Pritchardia kaalae	PRKA	54	54	3
8322	Lanai pritchardia	Pritchardia lanaiensis	PRLA3	54	54	3
8323	loulu	Pritchardia lanigera	PRLA4	54	54	3

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8324	Limahuli Valley pritchardia	Pritchardia limahuliensis	PRLI2	54	54	3
8325	Molokai pritchardia	Pritchardia lowreyana	PRLO2	54	54	3
8326	Koolau Range pritchardia	Pritchardia martii	PRMA5	54	54	3
8327	Alakai Swamp pritchardia	Pritchardia minor	PRMI3	54	54	3
8328	Kamalo pritchardia	Pritchardia munroi	PRMU3	54	54	3
8329	fan palm	Pritchardia pacifica	PRPA11	53	53	3
8330	Waioli Valley pritchardia	Pritchardia perlmanii	PRPE7	54	54	3
8331	Nihoa pritchardia	Pritchardia remota	PRRE	54	54	3
8336	lands of papa pritchardia	Pritchardia schattaueri	PRSC	54	54	3
8337	pritchardia	Pritchardia spp.	PRITC	54	54	3
8338	stickybud pritchardia	Pritchardia viscosa	PRVI2	54	54	3
8339	poleline pritchardia	Pritchardia waialealeana	PRWA	54	54	3
8340	guasimilla	Prockia crucis	PRCR2	54	54	3
8341	fua lole	Procris pedunculata	PRPE6	54	54	4
8342	jand	Prosopis cineraria	PRCI4	54	54	3
8343	mesquite	Prosopis juliflora	PRJU	54	54	3
8344	kiawe	Prosopis pallida	PRPA4	54	54	3
8346	West Indian cherry	Prunus myrtifolia	PRMY	54	54	3
8347	western cherry laurel	Prunus occidentalis	PROC	54	54	3
8348	cherry plum	Prunus cerasifera	PRCE2	55	55	3
8349	Prunus serotina	Prunus serotina ssp. capuli	PRSEC	54	54	3
8352	false breadnut	Pseudolmedia spuria	PSSP2	54	54	3
8353	Florida cherry palm	Pseudophoenix sargentii	PSSA	54	54	3
8354	mountain guava	Psidium amplexicaule	PSAM	54	54	3
8355	strawberry guava	Psidium cattleianum	PSCA	54	54	3
8356	guava	Psidium guajava	PSGU	54	54	3
8357	Yoshino flowering cherry	Prunus x yedoensis	PRYE	55	55	3
8358	Psidium longipes	Psidium longipes	PSLOO	54	54	3
8359	Sintenis' guava	Psidium sintenisii	PSSI2	54	54	3
8361	cachimbo-cumun	Psychotria berteriana	PSBE	54	54	3
8362	palo de cachimbo	Psychotria brachiata	PSBR2	54	54	3
8363	Browne's wild coffee	Psychotria brownei	PSBR3	54	54	3
8364	Psychotria domingensis	Psychotria domingensis	PSDO2	54	54	3
8365	Koolau Range wild coffee	Psychotria fauriei	PSFA	54	54	3
8366	largeflower wild coffee	Psychotria grandiflora	PSGR	54	54	3
8367	cachimbo grande	Psychotria grandis	PSGR2	54	54	3
8369	Kauai wild coffee	Psychotria greenwelliae	PSGR3	54	54	3
8370	Waianae Range wild coffee	Psychotria hathewayi	PSHA2	54	54	3
8373	kopikoula	Psychotria hawaiiensis	PSHA3	54	54	3
8377	woodland wild coffee	Psychotria hexandra	PSHE2	54	54	3
8382	Oahu wild coffee	Psychotria hexandra spp. oahuensis	PSHEO	54	54	3
8386	milolii kopiwai	Psychotria hobdyi	PSHO	54	54	3
8387	matalafi	Psychotria insularum	PSIN10	54	54	3
8388	kopiko kea	Psychotria kaduana	PSKA	54	54	3
8389	cachimbo de gato	Psychotria maleolens	PSMA4	54	54	3
8390	aplohkateng	Psychotria mariana	PSYMAR	54	54	3
8391	cachimbo de maricao	Psychotria maricaensis	PSMA5	54	54	3
8392	forest wild coffee	Psychotria mariniana	PSMA6	54	54	3
8393	opiko	Psychotria mauiensis	PSMA7	54	54	3
8394	thicket wild coffee	Psychotria microdon	PSMI	54	54	3
8395	floating balsamo	Psychotria nutans	PSNU2	54	54	3
8397	hairy wild coffee	Psychotria pubescens	PSPU	54	54	3
8398	Psychotria rhombocarpa	Psychotria rhombocarpa	PSRH2	54	54	3
8399	Psychotria rotensis	Psychotria rotensis	PSRO2	54	54	3
8400	wild coffee	Psychotria spp.	PSYCH	54	54	3

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8401	leatherleaf wild coffee	Psychotria wawrae	PSWA2	54	54	3
8402	alahee	Psydrax odorata	PSOD	54	54	3
8403	common hoptree	Ptelea trifoliata	PTTR	55	55	3
8404	Kauai pteralyxia	Pteralyxia kauaiensis	PTKA	54	54	3
8405	ridged pteralyxia	Pteralyxia macrocarpa	PTMA	54	54	3
8406	pteralyxia	Pteralyxia spp.	PTERA	54	54	3
8407	pterocarpus	Pterocarpus indicus	PTIN2	54	54	3
8408	Burma padauk	Pterocarpus macrocarpus	PTMA7	54	54	3
8409	Malabar kino	Pterocarpus marsupium	PTMA3	54	54	3
8410	dragonsblood tree	Pterocarpus officinalis	PTOF	54	54	3
8411	Chinese wingnut	Pterocarya stenoptera	PTST80	55	55	3
8412	Ptychococcus ledermannianus	Ptychococcus ledermannianus	PTLE3	54	54	3
8413	Psychotria cheathamiana	Psychotria cheathamiana	PSCH4	54	54	3
8415	Macarthur feather palm	Ptychosperma macarthuri	PTMA8	53	53	3
8416	chesdbuuch	Ptychosperma palauense	PTPA	54	54	3
8418	Ptychosperma	Ptychosperma spp.	PTYCH4	54	54	3
8419	pomegranate	Punica granatum	PUGR2	54	54	3
8420	pear	Pyrus Spp.	PYRUS	55	55	3
8421	Callery pear	Pyrus calleryana	PYCA80	55	55	3
8422	swizzlestick tree	Quararibea turbinata	QUTU	54	54	3
8423	common pear	Pyrus communis	PYCO	55	55	3
8424	cork oak	Quercus suber	QUSU5	54	54	3
8425	white indigoberry	Randia aculeata	RAAC	54	54	3
8426	Chinese pear	Pyrus pyrifolia	PYPY2	55	55	3
8427	sawtooth oak	Quercus acutissima	QUAC80	55	55	3
8429	bastard white oak	Quercus austrina	QUAU	55	55	3
8430	togo vao	Rapanea myricifolia	RAMY	54	54	3
8431	poison devils-pepper	Rauvolfia vomitoria	RAVO	54	54	4
8432	omechidel	Rauvolfia insularis	RAIN8	54	54	3
8433	palo amargo	Rauvolfia nitida	RANI2	54	54	3
8434	devils-pepper	Rauvolfia sandwicensis	RASA3	54	54	3
8435	devils-pepper	Rauvolfia spp.	RAUVO	54	54	3
8436	traveler's tree	Ravenala madagascariensis	RAMA7	54	54	3
8437	European turkey oak	Quercus cerris	QUCE	55	55	3
8438	Texas live oak	Quercus fusiformis	QUFU	55	55	3
8439	tortugo prieto	Ravenia urbanii	RAUR	54	54	3
8440	vi vao	Reynoldsia lanutoensis	RELA	54	54	3
8441	sand live oak	Quercus geminata	QUGE2	55	55	3
8442	ohe makai	Reynoldsia sandwicensis	RESA	54	54	3
8443	reynoldsia	Reynoldsia spp.	REYNO	54	54	3
8444	guama	Reynosia guama	REGU	53	53	3
8445	Krug's darlingplum	Reynosia krugii	REKR	53	53	3
8447	sloe	Reynosia uncinata	REUN	53	53	3
8449	Darlington oak	Quercus hemisphaerica	QUHE2	55	55	3
8450	holly oak	Quercus ilex	QUIL2	55	55	3
8453	pungent oak	Quercus pungens	QUPU	55	55	3
8455	lateleaf oak	Quercus tardifolia	QUTA	55	55	3
8456	Rheeda	Rheedia edulis	RHED4	54	54	3
8457	Toumey oak	Quercus toumeyi	QUTO2	55	55	3
8458	mangle	Rhizophora apiculata	RHAP2	54	54	3
8459	Sonoran scrub oak	Quercus turbinella	QUTU2	55	55	3
8460	Rhizophora lamarckii	Rhizophora lamarckii	RHLA12	54	54	3
8461	sandpaper oak	Quercus vaseyana	QUVA5	55	55	3
8462	mangle hembra	Rhizophora mucronata	RHMU	54	54	3
8463	mangrove	Rhizophora spp.	RHIZO	54	54	3

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8464	Rhizophora stylosa	Rhizophora stylosa	RHST8	54	54	3
8465	rose myrtle	Rhodomyrtus spp.	RHODO2	54	54	3
8466	Rhodomyrtus tomentosus	Rhodomyrtus tomentosa	RHTO10	54	54	3
8467	neneleau	Rhus sandwicensis	RHSA2	54	54	3
8468	sumac	Rhus spp.	RHUS	54	54	3
8469	tavai	Rhus taitensis	RHTA	54	54	3
8471	Catawba rosebay	Rhododendron catawbiense	RHCA8	55	55	3
8472	castorbean	Ricinus communis	RICO3	54	54	3
8473	ricinus	Ricinus spp.	RICIN	54	54	3
8474	Rinorea carolinensis	Rinorea carolinensis	RICA16	54	54	3
8475	winged sumac	Rhus copallinum	RHCO	55	55	3
8476	greenheart ebony	Rochefortia acanthophora	ROAC2	54	54	3
8477	smooth sumac	Rhus glabra	RHGL	55	55	3
8478	Rochefortia spinosa	Rochefortia spinosa	ROSP8	54	54	3
8479	prairie sumac	Rhus lanceolata	RHLA3	55	55	3
8480	Rollinia	Rollinia deliciosa	RODE5	54	54	3
8481	wild sugar apple	Rollinia mucosa	ROMU3	54	54	3
8483	cordobancillo	Rondeletia inermis	ROIN4	54	54	3
8484	cordobancillo peludo	Rondeletia pilosa	ROPI3	54	54	3
8485	Juan Tomas	Rondeletia portoricensis	ROPO	54	54	3
8486	bristly locust	Robinia hispida	ROHI	55	55	3
8487	bastard oak	Quercus sinuata var. breviloba	QUSIB	55	55	3
8489	Puerto Rico royal palm	Roystonea borinquena	ROBO	54	54	3
8490	Roystonea elata	Roystonea elata	ROEL	54	54	3
8491	royal palm	Roystonea oleracea	ROOL	53	53	3
8492	robust oak	Quercus robusta	QURO3	55	55	3
8494	Puerto Rico palmetto	Sabal causiarum	SACA	54	54	3
8495	dwarf palmetto	Sabal minor	SAMI8	55	55	3
8499	white hogwood	Sagraea umbrosa	SAUM3	54	54	3
8501	Salix humboldtiana	Salix humboldtiana	SAHU	54	54	3
8502	pussy willow	Salix discolor	SADI	55	55	3
8503	etkeam, cheskeam	Samadera indica	SAIN13	54	54	3
8505	raintree	Samanea saman	SASA10	54	54	3
8506	raintree	Samanea spp.	SAMAN	54	54	3
8508	Goodding's willow	Salix gooddingii	SAGO	55	55	3
8509	common elderberry	Sambucus nigra	SANIC4	54	54	3
8510	raintree	Sambucus spp.	SAMBU	54	54	3
8511	Graves oak	Quercus gravesii	QUGR2	26	47	4
8512	Mexican white oak	Quercus polymorpha	QUPO2	26	47	4
8513	Buckley oak	Quercus buckleyi	QUBU2	26	47	4
8514	Lacey oak	Quercus laceyi	QULA	26	47	4
8515	santol, kechapi	Sandoricum koetjape	SAKO4	54	54	4
8516	coastal sandalwood	Santalum ellipticum	SAEL2	54	54	3
8517	forest sandalwood	Santalum freycinetianum	SAFR4	54	54	3
8519	yellow willow	Salix lutea	SALU2	55	55	3
8521	Haleakala sandalwood	Santalum haleakalae	SAHA3	54	54	3
8522	mountain sandalwood	Santalum paniculatum	SAPA7	54	54	3
8523	diamondleaf willow	Salix planifolia	SAPL2	55	55	3
8524	silky willow	Salix sericea	SASE	55	55	3
8525	willowleaf sandalwood	Santalum salicifolium	SASA8	54	54	3
8526	sandalwood	Santalum spp.	SANTA	54	54	3
8527	European black elderberry	Sambucus nigra ssp. nigra	SANIN2	55	55	3
8528	lonomea	Sapindus oahuense	SAOA3	54	54	3
8529	wingleaf soapberry	Sapindus saponaria	SASA4	54	54	3
8531	soapberry	Sapindus spp.	SAPIN	54	54	3
8532	vitiensis	Sapindus vitiensis	SAVI17	54	54	3

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8533	gumtree	Sapium glandulosum	SAGL5	54	54	3
8534	maskerekur	Sapium indicum	SAIN2	54	54	3
8535	hinchahuevos	Sapium laurifolium	SALA25	54	54	3
8536	milktree	Sapium laurocerasus	SALA8	54	54	3
8544	uunu	Sarcopygme pacifica	SAPA35	54	54	3
8546	amansa guapo	Savia sessiliflora	SASE6	54	54	3
8548	Scaevola, naupaka	Scaevola cerasifolia	SCCE3	54	54	3
8549	naupaka kuahiwi	Scaevola chamissoniana	SCCH3	54	54	3
8550	mountain naupaka	Scaevola gaudichaudiana	SCGA2	54	54	3
8551	forest naupaka	Scaevola procera	SCPR	54	54	3
8552	naupaka	Scaevola spp.	SCAEV	54	54	3
8554	Florida boxwood	Schaefferia frutescens	SCFR	54	54	3
8555	schaefferia	Schaefferia spp.	SCHAE	54	54	3
8556	guayabilla	Samyda dodecandra	SADO7	54	54	3
8557	yuquilla	Schefflera gleasonii	SCGL6	54	54	3
8558	matchwood	Schefflera morototonii	SCMO10	54	54	3
8559	samoensis	Schefflera samoensis	SCSA10	54	54	3
8560	Toitoi	Scaevola taccada	SCTA	54	54	3
8561	Peruvian peppertree	Schinus molle	SCMO	54	54	3
8563	Brazilian peppertree	Schinus terebinthifolius	SCTE	54	54	3
8565	Brazilian firetree	Schizolobium parahybum	SCPA23	54	54	3
8567	lac tree	Schleichera oleosa	SCOL3	54	54	3
8571	arana	Schoepfia arenaria	SCAR2	54	54	3
8572	white beefwood	Schoepfia obovata	SCOB	54	54	3
8573	gulf graytwig	Schoepfia schreberi	SCSC3	54	54	3
8577	kuat	Scyphiphora hydrophyllacea	SCHY5	54	54	3
8583	poumuli	Securinega flexuosa	SEFL9	54	54	3
8586	tonget	Semecarpus venenosa	SEVE4	54	54	3
8588	emperor's candlesticks	Senna alata	SEAL4	54	54	3
8589	flor de San Jose	Senna atomaria	SEAT3	54	54	3
8590	Gaudichauds senna	Senna gaudichaudii	SEGA2	54	54	3
8591	false sicklepod	Senna multijuga	SEMU5	54	54	3
8592	valamuerto	Senna pendula	SEPE4	54	54	3
8594	retama prieta	Senna polyphylla	SEPO5	54	54	3
8595	senna	Senna septemtrionalis	SESE13	54	54	3
8596	Siamese cassia	Senna siamea	SESI3	54	54	3
8597	casia amarilla	Senna spectabilis	SESP9	54	54	3
8598	senna	Senna spp.	SENNA	54	54	3
8599	Senna sulfurea	Senna sulfurea	SESU10	54	54	3
8600	glossy shower	Senna surattensis	SESU4	54	54	3
8601	ukall	Serianthes kanehirae	SEKA2	54	54	3
8603	hayun lago, trongkon guafi	Serianthes nelsonii	SENE9	54	54	3
8605	vegetable hummingbird	Sesbania grandiflora	SEGR5	54	54	3
8606	Egyptian riverhemp	Sesbania sesban	SESE8	54	54	3
8607	riverhemp	Sesbania spp.	SESBA	54	54	3
8608	Shirakiopsis indica	Shirakiopsis indica	SHIN	54	54	3
8609	yellow llima	Sida fallax	SIFA	54	54	3
8610	fanpetals	Sida spp.	SIDA	54	54	3
8611	espejuelo	Sideroxylon cubense	SICU7	54	54	3
8612	saffron plum	Sideroxylon celastrinum	SICE2	55	55	3
8613	breakbill	Sideroxylon obovatum	SIOB	54	54	3
8614	Puerto Rico bully	Sideroxylon portoricense	SIPO3	54	54	3
8615	buckthorn bully	Sideroxylon lycioides	SILY	55	55	3
8616	tough bully	Sideroxylon tenax	SITE2	55	55	3
8617	simarouba	Simarouba spp.	SIMAR	54	54	3
8618	Tamaulipan Coma	Sideroxylon laetevirens	SILA4	55	55	3

SPCD	Common name	Scientific name	Species Symbol	E_SPGRCD	W_SPGRPCD	MAJOR_ SPGRPCD
8619	aceitillo falso	Simarouba tulae	SITU	54	54	3
8620	hoja menuda	Siphoneugena densiflora	SIDE6	54	54	3
8622	bullwood	Sloanea spp.	SLOAN	54	54	3
8623	motillo	Sloanea amygdalina	SLAM	54	54	3
8624	bullwood	Sloanea berteriana	SLBE	54	54	3
8626	Solanum bahamense	Solanum bahamense	SOBAB	54	54	3
8627	mullein nightshade	Solanum donianum	SODO3	54	54	3
8628	American black nightshade	Solanum americanum	SOAM	54	54	3
8629	potatotree	Solanum erianthum	SOER2	54	54	3
8631	earleaf nightshade	Solanum mauritianum	SOMA3	54	54	3
8632	forest nightshade	Solanum nudum	SONU4	54	54	3
8633	cakalaka berry	Solanum polygamum	SOPO	54	54	3
8634	tabacon aspero	Solanum rugosum	SORU	54	54	3
8635	nightshade	Solanum spp.	SOLAN	54	54	3
8636	turkey berry	Solanum torvum	SOTO4	54	54	3
8639	mangrove	Sonneratia alba	SOAL10	54	54	3
8641	mamani	Sophora chrysophylla	SOCH	54	54	3
8642	necklacepod	Sophora spp.	SOPHO	54	54	3
8643	silver bush	Sophora tomentosa	SOTO3	54	54	3
8644	African tuliptree	Spathodea campanulata	SPCA2	54	54	3
8645	spathodea	Spathodea spp.	SPATH	54	54	3
8646	Spiraeanthemum samoense	Spiraeanthemum samoense	SPSA7	54	54	3
8647	Japanese pagoda tree	Styphnolobium japonicum	STJA9	55	55	3
8648	mescal bean	Sophora secundiflora	SOSE3	55	55	3
8649	Spondias dulcis	Spondias dulcis	SPDU3	54	54	3
8650	yellow mombin	Spondias mombin	SPMO	54	54	3
8651	Anacahuita Texas Olive	Cordia boissieri	COBO2	27	47	4
8652	purple mombin	Spondias purpurea	SPPU	54	54	3
8653	Spondias	Spondias spp.	SPOND	54	54	3
8654	cobana negra	Stahlia monosperma	STMO	54	54	3
8655	ngmui	Stemonurus ammui	STAM10	54	54	3
8656	titmel	Spondias pinnata	SPPI4	54	54	3
8657	false spiraea	Sorbaria spp.	SORBA	55	55	3
8658	Greene's mountain ash	Sorbus scopulina	SOSC2	55	55	3
8659	western mountain ash	Sorbus sitchensis	SOSI2	55	55	3
8664	Panama tree	Sterculia apetala	STAP	54	54	3
8665	fanaio	Sterculia fanaiho	STFA5	54	54	3
8666	hazel sterculia	Sterculia foetida	STFO2	54	54	3
8667	Sterculia palauensis	Sterculia palauensis	STPA20	54	54	3
8668	silky camellia	Stewartia malacodendron	STMA	55	55	3
8669	anthropophagorum	Streblus anthropophagorum	STAN9	54	54	3
8670	Hawaii roughbush	Streblus pendulinus	STPE3	54	54	3
8671	streblus	Streblus spp.	STREB	54	54	3
8672	mountain camellia	Stewartia ovata	STOV	55	55	3
8673	American snowbell	Styrax americanus	STAM4	55	55	3
8674	palo de jazmin	Styrax portoricensis	STPO3	54	54	3
8675	Stewartia	Stewartia koreana	STKO2	55	55	3
8676	bay cedar	Suriana maritima	SUMA2	54	54	3
8678	mahogany	Swietenia spp.	SWIET	54	54	3
8679	Honduras mahogany	Swietenia macrophylla	SWMA	54	54	3
8683	nispero cimarron	Symplocos lanata	SYLA2	54	54	3
8684	Martinique sweetleaf	Symplocos martinicensis	SYMA	54	54	3
8685	aceitunilla	Symplocos micrantha	SYMI3	54	54	3
8687	chebtui, ebtui	Symplocos racemosa	SYRA6	54	54	3
8689	turpentine tree	Syncarpia glomulifera	SYGL	54	54	3
8690	turpentine tree	Syncarpia spp.	SYNCA	54	54	3

SPCD	Common name	Scientific name	Species Symbol	E_SPGRCD	W_SPGRPCD	MAJOR_ SPGRPCD
8691	Miracle Berry	Synsepalum dulcificum	SYDU	54	54	3
8693	common lilac	Syringa vulgaris	SYVU	55	55	3
8694	watery roseapple	Syzygium aqueum	SYAQ	54	54	3
8695	asi	Syzygium brevifolium	SYBR3	54	54	3
8696	popona	Syzygium carolinense	SYCA4	54	54	3
8697	asi vai	Syzygium clusiifolium	SYCL	54	54	3
8699	asi vai	Syzygium dealatum	SYDE3	54	54	3
8700	asi	Syzygium inophylloides	SYIN2	54	54	3
8701	Syzygium jambos	Syzygium jambos	SYJA	54	54	3
8702	Malaysian apple	Syzygium malaccense	SYMA2	54	54	3
8703	popona	Syzygium richii	SYRI3	54	54	3
8704	nonu vao	Syzygium samarangense	SYSA3	54	54	3
8705	fena vao	Syzygium samoense	SYSA6	54	54	3
8706	ohia ha	Syzygium sandwicense	SYSA	54	54	3
8708	syzygium	Syzygium spp.	SYZYG	54	54	3
8709	roble amarillo	Tabebuia chrysantha	TACH3	54	54	3
8710	primavera	Tabebuia donnell-smithii	TADO2	54	54	3
8712	roble cimarron	Tabebuia haemantha	TAHA	54	54	3
8713	white cedar	Tabebuia heterophylla	TAHE	54	54	3
8714	pink tabebuia	Tabebuia pallida	TAPA10	54	54	3
8715	roble de sierra	Tabebuia rigida	TARI	54	54	3
8716	pink trumpet-tree	Tabebuia rosea	TARO	54	54	3
8717	roble colorado	Tabebuia schumanniana	TASC2	54	54	3
8718	trumpet-tree	Tabebuia spp.	TABEB	54	54	3
8719	Tabernaemontana aurantiaca	Tabernaemontana aurantiaca	TAAU3	54	54	3
8720	milkwood	Tabernaemontana citrifolia	TACI	54	54	3
8722	Pulu	Tabernaemontana pandacaqui	TAPA13	54	54	3
8723	Tabernaemontana rotensis	Tabernaemontana rotensis	TARO3	54	54	3
8727	Athel tamarisk	Tamarix aphylla	TAAP	54	54	3
8728	five-stamen tamarisk	Tamarix chinensis	TACH2	55	55	3
8729	saltcedar	Tamarix ramosissima	TARA	55	55	3
8737	manunu	Tarenna sambucina	TASA2	54	54	3
8738	English yew	Taxus baccata	TABA80	56	56	3
8739	Japanese yew	Taxus cuspidata	TACU	56	56	3
8741	chestnutleaf trumpetbush	Tecoma castanifolia	TECA9	54	54	3
8743	yellow trumpetbush	Tecoma stans	TEST	54	54	3
8744	teak	Tectona grandis	TEGR	54	54	3
8745	tectona	Tectona spp.	TECTO	54	54	3
8748	tropical almond	Terminalia spp.	TERMI	54	54	3
8749	kehma	Terminalia carolinensis	TECA16	54	54	3
8750	tropical almond	Terminalia catappa	TECA	54	54	3
8751	esemiich, chesemiich	Terminalia crassipes	TECR3	54	54	3
8752	esemiich, chesemiich	Terminalia edulis	TEED	54	54	3
8754	Ivory Coast almond	Terminalia ivorensis	TEIV2	54	54	3
8755	tropical almond	Terminalia kaernbachii	TEKA4	54	54	3
8756	East Indian almond	Terminalia myriocarpa	TEMY	54	54	3
8757	Peruvian almond	Terminalia oblonga	TEOB	54	54	3
8758	malili	Terminalia richii	TERI3	54	54	3
8759	talie	Terminalia samoensis	TESA2	54	54	3
8761	superb terminalia	Terminalia superba	TESU2	54	54	3
8762	saintedwood	Ternstroemia heptasepala	TEHE3	54	54	3
8763	palo colorado	Ternstroemia luquillensis	TELU2	54	54	3
8764	copey vera	Ternstroemia peduncularis	TEPE	54	54	3
8766	mamey de cura	Ternstroemia stahlii	TEST3	54	54	3
8767	el yunque colorado	Ternstroemia subsessilis	TESU	53	53	3
8768	masa	Tetragastris balsamifera	TEBA	53	53	3

SPCD	Common name	Scientific name	Species Symbol	E_SPGRCD	W_SPGRPCD	MAJOR_ SPGRPCD
8770	Flynnsohe	Tetraplasandra flynnii	TEFL5	54	54	3
8771	Koolau Rangeohe	Tetraplasandra gymnocarpa	TEGY	54	54	3
8772	Hawaii ohe	Tetraplasandra hawaiensis	TEHA2	54	54	3
8773	ohe ohe	Tetraplasandra kavaiensis	TEKA3	54	54	3
8774	ohe mauka	Tetraplasandra oahuensis	TEOA	54	54	3
8775	tetraplasandra	Tetraplasandra spp.	TETRA11	54	54	3
8776	Mt. Waialeale ohe	Tetraplasandra waialealae	TEWA	54	54	3
8777	ohe kiko ola	Tetraplasandra waimeae	TEWA3	54	54	3
8778	stinkingfish	Tetrazygia angustifolia	TEAN2	54	54	3
8779	Florida clover ash	Tetrazygia bicolor	TEBI	54	54	3
8780	Puerto Rico clover ash	Tetrazygia biflora	TEBI2	54	54	3
8781	krekre	Tetrazygia elaeagnoides	TEEL	54	54	3
8783	cenizo	Tetrazygia urbanii	TEUR	54	54	3
8784	cacao	Theobroma cacao	THCA	54	54	3
8786	maga	Thespesia grandiflora	THGR2	54	54	3
8787	Portia tree	Thespesia populnea	THPO3	54	54	3
8788	thespesia	Thespesia spp.	THESP	54	54	3
8789	luckynut	Thevetia peruviana	THPE3	54	54	3
8793	ceboruquillo	Thouinia striata	THST2	54	54	3
8794	Puerto Rico ceboruquillo	Thouinia striata var. portoricensis	THSTP	54	54	3
8803	Brazilian glorytree	Tibouchina granulosa	TIGR3	54	54	3
8804	glorytree	Tibouchina spp.	TIBOU	54	54	3
8805	princess-flower	Tibouchina urvilleana	TIUR	54	54	3
8806	Timonius corymbosus	Timonius corymbosus	TICO7	54	54	3
8807	Timonius mollis	Timonius mollis	TIMO4	54	54	3
8808	Timonius	Timonius spp.	TIMON	54	54	3
8809	Timonius subauritus	Timonius subauritus	TISU3	54	54	3
8810	Timonius timon	Timonius timon	TITI	54	54	3
8811	redcedar	Toona spp.	TOONA	54	54	3
8812	Australian redcedar	Toona ciliata	TOCI	54	54	3
8813	littleleaf linden	Tilia cordata	TICO2	55	55	3
8814	Silver linden	Tilia tomentosa	TITO	55	55	3
8816	boje	Torralbasia cuneifolia	TOCU	54	54	3
8822	olona	Touchardia latifolia	TOLA	54	54	3
8823	touchardia	Touchardia spp.	TOUCH	54	54	3
8824	velvetleaf soldierbush	Tournefortia argentea	TOAR2	54	54	3
8825	cold withe	Tournefortia filiflora	TOFI	54	54	3
8826	soldierbush	Tournefortia spp.	TOURN	54	54	3
8827	magele	Trema cannabina	TRCA33	54	54	3
8828	Lamarck's trema	Trema lamarckianum	TRLA2	54	54	3
8829	Jamaican nettletree	Trema micranthum	TRMI2	54	54	3
8830	poison sumac	Toxicodendron vernix	TOVE	55	55	3
8831	oriental trema	Trema orientalis	TROR	54	54	3
8832	trema	Trema spp.	TREMA	54	54	3
8833	broomstick	Trichilia hirta	TRHI3	54	54	3
8834	gaita	Trichilia pallida	TRPA2	54	54	3
8836	bariaco	Trichilia triacantha	TRTR8	54	54	3
8837	Trichospermum ikutai	Trichospermum ikutai	TRIK	54	54	3
8838	elsau, oleiulakersus	Trichospermum ledermannii	TRLE8	54	54	3
8839	maouli	Trichospermum richii	TRRI9	54	54	3
8842	limeberry	Triphasia trifolia	TRTR7	54	54	3
8843	Triplaris spp.	Triplaris spp.	TRIPL5	54	54	3
8844	ant tree	Triplaris cumingiana	TRCU6	54	54	3
8846	faia	Tristiropsis obtusangula	TROB7	54	54	3
8848	white ramoon	Trophis racemosa	TRRA4	54	54	3

SPCD	Common name	Scientific name	Species Symbol	E_SPGRCD	W_SPGRPCD	MAJOR_ SPGRPCD
8850	muttonwood	Turpinia occidentalis	TUOC	54	54	3
8851	Chinese elm	Ulmus parvifolia	ULPA	55	55	3
8852	English elm	Ulmus procera	ULPR	55	55	3
8853	scratchbush	Urera baccifera	URBA	54	54	3
8854	flameberry	Urera caracasana	URCA2	54	54	3
8855	ortiga	Urera chlorocarpa	URCH2	54	54	3
8856	hopue	Urera glabra	URGL	54	54	3
8857	opuhe	Urera kaalae	URKA	54	54	3
8858	urera	Urera spp.	URERA	54	54	3
8859	Mexican buckeye	Ungnadia speciosa	UNSP	55	55	3
8860	farkleberry	Vaccinium arboreum	VAAR	55	55	3
8861	voa vanga	Vangueria madagascariensis	VAMA5	54	54	3
8866	Manila palm	Veitchia merrillii	VEME3	53	53	3
8869	mu oil tree	Vernicia montana	VEMO3	54	54	3
8870	vernicia	Vernicia spp.	VERNI	54	54	3
8871	lilac chastetree	Vitex agnus-castus	VIAG	54	54	3
8872	bars, beokel	Vitex cofassus	VICO17	54	54	3
8873	higuerillo	Vitex divaricata	VIDI2	54	54	3
8874	smallflower chastetree	Vitex parviflora	VIPA6	54	54	3
8875	chastetree	Vitex spp.	VITEX	54	54	3
8876	simpleleaf chastetree	Vitex trifolia	VITR7	54	54	3
8877	nannyberry	Viburnum lentago	VILE	55	55	3
8878	blackhaw	Viburnum prunifolium	VIPR	55	55	3
8879	rusty blackhaw	Viburnum rufidulum	VIRU	55	55	3
8880	Siebold's arrowwood	Viburnum sieboldii	VISI	55	55	3
8881	Wallenia lamarckiana	Wallenia lamarckiana	WALA	54	54	3
8883	California fan palm	Washingtonia filifera	WAFI	55	55	3
8884	ateate	Wedelia biflora	WEBI	54	54	3
8885	Washington fan palm	Washingtonia robusta	WARO	55	55	3
8886	Weinmannia affinis	Weinmannia affinis	WEAF	54	54	3
8887	bastard briziletto	Weinmannia pinnata	WEPI	54	54	3
8889	alpine false ohelo	Wikstroemia bicornuta	WIBI	54	54	3
8890	forest false ohelo	Wikstroemia furcata	WIFU	54	54	3
8891	montane false ohelo	Wikstroemia monticola	WIMO	54	54	3
8892	Oahu false ohelo	Wikstroemia oahuensis	WIOA	54	54	3
8895	Hawaii false ohelo	Wikstroemia phillyreifolia	WIPH2	54	54	3
8896	Kohala false ohelo	Wikstroemia pulcherrima	WIPU	54	54	3
8897	variableleaf false ohelo	Wikstroemia sandwicensis	WISA	54	54	3
8898	Skottsbergs false ohelo	Wikstroemia skottsbergiana	WISK	54	54	3
8899	false ohelo	Wikstroemia spp.	WIKST	54	54	3
8900	hairy false ohelo	Wikstroemia villosa	WIVI	54	54	3
8901	tallow wood	Ximenia americana	XIAM	54	54	3
8903	lalanyog	Xylocarpus granatum	XYGR	54	54	3
8904	leilei	Xylocarpus moluccensis	XYMO2	54	54	3
8905	Xylocarpus	Xylocarpus spp.	XYLOC2	54	54	3
8906	mucha-gente	Xylosma buxifolia	XYBU	54	54	3
8907	sawtooth logwood	Xylosma crenata	XYCR	54	54	3
8908	Hawaii brushholly	Xylosma hawaiiensis	XYHA	54	54	3
8909	Xylosma nelsonii	Xylosma nelsonii	XYNE2	54	54	3
8910	spiny logwood	Xylosma pachyphylla	XYPA2	54	54	3
8911	Xylosma samoensis	Xylosma samoensis	XYSA	54	54	3
8912	white logwood	Xylosma schaefferioides	XYSC2	54	54	3
8913	Schwaneck's logwood	Xylosma schwaneckeana	XYSC3	54	54	3
8914	mission manzanita	Xylococcus bicolor	XYBI	55	55	3
8915	xylosma	Xylosma spp.	XYLOS	54	54	3
8916	aloe yucca	Yucca aloifolia	YUAL	54	54	3

SPCD	Common name	Scientific name	Species Symbol	E_SPGRCD	W_SPGRPCD	MAJOR_ SPGRPCD
8918	moundlily yucca	Yucca gloriosa	YUGL2	54	54	3
8919	bluestem yucca	Yucca guatemalensis	YUGU	54	54	3
8923	Maricao pricklyash	Zanthoxylum bifoliolatum	ZABI	54	54	3
8924	prickly yellow	Zanthoxylum caribaeum	ZACA3	54	54	3
8925	kawau	Zanthoxylum dipetalum	ZADI	54	54	3
8928	West Indian satinwood	Zanthoxylum flavum	ZAFL	54	54	3
8929	Hawaii pricklyash	Zanthoxylum hawaiiense	ZAHA	54	54	3
8930	Kauai pricklyash	Zanthoxylum kauaense	ZAKA	54	54	3
8931	white pricklyash	Zanthoxylum martinicense	ZAMA	54	54	3
8932	yellow prickle	Zanthoxylum monophyllum	ZAMO	54	54	3
8933	Oahu pricklyash	Zanthoxylum oahuense	ZAOA	54	54	3
8934	dotted pricklyash	Zanthoxylum punctatum	ZAPU2	54	54	3
8935	niaragato	Zanthoxylum spinifex	ZASP	54	54	3
8936	pricklyash	Zanthoxylum spp.	ZANTH	54	54	3
8937	St. Thomas pricklyash	Zanthoxylum thomasianum	ZATH	54	54	3
8938	Zapoteca portoricensis	Zapoteca portoricensis	ZAPO2	54	54	3
8939	Indian jujube	Ziziphus mauritiana	ZIMA	54	54	3
8940	cacao rojo	Ziziphus reticulata	ZIRE	54	54	3
8941	soana	Ziziphus rignonii	ZIRI	54	54	3
8942	common pricklyash	Zanthoxylum americanum	ZAAM	55	55	3
8943	Taylor's jujube	Ziziphus taylorii	ZITA	54	54	3
8944	Hercules' club	Zanthoxylum clava-herculis	ZACL	55	55	3
8947	common jujube	Ziziphus zizyphus	ZIZI	55	55	3

Appendix E. Damage Codes and Thresholds

DAMAGE_ AGENT_CD	DAMAGE_AGENT_ GROUP_CD	COMMON_NAME	SCIENTIFIC_NAME	THRESHOLD	REGION
0	**0**	**No damage**	-	-	**ALL**
10000	**10000**	**General Insects**		Any damage to the terminal leader; damage ≥ 20% of the roots or boles with > 20% of the circumference affected; damage > 20% of the multiple-stems (on multi-stemmed woodland species) with > 20% of the circumference affected; >20% of the branches affected ; damage ≥ 20% of the foliage with ≥ 50% of the leaf/needle affected	**ALL**
10001	10000	thrips	-	-	**-**
10002	10000	Pine tip moth	-	-	**-**
10003	10000	wasp	-	-	**-**
10004	10000	Chinese rose beetle	Adoretus sinicus	-	**-**
10005	10000	rose beetle	Adoretus versutus	-	**-**
10006	10000	coconut hispid beetle	Brontispa longissima	-	**-**
10007	10000	clerid beetle	Cleridae	-	**-**
10008	10000	weevil	Curculionidae	-	**-**
10009	10000	green rose chafer	Dichelonyx backi	-	**-**
10010	10000	Allegheny mound ant	Formica exsectoides	-	**-**
10011	10000	ant	Formicidae	-	**-**
10012	10000	stick insect	Graeffea crovanii	-	**-**
10013	10000	Hulodes cranea	Hulodes cranea	-	**-**
10014	10000	conifer swift moth	Korsheltellus gracilis	-	**-**
10015	10000	Caroline shortnosed weevil	Lophothetes spp.	-	**-**
10016	10000	coconut rhinoceros beetle	Oryctes rhinoceros	-	**-**
10017	10000	bagworm moth	Psychidae	Any damage to the terminal leader; damage ≥ 20% of the foliage with ≥ 50% of the leaf/needle affected	**NRS**
10018	10000	coconut palm weevil	Rhobdoscelus asperipennis	-	**-**
10019	10000	scarab	Scarabaeidae	-	**-**
10020	10000	ash white fly	Siphoninus phillyreae	-	**-**
10021	10000	conifer seedling weevil	Steremnius carinatus	-	**-**
10022	10000	pyralid moth	Thliptoceras octoquttale	-	**-**
10023	10000	wood wasps	Siricidae spp.	-	**-**

DAMAGE_AGENT_CD	DAMAGE_AGENT_GROUP_CD	COMMON_NAME	SCIENTIFIC_NAME	THRESHOLD	REGION
11000	**11000**	**Bark Beetles**		Any evidence of a successful attack (successful attacks generally exhibit boring dust, many pitch tubes and/or fading crowns)	**ALL**
11001	11000	roundheaded pine beetle	Dendroctonus adjunctus	-	-
11002	11000	western pine beetle	Dendroctonus brevicomis	-	-
11003	11000	southern pine beetle	Dendroctonus frontalis	Any occurrence	**SRS**
11004	11000	Jeffery pine beetle	Dendroctonus jeffreyi	-	-
11005	11000	lodgepole pine beetle	Dendroctonus murrayanae	-	-
11006	11000	mountain pine beetle	Dendroctonus ponderosae	Any evidence of a successful attack	**IW**
11007	11000	Douglas-fir beetle	Dendroctonus pseudotsugae	-	-
11008	11000	Allegheny spruce beetle	Dendroctonus punctatus	-	-
11009	11000	spruce beetle	Dendroctonus rufipennis	Any evidence of a successful attack	**IW; PNW**
11010	11000	eastern larch beetle	Dendroctonus simplex	-	-
11011	11000	black turpentine beetle	Dendroctonus terebrans	Any evidence of a successful attack	**SRS**
11012	11000	red turpentine beetle	Dendroctonus valens	Any evidence of a successful attack	**NRS**
11013	11000	Dryocoetes affaber	Dryocoetes affaber	-	-
11014	11000	Dryocoetes autographus	Dryocoetes autographus	-	-
11015	11000	western balsam bark beetle	Dryocoetes confusus	-	-
11016	11000	Dryocoetes sechelti	Dryocoetes sechelti	-	-
11017	11000	ash bark beetles	Hylesinus spp.	-	-
11018	11000	native elm bark beetle	Hylurgopinus rufipes	-	-
11019	11000	pinon ips	Ips confusus	-	-
11020	11000	small southern pine engraver	Ips avulsus	-	-
11021	11000	sixspined ips	Ips calligraphus	-	-
11022	11000	emarginate ips	Ips emarginatus	-	-
11023	11000	southern pine engraver beetle	Ips grandicollis	-	-
11024	11000	Orthotomicus latidens	Orthotomicus latidens	-	-
11025	11000	Arizona five-spined ips	Ips lecontei	-	-
11026	11000	Monterey pine ips	Ips mexicanus	-	-
11027	11000	California fivespined ips	Ips paraconfusus	-	
11028	11000	northern spruce engraver beetle	Ips perturbatus	-	-
11029	11000	pine engraver	Ips pini	-	-
11030	11000	Ips engraver beetles	Ips spp.	Any evidence of a successful attack	**IW; SRS**
11031	11000	Ips tridens	Ips tridens	-	-
11032	11000	western ash bark beetle	Leperisinus californicus	-	-
11033	11000	Oregon ash bark beetle	Leperisinus oregonus	-	-
11034	11000	Orthotomicus caelatus	Orthotomicus caelatus	-	-
11035	11000	cedar bark beetles	Phloeosinus spp.	-	-

DAMAGE_AGENT_CD	DAMAGE_AGENT_GROUP_CD	COMMON_NAME	SCIENTIFIC_NAME	THRESHOLD	REGION
11036	11000	western cedar bark beetle	Phloeosinus punctatus	-	**-**
11037	11000	tip beetles	Pityogenes spp.	-	**-**
11038	11000	Douglas-fir twig beetle	Pityophthorus pseudotsugae	-	**-**
11039	11000	twig beetles	Pityophthorus spp.	-	**-**
11040	11000	foureyed spruce bark beetle	Polygraphus rufipennis	-	**-**
11041	11000	fir root bark beetle	Pseudohylesinum granulatus	-	**-**
11042	11000	Pseudohylesinus dispar	Pseudohylesinus dispar	-	**-**
11043	11000	Douglas-fir pole beetle	Pseudohylesinus nebulosus	-	**-**
11044	11000	silver fir beetle	Pseudohylesinus sericeus	-	**-**
11045	11000	small European elm bark beetle	Scolytus multistriatus	-	**-**
11046	11000	spruce engraver	Scolytus piceae	-	**-**
11047	11000	hickory bark beetle	Scolytus quadrispinosus	-	**-**
11048	11000	true fir bark beetles	Scolytus spp.	-	**-**
11049	11000	Douglas-fir engraver	Scolytus unispinosus	-	**-**
11050	11000	fir engraver	Scolytus ventralis	-	**-**
11051	11000	striped ambrosia beetle	Tryachykele lineatum	-	**-**
11052	11000	Sitka spruce engraver beetle	Ips conncinnus	-	**-**
11053	11000	four-eyed bark beetle	Polygraphus spp.	-	**-**
11054	11000	hemlock beetle	Pseudohylesinus tsugae	-	**-**
11055	11000	spruce ips	Ips pilifrons	-	**-**
11056	11000	(smaller) Mexican pine beetle	Dendroctonus mexicanus	-	**-**
11057	11000	banded elm bark beetle	Scolytus schevyrewi	-	**-**
11058	11000	redbay ambrosia beetle	Xyleborus glabratus	-	**-**
11059	11000	southern cypress beetle	Phloeosinus taxodii	-	**-**
11060	11000	Mediterranean pine engraver	Orthotomicus erosus	-	**-**
11800	11000	other bark beetle (known)	other bark beetle (known)	-	**-**
11900	11000	unknown bark beetle	unknown bark beetle	-	**-**
11999	11000	western bark beetle complex	western bark beetle complex	-	**-**
12000	**12000**	**Defoliators**	-	Any damage to the terminal leader; damage ≥ 20% of the foliage with ≥ 50% of the leaf/needle affected	**ALL**
12001	12000	casebearer	-	-	**-**
12002	12000	leaftier	-	-	**-**
12003	12000	loopers	-	-	**-**
12004	12000	needleminers	-	-	**-**
12005	12000	sawflies	-	Any damage to the terminal leader; damage ≥ 20% of the foliage with ≥ 50% of the leaf/needle affected	**NRS**

DAMAGE_ AGENT_CD	DAMAGE_AGENT_ GROUP_CD	COMMON_NAME	SCIENTIFIC_NAME	THRESHOLD	REGION
12006	12000	skeletonizer	-	-	**-**
12007	12000	larger elm leaf beetle	Monocesta coryli	-	**-**
12008	12000	spanworm	-	-	**-**
12009	12000	webworm	-	-	**-**
12010	12000	pine false webworm	Acantholyda erythrocephala	-	**-**
12011	12000	western blackheaded budworm	Acleris gloverana	-	**-**
12012	12000	eastern blackheaded budworm	Acleris variana	-	**-**
12013	12000	whitefly	Aleyrodoidae	-	**-**
12014	12000	fall cankerworm	Alsophila pometaria	-	**-**
12015	12000	alder flea beetle	Altica ambiens	-	**-**
12016	12000	mountain mahogany looper	Anacamptodes clivinaria profanata	-	**-**
12017	12000	birch leaffolder	Ancylis disigerana	-	**-**
12018	12000	oak worms	Anisota spp.	-	**-**
12019	12000	orange-striped oakworm	Anisota senatoria	-	**-**
12020	12000	western larch sawfly	Anoplonyx occidens	-	**-**
12021	12000	fruittree leafroller	Archips argyrospila	-	**-**
12022	12000	uglynest caterpillar	Archips cerasivorana	-	**-**
12023	12000	boxelder defoliator	Archips negundanus	-	**-**
12024	12000	oak leafroller	Archips semiferana	-	**-**
12025	12000	birch sawfly	Arge pectoralis	-	**-**
12026	12000	arborvitae leafminer	Argyresthia thuiella	-	**-**
12027	12000	coconut scale	Aspidiotus destructor	-	**-**
12028	12000	texas leafcutting ant	Atta texana	Any damage to the terminal leader; damage ≥ 20% of the foliage with ≥ 50% of the leaf/needle affected	**SRS**
12029	12000	oak skeletonizer	Bucculatrix ainsliella	Any damage to the terminal leader; damage ≥ 20% of the foliage with ≥ 50% of the leaf/needle affected	**NRS**
12030	12000	pear sawfly	Caliroa cerasi	-	**-**
12031	12000	scarlet oak sawfly	Caliroa quercuscoccineae	-	**-**
12032	12000	elm calligrapha	Calligrapha scalaris	-	**-**
12033	12000	boxelder leafroller	Caloptilia negundella	-	**-**
12034	12000	maple petiole borer	Caulocampus acericaulis	-	**-**
12035	12000	spruce webspinning sawfly	Cephalcia fascipennis	-	**-**
12036	12000	two-year budworm	Choristoneura biennis	-	**-**
12037	12000	large aspen tortrix	Choristoneura conflictana	-	**-**
12038	12000	spruce budworm	Choristoneura fumiferana	Any damage to the terminal leader; damage ≥ 20% of the foliage with ≥ 50% of the leaf/needle affected	**NRS**

DAMAGE_ AGENT_CD	DAMAGE_AGENT_ GROUP_CD	COMMON_NAME	SCIENTIFIC_NAME	THRESHOLD	REGION
12039	12000	western pine budworm	Choristoneura lambertiana	-	**-**
12040	12000	western spruce budworm	Choristoneura occidentalis	Any damage to the terminal leader; damage ≥ 20% of the foliage with ≥ 50% of the leaf/needle affected	**IW, PNW**
12041	12000	jack pine budworm	Choristoneura pinus	Any damage to the terminal leader; damage ≥ 20% of the foliage with ≥ 50% of the leaf/needle affected	**NRS**
12042	12000	Modoc budworm	Choristoneura retiniana	-	**-**
12043	12000	aspen leaf beetle	Chrysomela crotchi	-	**-**
12044	12000	cottonwood leaf beetle	Chrysomela scripta	-	**-**
12045	12000	leafhopper	Cicadellidae	-	**-**
12046	12000	poplar tentmaker	Clostera inclusa	-	**-**
12047	12000	larch casebearer	Coleophora laricella	Any damage to the terminal leader; damage ≥ 20% of the foliage with ≥ 50% of the leaf/needle affected	**NRS**
12048	12000	birch casebearer	Coleophora serratella	Any damage to the terminal leader; damage ≥ 20% of the foliage with ≥ 50% of the leaf/needle affected	**NRS**
12049	12000	lodgepole needleminer	Coleotechnites milleri	-	**-**
12050	12000	Gelechiid moths/ needleminers	Coleotechnites spp.	-	**-**
12051	12000	Black Hills pandora moth	Coloradia doris	-	**-**
12052	12000	pandora moth	Coloradia pandora	-	**-**
12053	12000	sycamore lace bug	Corythucha ciliata	-	**-**
12054	12000	lace bugs	Corythucha spp.	-	**-**
12055	12000	oak leaftier	Croesia semipurpurana	-	**-**
12056	12000	dusky birch sawfly	Croesus latitarsus	-	**-**
12057	12000	walnut caterpillar	Datana integerrima	-	**-**
12058	12000	yellownecked caterpillar	Datana ministra	-	**-**
12059	12000	walkingstick	Diapheromera femorata	-	**-**
12060	12000	spruce coneworm	Dioryctria reniculelloides	-	**-**
12061	12000	introduced pine sawfly	Diprion similis	-	**-**
12062	12000	greenstriped mapleworm	Dryocampa rubicunda	-	**-**
12063	12000	spruce needleminer (east)	Endothenia albolineana	-	**-**
12064	12000	elm spanworm	Ennomos subsignaris	Any damage to the terminal leader; damage ≥ 20% of the foliage with ≥ 50% of the leaf/needle affected	**NRS**
12065	12000	maple trumpet skeletonizer	Epinotia aceriella	-	**-**
12066	12000	white fir needleminer	Epinotia meritana	-	**-**
12067	12000	linden looper	Erannis tiliaria	-	**-**

DAMAGE_ AGENT_CD	DAMAGE_AGENT_ GROUP_CD	COMMON_NAME	SCIENTIFIC_NAME	THRESHOLD	REGION
12068	12000	browntail moth	Euproctis chrysorrhoea	Any occurrence	**NRS**
12069	12000	pine needleminer	Exoteleia pinifoliella	-	**-**
12070	12000	birch leafminer	Fenusa pusilla	-	**-**
12071	12000	elm leafminer	Fenusa ulmi	-	**-**
12072	12000	geometrid moth	Geometridae	-	**-**
12073	12000	leafblotch miner	Gracillariidae	-	**-**
12074	12000	spotted tussock moth	Halisidota maculata	-	**-**
12075	12000	pale tussock moth	Halysidota tessellaris	-	**-**
12076	12000	hesperiid moth	Hasora choromus	-	**-**
12077	12000	brown day moth	Hemileuca eglanterina	-	**-**
12078	12000	buck moth	Hemileuca maia	-	**-**
12079	12000	saddled prominent	Heterocampa guttivitta	-	**-**
12080	12000	variable oakleaf caterpillar	Heterocampa manteo	-	**-**
12081	12000	cherry scallop shell moth	Hydria prunivorata	Any damage to the terminal leader; damage ≥ 20% of the foliage with ≥ 50% of the leaf/needle affected	**NRS**
12082	12000	fall webworm	Hyphantria cunea	Any damage to the terminal leader; damage ≥ 20% of the foliage with ≥ 50% of the leaf/needle affected	**SRS**
12083	12000	hemlock looper	Lambdina fiscellaria	-	**-**
12084	12000	oak looper	Lambdina punctat	-	**-**
12085	12000	tent caterpillar moth	Lasiocampidae	-	**-**
12086	12000	satin moth	Leucoma salicis	Any damage to the terminal leader; damage ≥ 20% of the foliage with ≥ 50% of the leaf/needle affected	**NRS**
12087	12000	willow leafblotch miner	Lithocolletis spp.	-	**-**
12088	12000	aspen blotchminer	Lithocolletis tremuloidiella	-	**-**
12089	12000	gypsy moth	Lymantria dispar	Any occurrence	**NRS; SRS**
12090	12000	cottonwood leafminers	Lyonetia spp.	-	**-**
12091	12000	dogwood sawfly	Macremphytus tarsatus	-	**-**
12092	12000	rose chafer	Macrodactylus subspinosus	-	**-**
12093	12000	eastern tent caterpillar	Malacosoma americanum	Any damage to the terminal leader; damage ≥ 20% of the foliage with ≥ 50% of the leaf/needle affected	**NRS; SRS**
12094	12000	western tent caterpillar	Malacosoma californicum	-	**-**
12095	12000	Pacific tent caterpillar	Malacosoma constrictum	-	**-**
12096	12000	forest tent caterpillar	Malacosoma disstria	Any damage to the terminal leader; damage ≥ 20% of the foliage with ≥ 50% of the leaf/needle affected.	**NRS**
12097	12000	southwestern tent caterpillar	Malacosoma incurvum	-	**-**
12098	12000	leafcutting bees	Megachilidae	-	**-**

DAMAGE_ AGENT_CD	DAMAGE_AGENT_ GROUP_CD	COMMON_NAME	SCIENTIFIC_NAME	THRESHOLD	REGION
12099	12000	blister beetle	Meloidae	-	-
12100	12000	early birch leaf edgeminer	Messa nana	-	-
12101	12000	juniper sawfly	Monoctenus fulvus	-	-
12102	12000	common sawflies	Nematus spp.	-	-
12103	12000	balsam fir sawfly	Neodiprion abietis	-	-
12104	12000	lodgepole sawfly	Neodiprion burkei	-	-
12105	12000	blackheaded pine sawfly	Neodiprion excitans	-	-
12106	12000	pine infesting sawflies	Neodiprion fulviceps	-	-
12107	12000	redheaded pine sawfly	Neodiprion lecontei	-	-
12109	12000	ponderosa pine sawfly	Neodiprion mundus	-	-
12110	12000	white pine sawfly	Neodiprion pinetum	-	-
12111	12000	jack pine sawfly	Neodiprion pratti banksianae	-	-
12112	12000	Virginia pine sawfly	Neodiprion pratti pratti	-	-
12113	12000	European pine sawfly	Neodiprion sertifer	-	-
12114	12000	loblolly pine sawfly	Neodiprion taedae linearis	-	-
12115	12000	hemlock sawfly	Neodiprion tsugae	-	-
12116	12000	pine butterfly	Neophasia menapia	-	-
12117	12000	false hemlock looper	Nepytia canosaria	-	-
12118	12000	California tortoiseshell	Nymphalis californica	-	-
12119	12000	locust leafminer	Odontota dorsalis	-	-
12120	12000	Bruce spanworm	Operophtera bruceata	-	-
12121	12000	rusty tussock moth	Orgyia antiqua	-	-
12122	12000	whitemarked tussock moth	Orgyia leucostigma	-	-
12123	12000	Douglas-fir tussock moth	Orgyia pseudotsugata	-	-
12124	12000	western tussock moth	Orgyia vetusta	-	-
12125	12000	spring cankerworm	Paleacrita vernata	-	-
12126	12000	black citrus swallowtail butterfly	Papilio polytes	-	-
12127	12000	maple leafcutter	Paraclemensia acerifoliella	-	-
12128	12000	pine tussock moth	Parorgyia grisefacta	-	-
12129	12000	poinciana looper	Pericyma cruegeri	-	-
12130	12000	half-wing geometer	Phigalia titea	-	-
12131	12000	Phoberia moth	Phoberia atomaris	-	-
12132	12000	California oakworm	Phryganidia californica	-	-
12133	12000	European snout beetle	Phyllobius oblongus	-	-
12134	12000	citrus leafminer	Phyllocnistis citrella	-	-
12135	12000	aspen leafminer	Phyllocnistis populiella	-	-

DAMAGE_ AGENT_CD	DAMAGE_AGENT_ GROUP_CD	COMMON_NAME	SCIENTIFIC_NAME	THRESHOLD	REGION
12136	12000	yellowheaded spruce sawfly	Pikonema alaskensis	Any damage to the terminal leader; damage ≥ 20% of the foliage with ≥ 50% of the leaf/needle affected	**NRS**
12137	12000	tenlined June beetle	Polyphylla decemlineata	-	**-**
12138	12000	Japanese beetle	Popillia japonica	-	**-**
12139	12000	larch sawfly	Pristiphora erichsonii	-	**-**
12140	12000	mountain-ash sawfly	Pristiphora geniculata	-	**-**
12141	12000	elm leaf beetle	Pyrrhalta luteola	-	**-**
12142	12000	spearmarked black moth	Rheumaptera hastata	-	**-**
12143	12000	giant silkworm moth	Saturniidae	-	**-**
12144	12000	redhumped caterpillar	Schizura concinna	-	**-**
12145	12000	redbanded thrips	Selenothrips rubrocinctus	-	**-**
12146	12000	green larch looper	Semiothisa sexmaculata	-	**-**
12147	12000	maple leafroller	Sparganothis acerivorana	-	**-**
12148	12000	redhumped oakworm	Symmerista canicosta	-	**-**
12149	12000	orangehumped mapleworm	Symmerista leucitys	-	**-**
12150	12000	spruce needleminer (west)	Taniva albolineana	-	**-**
12151	12000	maple webworm	Tetralopha asperatella	-	**-**
12152	12000	pine webworm	Tetralopha robustella	-	**-**
12153	12000	introduced basswood thrips	Thrips calcaratus	-	**-**
12154	12000	bagworm	Thyridopteryx ephemeraeformis	Any damage to the terminal leader; damage ≥ 20% of the foliage with ≥ 50% of the leaf/needle affected	**SRS**
12155	12000	leafroller/seed moth	Tortricidae	-	**-**
12156	12000	willow defoliation	Tortricidae	-	**-**
12157	12000	euonymus caterpillar	Yponomeuta spp.	-	**-**
12158	12000	spruce bud moth	Zeiraphera canadensis	-	**-**
12159	12000	larch bud moth	Zeiraphera improbana	-	**-**
12160	12000	pine needle sheathminer	Zelleria haimbachi	-	**-**
12161	12000	cypress looper	Anacamptodes pergracilis	-	**-**
12162	12000	Chrysomela leaf beetle	Chrysomela spp.	-	**-**
12163	12000	pine colaspis	Colaspis pini	-	**-**
12164	12000	saddleback looper	Ectropis crepuscularia	-	**-**
12165	12000	birch leaf roller	Epinotia solandriana	-	**-**
12166	12000	New Mexico fir looper	Galenara consimilis	-	**-**
12167	12000	striped alder sawfly	Hemichroa crocea	-	**-**
12168	12000	greenstriped looper	Melanoplophia imitata	-	**-**
12169	12000	willow leaf blotchminer	Micrurapteryx salicifoliella	-	**-**
12170	12000	pine sawfly	Neodiprion autmnalis	-	**-**
12171	12000	pinon sawfly	Neodiprion edulicolus	-	**-**
12172	12000	Neodiprion gilletti	Neodiprion gilletti	-	**-**

DAMAGE_AGENT_CD	DAMAGE_AGENT_GROUP_CD	COMMON_NAME	SCIENTIFIC_NAME	THRESHOLD	REGION
12173	12000	Neodiprion ventralis	Neodiprion ventralis	-	**-**
12174	12000	pine looper	Phaeoura mexicanaria	-	**-**
12175	12000	Zadiprion rohweri	Zadiprion rohweri	-	**-**
12176	12000	bull pine sawfly	Zadiprion townsendi	-	**-**
12177	12000	Douglas-fir budmoth	Zeiraphera hesperiana	-	**-**
12178	12000	western oak looper	Lambdina fiscellaria somniaria	-	**-**
12179	12000	phantom hemlock looper	Nepytia phantasmaria	-	**-**
12180	12000	tent caterpillar	Malacosoma spp.	-	**-**
12181	12000	Abbot's sawfly	Neodiprion abbotii	-	**-**
12182	12000	slash pine sawfly	Neodiprion merkeli	-	**-**
12183	12000	sand pine sawfly	Neodiprion pratti	-	**-**
12184	12000	melalueca leaf weevil	Oxyops vitiosa	-	**-**
12185	12000	cypress leaf beetle	Systena marginalis	-	**-**
12186	12000	Nepytia janetae	Nepytia janetae	-	**-**
12187	12000	agromyzid fly	Agromyza viridula	-	**-**
12188	12000	elm sawfly	Cimbex americana	-	**-**
12189	12000	june beetle	Phyllophaga spp.	-	**-**
12190	12000	hickory tussock moth	Halisidota caryae	-	**-**
12191	12000	pin oak sawfly	Caliroa lineata	-	**-**
12192	12000	palmerworm	Dichomeris ligulella	-	**-**
12193	12000	pitch pine looper	Lambdina athasaria pellucidaria	-	**-**
12194	12000	red pine sawfly	Neodiprion nanulus nanulus	-	**-**
12195	12000	pine tube moth	Argyrotaenia pinatubana	-	**-**
12196	12000	baldcypress leafroller	Archips goyerana	-	**-**
12197	12000	winter moth	Operophtera brumata	Any occurrence	**NRS**
12198	12000	basswood thrips	Neohydatothrips tiliae	-	**-**
12199	12000	noctuid moth	Xylomyges simplex (Walker)	-	**-**
12200	12000	pyralid moth	Palpita magniferalis	Any damage to the terminal leader; damage ≥ 20% of the foliage with ≥ 50% of the leaf/needle affected	**NRS**
12201	12000	pacific silver fir budmoth	Zeiraphera spp.	-	**-**
12202	12000	red pine needle midge	Thecodiplosis piniresinosae	-	**-**
12203	12000	western hemlock looper	Lambdina fiscellaria lugubrosa	-	**-**
12204	12000	lodgepole pine sawfly	Neodiprion nanulus contortae	-	**-**
12205	12000	silverspotted tiger moth	Lophocampa argentata	-	**-**
12206	12000	green alder sawfly	Monsoma pulveratum	-	**-**
12207	12000	conifer sawflies	conifer sawflies	-	**-**
12208	12000	ambermarked birch leafminer	Profenusa thomsoni	-	**-**

DAMAGE_ AGENT_CD	DAMAGE_AGENT_ GROUP_CD	COMMON_NAME	SCIENTIFIC_NAME	THRESHOLD	REGION
12209	12000	cycad blue butterfly	Chilades pandava	-	**-**
12300	12000	budworm	budworms	Any damage to the terminal leader; damage ≥ 20% of the foliage with ≥ 50% of the leaf/needle affected	**PNW**
12800	12000	other defloiater (known)	other defloiater (known)	-	**-**
12900	12000	unknown defoliator	unknown defoliator	-	**-**
13000	**13000**	**Chewing Insects**		Any damage to the terminal leader; damage ≥ 20% of the foliage with ≥ 50% of the leaf/needle affected	**SRS, IW**
13001	13000	grasshopper		-	**-**
13002	13000	shorthorn grasshoppers	Acrididae	-	**-**
13003	13000	black cutworm	Agrotis ipsilon	-	**-**
13004	13000	Palau coconut beetle	Brontispa palauenis	-	**-**
13005	13000	clearwinged grasshopper	Camnula pellucida	-	**-**
13006	13000	cicadas	Cicadidae	Any damage to the terminal leader; damage ≥ 20% of the foliage with ≥ 50% of the leaf/needle affected	**SRS**
13007	13000	eurytomids	Eurytoma spp.	-	**-**
13008	13000	cutworms	Euxoa excellens	-	**-**
13009	13000	whitefringed beetles	Graphognathus spp.	-	**-**
13010	13000	pales weevil	Hylobius pales	-	**-**
13011	13000	vegetable weevil	Listroderes difficilis	-	**-**
13012	13000	periodical cicada	Magicicada septendecim	-	**-**
13013	13000	migratory grasshopper	Melanoplus sanguinipes	-	**-**
13014	13000	valley grasshopper	Oedaleonotus enigma	-	**-**
13015	13000	strawberry root weevil	Otiorhyhchus ovatus	-	**-**
13016	13000	black vine weevil	Otiorhynchus sulcatus	-	**-**
13017	13000	pandanus beetle	Oxycephala pandani	-	**-**
13018	13000	spaeth pandanus	Oxycephala spaethi	-	**-**
13019	13000	agamemnon butterfly	Papilio agememnon	-	**-**
13020	13000	northern pitch twig moth	Petrova albicapitana	-	**-**
13021	13000	ponderosa pine tip moth	Rhyacionia zozana	-	**-**
13022	13000	pine needle weevil	Scythropus spp.	-	**-**
13023	13000	coconut longhorned grasshopper	Segestes unicolor	-	**-**
13024	13000	clover root curculio	Sitona hispidulus	-	**-**
13025	13000	Madron thrips	Thrips madronii	-	**-**
13026	13000	ash plant bug	Tropidosteptes amoenus	-	**-**
13027	13000	shorthorned grasshopper	Valanga nigricornis	-	**-**
13028	13000	pitch-eating weevil	Pachylobius picivorus	-	**-**
13029	13000	eastern pine weevil	Pissodes nemorensis	-	**-**

DAMAGE_AGENT_CD	DAMAGE_AGENT_GROUP_CD	COMMON_NAME	SCIENTIFIC_NAME	THRESHOLD	REGION
13030	13000	adana tip moth	Rhyacionia adana	-	**-**
13800	13000	other chewing insect (known)	other chewing insect (known)	-	**-**
13900	13000	unknown chewing insect	unknown chewing insect	-	**-**
14000	**14000**	**Sucking Insects**		Any damage to the terminal leader; damage ≥ 20% of the foliage with ≥ 50% of the leaf/needle affected	**ALL**
14001	14000	scale insects		Any damage to the terminal leader; damage ≥ 20% of the foliage with ≥ 50% of the leaf/needle affected	**NRS**
14002	14000	western larch woolly aphid	Adelges oregonensis	-	**-**
14003	14000	balsam woolly adelgid	Adelges piceae	Any occurrence	**ALL**
14004	14000	hemlock woolly adelgid	Adelges tsugae	Any occurrence	**NRS; SRS; IW**
14005	14000	spiraling whitefly	Aleurodicus dispersus	-	**-**
14006	14000	aphid	Aphididae	-	**-**
14007	14000	pine spittlebug	Aphrophora parallela	-	**-**
14008	14000	western pine spittlebug	Aphrophora permutata	-	**-**
14009	14000	Saratoga spittlebug	Aphrophora saratogensis	-	**-**
14010	14000	spittlebug	Cercopidae	-	**-**
14011	14000	wax scale	Ceroplastes spp.	-	**-**
14012	14000	pine needle scale	Chionaspis pinifoliae	-	**-**
14014	14000	giant conifer aphids	Cinara spp.	-	**-**
14015	14000	white pine aphid	Cinara strobi	-	**-**
14016	14000	beech scale	Cryptococcus fagisuga	Any occurrence	**NRS**
14017	14000	spruce aphid	Elatobium abietinum	-	**-**
14018	14000	woolly apple aphid	Eriosoma lanigerum	-	**-**
14019	14000	striped mealybug	Ferrisia vergata	-	**-**
14020	14000	elongate hemlock scale	Fiorinia externa	Any damage to the terminal leader; damage ≥ 20% of the foliage with ≥ 50% of the leaf/needle affected	**NRS**
14021	14000	coconut red scale	Furcaspis oceanica	-	**-**
14022	14000	pine thrips	Gnophothrips spp.	-	**-**
14023	14000	leucaena psyllid	Heteropsylla cubana	-	**-**
14024	14000	honeysuckle aphids	Hyadaphis tataricae	-	**-**
14025	14000	Egyptian fluted scale	Icerya aegyptiaca	-	**-**
14026	14000	Lecanium scale	Lecanium spp.	-	**-**
14027	14000	common falsepit scale	Lecanodiaspis prosopidis	-	**-**
14028	14000	oystershell scale	Lepidosaphes ulmi	-	**-**
14029	14000	pinyon needle scale	Matsucoccus acalyptus	-	**-**

DAMAGE_ AGENT_CD	DAMAGE_AGENT_ GROUP_CD	COMMON_NAME	SCIENTIFIC_NAME	THRESHOLD	REGION
14030	14000	ponderosa pine twig scale	Matsucoccus bisetosus	-	**-**
14031	14000	pine twig scale	Matsucoccus californicus	-	**-**
14032	14000	ponderosa pine scale	Matsucoccus degeneratus	-	**-**
14033	14000	red pine scale	Matsucoccus resinosae	Any occurrence	**NRS**
14034	14000	Prescott scale	Matsucoccus vexillorum	-	**-**
14035	14000	treehoopers	Membracidae	-	**-**
14036	14000	hibiscus psyllid	Mesohomotoma hibisci	-	**-**
14037	14000	balsam twig aphid	Mindarus abietinus	-	**-**
14038	14000	hibiscus mealybug	Nipaecoccus vastator	-	**-**
14039	14000	black pineleaf scale	Nuculaspis californica	-	**-**
14040	14000	spruce spider mite	Oligonychus ununquis	-	**-**
14041	14000	twig girdler	Oncideres cingulata	Any damage to the terminal leader; damage ≥ 20% of the foliage with ≥ 50% of the leaf/needle affected	**SRS**
14042	14000	woolly alder aphid	Paraprociphilus tessellatus	-	**-**
14043	14000	maple aphids	Periphyllus spp.	-	**-**
14044	14000	spruce bud scale	Physokermes piceae	-	**-**
14045	14000	red pine adelgid	Pineus borneri	-	**-**
14046	14000	pine leaf adelgid	Pineus pinifoliae	-	**-**
14047	14000	white pine adelgid	Pineus spp.	-	**-**
14048	14000	pine bark adelgid	Pineus strobi	-	**-**
14049	14000	root aphid	Prociphilus americanus	-	**-**
14050	14000	mealybug	Pseudococcidae	-	**-**
14051	14000	cottony maple scale	Pulvinaria innumerabilis	-	**-**
14052	14000	fir mealybug	Puto cupressi	-	**-**
14053	14000	Douglas-fir mealybug	Puto profusus	-	**-**
14054	14000	spruce mealybug	Puto sandini	-	**-**
14055	14000	hemispherical scale	Saissetia coffeae	-	**-**
14056	14000	woolly pine needle aphid	Schizolachnus piniradiatae	-	**-**
14057	14000	steatococcus scale	Steatococcus samaraius	-	**-**
14058	14000	pear thrips	Taeniothrips inconsequens	-	**-**
14059	14000	mulberry whitefly	Tetraleurodes mori	-	**-**
14060	14000	tuliptree scale	Toumeyella liriodendri	-	**-**
14061	14000	pine tortoise scale	Toumeyella parvicornis	-	**-**
14062	14000	citrus snow scale	Unaspis citri	-	**-**
14063	14000	birch aphid	Euceraphis betulae	-	**-**
14064	14000	Kermes scale	Allokermes spp.	-	**-**
14065	14000	Casuarina spittlebug	Clastoptera undulata	-	**-**
14066	14000	giant bark aphid	Longistigma caryae	-	**-**
14067	14000	woolly pine scale	Pseudophilippia quaintancii	-	**-**
14068	14000	european elm scale	Gossyparia spuria	-	**-**

DAMAGE_AGENT_CD	DAMAGE_AGENT_GROUP_CD	COMMON_NAME	SCIENTIFIC_NAME	THRESHOLD	REGION
14069	14000	elm scurfy scale	Chionaspis americana	-	**-**
14070	14000	magnolia scale	Neolecanium cornuparvum	-	**-**
14071	14000	beech blight aphid	Grylloprociphilus imbricator	-	**-**
14072	14000	beech woolly aphid	Phyllaphis fagi	-	**-**
14073	14000	Asian cycad scale	Aulacaspis yasumatsui	-	**-**
14074	14000	European fruit lecanium scale	Parthenolecanium corni	-	**-**
14075	14000	lobate lac scale	Paratachardina lobata	-	**-**
14800	14000	other sucking insect (known)	other sucking insect (known)	-	**-**
14900	14000	unknown sucking insect	unknown sucking insect	-	**-**
15000	**15000**	**Boring Insects**		Any damage to the terminal leader; damage ≥20% of the roots, stems, or branches	**ALL**
15001	15000	shoot borer		Any damage to the terminal leader; damage ≥20% of the roots, stems, or branches	**NRS**
15002	15000	termite		-	**-**
15003	15000	ponderosa pine bark borer	Acanthocinus princeps	-	**-**
15004	15000	bronze birch borer	Agrilus anxius	Any damage to the terminal leader; damage ≥20% of the roots, stems, or branches	**NRS**
15005	15000	twolined chestnut borers	Agrilus bilineatus	-	**-**
15006	15000	bronze poplar borer	Agrilus liragus	-	**-**
15007	15000	carpenter bees	Apidae	-	**-**
15008	15000	flatheaded borer	Buprestidae	-	**-**
15009	15000	golden buprestid	Buprestis aurulenta	-	**-**
15010	15000	carpenter ants	Camponotus spp.	-	**-**
15011	15000	gouty pitch midge	Cecidomyia piniinopis	-	**-**
15012	15000	shootboring sawflies	Cephidae	-	**-**
15013	15000	roundheaded borer	Cerambycidae	-	**-**
15014	15000	flatheaded apple tree borer	Chrysobothris femorata	-	**-**
15015	15000	cranberry girdler	Chrysoteuchia topiaria	-	**-**
15016	15000	Columbian timber beetle	Corthylus columbianus	-	**-**
15017	15000	pitted ambrosia beetle	Corthylus punctatissimus	-	**-**
15018	15000	carpenterworm moths	Cossidae	-	**-**
15019	15000	poplar and willow borer	Cryptorphynchus lapathi	-	**-**
15020	15000	pine reproduction weevil	Cylindrocopturus eatoni	-	**-**
15021	15000	Douglas-fir twig weevil	Cylindrocopturus furnissi	-	**-**
15022	15000	Zimmerman pine moth	Dioryctria zimmermani	-	**-**
15023	15000	oak twig borers	Elaphidionoides spp.	-	**-**

DAMAGE_ AGENT_CD	DAMAGE_AGENT_ GROUP_CD	COMMON_NAME	SCIENTIFIC_NAME	THRESHOLD	REGION
15024	15000	twig pruner	Elaphidionoides villosus	-	**-**
15025	15000	lesser cornstalk borer	Elasmopalpus lignosellus	-	**-**
15026	15000	red oak borer	Enaphalodes rufulus	Damage to ≥10% of the bole circumference.	**SRS, NRS**
15027	15000	ponderous borer	Ergates spiculatus	-	**-**
15028	15000	eastern pine shoot borer	Eucosma gloriola	-	**-**
15029	15000	western pine shoot borer	Eucosma sonomana	-	**-**
15030	15000	Eucosma shoot borers	Eucosma spp.	-	**-**
15031	15000	sugar maple borer	Glycobius speciosus	Any damage to the terminal leader; damage ≥20% of the roots, stems, or branches	**NRS**
15032	15000	Goes borers	Goes spp.	-	**-**
15033	15000	pine root collar weevil	Hylobius radicis	-	**-**
15034	15000	Warren root collar weevil	Hylobius warreni	-	**-**
15035	15000	powderpost beetle	Lyctidae	-	**-**
15036	15000	tarnished plant bug	Lygus lineolaris	-	**-**
15037	15000	bark weevils	Magdalis spp.	-	**-**
15038	15000	white pine barkminer moth	Marmara fasciella	-	**-**
15039	15000	locust borer	Megacyllene robiniae	-	**-**
15040	15000	California flathead borer	Melanophila californica	-	**-**
15041	15000	flatheaded fir borer	Melanophila drummondi	-	**-**
15042	15000	whitespotted sawyer	Monochamus scutellatus	-	**-**
15043	15000	redheaded ash borer	Neoclytus acuminutus	-	**-**
15044	15000	western ash borer	Neoclytus conjunctus	-	**-**
15045	15000	oberea shoot borers	Oberea spp.	-	**-**
15046	15000	eucalyptus longhorned borer	Phoracantha semipunctata	-	**-**
15047	15000	northern pine weevil	Pissodes approximatus	-	**-**
15048	15000	balsam bark weevil	Pissodes dubius	-	**-**
15049	15000	Monterey pine weevil	Pissodes radiatae	-	**-**
15050	15000	Engelmann spruce weevil	Pissodes strobi	-	**-**
15051	15000	lodgepole terminal weevil	Pissodes terminalis	-	**-**
15052	15000	ambrosia beetles	Platypus spp.	Damage to ≥ 10% of the bole circumference.	**SRS**
15053	15000	cottonwood borer	Plectrodera scalator	-	**-**
15054	15000	balsam shootboring sawfly	Pleroneura brunneicornis	-	**-**
15055	15000	pine gall weevil	Podapion gallicola	-	**-**
15056	15000	ash borer	Podesesia syringae fraxini	-	**-**
15057	15000	lilac borer	Podosesia syringae	-	**-**
15058	15000	carpenterworm	Prionoxystus robiniae	-	**-**
15059	15000	maple shoot borers	Proterteras spp.	-	**-**

DAMAGE_AGENT_CD	DAMAGE_AGENT_GROUP_CD	COMMON_NAME	SCIENTIFIC_NAME	THRESHOLD	REGION
15060	15000	western subterranean termite	Reticulitermes hesperus	-	**-**
15061	15000	coconut trunk weevil	Rhabdoscelus asperipennis	-	**-**
15062	15000	New Guinea sugarcane weevil	Rhabdoscelus obscurus	-	**-**
15063	15000	European pine shoot moth	Rhyacionia buoliana	-	**-**
15064	15000	western pine tip moth	Rhyacionia bushnelli	-	**-**
15065	15000	Nantucket pine tip moth	Rhyacionia frustrana	-	**-**
15066	15000	lodgepole pine tip moth	Rhyacionia montana	-	**-**
15067	15000	southwestern pine tip moth	Rhyacionia neomexicana	-	**-**
15068	15000	poplar borer	Saperda calcarata	-	**-**
15069	15000	roundheaded appletree borer	Saperda candida	-	**-**
15070	15000	Saperda shoot borer	Saperda spp.	-	**-**
15071	15000	clearwing moths	Sesiidae	-	**-**
15072	15000	dogwood borer	Synanthedon scitula	-	**-**
15073	15000	roundheaded fir borer	Tetropium abietis	-	**-**
15074	15000	western larch borer	Tetropium velutinum	-	**-**
15075	15000	western cedar borer	Trachykele blondeli	-	**-**
15076	15000	Douglas-fir pitch moth	Vespamima novaroensis	-	**-**
15077	15000	sequoia pitch moth	Vespamima sequoia	-	**-**
15078	15000	black twig borer	Xylosandrus compactus	-	**-**
15079	15000	Pacific dampwood termite	Zootermopsis angusticollis	-	**-**
15080	15000	subtropical pine tip moth	Rhyacionia subtropica	-	**-**
15081	15000	Asian ambrosia beetle	Xylosandrus crassiusculus	-	**-**
15082	15000	Asian longhorned beetle	Anoplophora glabripennis	Any occurrence	**SRS**
15083	15000	cottonwood twig borer	Gypsonoma haimbachiana	-	**-**
15084	15000	southern pine sawyer	Monochamus titillator	-	**-**
15085	15000	banded ash borer	Neoclytus capraea	-	**-**
15086	15000	sitka spruce weevil	Pissodes sitchensis	-	**-**
15087	15000	emerald ash borer	Agrilus planipennis	Any occurrence	**NRS; SRS**
15088	15000	hemlock borer	Melanophila fulvoguttata	Any damage to the terminal leader; damage ≥20% of the roots, stems, or branches	**NRS**
15089	15000	Formosan subterranean termite	Coptotermes formosanus	-	**-**
15090	15000	sirex woodwasp	Sirex noctilio	-	**-**
15091	15000	Oregon fir sawyer	Monochamus scutellatus oregonensis	-	**-**

DAMAGE_AGENT_CD	DAMAGE_AGENT_GROUP_CD	COMMON_NAME	SCIENTIFIC_NAME	THRESHOLD	REGION
15092	15000	cypress weevil	Eudociminus mannerheimii	-	-
15093	15000	camphor shot borer	Xylosandrus mutilatus	-	-
15094	15000	goldenspotted oak borer	Agrilus coxalis	-	-
15095	15000	European oak borer	Agrilus sulcicollis	-	-
15096	15000	X. germanus ambrosia beetle	Xylosandrus germanus	-	-
15097	15000	Icosium tomentosum	Icosium tomentosum	-	-
15800	15000	other boring insect (known)	other boring insect (known)	-	-
15900	15000	unknown boring insect	unknown boring insect	-	-
16000	**16000**	**Seed/Cone/Flower/Fruit Insects**		-	-
16001	16000	Douglas-fir cone moth	Barbara colfaxiana	-	-
16002	16000	lodgepole cone beetle	Conophthorus contortae	-	-
16003	16000	limber pine cone beetle	Conophthorus flexilis	-	-
16004	16000	mountain pine cone beetle	Conophthorus monticolae	-	-
16005	16000	ponderosa pine cone beetle	Conophthorus ponderosae	-	-
16006	16000	Monterey pine cone beetle	Conophthorus radiatae	-	-
16007	16000	red pine cone beetle	Conophthorus resinosae	-	-
16008	16000	white pine cone beetle	Conopthorus coniperda	-	-
16009	16000	black walnut curculio	Conotrachelus retentus	-	-
16010	16000	Douglas-fir cone gall midge	Contarinia oregonensis	-	-
16011	16000	Douglas-fir cone scale midge	Contarinia washingtonensis	-	-
16012	16000	acorn/nut weevils	Curculio spp.	-	-
16013	16000	Caroline fruitfly	Dacus frauenfeldi	-	-
16014	16000	spruce bud midge	Dasineura swainei	-	-
16015	16000	fir coneworm	Dioryctria abietivorella	-	-
16016	16000	southern pine cone worm	Dioryctria amatella	-	-
16017	16000	ponderosa pine coneworm	Dioryctria auranticella	-	-
16018	16000	loblolly pine cone worm	Dioryctria merkeli	-	-
16019	16000	ponderosa twig moth	Dioryctria ponderosae	-	-
16020	16000	Dioryctria pseudotsugella	Dioryctria pseudotsugella	-	-
16021	16000	Dioryctria moths	Dioryctria spp.	-	-
16022	16000	lodgepole cone moth	Eucosma rescissoriana	-	-
16023	16000	seed chalcid	Eurytomidae	-	-
16024	16000	slash pine flower thrips	Gnophothrips fuscus	-	-
16025	16000	spruce cone maggot	Hylemya anthracina	-	-
16026	16000	longleaf pine seed worm or moth	Laspeyresia ingens	-	-
16027	16000	ponderosa pine seed moth	Laspeyresia piperana	-	-
16028	16000	spruce seed moth	Laspeyresia youngana	-	-
16029	16000	boxelder bug	Leptocoris trivittatus	-	-

DAMAGE_ AGENT_CD	DAMAGE_AGENT_ GROUP_CD	COMMON_NAME	SCIENTIFIC_NAME	THRESHOLD	REGION
16030	16000	leaffooted pine seed bug	Leptoglossus corculus	-	-
16031	16000	western conifer seed bug	Leptoglossus occidentalis	-	-
16032	16000	hollyhock thrips	Liothrips varicornis	-	-
16033	16000	Magastigmus lasiocarpae	Magastigmus lasiocarpae	-	-
16034	16000	spruce seed chalcid	Magastigmus piceae	-	-
16035	16000	ponderosa pine seed chalcid	Megastigmus albifrons	-	-
16036	16000	fir seed chalcid	Megastigmus pinus	-	-
16037	16000	Douglas-fir seed chalcid	Megastigmus spermotrophs	-	-
16038	16000	yellow poplar weevil	Odontopus calceatus	-	-
16039	16000	fruitpiercing moth	Othreis fullonia	-	-
16040	16000	roundheaded cone borer	Paratimia conicola	-	-
16041	16000	mango shoot caterpillar	Penicillaria jocosatrix	-	-
16042	16000	coneworm	Phycitidae	-	-
16043	16000	harvester ants	Pogonomyrmex spp.	-	-
16044	16000	citrus flower moth	Prays citri	-	-
16045	16000	fir cone maggot	Strobilomyia abietis	-	-
16046	16000	spruce cone maggot	Strobilomyia anthracina	-	-
16047	16000	shieldbacked pine seed bug	Tetyra bipunctata	-	-
16048	16000	coneworm	Hylemia spp.	-	-
16049	16000	prairie tent caterpillar	Malacosoma lutescens	-	-
16050	16000	jack pine tip beetle	Conophthorus banksianae	-	-
16051	16000	webbing coneworm	Dioryctria disclusa	-	-
16052	16000	blister coneworm	Dioryctria clarioralis	-	-
16053	16000	southern cone gall midge	Cecidomyia bisetosa	-	-
16054	16000	seed bugs	Lygaeidae spp.	-	-
16800	16000	other seed/cone/flower insect (known)	other seed/cone/flower insect (known)	-	-
16900	16000	unknown seed/cone/ flower insects	unknown seed/cone/ flower insects	-	-
17000	**17000**	**Gallmaker Insects**		-	-
17001	17000	birch budgall mite	Aceria rudis	-	-
17002	17000	eastern spruce gall adelgid	Adelges abietis	-	-
17003	17000	Cooley spruce gall adelgid	Adelges cooleyi	-	-

DAMAGE_ AGENT_CD	DAMAGE_AGENT_ GROUP_CD	COMMON_NAME	SCIENTIFIC_NAME	THRESHOLD	REGION
17004	17000	horned oak gall	Callirhytis cornigera	-	-
17005	17000	oak gall wasp	Callirhytis quercuspunctata	-	-
17006	17000	gall midge	Cecidomyiidae	-	-
17007	17000	Douglas-fir needle gall midge	Contarinia pseudotsugae	-	-
17008	17000	gall mite	Eriophyidae	-	-
17009	17000	spruce gall midge	Mayetiola piceae	-	-
17010	17000	hackberry nipplegall maker	Pachypsylla celtidismamma		-
17011	17000	balsam gall midge	Paradiplosis tumifex	Any damage to the terminal leader; damage ≥ 20% of the foliage with ≥ 50% of the leaf/needle affected	**NRS**
17012	17000	hickory gall Phylloxera	Phylloxera caryaecaulis	-	-
17013	17000	gall aphid	Phylloxeridae	-	-
17014	17000	alder gall mite	Phytoptus laevis	-	-
17015	17000	psyllid	Psyllidae	-	-
17016	17000	sugarberry psyllid	Tetragonocephela flava	-	-
17017	17000	mountain apple psyllid	Trioza vitiensis	-	-
17018	17000	gouty pitch midge	Cedidomyia piniinopsis	-	-
17019	17000	spider mites	Oligonychus spp.	-	-
17020	17000	cypress gall midges	Taxodiomyia spp.	-	-
17021	17000	jumping oak gall wasp	Neuroterus saltatorius	-	-
17022	17000	erythrina gall wasp	Quadrastichus erythrinae	-	-
17800	17000	other gallmaking insect (known)	other gallmaking insect (known)	-	-
17900	17000	unknown gallmaking insect	unknown gallmaking insect	-	-
18000	**18000**	**Insect Predators**		-	-
18001	18000	lacewing		-	-
18002	18000	blackbellied clerid	Enoclerus lecontei	-	-
18003	18000	redbellied clerid	Enoclerus sphegeus	-	-
18004	18000	red wood ant	Formica rufa	-	-
18005	18000	western yellowjacket	Vespula pennsylvanica	-	-
19000	**19000**	**General Diseases**		Any damage to the terminal leader; damage ≥ 20% of the roots or boles with > 20% of the circumference affected; damage > 20% of the multiple-stems (on multi-stemmed woodland species) with > 20% of the circumference affected; > 20% of the branches affected ; damage ≥ 20% of the foliage with ≥ 50% of the leaf/needle affected	**ALL**

DAMAGE_AGENT_CD	DAMAGE_AGENT_GROUP_CD	COMMON_NAME	SCIENTIFIC_NAME	THRESHOLD	REGION
20000	**20000**	**Biotic Damage**		-	-
20001	20000	damping off		-	-
20002	20000	gray mold	Botrytis cinerea	-	-
20003	20000	Cassytha	Cassytha filiformis	-	-
20004	20000	hemlock fluting		-	-
21000	**21000**	**Root/Butt Diseases**		Any occurrence	**ALL**
21001	21000	Armillaria root disease	Armillaria spp.	Any occurrence	**PNW; NRS; SRS**
21002	21000	yellow stringy rot	Corticium galactimum	-	-
21003	21000	Cylindrocladium root disease	Cylindrocladium spp.	-	-
21004	21000	brown crumbly rot	Fomitopsis pinicola	-	-
21005	21000	black root rot of pine	Fusarium oxysporum	-	-
21006	21000	Fusarium root rot	Fusarium spp.	-	-
21007	21000	white mottled rot	Ganoderma applanatum	-	-
21008	21000	Ganoderma rot of hardwoods	Ganoderma lucidum	-	-
21009	21000	Ganoderma rot of conifers	Ganoderma tsugae	-	-
21010	21000	Heterobasidion root disease	Heterobasidion annosum	Any occurrence	**PNW; NRS; SRS**
21011	21000	circinatus root rot	Inonotus circinatus	-	-
21012	21000	tomentosus root rot/false velvet top fungus	Inonotus tomentosus	-	-
21013	21000	charcoal root rot	Macrophomina phaseolina	-	-
21014	21000	black stain root disease	Ophiostoma wageneri	Any occurrence	**PNW**
21015	21000	Schweinitzii root and butt rot	Phaeolus schweinitzii	Any occurrence	**PNW**
21016	21000	flame tree root disease	Phellinus noxious		
21017	21000	laminated root rot	Phellinus weirii	Any occurrence	**PNW**
21019	21000	littleleaf disease/ Phytophthora root rot	Phytophthora cinnamomi	Any occurrence	**SRS**
21020	21000	Port-Orford-Cedar root disease	Phytophthora lateralis	Any occurrence	**PNW**
21022	21000	Pythium root rot	Pythium spp.	-	-
21023	21000	procera root disease of conifers	Verticicladiella procera	-	-
21024	21000	crown gall	Agrobacterium tumefaciens	-	-
21025	21000	borealis conk	Climacocystis borealis	-	-
21026	21000	yellow pitted rot	Hericium abietis	-	-
21027	21000	brown cubical rot	Laetiporus sulphureus	Any occurrence	**PNW**

DAMAGE_ AGENT_CD	DAMAGE_AGENT_ GROUP_CD	COMMON_NAME	SCIENTIFIC_NAME	THRESHOLD	REGION
21028	21000	sudden oak death	Phytophthora ramorum	Any occurrence	**PNW; SRS**
21029	21000	Rhizina root disease	Rhizina undulata	-	-
21030	21000	yellow root rot	Perenniporia subacida	-	-
21031	21000	brown top rot	Fomitopsis cajanderi	-	-
21033	21000	pocket dry rot	Tyromyces amarus	-	-
21700	21000	root or butt decay (indicators present)	root or butt decay (indicators present)	-	-
21800	21000	other root or butt disease (known)	other root or butt disease (known)	-	-
21900	21000	unknown root or butt disease	unknown root or butt disease	-	-
22000	**22000**	**Cankers**		Any occurrence	**All**
22001	22000	heart rot		Any visual evidence	**SRS**
22002	22000	stem rot		-	-
22003	22000	sap rot		-	-
22004	22000	slime flux		-	-
22005	22000	viruses		-	-
22006	22000	black knot of cherry	Apiosporina morbosa	Any occurrence on the bole or on branches ≤1 foot from bole; damage to ≥50% of branches	**NRS; SRS**
22007	22000	Atropellis canker	Atropellis piniphila	-	-
22008	22000	Siberian elm canker	Botryodiplodia hypodermia	-	-
22009	22000	Botryosphaeria canker	Botryosphaeria ribis	-	-
22010	22000	black rot fungus	Botryosphaeria stevensii	-	-
22011	22000	Caliciopsis canker	Caliciopsis pinea	Any occurrence	**NRS**
22012	22000	black canker of aspen	Ceratocystis fimbriata	-	-
22013	22000	sycamore canker stain	Ceratocystis fimbriata f.sp. plataini	-	-
22023	22000	chestnut blight	Cryphonectria parasitica	Any occurrence	**NRS**
22024	22000	gray-brown sap rot	Cryptoporus volvatus	-	-
22025	22000	Cryptosphaeria canker of aspen	Cryptosphaeria populina	-	-
22026	22000	Cytospora canker of fir	Cytospora abietis	-	-
22027	22000	western red rot	Dichomitus squalens	-	-
22028	22000	Indian paint fungus	Echinodontium tinctorium	Any occurrence	**PNW**
22029	22000	sooty-bark canker	Encoelia pruinosa	-	**-**
22030	22000	Eutypella canker	Eutypella parasitica	Any occurrence	**NRS**
22031	22000	Fusarium cortical stem rot	Fusarium avenaceum	-	**-**
22032	22000	pitch canker of pines	Fusarium subglutinans	Any occurrence	**PNW**
22033	22000	Fusicoccum canker	Fusicoccum spp.	-	-
22034	22000	Scleroderris canker	Gremmeniella abietina	-	-

DAMAGE_ AGENT_CD	DAMAGE_AGENT_ GROUP_CD	COMMON_NAME	SCIENTIFIC_NAME	THRESHOLD	REGION
22035	22000	amelanchier rust	Gymnosporangium harknessianum	-	-
22036	22000	cedar apple rust	Gymnosporangium juniperi-virginianae	-	-
22037	22000	Hypoxylon canker of oak	Hypoxylon atropunctatum	Any occurrence	**SRS**
22038	22000	Hypoxylon canker of aspen	Hypoxylon mammatum	Any occurrence	**NRS**
22039	22000	canker rot of oak	Inonotus hispidus	-	-
22040	22000	sterile conk trunk rot of birch	Inonotus obliquus	-	-
22041	22000	European larch canker	Lachnellula willkommii	-	-
22042	22000	beech bark disease	Nectria coccinea	Any occurrence	**NRS; SRS**
22043	22000	Nectria canker	Nectria galligena	Any occurrence	**NRS**
22044	22000	ash heart rot	Pereniporia fraxinophila	-	**-**
22047	22000	red heart rot	Phellinus pini	Any occurrence	**PNW**
22048	22000	aspen trunk rot	Phellinus tremulae	-	-
22049	22000	stem decay of black walnut	Phellinus weirianus	-	-
22050	22000	Phomopsis canker	Phomopsis occulta	-	-
22051	22000	Phomopsis canker	Phomopsis spp.	-	-
22052	22000	cypress canker	Seiridium cardinale	-	-
22053	22000	butternut canker	Sirococcus clavigignenti-jugl.	Any occurrence	**NRS**
22054	22000	maple canker	Steganosporium spp.	-	-
22055	22000	Thyronectria canker	Thyronectria austro-americana	-	-
22056	22000	citrus canker	Xanthomonas citri	-	-
22057	22000	Cytospora canker of aspen	Cytospora chrysosperma	-	-
22058	22000	Dothichiza canker	Dothichiza populae	-	-
22059	22000	red belt fungus/brown crumbly rot	Fomitopsis pinicola	-	-
22060	22000	Leucocytospora canker of spruce	Leucocytospora kunzei	-	-
22062	22000	quinine fungus/brown trunk rot	Fomitopsis Officinalis	-	-
22063	22000	brown cubical decay	Coniophora puteana	-	-
22064	22000	tinder fungus	Fomes fomentarius	-	-
22065	22000	purple conk	Hirschioporus abietinus	-	-
22066	22000	pinyon black stain	Leptographium wagnerii	-	-
22067	22000	Phellinus hartigii	Phellinus hartigii	-	-
22068	22000	false tinder fungus	Phellinus igniarius	-	-
22069	22000	robustus conk	Phellinus robustus	-	-
22070	22000	yellow cap fungus	Pholiota spp.	-	-
22071	22000	oyster mushroom	Pleurotus ostreatus	-	-

DAMAGE_ AGENT_CD	DAMAGE_AGENT_ GROUP_CD	COMMON_NAME	SCIENTIFIC_NAME	THRESHOLD	REGION
22072	22000	white ring rot	Poria albipellucida	-	-
22073	22000	hemlock canker	Xenomeris abietis	-	-
22074	22000	cedar brown pocket rot	Poria sericeomollis	-	-
22075	22000	Lachnellula canker	Lachnellula flavovirens	Any occurrence	**NRS**
22076	22000	strumella canker	Strumella coryneoidea	Any occurrence	**NRS**
22077	22000	phomopsis blight	Phomopsis juniperovora	-	-
22078	22000	fusarium canker of yellow poplar	Fusarium solani	-	-
22079	22000	sterile conk of maple and beech	Inonotus glomeratus	-	-
22080	22000	canker of spruce	Aleurodiscus spp.	-	-
22081	22000	birch conk	Piptoporus betulinus	-	-
22082	22000	Discocainia canker	Discocainia treleasei	-	-
22083	22000	red ring rot canker	Phellinus pini var. cancriformans	-	-
22084	22000	Douglas-fir cankers	Douglas-fir cankers	-	-
22085	22000	Scleroderris canker of western firs	Grovesiella abieticola	-	-
22086	22000	Thousand cankers disease	Geosmithia morbida	Any occurrence	**SRS**
22087	22000	nonrust canker	unknown	Damage ≥20% of bole circumference (in a running 3-foot section) at point of occurrence	**PNW**
22300	22000	other canker disease (known)	other canker disease (known)	-	-
22400	22000	unknown canker disease	unknown canker disease	-	-
22500	22000	Stem Decay		Any visual evidence (conks; fruiting bodies; rotten wood)	**All**
22800	22000	other stem decay (known)	other stem decay (known)	-	-
22900	22000	unknown stem decay	unknown stem decay	-	-
23000	**23000**	**Parasitic/Epiphytic Plants**		Dwarf mistletoes with Hawksworth rating of ≥3; true mistletoes or vines covering ≥ 50% of crown	**ALL**
23001	23000	mistletoe	mistletoe	-	-
23002	23000	parasitic plants	parasitic plants	-	-
23003	23000	vine damage	vine damage	Vines covering ≥50% of crown	**PNW; NRS**
23005	23000	white fir dwarf mistletoe	Arceuthobium abietinum f. sp. concoloris	-	-
23006	23000	lodgepole pine dwarf mistletoe	Arceuthobium americanum	-	-
23007	23000	Apache dwarf mistletoe	Arceuthobium apachecum	-	-
23008	23000	western dwarf mistletoe	Arceuthobium campylopodum	-	-

DAMAGE_ AGENT_CD	DAMAGE_AGENT_ GROUP_CD	COMMON_NAME	SCIENTIFIC_NAME	THRESHOLD	REGION
23009	23000	limber pine dwarf mistletoe	Arceuthobium cyanocarpum	-	-
23010	23000	pinyon dwarf mistletoe	Arceuthobium divaricatum	-	-
23011	23000	Douglas-fir dwarf mistletoe	Arceuthobium douglasii	Dwarf mistletoes with Hawksworth rating of ≥3; true mistletoes or vines covering ≥ 50% of crown	**SRS**
23012	23000	Chihuahua pine dwarf mistletoe	Arceuthobium gillii	-	-
23013	23000	larch dwarf mistletoe	Arceuthobium laricis	-	-
23014	23000	western spruce dwarf mistletoe	Arceuthobium microcarpum	-	-
23015	23000	eastern dwarf mistletoe	Arceuthobium pusillum	Any occurrence	**NRS**
23016	23000	hemlock dwarf mistletoe	Arceuthobium tsugense	-	**-**
23017	23000	southwestern dwarf mistletoe	Arceuthobium vaginatum subsp. crytopodum	Dwarf mistletoes with Hawksworth rating of ≥3; true mistletoes or vines covering ≥ 50% of crown	**SRS**
23018	23000	dodder	Cuscuta spp.	-	-
23019	23000	white fir mistletoe	Phoradendron bolleanum subsp. pauciflorum	-	-
23020	23000	true mistletoe (other)		True mistletoe covering ≥50% of crown	**IW; PNW**
23021	23000	red fir dwarf mistletoe	Arceuthobium abietinum f. sp. magnificae	-	-
23022	23000	juniper true mistletoe	Phoradendron juniperum	-	-
23023	23000	dwarf mistletoe	Arceuthobium spp.	Hawksworth rating of ≥3	**IW; PNW**
23024	23000	Weins dwarf mistletoe	Arceuthobium abietinum f. sp magnificae	-	**-**
24000	**24000**	**Decline Complexes/Dieback/Wilts**		Damage ≥ 20% dieback of crown area	**ALL**
24001	24000	Alaska-yellow cedar decline	Alaska-yellow cedar decline	-	-
24002	24000	Norfolk Island pine decline	Norfolk Island pine decline	-	-
24003	24000	Stillwell's syndrome	Stillwell's syndrome	-	-
24004	24000	ash decline/yellows	ash decline/yellows	Damage ≥ 20% dieback of crown area	**NRS**
24005	24000	birch dieback	birch dieback	-	-
24006	24000	coconut cadang-cadang viroid	Cocadviroid coconut cadang-cadang viroid	-	-
24007	24000	complex	complex	-	-
24008	24000	decline	decline	-	-
24009	24000	fall hardwood defoliator complex	fall hardwood defoliator complex	-	-
24010	24000	joga decline	joga decline	-	-

DAMAGE_ AGENT_CD	DAMAGE_AGENT_ GROUP_CD	COMMON_NAME	SCIENTIFIC_NAME	THRESHOLD	REGION
24011	24000	larch decline	larch decline	-	-
24012	24000	looper abiotic complex	looper abiotic complex	-	-
24013	24000	maple decline	maple decline	-	-
24014	24000	oak decline	Hypoxylon spp.	Damage ≥ 20% dieback of crown area	**SRS**
24015	24000	pingelap disease	pingelap disease	-	-
24016	24000	sprout dieback	sprout dieback	-	-
24017	24000	true fir pest complex	true fir pest complex	-	-
24018	24000	western X disease	western X disease	-	-
24019	24000	pinewood nematode	Bursaphelenchus xylophilus	-	-
24020	24000	sapstreak disease of sugar maple	Ceratocystis coerulescens	-	-
24021	24000	oak wilt	Ceratocystis fagacearum	Damage ≥ 20% dieback of crown area	**NRS**
24022	24000	Dutch elm disease	Ceratocystis ulmi	Damage ≥ 20% dieback of crown area	**NRS; SRS**
24023	24000	bacterial wetwood	Erwinia nimipressuralis	-	-
24024	24000	mimosa wilt	Fusarium oxysporum f. sp. perniciosum	-	-
24025	24000	Verticillium wilt	Verticilium albo-atrum	-	-
24026	24000	bacterial leaf scorch	Xylella fastidiosa	-	-
24027	24000	wetwood	wetwood	-	-
24028	24000	hemlock decline	hemlock decline	-	-
24029	24000	Pacific madrone decline	Pacific madrone decline	-	-
24030	24000	elm phloem necrosis	Mycoplasma spp.	-	-
24031	24000	laurel wilt	Raffaelea spp.	Damage ≥ 20% dieback of crown area	**SRS**
24032	24000	sudden aspen decline	sudden aspen decline	-	-
24800	24000	other decline/complex/wilt (known)	other decline/complex/ wilt (known)	-	-
24900	24000	unknown decline/complex/ wilt	unknown decline/complex/ wilt	-	-
25000	25000	Foliage diseases		Damage ≥20% of the foliage with ≥50% of the leaf/needle affected	**ALL**
25001	25000	blight	blight	-	-
25003	25000	juniper blights	juniper blights	-	-
25004	25000	leaf spots	leaf spots	-	-
25005	25000	needlecast	needlecast	-	-
25006	25000	powdery mildew	powdery mildew	-	-
25007	25000	tobacco mosaic virus	tobacco mosaic virus	-	-
25008	25000	tobacco ringspot virus of ash	Nepovirus TRSV	-	-
25009	25000	true fir needlecast	true fir needlecast	-	-

DAMAGE_ AGENT_CD	DAMAGE_AGENT_ GROUP_CD	COMMON_NAME	SCIENTIFIC_NAME	THRESHOLD	REGION
25010	25000	sycamore anthracnose	Apiognomonia veneta	Damage ≥20% of the foliage with ≥50% of the leaf/needle affected	**SRS**
25011	25000	Cercospora blight of juniper	Cercospora sequoiae	-	-
25013	25000	large-spored spruce-laborador tea rust	Chrysomyxa ledicola	-	-
25014	25000	ink spot of aspen	Ciborinia whetzelii	-	-
25015	25000	pine needle rust	Coleosporium spp.	Damage ≥20% of the foliage with ≥50% of the leaf/needle affected	**SRS**
25016	25000	anthracnose on Russian olive	Colletotrichum spp.	-	-
25017	25000	Coronado limb rust	Cronartium arizonicum	-	-
25018	25000	leaf shothole	Cylindrosporium spp.	-	-
25019	25000	cedar leaf blight	Didymascella thujina	-	-
25020	25000	dogwood anthracnose	Discula spp.	Damage ≥20% of the foliage with ≥50% of the leaf/needle affected	**SRS**
25021	25000	mango scab	Elsinoe magiferae	-	**-**
25022	25000	Elytroderma needle blight	Elytroderma deformans	Damage ≥20% of the foliage with ≥50% of the leaf/needle affected	**PNW**
25023	25000	fire blight	Erwinia amylovora	-	**-**
25024	25000	walnut anthracnose	Gnomonia leptostyla	Damage ≥20% of the foliage with ≥50% of the leaf/needle affected	**SRS**
25025	25000	anthracnose	Gnomonia spp.	-	-
25027	25000	brown felt blight	Herpotrichia juniperi	-	-
25028	25000	larch needle blight	Hypodermella laricis	-	-
25029	25000	hardwood anthracnose	Kabatiella apocrypta	-	-
25030	25000	Lasiodiplodia cone damage	Lasiodiplodia spp.	-	-
25031	25000	spruce needle cast	Lirula macrospora	-	-
25032	25000	fir needle cast	Lirula spp.	-	-
25033	25000	white pine needle cast	Lophodermella arcuata	-	-
25034	25000	Lophodermella needle cast	Lophodermella spp.	-	-
25036	25000	Marssonina blight	Marssonina populi	-	-
25037	25000	Douglas-fir rust	Melampsora medusae	-	-
25039	25000	larch needle cast	Meria laricis	-	-
25040	25000	Dothistroma needle blight	Mycosphaerella pini	-	-
25041	25000	brown felt blight of pines	Neopeckia coulteri	-	-
25042	25000	snow blight	Phacidum abietis	-	-
25043	25000	Swiss needle cast	Phaeocryptopus gaumannii	-	-
25044	25000	Phoma blight	Phoma spp.	-	-
25045	25000	Phyllosticta leaf spot	Phyllosticta spp.	-	-

DAMAGE_ AGENT_CD	DAMAGE_AGENT_ GROUP_CD	COMMON_NAME	SCIENTIFIC_NAME	THRESHOLD	REGION
25046	25000	bud rot	Phytophthora palmivora	-	-
25047	25000	Ploioderma needle cast	Ploioderma spp.	-	-
25048	25000	ash rust	Puccinia sparganioides	-	-
25049	25000	fir and hemlock needle rusts	Pucciniastrum spp.	-	-
25050	25000	Rhabdocline needle cast	Rhabdocline spp.	-	-
25051	25000	Rhizoctonia needle blight	Rhizoctonia spp.	-	-
25052	25000	Rhizophaeria needle cast	Rhizophaeria spp.	-	-
25053	25000	Rhizopus rot	Rhizopus artocarpi	-	-
25054	25000	brown spot needle blight	Scirrhia acicola	-	-
25055	25000	Septoria leaf spot	Septoria alnifolia	-	-
25056	25000	Septoria leaf spot and canker	Septoria musiva	-	-
25057	25000	Sirococcus tip blight	Sirococcus conigenus	Damage ≥20% of the foliage with ≥50% of the leaf/needle affected	**NRS**
25058	25000	Diplodia canker	Sphaeropsis sapinea	-	-
25059	25000	leaf blister of oak	Taphrina caerulescens	-	-
25060	25000	Venturia leaf blight of maple	Venturia acerina	-	-
25061	25000	shepherd's crook	Venturia tremulae	-	-
25062	25000	Dothistroma needle blight	Dothistroma septospora	-	-
25063	25000	yellow-cedar shoot blight	Apostrasseria spp.	-	-
25065	25000	spruce needle rust	Chrysomyxa weirii	-	-
25066	25000	cedar leaf blight	Gymnosporangium nootkatense	-	-
25067	25000	spruce needle cast	Lophodermium picea	-	-
25068	25000	hardwood leaf rusts	Melampsora spp.	-	-
25070	25000	hemlock needle rust	Pucciniastrum vaccinii	-	-
25071	25000	spruce needle cast	Rhizosphaera pini	-	-
25072	25000	sirococcus shoot blight	Sirococcus strobilinus	Damage ≥20% of the foliage with ≥50% of the leaf/needle affected	**NRS**
25073	25000	shepherds crook	Venturia populina	-	-
25074	25000	Delphinella shoot blight	Delphinella abietis	-	-
25075	25000	tar spot	Rhytisma acerinum	-	-
25076	25000	birch leaf fungus	Septoria betulae	-	-
25077	25000	Septoria leaf spot of maple	Septoria aceris	-	-
25800	25000	other /shoot disease (known)	other /shoot disease (known)	-	-
25900	25000	unknown foliage /shoot disease	Unknown foliage /shoot disease	-	-

DAMAGE_ AGENT_CD	DAMAGE_AGENT_ GROUP_CD	COMMON_NAME	SCIENTIFIC_NAME	THRESHOLD	REGION
26000	**26000**	**Stem Rusts**		Any occurrence on the bole or stems (on multi-stemmed woodland species), or on branches ≤1 foot from boles or stems; damage to ≥ 20% of branches	**ALL**
26001	26000	white pine blister rust	Cronartium ribicola	Any occurrence on the bole or stems (on multi-stemmed woodland species), or on branches ≤1 foot from boles or stems; damage to ≥ 20% of branches	**PNW; SRS**
26002	26000	western gall rust	Peridermium harknessii	Any occurrence on the bole or stems (on multi-stemmed woodland species), or on branches ≤1 foot from boles or stems; damage to ≥ 20% of branches	**PNW**
26003	26000	stalactiform blister rust	Cronartium coleosporioides	-	**-**
26004	26000	comandra blister rust	Cronartium comandrae	Any occurrence on the bole or stems (on multi-stemmed woodland species), or on branches ≤1 foot from boles or stems; damage to ≥ 20% of branches	**SRS**
26005	26000	pinyon rust	Cronartium occidentale	-	**-**
26006	26000	eastern gall rust	Cronartium quercuum	Any occurrence on the bole or stems (on multi-stemmed woodland species), or on branches ≤1 foot from boles or stems; damage to ≥ 20% of branches	**SRS**
26007	26000	gall rust of jack pine	Cronartium quercuum f. sp. banksignae	-	-
26008	26000	gall rust of shortleaf pine	Cronartium quercuum f. sp. echinatae	-	-
26009	26000	fusiform rust	Cronartium quercuum f. sp. fusiforme	Any occurrence on the bole or stems (on multi-stemmed woodland species), or on branches ≤1 foot from boles or stems; damage to ≥ 20% of branches.	**SRS**
26010	26000	gall rust of virginia pine	Cronartium quercuum f. sp. virginianae	-	-
26011	26000	Bethuli rust	Peridermium bethuli	-	-
26012	26000	limb rust	Peridermium filamentosum	-	-
26013	26000	southern cone rust	Cronartium strobilinum	-	-
26800	26000	other stem rust (known)	other stem rust (known)	-	-

DAMAGE_ AGENT_CD	DAMAGE_AGENT_ GROUP_CD	COMMON_NAME	SCIENTIFIC_NAME	THRESHOLD	REGION
26900	26000	unknown stem rust	unknown stem rust	-	**-**
27000	**27000**	**Broom Rusts**		≥50% of crown area affected	**ALL**
27001	27000	spruce broom rust	Chrysomyxa arctostaphyli	-	-
27002	27000	Incense cedar broom rust	Gymnosporangium libocedri	-	-
27003	27000	juniper broom rust	Gymnosporangium nidus-avis	-	-
27004	27000	fir broom rust	Melampsorella caryophyllacearum	-	-
27800	27000	other broom rust (known)	other broom rust (known)	-	-
27900	27000	unknown broom rust	unknown broom rust	-	-
30000	**30000**	**Fire**		Damage ≥ 20% of bole circumference; >20% of stems on multi-stemmed woodland species affected; ≥20% of crown affected.	**ALL**
30001	30000	wild fire		-	-
30002	30000	human caused fire		-	-
30003	30000	crown fire damage		-	-
30004	30000	ground fire damage		-	-
41000	**41000**	**Wild Animals**		Any damage to the terminal leader; damage ≥20% of the roots or boles with >20% of the circumference affected; damage > 20% of the multiple-stems (on multi-stemmed woodland species) with >20% of the circumference affected; >20% of the branches affected ; damage ≥ 20% of the foliage with ≥ 50% of the leaf/needle affected.	**ALL**
41001	41000	bears	Ursus spp.	Any damage to the terminal leader; damage ≥20% of the roots or boles with >20% of the circumference affected; damage > 20% of the multiple-stems (on multi-stemmed woodland species) with >20% of the circumference affected; >20% of the branches affected ; damage ≥ 20% of the foliage with ≥ 50% of the leaf/needle affected.	**PNW**

DAMAGE_ AGENT_CD	DAMAGE_AGENT_ GROUP_CD	COMMON_NAME	SCIENTIFIC_NAME	THRESHOLD	REGION
41002	41000	beavers	Castor canadensis	Any damage to the terminal leader; damage ≥20% of the roots or boles with >20% of the circumference affected; damage > 20% of the multiple-stems (on multi-stemmed woodland species) with >20% of the circumference affected; >20% of the branches affected ; damage ≥ 20% of the foliage with ≥ 50% of the leaf/needle affected	**SRS, PNW**
41003	41000	big game	big game	Any damage to the terminal leader; damage ≥20% of the roots or boles with >20% of the circumference affected; damage > 20% of the multiple-stems (on multi-stemmed woodland species) with >20% of the circumference affected; >20% of the branches affected ; damage ≥ 20% of the foliage with ≥ 50% of the leaf/needle affected	**IW, PNW**
41004	41000	mice or voles	mice or voles	Any damage to the terminal leader; damage ≥20% of the roots or boles with >20% of the circumference affected; damage > 20% of the multiple-stems (on multi-stemmed woodland species) with >20% of the circumference affected; >20% of the branches affected ; damage ≥ 20% of the foliage with ≥ 50% of the leaf/needle affected.	**PNW**
41005	41000	pocket gophers	Geomyidae spp.	Any damage to the terminal leader; damage ≥20% of the roots or boles with >20% of the circumference affected; damage > 20% of the multiple-stems (on multi-stemmed woodland species) with >20% of the circumference affected; >20% of the branches affected ; damage ≥ 20% of the foliage with ≥ 50% of the leaf/needle affected	**IW, PNW**

DAMAGE_ AGENT_CD	DAMAGE_AGENT_ GROUP_CD	COMMON_NAME	SCIENTIFIC_NAME	THRESHOLD	REGION
41006	41000	porcupines	Erethizon dorsatum	Any damage to the terminal leader; damage ≥20% of the roots or boles with >20% of the circumference affected; damage > 20% of the multiple-stems (on multi-stemmed woodland species) with >20% of the circumference affected; >20% of the branches affected ; damage ≥ 20% of the foliage with ≥ 50% of the leaf/needle affected	**IW, PNW**
41007	41000	rabbits or hares	Sylvilagus spp.	Any damage to the terminal leader; damage ≥20% of the roots or boles with >20% of the circumference affected; damage > 20% of the multiple-stems (on multi-stemmed woodland species) with >20% of the circumference affected; >20% of the branches affected ; damage ≥ 20% of the foliage with ≥ 50% of the leaf/needle affected.	**PNW**
41008	41000	sapsuckers	Sphyrapicus spp.	Any damage to the terminal leader; damage ≥20% of the roots or boles with >20% of the circumference affected; damage > 20% of the multiple-stems (on multi-stemmed woodland species) with >20% of the circumference affected; >20% of the branches affected ; damage ≥ 20% of the foliage with ≥ 50% of the leaf/needle affected.	**IW; SRS**
41009	41000	squirrels	Sciuridae spp.	Any damage to the terminal leader; damage ≥20% of the roots or boles with >20% of the circumference affected; damage > 20% of the multiple-stems (on multi-stemmed woodland species) with >20% of the circumference affected; >20% of the branches affected ; damage ≥ 20% of the foliage with ≥ 50% of the leaf/needle affected.	**PNW**
41010	41000	woodpeckers	Piciformes spp.	-	-
41011	41000	moose	Alces alces	-	-
41012	41000	elk	Cervus elaphus	-	-
41013	41000	deer	Odocoileus spp.	-	-

DAMAGE_ AGENT_CD	DAMAGE_AGENT_ GROUP_CD	COMMON_NAME	SCIENTIFIC_NAME	THRESHOLD	REGION
41014	41000	feral pigs	Sus scrofa	-	**-**
41015	41000	mountain beaver	Aplodontia rufa	Any damage to the terminal leader; damage ≥20% of the roots or boles with >20% of the circumference affected; damage > 20% of the multiple-stems (on multi-stemmed woodland species) with >20% of the circumference affected; >20% of the branches affected ; damage ≥ 20% of the foliage with ≥ 50% of the leaf/needle affected	**PNW**
41017	41000	earthworms	Lumbricidae	-	-
41800	41000	other wild animals (known)	other wild animals (known)	-	-
41900	41000	unknown wild animals	unknown wild animals	-	-
42000	**42000**	**Domestic Animals**		Any damage to the terminal leader; damage ≥20% of the roots or boles with > 20% of the circumference affected; damage > 20% of the multiple-stems (on multi-stemmed woodland species) with > 20% of the circumference affected; > 20% of the branches affected ; damage ≥20% of the foliage with ≥50% of the leaf/needle affected	**ALL**
42001	42000	cattle	Bos taurus	-	-
42002	42000	goats	Capra hircus	-	-
42003	42000	horses	Equus caballus	-	-
42004	42000	sheep	Ovis aries	-	-
42800	42000	other domestic animal (unknown)	other domestic animal (unknown)	-	-
42900	42000	unknown domestic animals	unknown domestic animals	-	-
50000	**50000**	**Abiotic Damage**		Any damage to the terminal leader; damage ≥20% of the roots or boles with > 20% of the circumference affected; damage > 20% of the multiple-stems (on multi-stemmed woodland species) with > 20% of the circumference affected; > 20% of the branches affected ; damage ≥20% of the foliage with ≥50% of the leaf/needle affected	**ALL**

DAMAGE_ AGENT_CD	DAMAGE_AGENT_ GROUP_CD	COMMON_NAME	SCIENTIFIC_NAME	THRESHOLD	REGION
50001	50000	air pollutants		Any damage to the terminal leader; damage ≥20% of the roots or boles with > 20% of the circumference affected; damage > 20% of the multiple-stems (on multi-stemmed woodland species) with > 20% of the circumference affected; > 20% of the branches affected ; damage ≥20% of the foliage with ≥50% of the leaf/needle affected	**IW**
50002	50000	chemical		Any damage to the terminal leader; damage ≥ 20% of the roots, stems, or branches; damage ≥ 20% of the foliage with ≥ 50% of the leaf/needle affected	**NRS**
50003	50000	drought		Any damage to the terminal leader; damage ≥20% of the roots or boles with > 20% of the circumference affected; damage >20% of the multiple-stems (on multi-stemmed woodland species) with > 20% of the circumference affected; >20% of the branches affected ; damage ≥20% of the foliage with ≥50% of the leaf/needle affected	**IW; NRS**
50004	50000	flooding/high water		Any damage to the terminal leader; damage ≥20% of the roots or boles with >20% of the circumference affected; damage >20% of the multiple-stems (on multi-stemmed woodland species) with >20% of the circumference affected; >20% of the branches affected ; damage ≥20% of the foliage with ≥50% of the leaf/needle affected	**IW; NRS; SRS**

DAMAGE_AGENT_CD	DAMAGE_AGENT_GROUP_CD	COMMON_NAME	SCIENTIFIC_NAME	THRESHOLD	REGION
50005	50000	frost		Any damage to the terminal leader; damage ≥20% of the roots or boles with >20% of the circumference affected; damage >20% of the multiple-stems (on multi-stemmed woodland species) with >20% of the circumference affected; >20% of the branches affected ; damage ≥20% of the foliage with ≥50% of the leaf/needle affected	**IW**
50006	50000	hail		-	-
50007	50000	heat		-	-
50008	50000	lightning		Any damage to the terminal leader; damage ≥20% of the roots or boles with >20% of the circumference affected; damage >20% of the multiple-stems (on multi-stemmed woodland species) with >20% of the circumference affected; >20% of the branches affected ; damage ≥20% of the foliage with ≥50% of the leaf/needle affected	**ALL**
50009	50000	nutrient imbalances		-	**-**
50010	50000	radiation		Any damage to the terminal leader; damage ≥20% of the roots or boles with >20% of the circumference affected; damage >20% of the multiple-stems (on multi-stemmed woodland species) with >20% of the circumference affected; >20% of the branches affected ; damage ≥20% of the foliage with ≥50% of the leaf/needle affected	**IW**

DAMAGE_AGENT_CD	DAMAGE_AGENT_GROUP_CD	COMMON_NAME	SCIENTIFIC_NAME	THRESHOLD	REGION
50011	50000	snow/ice		Any damage to the terminal leader; damage ≥20% of the roots or boles with > 20% of the circumference affected; damage > 20% of the multiple-stems (on multi-stemmed woodland species) with > 20% of the circumference affected; >20% of the branches affected ; damage ≥20% of the foliage with ≥50% of the leaf/needle affected	**ALL**
50013	50000	wind		Any damage to the terminal leader; damage ≥20% of the roots or boles with > 20% of the circumference affected; damage > 20% of the multiple-stems (on multi-stemmed woodland species) with > 20% of the circumference affected; >20% of the branches affected ; damage ≥ 20% of the foliage with ≥50% of the leaf/needle affected	**ALL**
50014	50000	winter injury		Any damage to the terminal leader; damage ≥20% of the roots or boles with > 20% of the circumference affected; damage > 20% of the multiple-stems (on multi-stemmed woodland species) with > 20% of the circumference affected; >20% of the branches affected ; damage ≥20% of the foliage with ≥50% of the leaf/needle affected	**IW**
50015	50000	avalanche		Any damage to the terminal leader; damage ≥20% of the roots or boles with > 20% of the circumference affected; damage > 20% of the multiple-stems (on multi-stemmed woodland species) with > 20% of the circumference affected; >20% of the branches affected ; damage ≥20% of the foliage with ≥50% of the leaf/needle affected	**IW**
50016	50000	mud-land slide		-	-
50017	50000	volcano		-	-
50018	50000	other geologic event		-	-

DAMAGE_ AGENT_CD	DAMAGE_AGENT_ GROUP_CD	COMMON_NAME	SCIENTIFIC_NAME	THRESHOLD	REGION
50019	50000	mechanical (non-human caused)		-	-
50020	50000	saltwater injury - flooding/hurricane		-	-
50800	50000	other abiotic damage (known)	other abiotic damage (known)	-	-
50900	50000	unknown abiotic damage	unknown abiotic damage	-	-
60000	**60000**	**Competition**		Overtopped shade intolerant trees that are not expected to survive for 5 years or saplings not expected to reach tree size (5.0 inches DBH/DRC)	**ALL**
60001	60000	Suppression		Overtopped shade intolerant trees that are not expected to survive for 5 years or saplings not expected to reach tree size (5.0 inches DBH/DRC)	**IW**
70000	**70000**	**Human Activities**		Any damage to the terminal leader; damage ≥20% of the roots or boles with > 20% of the circumference affected; damage > 20% of the multiple-stems (on multi-stemmed woodland species) with > 20% of the circumference affected; >20% of the branches affected ; damage ≥20% of the foliage with ≥50% of the leaf/needle affected	**ALL**
70001	70000	herbicides		Any damage to the terminal leader; damage ≥20% of the roots or boles with > 20% of the circumference affected; damage > 20% of the multiple-stems (on multi-stemmed woodland species) with > 20% of the circumference affected; >20% of the branches affected ; damage ≥20% of the foliage with ≥50% of the leaf/needle affected	**SRS**
70003	70000	imbedded objects		Any occurrence on the bole.	**SRS; NRS**
70004	70000	improper planting technique		-	**-**

DAMAGE_ AGENT_CD	DAMAGE_AGENT_ GROUP_CD	COMMON_NAME	SCIENTIFIC_NAME	THRESHOLD	REGION
70005	70000	land clearing		Any damage to the terminal leader; damage ≥20% of the roots or boles with > 20% of the circumference affected; damage > 20% of the multiple-stems (on multi-stemmed woodland species) with > 20% of the circumference affected; >20% of the branches affected ; damage ≥20% of the foliage with ≥50% of the leaf/needle affected	**SRS**
70006	70000	land use conversion			
70007	70000	logging damage		Any damage to the terminal leader; damage ≥20% of the roots or boles with > 20% of the circumference affected; damage > 20% of the multiple-stems (on multi-stemmed woodland species) with > 20% of the circumference affected; >20% of the branches affected ; damage ≥20% of the foliage with ≥50% of the leaf/needle affected	**ALL**
70008	70000	mechanical		-	-
70009	70000	pesticides		-	-
70010	70000	roads		-	-
70011	70000	soil compaction		-	-
70013	70000	vehicle damage		-	-
70014	70000	road salt		-	-
71000	71000	Harvest		Removal of ≥10% cubic volume	**ALL**
71001	71000	Woodland cutting		Removal of ≥10% cubic volume	**IW**
80000	**80000**	**Multi-Damage (Insect/Disease)**		-	-
80001	80000	aspen defoliation (caused by 12037, 12096, 25036 and 25037)		-	-
80002	80000	subalpine fir mortality		-	-
80003	80000	five-needle pine decline		-	-
80004	80000	pinyon pine mortality		-	-
85000	85000	Invasive Plants		-	-

DAMAGE_ AGENT_CD	DAMAGE_AGENT_ GROUP_CD	COMMON_NAME	SCIENTIFIC_NAME	THRESHOLD	REGION
90000	**90000**	**Other Damages and Symptoms**		Any damage to the terminal leader; damage ≥20% of the roots or boles with > 20% of the circumference affected; damage > 20% of the multiple-stems (on multi-stemmed woodland species) with > 20% of the circumference affected; >20% of the branches affected ; damage ≥20% of the foliage with ≥50% of the leaf/needle affected	**ALL**
90001	90000	broken top	Not recorded for multi-stemmed trees	When actual length is less than total length	**ALL**
90002	90000	dead top		Any occurrence	**IW; PNW; NRS**
90003	90000	limby-wolf tree	Not recorded for non sawlog trees	Damage when board foot defect is ≥ 10%	**IW**
90004	90000	forked top	Not recorded for non sawlog trees	Any occurrence	**PNW**
90005	90000	forked below merch top	Not recorded for non sawlog trees	Damage when board foot defect is ≥ 10%	**IW; PNW**
90006	90000	crook or sweep	Not recorded for non sawlog trees	Damage when board foot defect is ≥ 10%	**IW; PNW**
90007	90000	checks, bole cracks	Not recorded for non sawlog trees	Damage when board foot defect is ≥ 10%	**PNW**
90008	90000	foliage discoloration		Damage ≥ 20% of crown affected	**IW; NRS;PNW**
90010	90000	dieback		Damage ≥ 20% of crown affected	**IW, PNW, NRS**
90011	90000	open wound		Damage ≥ 20% of bole circumference (in a running 3-foot section) at point of occurrence	**IW; PNW**
90012	90000	resinosis		Damage ≥ 20% of bole circumference (in a running 3-foot section) at point of origin; ≥ 20% of branches affected	**PNW**
90013	90000	broken branches		Damage ≥ 20% of branches affected	**PNW**

DAMAGE_ AGENT_CD	DAMAGE_AGENT_ GROUP_CD	COMMON_NAME	SCIENTIFIC_NAME	THRESHOLD	REGION
99000	**99000**	**UNKNOWN**		Any damage to the terminal leader; damage ≥20% of the roots or boles with > 20% of the circumference affected; damage > 20% of the multiple-stems (on multi-stemmed woodland species) with > 20% of the circumference affected; >20% of the branches affected ; damage ≥ 20% of the foliage with ≥ 50% of the leaf/needle affected	**ALL**