Sub-Regional Timber Supply Model (SRTS) User Guide & Documentation

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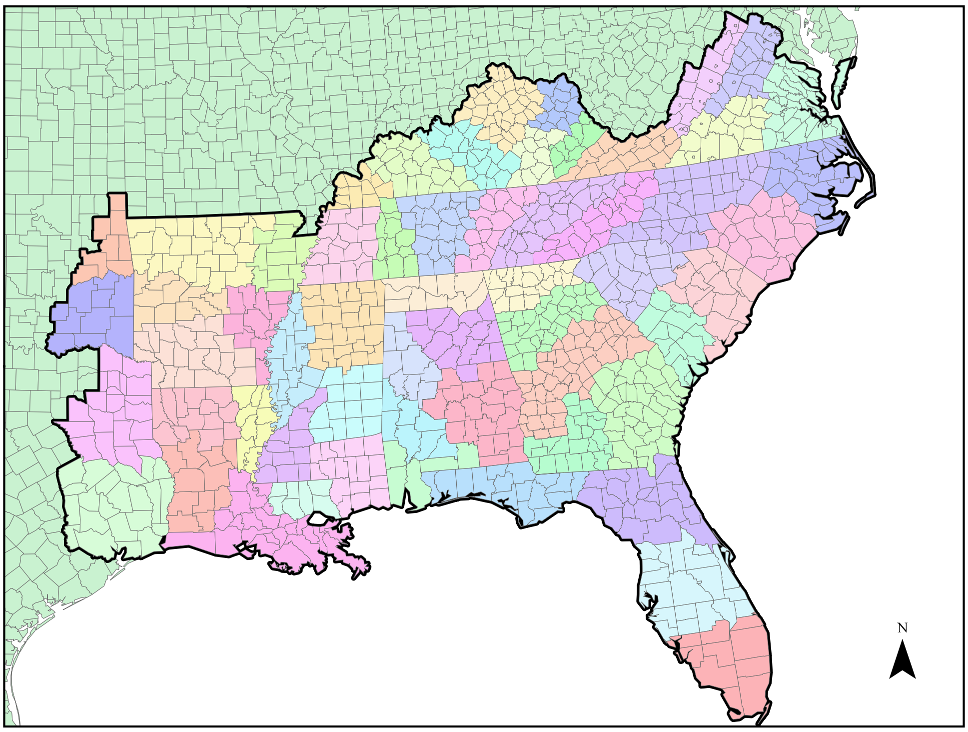
Chapter 1

Running SRTS

1.1 Introduction

SRTS is an economic model of timber supply based on detailed, empirical US Forest Service Forest Inventory and Analysis (FIA) data. From these data we are able extract forest inventory, removals and biological factors for custom sub-regions that are important to a model client. The flexibility of regional scope makes SRTS applicable to analyzing a variety of problems: from broader policy and sustainability questions to analysis of a small timber basin. The maximum regional extent of the model is the US Southeast (see the figure below). As a model of timber supply in stumpage markets only, it is up to the user to specify demand projections. Procedures to ensure the correct starting point for a demand projection are discussed below. For a detailed review of how the model works, see Projecting southern timber supply for multiple products by subregion (Abt, Abt & Cubbage, 2009), available in the SRTS Documentation folder.



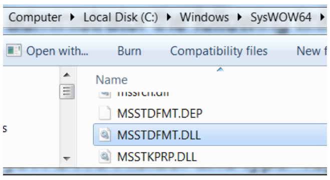
1.2 Installation

SRTS is a standalone executable written in the Visual Basic programming language. As such, it does not require installation with an installer package. However, some steps need to be taken to ensure proper functionality on 64-bit operating systems. SRTS is compatible with computers running a Windows operating system. Computers running other operating systems have shown mixed compatibility, and support is not guaranteed for those systems.

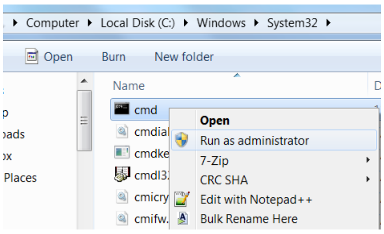
To apply the *fix* for 64-bit machines, take the following steps:

1. Navigate to the Documentation > 64-bit Installation folder.

2. Copy the *MSSTDFMT.DLL* file to the directory: C:\Windows\SysWOW64\

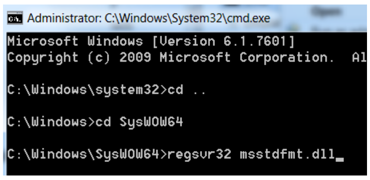
   

3. Open cmd.exe as administrator (right-click, *Run as administrator*)

4. Change directories to Windows\SysWOW64 folder and register the DLL:

   - Type "cd .." and hit Enter.
   - Type "cd SysWOW64" and hit Enter.
   - Type "regsvr32 msstdfmt.dll", hit Enter.

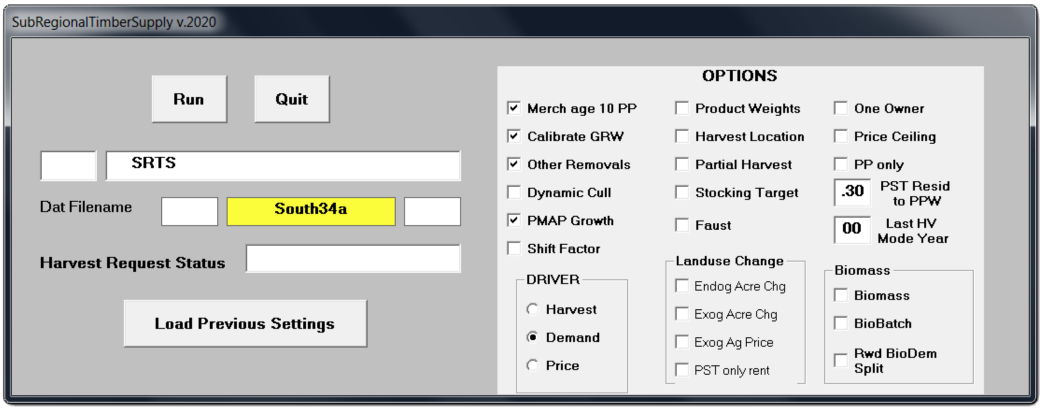
   

1.3 Running the Model–A Brief Tutorial

The SRTS Distribution comes pre-configured to run a southwide and state-level analyses. To make your first SRTS run, follow these steps.

1. If you have not already read the preceding *Installation* section, do so now to ensure compatibility of SRTS with your computer.

2. Double-click the SRTS executible in the main SRTS directory: srts_mmddyy. The user interface shown below should appear.



3. Click 'Run' and the model should successfully make a run based on a DAT file with the name highlighted in yellow above (i.e. South33a.DAT). Note: A 'Not Responding' message in the user interface is nothing to be concerned about.

4. After the model run is complete, the word 'END' will appear on the user interface. Several output files will also appear in the same folder as the SRTS executable.

5. To close SRTS, you must click the 'Quit' button.

After completing the preceeding steps, you have technically completed a SRTS run. The remainder of the process is understanding the purpose of the assorted input files. The remaining documentation discusses the purpose and format of each input and output file. To complete the basic tutorial, however, the following outlines the basic order of preparation for running the model.

1. Identify a region of interest and submit a basin request
   (a) Arrange a comma-delimited 'basin request' file as described in Chapter 2, section 2. Submit this csv file by email to the SOFAC Research Associate to obtain an inventory file with differentiated ownership (corporate and non-corporate).
   (b) The basin request must include a minimum of 5 to 8 counties per sub-region for compliance with an MOU.
   (c) Optionally request a History (.Hist) file showing historical merchantable volume.
   (d) Alternatively create your own inventory file for 'One-owner mode' runs using the INVmaker.exe located in the Data folder.

2. Set up your DAT file
   (a) Following an included DAT file template and consulting the section describing the DAT file, create the DAT file for your run.
   (b) Use 'MPCONST.PRJ' for your demand projection in this initial construction.
   (c) Insure that other input files listed in the DAT file are located in the Data folder.
   (d) Alternatively use the SRTSassistant.exe to create DAT files and PRD files.

3. Make a run with your DAT file
   (a) After the run is complete, locate MPCONST.PRJ in the Data folder, and open it to edit the file in Excel.
   (b) Leave year 0 removals by product unchanged.
   (c) Change consecutive years to match your anticipated demand projection.
   (d) Save your custom PRJ file in the Data Folder

4. Prepare other input files
   (a) Revise your DAT file by renaming the PRJ file to match your custom PRJ file saved in the last step.
   (b) Create additional input files as required for selected model options if necessary.
5. Make your final run
   (a) Run SRTS with your DAT file
   (b) Examine the output files of interest. The main output file is the GPG file.

1.4 File Structure

The basic SRTS file structure is organized in the following manner:

SRTS folder

1. Data (folder)
   (a) INVmaker (executable)
   (b) Assorted required files
   (c) PRD, INV, PRJ, DBH files
2. Documentation (folder)
3. Figures (folder)
4. lib (folder)
   (a) Assorted required files
5. CarbonWelfare2019 (executable)
6. SRTSassistant (executable)
7. FigureSRTS (R file)
8. SRTS_mmddyy (executable)
9. DAT files
10. Option files
11. All Output files

1.5 Input Files and Model Options

Input files needed to run the model are typically space or comma delimited text files with custom file extensions (e.g. DAT, PRD, INV). To view or edit input files, it is useful to download and install a text editor program like Notepad++ or Wordpad. Right-click the input file and *Open With...* your chosen text editor program. In the sections that follow, you may copy example input files to use as templates for your own input files. Alternatively, you may use SRTSassistant to create DAT and PRD files. Inventory (INV) files are not created manually by the user.

1.5.1 Main Configuration File – *.DAT

This section of the document gives a line by line description of the *.DAT* file and a general description of associated input files. The *.DAT* file is the run configuration file. This is the file that identifies the parameters and input files for the run. The name of this file is the only input required on the SRTS user interface. The user interface simply concatenates the three *DAT Filename* textboxes and looks for the *.DAT* file extension in the folder where the SRTS application is located. For example, the screen below instructs SRTS to read the configuration file *AL.DAT*. This name is not case sensitive. All of the information required for a basic run is in this file. The user hits the RUN button and at the end of the run either quits or enters a new DAT file name.

```
AL
"standard5.PRD" "MPCONST.PRJ" "v34a_1in_dbh_gs.csv" "ALStack_34a_gs.inv" "AL"
6 5 2016 44 1
1 "AL-SW_S" 2 "AL-SW_N" 3 "AL-SE" 4 "AL-WCtrl" 5 "AL-NCtrl" 6 "AL-North"
0.3 0.3 0.3 0.3 0.3
0.3 0.4 0.5 0.3 0.5
1.0 1.0 1.0 0.7 0.7
0.3 0.4 0.5 0.5 0.5
1.0 1.0 0.7 0.7 0.7
```

Saving the DAT file from a run gives a summary of all of the input filenames, output filenames, regions, and elasticities. After the run a YourRunID.INI file is created that shows all of the menu settings from that run. The YourOutputFilename.DSC output file described in OutputFiles.PDF gives a full description of the run.

By default SRTS starts with the DAT file and settings from the last run made. If you put in a DAT filename from a previous run and then push the "Load Previous Settings" button, the previous settings associated with that DAT file run are loaded. Note that this requires that the previous run was done with SRTS 3.9 or later, which creates an ".INI" file for every run. You can then enter a new DAT filename and retain the settings from the previous run.

DAT File Contents

The DAT file is read in list format, so line numbers aren't important as long as the data is in the expected order. Still, organizing a DAT file by lines is useful for troubleshooting and explaining the sections. The following descriptions reference the line numbers in the preceding example DAT file. Note that the line numbers are not actually part of the file contents.

Run Description (Line 1):

```
AL
```

This is an optional line to describe the run. If the program sees "PRJ" and "PRD" on this line, it assumes you don't have a Run Description line. The Run Description line is also used for the advanced OptionFile procedure, discussed in a later section.

File Names (Line 2):

```
"standard5.PRD" "MPCONST.PRJ" "v34a_1in_dbh_gs.csv" "ALStack_34a_gs.inv" "AL"
```

This line name four files that must be located in your "/Data/" folder, followed by an output file name of your choice – a total of five terms. When this example DAT file is run by SRTS, the four files must be present to avoid errors. Typos are a common mistake related to this line. When SRTS runs successfully, the output files are produced in the same folder as the DAT file, and they will all be named according to your chosen output file name. Acronyms for the file types are explained below, and a full description of the file contents are described in later sections.

1. PRD Product Definition File
2. PRJ Harvest Projection File
3. DBH.TXT Diameter Distribution File (diameter at breast height)
4. INV Summarized FIA Inventory Data
5. OUTPUT Filename to be used for output files

Run Parameters (Line 3):

```
6 5 2016 44 1
```

These are parameters for the run. Certain parameters must be consistent with the files listed on line 2 or internally consistent with the DAT file. Check these consistencies to troubleshoot, especially if you get "subscript out of range" errors. Here is a description of each parameters meaning along with places to check for consistency:

Parameter	Meaning	Check for Consistency
6	Number of regions	SRTS Region Numbers & Labels
5	Number of products	PRD file, custom PRJ file columns
2016	Starting Year	Average re-measurement date for INV
44	Number of years to project	Custom PRJ file row index
1	Interval (years) between detailed reports	None

SRTS Region Numbers and Region Labels (Line 4):

```
1 "AL-SW_S" 2 "AL-SW_N" 3 "AL-SE" 4 "AL-WCtrl" 5 "AL-NCtrl" 6 "AL-North"
```

This section follows a format with a SRTS Region Number followed by a Region Label in quotes. The SRTS Region Numbers are specific to these survey units. They are keyed to the quotes. The SRTS Region Numbers are specific to these survey units. They are keyed to the "stateunitphyky.txt" file located in the Data folder, which allows the program to match DBH distributions to sections (Southeast or South Central) and physiographic regions. Refer to the Southwide input file or the "SRTS_REGION_LOOKUP.xls" worksheet to select the appropriate SRTS number for any subregion. Alternatively, you can use the SRTSassistant executable to automatically determine the SRTS Region Number that fits a custom basin, based on the survey unit that most of the counties fall in. If you were running just one basin in SE Georgia, for example, you would use SRTS Region Number 16 to key the program to the right diameter distribution. These numbers do not have to be unique; all of the basins in a run could use the same number.

Region Labels are used in the output reports. The order of these regions in the DAT file must match the order of the data in the INV data file.

Elasticities

Following the regions and labels listing, we list elasticities by product. The number of elasticity measures in each category described below must match the number of products specified on Line 2, and product order must match the product definition file. If the run uses one-owner mode, Lines 19 and 20 should be omitted from the DAT file.

Demand Price Elasticities by Product (Line 5):

```
0.3 0.3 0.3 0.3 0.3
```

The percent change in quantity of stumpage demanded from a percent change in stumpage price. For example, .3 means that a 1% change in price would lower demand by .3%. In harvest driven runs, these numbers don't matter because the model is solving for the price that would be required to meet the requested harvest given what is happening to inventory. In a demand driven run, the demand elasticity dictates the sensitivity of harvest to price.

Supply Price Elasticities by Product for Industrial/Corporate Owners (Line 6)

```
0.3 0.4 0.5 0.3 0.5
```

The percent change in quantity of stumpage supplied from this ownership induced by a percent change in stumpage price. For example, .5 means that a 1% change in price would increase harvest by .5% other thing being equal. These numbers have a direct effect on the price required to achieve a given harvest. There must be as many entries here as there are products.

Supply Inventory Elasticities by Product for Corporate Owners (Line 7):

```
1.0 1.0 1.0 0.7 0.7
```

The percent change in quantity of stumpage supplied from this ownership induced by a percent change in product inventory. For example, 1 means that a 1% change in inventory would increase harvest by 1% other things being equal. These numbers have a direct effect on the price required to achieve a given harvest. There must be as many entries here as there are products. The .7 above for hardwoods implies that if total hardwood inventor goes up by 1%, the timber supply only goes up by .7% to reflect availability restrictions for hardwoods.

Supply Price Elasticities By Product for Non-Corporate Owners (Line 8):

```
0.3 0.4 0.5 0.5 0.5
```

This entry characterizes Non-Corporate Owners and is analogous to Line 6.

Supply Inventory Elasticities By Product for Non-Corporate Owners (Line 9):

```
1.0 1.0 0.7 0.7 0.7
```

This entry characterizes Non-Corporate Owners and is analogous to Line 7.

1.5.2 Product Definition File – * *.PRD

Example File *"stand5default.PRD"*

```
SP PR PROD LABEL MINDBH PCTCULL WGTFACTOR
1 1 "Product1" 5 1.0 35.5
1 2 "Product2" 9 0.5
1 3 "Product3" 12 0.1
2 1 "Product1" 5 1.0 37
2 2 "Product2" 10 0.25
```

The product definition file is where the merchandizing rules are summarized. The first column is the species group. If there are 2 species groups they are assumed to be pine and hardwood. If there are 3 species groups they are assumed to be pine, soft hardwood, and hard hardwood. Within each product group, products are listed in order from smallest diameter to largest and assigned an index for the product (PR) column. In this case there are 2 pine products and 2 hardwood products. The third column gives the product label. These can be 8 characters long, but should be unique in the first 4 characters because some output files truncate this label.

Column four gives the minimum diameter at breast height (MINDBH) for the product. The standard DBH distribution file (described below) using the standard 2-inch dbh classes starting with 5 inches. In the MinDBH column you list the minimum dbh class that qualifies for this product. The PctPulp columns indicates how much of this product class should be considered pulpwood. The fifth column gives a weight conversion factor by species. All of the input data is in thousands of cubic feet (MCF). Output is multiplied by the WGTFACTOR for each species group just before it is written to the output file. The weights above convert the output units to green tons. If you entered a *1* here, output would be reported in MCF.

1.5.3 Demand Projection File – *.PRJ

The harvest projection file (PRJ) is an optional file to describe the harvest projection by product. If in the DAT file, the name “MPCONST.PRJ” is used as the filename for the demand projection, the model will project year zero removals by product for the entirety of the model run. The “MPCONST.PRJ” file will be created during the run. The following is an example of the contents of MPCONST.PRJ for the first five years of a southwide run.

```
0  2412149 853842 2448559 930257 1310979
1  2412149 853842 2448559 930257 1310979
2  2412149 853842 2448559 930257 1310979
3  2412149 853842 2448559 930257 1310979
4  2412149 853842 2448559 930257 1310979
5  2412149 853842 2448559 930257 1310979
```

The output units are in thousand cubic feet (MCF) and the product order is determined by the PRD file. The first column is the projection year; the second is harvest of product 1 in MCF, and so forth.

Custom harvest trends, for example a 1% increase for 5 years before flattening off, can be created by importing this file into Excel and editing appropriately. Save the file with some name other the “MPCONST.PRJ”, specify this name as the harvest projection file in the DAT file. Do NOT change line “0” since this reflects the starting point of the FIA data in the INV file.

1.5.4 Diameter Distribution File – *.DBHtxt or *.csv

SRTS currently works with 5 year age classes. As of 2020, the new default diameter distribution file uses 1-inch delineations (e.g. ’v34a_1in_dbh_gs.csv’), in contrast to 2-inch default in previous versions. The 2-inch diameter distribution file contained the diameter distribution across the nine 2” dbh classes, starting with 5-6.9” and ending with 19+”. The new 1-inch diameter distribution file represents dbh class directly with its measure in inches, beginning at 5 and ending with 28. Product file (PRD) should adopt and reference these new 1-inch delineations. However, SRTS currently detects if the old product file format is in use and accounts for this within the model.

Column	Variable	Codes
1	Station	1 = Southeast, 2 = South Central
2	Physiographic Region	1 = Coastal Plain, 2 = Delta, 3 = Mountain, 4 = Piedmont
3	Owner	1 = Industrial/Corp, 2= Non-Industrial/Corp., 3= Total Private
4	Species Group	1 = Pine, 2 = Hardwood, 3 = Soft Hardwood, 4 = Hard Hardwood
5	Mgt Type	1 = Plantation, 2 = Nat Pine, 3 = Mix Pine, 4 = Upl Hwd, 5 = Lowl Hwd
6	Age Class	4 = 15-19, 5 = 20-24, 6 = 25-29, ...
7	Dbh Class	5 = [5”-5.99”), 6 = [6”-6.99”), ...
8	Proportion of Volume in DBH Class	Continuous Number

1.5.5 Inventory File – *.INV *or* *.csv

The INV file is the starting inventory, growth, removal and acreage data for the run, summarized from FIA data. The following table identifies the variables by column for the file.

Column	Variable	Codes/Meaning
1	State or Basin Number	NA
2	Sub-Region Number	Ordered by basin request
3	Owner	1 = Industrial/Corp, 2= Non-Industrial/Corp., 3= Total Private
4	Mgt Type	1 = Plantation, 2 = Nat Pine, 3 = Mix Pine, 4 = Upl Hwd, 5 = Lowl Hwd
5	Species Group	1 = Pine, 2 = Hardwood, 3 = Soft Hardwood, 4 = Hard Hardwood
6	Age Class	4 = 15-19, 5 = 20-24, 6 = 25-29, ...
7	Growing Stock	Inventory in MCF
8	Cell GPA	Actual FIA growth/acre for the unit in cubic feet per acre per year
9	Regressed GPA	Smoothed growth/acre
10	Removals	Removals in MCF[1]
11	Growing Stock	Inventory in MCF
12	Growing Stock	Inventory in MCF
13	Acres	Inventory in MCF

Making a Basin Request

Before running SRTS, a region of interest must be specified. A region, represented by a list of state and county FIPS codes, is used to construct an inventory (INV) file. The Southern Forest Resource Assessment Consortium (SOFAC) produces INV files based on basin requests. Model users submit a CSV file (preferred) or Excel file by email, arranged in the following manner:

Excel

1	58		
2	AL-SW_S	1	3
3	AL-SW_S	1	39
4	AL-SW_S	1	53
5	AL-SW_S	1	97
6	AL-SW_S	1	129
7	AL-SW_N	1	23
8	AL-SW_N	1	25
9	AL-SW_N	1	35
10	AL-SW_N	1	91
11	AL-SW_N	1	99
12	AL-SW_N	1	119
13	AL-SW_N	1	131
14	AL-SE	1	1
15	AL-SE	1	5
16	AL-SE	1	11
17	AL-SE	1	13

Text Editor

```
58,,
AL-SW_S,1,3
AL-SW_S,1,39
AL-SW_S,1,53
AL-SW_S,1,97
AL-SW_S,1,129
AL-SW_N,1,23
AL-SW_N,1,25
AL-SW_N,1,35
AL-SW_N,1,91
AL-SW_N,1,99
AL-SW_N,1,119
AL-SW_N,1,131
AL-SE   ,1,1
AL-SE   ,1,5
AL-SE   ,1,11
AL-SE   ,1,13
AL-SE   ,1,17
AL-SE   ,1,21
AL-SE   ,1,31
```

[H]

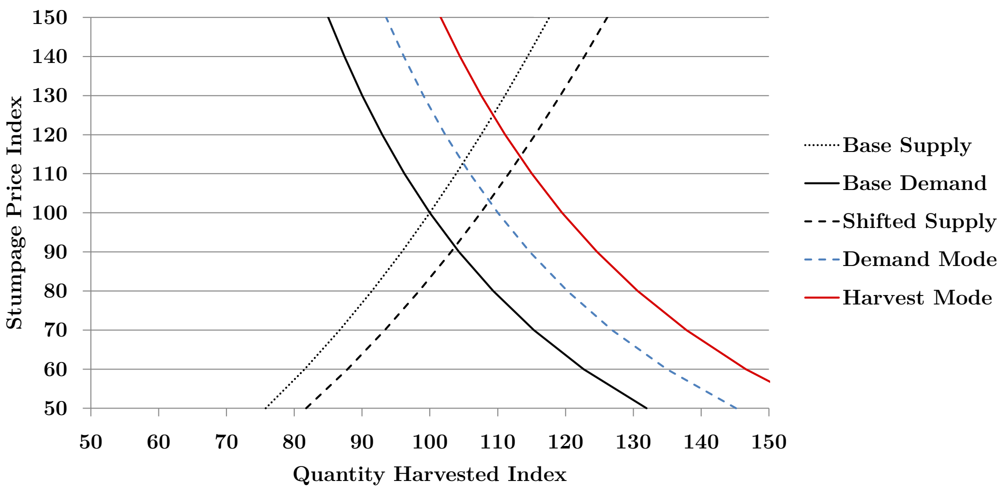
The actual number of counties per basin in a basin request is typically more like twenty or more. Furthermore, the state and county lists should represent a contiguous area. For example, some users use external tools to determine which counties lie within a certain distance from a point of interest. For small basins (e.g. less than 5 counties) we recommend using "one owner" mode, since the USFS is very sensitive to disclosure of ownership data.

1.6 Modeling Options

1.6.1 DRIVER options

Default: *Demand*

Three model driver options are available: harvest mode, demand mode, and price mode. In harvest mode, the path of removals specified in the projection (PRJ) file is followed exactly. SRTS shifts the demand curve in order to obtain the requested harvest. In demand mode the PRJ file tells the model how far to shift the demand curve itself. The difference is illustrated in the figure below. Price mode is equivalent to the harvest mode, except the PRJ file is interpreted as an explicit pathway of prices.



1.6.2 Biomass Options

Depending on the application, scenarios exploring the use of biomass can use built-in biomass options or simply use different DAT files that reference a baseline custom PRJ file and a custom PRJ file that adds biomass to the projection.

- **No Options Checked**–*default*: Demand is based only on the PRJ file.
- **Biomass**: If this box is checked the model read a biomass demand file. This biomass demand file has the same filename as the DAT file but with a ".BM" extension. The format of the biomass file is:

```
"su_logging_09.dat"
Year     BioDemand    PNPCT    PNUTIL  HWUTIL
2010     0     0     0     0
2011     0     0     0     0
2012     0     0     0     0
2013     660000   20   5    5
2014     1320000 20   5    5
2015     1320000 20   5    5
2016     1320000 20   5    5
2017     1320000 20   5    5
2018     1320000 20   5    5
2019     1320000 20   5    5
2020     1320000 20   5    5
```

  The first line of the file specifies the source of the logging residue coefficients by survey unit. This file is based on TPO removal and utilization studies adjusted for stumps. The second line is a descriptor line and is not read. For each year (column 1), a biomass demand (column 2, green tons) is specified. Column three specifies the percentage of the biomass that should come from pine feedstock. Note that "99" is interpreted as a code to use the current pulpwood harvest split between species including consideration of logging residues. A "50" in this column would imply a 50/50 split. The next two columns specify the maximum percentage of logging residues that are assumed to offset biomass demand. In this case 15% of both pine and hardwood logging residues are assumed to offset biomass demand. Biomass demand NOT offset by logging residues are assumed to add to pulpwood demand. Use of the biomass option requires use of an Excel template to compare with and without biomass demand runs including market impacts, residue utilization, displacement/leakage, etc.

- **BioBatch**: This is a custom programming option that allows whole sets of DAT files to be run in batch mode. Contact Bob Abt for details.
- **Rwd Bio Dem Split**: If this box is checked and the model is determining the species split (PNPCT=99), the model bases the split only on the roundwood species split and does not adjust the percentage based on residue availability.

1.6.3 Merch Age 10 PP

Default: *On*

If this box is checked then volume in the 10-15 age class are merchandized in terms of removals and inventory. This increases pulpwood volume more that removals but allow better modeling of first thinnings.

1.6.4 Calibrate Growth – *Calibrate GRW*

Default: *On*

There are two growth columns in the .INV file. The CELLGPA column shows the growth per acre actually found in the FIA data. The REGGPA column shows the results of a growth regression that uses data by state, physiographic region (coastal plain, piedmont, mountain, delta), management type and owner to develop a smooth growth curve for the model to use.

Growth calibration calculates the mean growth in pine plantations for ages 15 to 30 for both cell and regression estimates. The regression estimates are then moved up such that the mean of the regression growth is equal to the mean of the cell growth for these ages. This calibrates the smoothed growth curve to match the levels seen in the local data. Growth calibration is implemented unless this option is turned off.

1.6.5 Oth Removals

Default: *On*

The INV file now contains columns of removals, landuse removals, and other removals. Removals are harvests from land that remains in timberland, landuse removals are removals from land that does not remain in timberland, other removals are land that moves into a category where harvest is restricted (e.g. conservation easement). When this box is checked, landuse removals are added to removals in SRTS. Other removals are not considered part of removals in SRTS.

1.6.6 Dynamic Cull Factor – *Dynamic Cull*

Default: *Off*

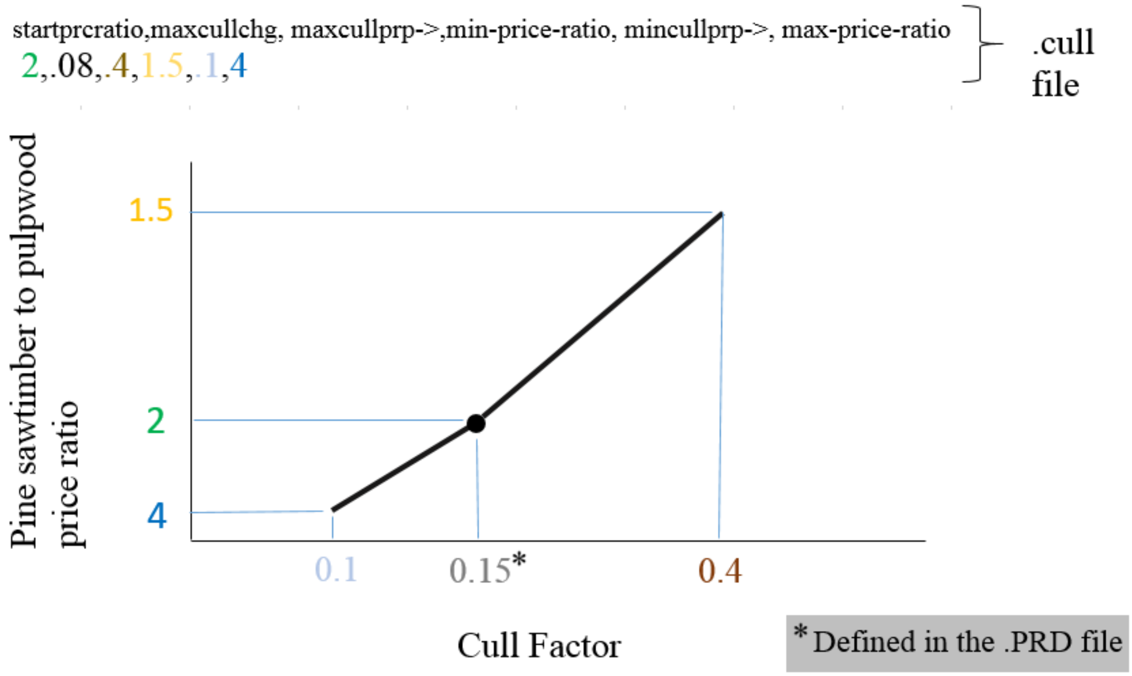
This option creates a dynamic cull factor which allows the cull factor from product 2 to product 1 to change over time in relation to the change in price ratio. In a standard four product run, this option would increase the cull from pine sawtimber to pine pulpwood in response to pine pulpwood prices increasing relative to pine sawtimber prices.

This option requires a ".cull" file which matches the name of the DAT file. The file has six parameters in comma delimited format.

1. The beginning price ratio of product 2 to product 1 (e.g. sawtimber to pulp).
2. The maximum amount the cull factor can change in a given year. This parameter simulates gradual adjustment and prevents the model from oscillating between extremes.
3. The maximum cull proportion of product 2 to product 1. This number should be larger than the cull factor specified in the PRD file (which is the cull factor the model will start with), and it should be less than 1.
4. The minimum price ratio of product 2 to 1.
5. The minimum cull proportion of product 2 to 1.
6. The maximum price ratio of product 2 to 1.

An example format is the following. It can be copied and pasted into a text editor and saved as a ".cull" file:
startprcratio,maxcullchg, maxcullprp-¿,min-price-ratio, mincullprp-¿, max-price-ratio
2,.08,.4,1.5,.1,4

The following figure shows graphically how the numbers in the cull file are related:



1.6.7 Supply Shift Factor File – **.sf*

By default SRTS assumes that demand is mobile and that the market efficiently allocates demand to regions in which supply is increasing. Inventory growth in certain sub-regions may lead to increased removals in that region. If users deem this dynamic to be unreasonable based on knowledge of the region, this effect can be dampened with the supply shift factor option.

```
Product,Region,Owner,DemFctr,SupFctr
1,7,1,1,1
2,1,1,1,0.5
3,7,1,1,0.5
4,4,1,1,0.4
```

The above file dampens the supply shift of products 2-4, corporate owners in regions 1, 7, 4 in the DAT file order. The first line should not be necessary since the default is "1"

1.6.8 Pinemap Growth – *PMAP Growth*

Default: *On*

Data from 20 climate models, in addition to biometric data from the PINEMAP project were incorporated into the Physiological Processes Predicting Growth 3-PG model. The model simulated growth across the historic range of southern yellow pine, growing trees for each planting year between 1971 and 2099, and ending in 2099. County level data was then supplied to us, which we aggregated to survey units and across climate models using regression techniques.

The PMAP Growth option in the latest SRTS version accesses the table of regression coefficients, normalizes the growth to the empirical growth determined by the FIA data, and applies future growth increases in the PINEMAP growth data to the forest inventory. These growth increases vary by planting year, annual age, and FIA survey unit. Selecting this option will apply this growth forecast to the forest inventory.

1.6.9 Dynamic Supply Elasticity – **.de (beta)*

This option was developed for work on a Southern Forest Futures project. It currently works for a four product run only and allows the user to specify a supply elasticity by year for each product. This option requires a *.de file of the following form:

```
A2
2016   0.07   0.18   0.19   0.42
2017   0.07   0.18   0.21   0.44
2018   0.06   0.18   0.22   0.46
2019   0.06   0.18   0.24   0.48
2020   0.05   0.18   0.25   0.50
2021   0.05   0.19   0.24   0.50
2022   0.05   0.19   0.23   0.49
2023   0.06   0.20   0.23   0.49
2024   0.06   0.21   0.22   0.48
2025   0.06   0.22   0.21   0.48
2026   0.06   0.22   0.20   0.47
2027   0.06   0.23   0.19   0.47
2028   0.07   0.24   0.19   0.46
2029   0.07   0.24   0.18   0.46
2030   0.07   0.25   0.17   0.45
2031   0.08   0.25   0.18   0.45
2032   0.08   0.25   0.19   0.45
2033   0.09   0.25   0.21   0.44
2034   0.09   0.25   0.22   0.44
2035   0.10   0.26   0.23   0.44
2036   0.11   0.26   0.24   0.44
```

1.6.10 Product Weights

Default: *Off*

After solving for the equilibrium allocation of all products in a region owner, the model uses a goal program to allocate harvest across management types and age classes. The program attempts to meet the new harvest request while maintaining historical harvest patterns. If it can't it relaxes the historical harvest pattern constraint. The goal program is set up with an equal incentive to hit all product requests. If the inventory is significantly depleted (¿30%) it will likely miss harvest requests. The harvest in the gpg file is the harvest request. If less than 95% of requested harvest is obtained in any year, region, or owner the "CHECK HVMISS FILE" is flagged. This file shows the difference between the request and actual harvest.

If the user wants the program to put a higher priority on meeting the request for one product, the user can change the product weights. Specifying this option requires the presence of an additional file in the model folder. This file must have the same name as the DAT file, but with a .pw extension (e.g. south26.pw). The format of this file is:

```
Prod Goal Wgt Relative to Other Products Format - Prod, Wgt
1 1000
```

In this example, missing product 1 (based on the order in the .PRD file) harvest request will be penalized 1000 times more than other products.

1.6.11 Harvest Location – *.DC

Default: *On–Advanced*

This option allows the user to increase or decrease demand or harvest by product in specific regions. In contrast, by default the model moves harvest among regions and owners based on supply and demand. In order to simulate production increases or decreases in specific regions in a specific year, the economic solution – where demand is satisfied at whatever location is optimal – must be bypassed for that year. After the model finds an optimal solution, in any year where the harvest location option applies, specified harvest in select regions are applied over and above the optimal solution. Regions not specified in the file are held constant for that year.

Specifying this option requires the presence of an additional file in the Input folder. This *direct change* file must have the same name as the DAT file, but with a DC extension (e.g. south16_3.DC). The DC file is formatted with a column for: (1) the year, (2) an index corresponding to regions based on the order of their appearance in the DAT file (DAT number, not the SRTS Region number), and (3) a column for each product listing the increase or decrease in green tons. The top row is a heading row and is ignored as long no year is included. Below is an example in which:

1. The harvest for all four products, in the first four regions listed in the DAT file, are changed for the year 2011.

2. In the year 2017, only the fourth listed region is changed, and only pine and hardwood pulpwood are affected.

The preceding example presents a way to adjust the starting point for the beginning of a run (assuming 2010 is the beginning) and then to bump up pulpwood demand in 2017 for the fourth listed region only.

The DC file in new versions of SRTS automatically adjusts the PRJ file to be consistent with the DC file contents. A custom PRJ can be used in concert with a DC file, but to avoid double-counting, be sure to remember that the contents of these files will effectively be added together.

1.6.12 Partial Harvest – *.ph

This option was developed for the northern version of SRTS. It transforms harvest from an age based classification to a stocking based system. By management type, it specifies proportion of partial harvest and clearcut. The file has the following structure:

```
Mtype PHvstProp CCutProp
1 .29 .15
2 .47 .28
4 .27 .06
5 .17 .02
6 .19 .05
7 .35 .30
8 .46 .17
```

1.6.13 Stocking Target – *.ST

SRTS allocates harvest between thinning and clearcuts based on a stocking (volume per acre) target by owner, forest type, and age class. The default stocking target is the base FIA data from the INV file. One consequence of using starting stocking as the target is that thinning is probably underestimated in early years since most stands are near their target. Checking this option requires an auxiliary file with the same filename as the DAT file but with a ".ST" extension. The format of the file is shown below. The first line is a descriptor line followed by lines that have the manage-type number and the relative stocking target. In the file below the stocking target is set at 50% higher than the base volume per acre for pine plantations, but equal to the base stocking target for other forest types.

```
Stocking Targets by Mgmt Type
1 1.5
2 1
3 1
```

```
4 1
5 1
```

1.6.14 One Owner

The default option is to model corporate and non-corporate owners separately. Access to these data by county is restricted. Alternatively total private ownership by county is not restricted. Currently we are creating both two-owner and one-owner datasets. In this structure corporate is owner 1, non-corporate is 2, and combined is 3. If the "One Owner" button is checked SRTS runs in one owner mode and screens out anything that is not owner 3. Owner 3 is available in newer DBH distribution files so the same DBH file can be used in two types of runs.

1.6.15 Price Ceiling

Projected prices can often exceed what could realistically be expected. This is especially true in harvest mode. This option allows the user to specify a price ceiling by product. In a harvest driven run, the harvest trend follows the inventory trend after the ceiling is met. In a demand driven run, demand is assumed to be constant after the price ceiling is met. The price ceiling is expressed relative to the year 2 price.

Specifying this option requires the presence of an additional file in the model folder. This file must have the same name as the DAT file, but with a .PC extension (e.g. South33a.PC). The format of this file is:

```
Price Ceiling Relative to Year 2 Price - Format - Prod, Ceiling
1 1.5
```

In this example, product 1 (based on the order in the PRD file) will hit its price ceiling when its price increases by 50 percent.

1.6.16 Pine Plantations Only – *PP Only*

If this option is checked then SRTS only models the pine plantation (Management Type 1) resource. All other parts of the forest base are dropped and all demand must be met from plantations.

1.6.17 Pine Sawtimber Residuals to Pulpwood – *PST Resid to PPW*

Default: *.30*

This modeling option allocates a portion of pine sawmill residual chips to off set pine pulpwood roundwood demand. Valid entries are *.00* to *.99*, but the highest value that should be entered is in the range 0.3 - 0.5. The default proportion is 0.30. If a non-zero value is entered, that proportion of pine sawtimber harvest increase is assumed to be available as sawmill residual chips to offset pine pulpwood roundwood demand. Only the *increase* above the initial pine sawtimber harvest is included in this calculation. Residual sawmill chips are assumed to already be fully allocated in the start year. To provide an example, entering *.30* means that as pine sawtimber harvest increases, 30 percent of that increase is assumed to offset pine pulpwood demand.

1.7 Landuse Change Options

1.7.1 No Options Checked

The model assumes the total acres by forest type do not change over the projection. Age class distribution changes, but not total acres.

1.7.2 Endog Acre Change

The model uses updated reduced form of results from: Hardie, I.W., P.J. Parks, P.Gottlieb and D. N. Wear. 2000. Responsiveness of rural and urban land uses to land rent determinants in the U.S. South. Land Economics.78 (4): 659-673. These build in loss of rural land from projected population increases. The timberland acres are also sensitive to shifts in rural land between agriculture and forestry. Unless agriculture prices are provided using one of the other land use options, agriculture prices are held constant. Pine pulp and sawtimber prices are used to determine if acres of timberland increase or decrease. Hardwood prices are not part of the rent calculation.

1.7.3 Exog Acre Change

The user specifies the acreage change by forest type in an auxiliary file. The filename must be the same as the DAT filename with an ".AC" extension. The first line of the file is a description line which is not read. The following lines specify the region number followed by the annual percentage acreage change by forest type. Note the region number in this case is based on the order in the region list, NOT the SRTS region number used to link to the dbh distribution. The first region listed is region 1, second is region 2, etc. In the file below region "1" acres are assumed to change as follows: MT1 (plantations) up 1%/year, MT2 (natural pine) down .5% per year, MT3 (mixed pine) down .4% per year, etc.

```
Acre Change Southwide Example File Format- Reg, PctChg Per Year
1 1 -.5 -.4 -.3 -.2
```

1.7.4 Exog Ag Price

The user specifies exogenous ag rent in an auxiliary file "lu_agprc.csv". Contact Bob Abt for details.

1.7.5 PST Only Rent

If this box is checked pine pulpwood prices are excluded from the timberland rent calculation and only pine sawtimber affects interaction with agriculture.

1.7.6 Ag = For Rent

If this box is checked ag rents are assumed to change with forest rents which dampens the forest agriculture land exchange.

1.8 Output Files

1.8.1 The Main Output File – *.GPG

1.8.2 Configuration Settings File (Initialization) – *.INI

1.8.3 Run Description File – *.DSC

The DSC file is a run description file that shows all settings from a model run with the same DAT file name. This file also shows whether the harvest miss file (*.HVMISS) should be checked.

1.8.4 Harvest Miss File – *.HVMISS

After solving for the equilibrium allocation of all products in a region-owner, the model uses a goal program to allocate harvest across management types and age classes. The program attempts to meet the new harvest request while maintaining historical harvest patterns. The goal program is set up with an equal incentive to hit all product requests. If the inventory is significantly depleted

(¿30%) it will likely miss harvest requests. The harvest in the gpg file is the harvest request. If less than 95% of requested harvest is obtained in any year, region, or owner the "CHECK HVMISS FILE" is flagged. This file shows the difference between the request and actual harvest. The columns of this file are year, region, and owner, followed by a column for the harvest miss in tons for each product, in the same order as the PRD file.

1.8.5 Harvest Output File – harvout.dat

Fractional changes in inventory, harvest and price by product (Prod Hvst), owner, region, and year.

1.8.6 Growth Adjustment File – *.grwadj

When the Calibrate Growth option is checked (by default), this output file reports the growth factors and adjusted growth per acre resulting from the calibration.

1.8.7 Debug File – *.debug

1.8.8 DBH File – *.DBH

Reports organized in table form for growth, removals and volume by DBH class, management type, owner, region, owner, year and species.

1.8.9 DBH List File – *.DBHLST

Flat file version of the DBH file. Growth, removals and volume by DBH class, management type, owner, region, owner, year and species.

1.8.10 Rent File – *.rent

By year, this file gives indexed pine sawtimber and pine pulpwood prices (PSWPrc and PPWPrc), their respective weights in the rent calculation (PSTWgt and PPWWgt), and indexes for timber and agricultural rent (TbrRent and AgRent).

1.8.11 Land Use File – *.LANDUSE

Gives forest and agricultural land area by region and year.

1.8.12 Age File – *.AGE

Reports organized in table form for acres, volume, growth and removals by age class for each species, year, region, owner and management type.

1.8.13 Acres by Age File – *.ACBYAG

A flat file containing volume, growth, removals and acres by age class, management type, owner, region (and region number), species and year.

1.8.14 Harvest Acres File – *.hvstac

Gives clearcut volume (ClearcutVol), thinned volume (ThinVolume(MCF)), clearcut acres (ClearcutAcres), thinned acres (ThinAcres), and total acres (TotalAcres) by region (Rg), owner (Ow), management type (MT), and age class (AgeCls).

1.8.15 Clearcut Acres File – *.ccacre

Gives acres that have been clearcut (Age0_Acres) by region (Rg), owner, (Ow), management type (MT), and year (Year).

1.8.16 Regional Price Change File – *.rp

In a multi-region run, the model can produce a price output for each region and owner combination, showing how that sub-region alone would react to the demand shift in the PRJ file. This might be useful to rank supply constraints in sub-regions.

The regional price produced is a *spot price* that does not correspond to the actual removals from the region. The actual removals from a region come from assuming that one market-clearing price clears all regional markets.

1.8.17 Dynamic Cull Factor File – *.dcf

When the dynamic cull factor option is employed, this file give the price ratio, cull factor and maximum cull factor change by year.

1.8.18 Linear Program File – lpfile.txt

A printout of the minimized model and constraints. Variable names are abstract.

1.9 OptionFile

Users can employ the *OptionFile* setting for advanced settings in which the user needs to make many SRTS runs and wishes to reuse input files related to Modeling Options. By default, SRTS looks for optional files with the same name as the DAT file being run (e.g. for South34a.DAT, SRTS looks for South34a.DC or South34a.faust). If the user writes the word OptionFile in the Run Description line of the DAT file, SRTS then looks for an additional filename on the line following the SRTS Region Numbers and Region Labels line. "MyOptionFile" can be any custom name.

```
AL OptionFile
"standard5.PRD" "MPCONST.PRJ" "v34a_1in_dbh_gs.csv" "ALStack_34a_gs.inv" "AL"
6 5 2016 44 1
1 "AL-SW_S" 2 "AL-SW_N" 3 "AL-SE" 4 "AL-WCtrl" 5 "AL-NCtrl" 6 "AL-North"
"MyOptionFile"
0.3 0.3 0.3 0.3 0.3
0.3 0.4 0.5 0.3 0.5
1.0 1.0 1.0 0.7 0.7
0.3 0.4 0.5 0.5 0.5
1.0 1.0 0.7 0.7 0.7
```

Chapter 2

Connected Models

2.1 Output Visualization

SRTS produces text and csv file outputs. There are a few methods for visualizing results.

2.1.1 Excel

Some example Excel templates are provided in the documentation folder. Read "outputname.gpg" into Excel, where "outputname" is given in the .DAT file

1. Open as a space- and comma-delimited file.
2. Copy these data over a pre-existing worksheet with price equations, etc.
3. With the new data selected, sort by RegIdx, OwnIdx,ProdIdx (hidden columns) (or columns B, D, and G in the original datafile)

2.1.2 FigureSRTS

A program that automatically plots SRTS results using R has been developed in a beta stage. We are releasing FigureSRTS with the SRTS distribution. It can be found in the same folder as the SRTS executable. Installation of R is necessary to run the code, and can be downloaded from the r-project website: `https://www.r-project.org/`.

To use the program, first run the SRTS model with a DAT file of your choice. After installation of R (which only needs to be done once), open FigureSRTSBeta. Next, follow the documentation within the code to complete the following necessary steps for setup:

1. Enter the name of your DAT file without the '.DAT' file extension, inside quotes.
2. Enter the year that you want to be your baseline for indexing.
3. Enter a "Y" or "N" based on if you want the figures to include price.
4. Enter a "Y" or "N" based on if you want the include figures and indexed data
5. Enter the file path to the folder where your SRTS executable resides, using double-forward slashes instead of backslashes. One can obtain the file path by clicking on the bar at the top of the Windows Explorer window.
6. Copy and paste this path into FigureSRTS, changing the backslashes to double-forward slashes. Be sure to put a final double-forward slash in the file path.

7. The R installation needs a few more packages in order for the FigureSRTS code to work. Enter a "Y" for the variable FirstTime the first time you run the code. After running this once, you can change it to "N" thereafter.

8. (Optional) If you have named your GPG file using hyphens, underscores or other characters, fill out the optional setup beyond step 6.

9. To run the program, press 'Ctrl + A' to select all lines of the code, then hit the symbol at the top left. After running the program, resulting figures and data will appear in the Figures folder, a subfolder of the SRTS 33a folder.

2.1.3 Interpreting and Validating Results

It is possible to successfully run the SRTS model, yet produce output that is unexpected. Here are some rules of thumb that should be observed.

1. If inventory is increasing at a faster rate than removals while demand is constant, prices should go down and vice versa.

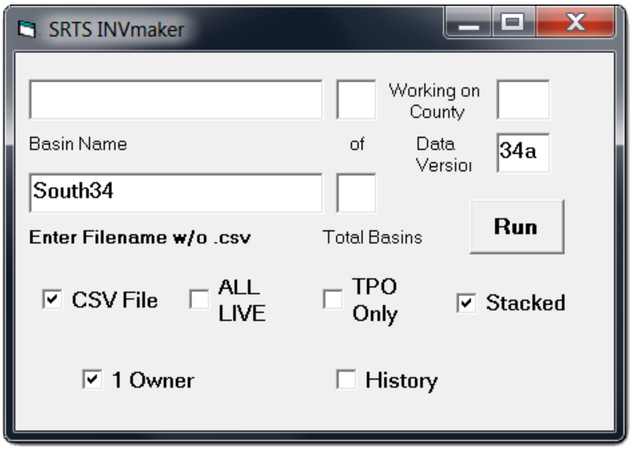
2. If demand is rising and removals are rising, prices may rise, and inventory increases should counteract those price increases.

3. Under smooth demand projections, sharp year-to-year kinks are not typical.

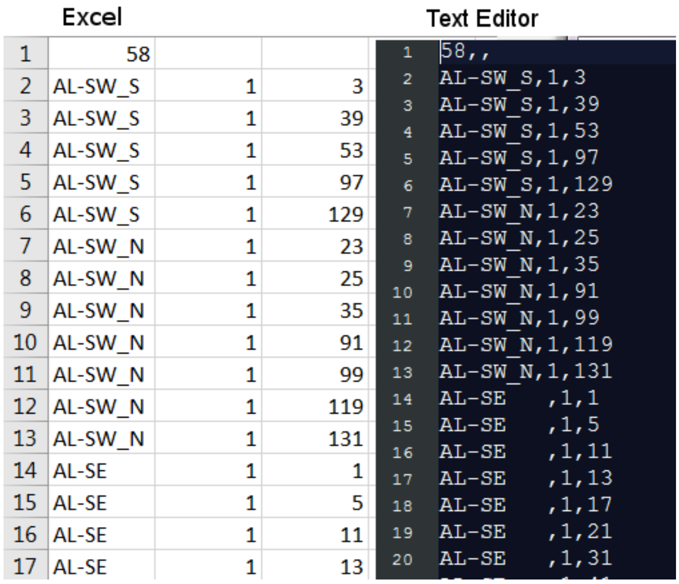
4. If error codes or the 'Check HVMISS' message are encountered, see the appropriate documentation.

5. Consider using some of the advanced procedures if the model behavior defies expectations.

2.2 INVmaker

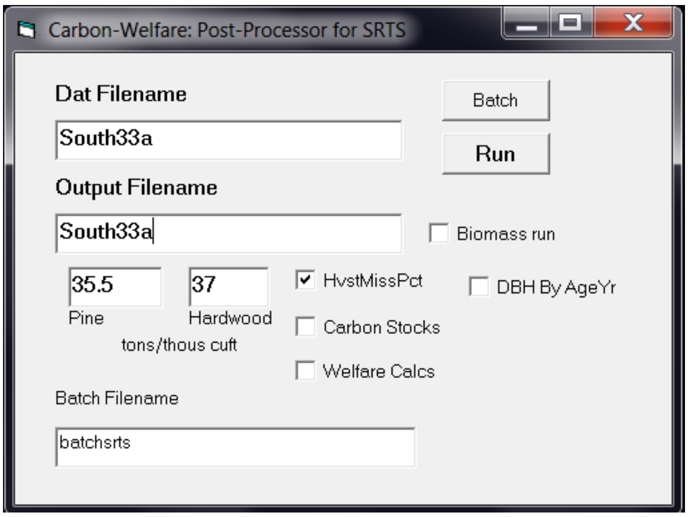


Users have the option to create INV files themselves, which do not differentiate by owner. The INVmaker executable is located in the Data folder. It looks for a basin request file (.csv) with three columns. On the first row and first column, the total number of sub-regions should be designated. Sub-region labels, state FIPS code and county FIPS code should constitute the three columns in the file. The basin request for the entire south, South34a.csv, located in the Data folder, demonstrates the appropriate format of this file. The following is an excerpt of a basin request file, shown in Microsoft Excel and in a text editor:



2.3 Carbon & Welfare

The Carbon-Welfare post-processor uses output files from SRTS to derive economic welfare and carbon pools implied by SRTS run results. To run the program, write the DAT filename and Output filename in the appropriate fields, select the desired output files, and click 'Run'. To run the program for multiple SRTS runs, write the name of a batch file in the 'Batch Filename' field and instead click 'Batch'.



2.3.1 DBH by Age – *.DBHXAGE

From the CarbonWelfare post-processor, selecting the 'DBH By AgeYr' option produces this file. It is a flat file containing growth, volume, acres, removals and acres by DBH class, species, age class, management type, owner, regiona and year.

2.3.2 Carbon by Age – *.CARB_BYAG

From the CarbonWelfare post-processor, selecting the 'Carbon Stocks' option produces this file. By year, region, owner, management type and age class, it gives acres, volume in cubic feet, volume in cubic meters per hectare, hectares, and metric tons for the following carbon pools: live tree, dead tree, understory, down and dead, forest floor and total aboveground carbon. YR,RG,OW,MTYPE,AgeClass,Acres,VolCuFt,m Mg/h

2.3.3 Welfare Analysis File – *.welfare

From the CarbonWelfare post-processor, selecting the 'Welfare Calcs' option produces this file. It gives producer surplus, consumer surplus, price and removals by product, owner, region and year.

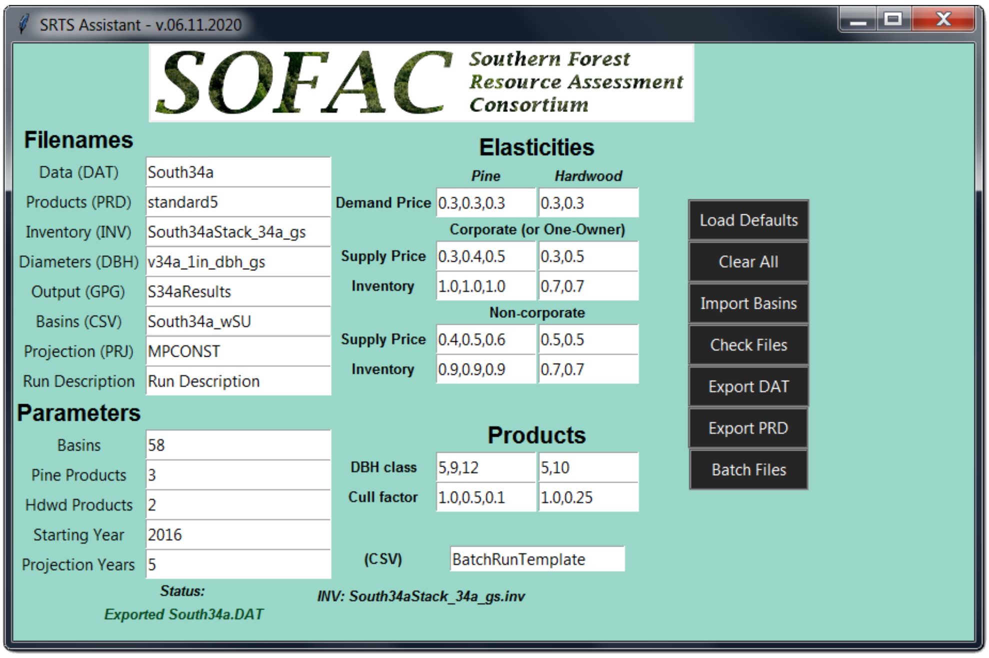
2.4 MapSRTS – *Beta*

An R program used to produce maps of SRTS run results is under development and should be released to members in the 2019-2020 year.

2.5 SRTSassistant

This standalone executable written in Python is located in the same directory as the SRTS executable. It properly formats DAT files and product (PRD) files, ensuring consistency and placing them in the appropriate location. The program automatically finds the SRTS ecoregion number that corresponds to custom basins.

The default values used by the program are found in the Data folder with a *.default* file type. For advanced users, it is possible to manually alter these files using a text editor.

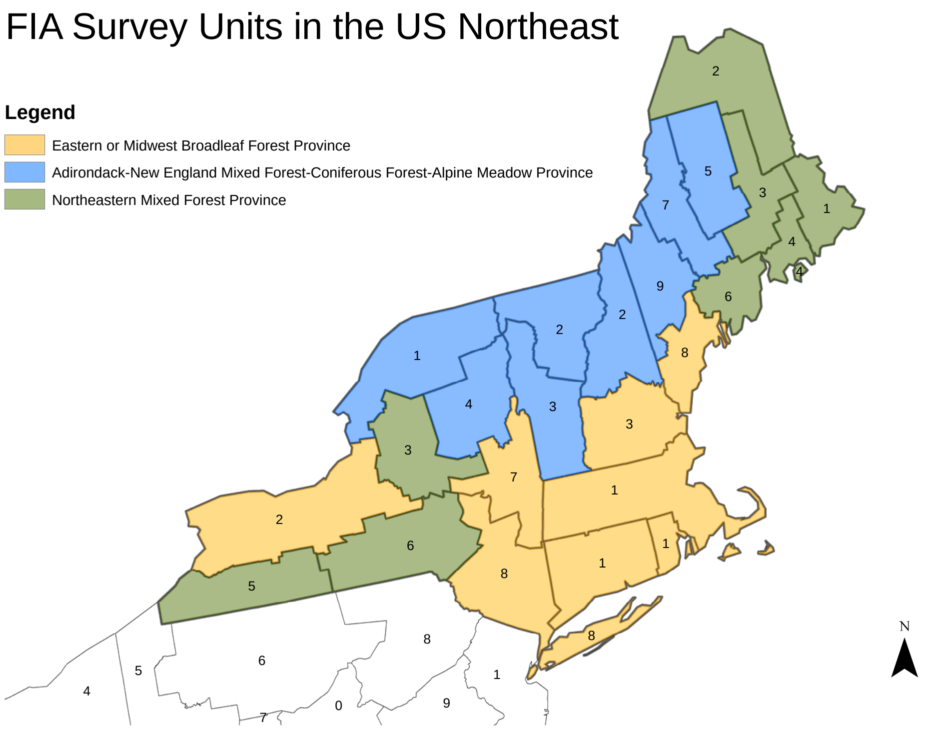


Chapter 3

Extended SRTS Versions

3.1 Northern SRTS

Latest Version - July 2015



Northern SRTS was developed in collaboration with researchers in New Hampshire. It sought to introduce more detail in hardwoods, primarily expressed through partial harvest functionality. This effort contained one hardwood species group category, with 8 management types reflecting more heterogeneity by species.

3.2 Hardwood SRTS

Under Development

A Hardwood SRTS model is being developed to study developing hardwood scarcity issues outside the scope of the standard SRTS model. The following tables show the current proposed species groups, based on a 5% cut-off for species abundance (Table 3.1 and 3.2). Table 3.3 shows forest types, or management types.

Table 3.1: Selected Species Groups for the Hardwood SRTS Study Region

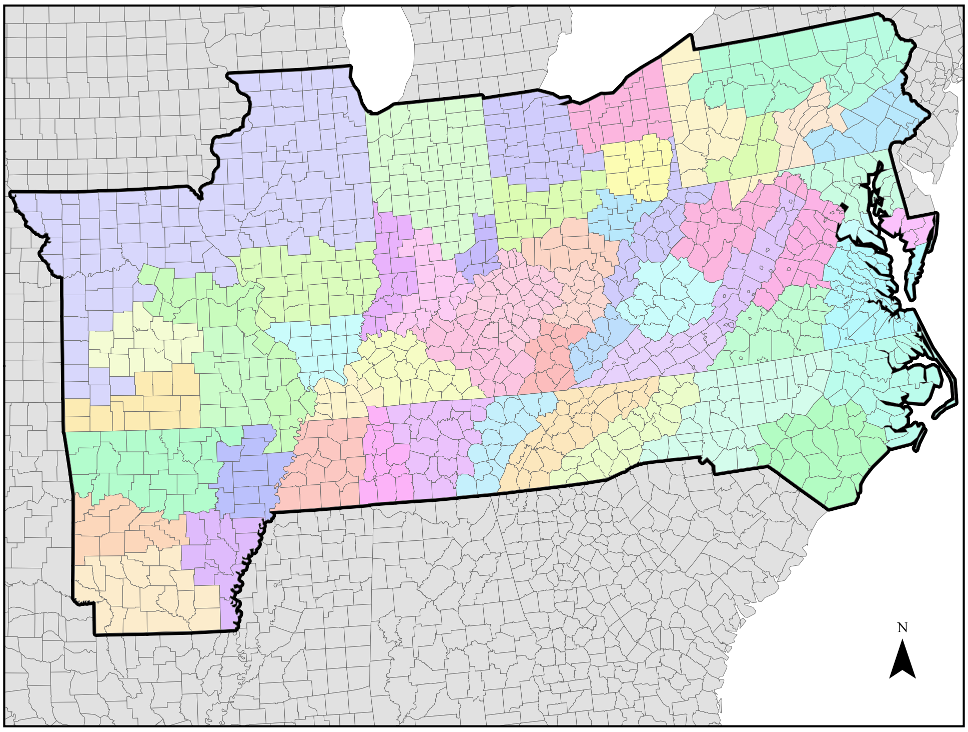
SPGRPCD	SPGRP_NAME	Percent	Species Code	Species Abbrev.
39	Yellow-poplar	12.11	**1**	POP
25	Select white oaks	9.7	**2**	SWO
2	Loblolly and shortleaf pines	9.26	**3**	SYP
28	Other red oaks	8.37	**4**	ORO
32	Soft maple	8.23	**5**	MAP
41	Other eastern soft hardwoods	7.35	**6**	OSH
27	Other white oaks	6.77	**7**	OWO
29	Hickory	6.54	**8**	OHH
26	Select red oaks	5.83	**9**	SRO
31	Hard maple	4.34	8	OHH
36	Ash	3.08	8	OHH
34	Sweetgum	2.56	6	OSH
3	Other yellow pines	2.12	3	SYP
4	Eastern white and red pines	2.05	**10**	CON
42	Other eastern hard hardwoods	2	8	OHH
33	Beech	1.98	8	OHH
35	Tupelo and blackgum	1.62	6	OSH
7	Eastern hemlock	1.26	10	CON
40	Black walnut	1.08	8	OHH
38	Basswood	1	6	OSH
37	Cottonwood and aspen	0.99	6	OSH
9	Other eastern softwoods	0.83	10	CON
1	Longleaf and slash pines	0.29	3	SYP
8	Cypress	0.28	10	CON
30	Yellow birch	0.26	8	OHH
6	Spruce and balsam fir	0.11	10	CON
5	Jack pine	0	10	CON
43	Eastern noncommercial hardwoods	0	6	OSH

Table 3.2: Species Codes, Abbreviations and Descriptions.

Species Code	Species Abbrev.	Species Description
1	POP	Yellow Poplar
2	SWO	Select White Oak
3	SYP	Southern Yellow Pine
4	ORO	Other Red Oaks
5	MAP	Soft Maple
6	OSH	Other Soft Hardwoods
7	OWO	Other White Oak
8	OHH	Other Hard Hardwoods
9	SRO	Select Red Oak
10	CON	Other Softwood, Conifers

Table 3.3: Selected Forest Type Groups for the Hardwood SRTS Study Region

TYPGRPCD	Name
	Oak
500	Oak / hickory group
	Maple & Birch
800	Maple / beech / birch group
900	Aspen / birch group
100	White / red / jack pine group
	Southern Yellow Pine
160	Loblolly / shortleaf pine group
140	Longleaf / slash pine group
	Mixed Oak & Pine
400	Oak / pine group
	Other Softwoods
120	Spruce / fir group
170	Other eastern softwoods group
200	Douglas-fir group
260	Fir / spruce / mountain hemlock group
380	Exotic softwoods group
390	Other softwoods group
	Bottomland & Other Hardwoods
600	Oak / gum / cypress group
700	Elm / ash / cottonwood group
960	Other hardwoods group
990	Exotic hardwoods group



Chapter 4

Technical Documentation

4.1 Economics

The Sub-regional Timber Supply Model (SRTS) is a partial-equilibrium economic model that spatially optimizes timber harvests for a market-wide demand, subject to sub-regional supply curves that reflect price and inventory constraints.

The economic module in SRTS uses constant elasticity supply and demand curves. For each sub-region (i), owner (o), and product (j) in one-year time step (t), the supply function (Q^S) is a function of price (P) and total growing stock inventory (I), parameterized by a price elasticity of supply (γ) and an inventory elasticity (τ) as represented in Equation 1. The model sums sub-regional supply curves to obtain supply market-wide supply (Equation 2). Recursively on an annual time step, the model uses a linear optimization algorithm to produce equilibrium with the market-wide demand (Q^D) curve (Equation 3), parameterized by a price elasticity of demand (ϵ) and an exogenous demand shifter (G).

$$Q^S_{iojt} = \alpha P_t^{\gamma_{oj}} I_{iojt}^{\tau_j} \tag{4.1}$$

$$\sum_{ioj} Q^S_{iojt} = Q^S_t = Q^D_t \tag{4.2}$$

$$Q^D_t = \beta P_t^{\epsilon_j} G_t^{\delta} \tag{4.3}$$

4.2 FIA Summary Procedures

The biology and initial conditions in SRTS derive from summarized Forest Inventory and Analysis (FIA) plot data for growth, inventory and removals for each sub-region, retaining heterogeneous features of ownership (corporate, non-corporate), management type, species, age class, and diameter-at-breast-height (dbh) distributions by physiographic region.

4.3 Merchandising Procedure

Users define products by their diameter-at-breast-height (DBH) measurement in inches in the PRD file. DBH distributions by age class and other dimensions, contained in the DBH file, are combined with growing stock and removals information in the INV file to obtain growing stock and removals by product in each age class by species, ownership, and management type.

4.4 Advanced Options

4.5 SRTS Code

SRTS is currently written in Visual Basic. The logical structure of the model is presented below, organized by module components.

4.5.1 Main – srtsmmddyy.FRM

This form file controls the design and variable inputs from the user interface.

Sub-processes:

1. Command1_Click()
   - Calls MakeHvstPrj()
2. LoadSettings_Click()
   - Loads the *.ini file
3. Form_Load()
   - Loads the setup.id file

4.5.2 GPHARV – gphvstmmddyy.BAS

This module manages harvest calculations.

Sub-processes:

1. GPHVST()
   - Calls the goal program to minimize harvest misses by management type and age class.
2. MakeHvstPrj()
   - Determines removals by product implied by the INV, PRD and DBH files and creates the MPCONST.PRJ file.
3. ProdVolByAC()
   - Calculates product volume by age class, merchandizing through the DBH file.
4. ReadVolByDBH()
   - Reads the DBH file.
5. RedimArrays()
   - Redimension arrays to save memory.
6. ToAnnual()
   - Annualizes removals and volume data from age class data.
   - Makes growth calculations

4.5.3 Module 1 – frontkey.bas

This module simply provides a license key for the linear programming solver.

4.5.4 MPMAIN – mpmainmmddyy.bas

This module declares most variables in the model, simulates biology, and handles particular model behaviors related to user settings.

Sub-processes:

1. ConstantsAndLabels()
2. NewRemovals()
3. OutByDBH()
4. OutRatio()
5. OuttoFile()
6. ProdtPrint()
   - Calls OutToFile, OutByDBH
7. ProjectionLoop()
   - Initiates most output files: harvout.dat, GPG, .AGE", .ACR, .DBH, .ACbyAg, .debug, .DSC, .DBHLST, .landuse, .hvstac, .ccacre, .rent, .dcf
   - Calls other subproceeses: SumAgeClass, ProdtPrint, SRTS, GPHVST, NewRemovals, SumPrint
8. ReadData()
   - Reads the INV file (var = *DataFile*)
   - Creates the *.grwadj file
9. ReadSetupParams()
   - Reads the DAT file
   - Reads Modeling options from the user interface, conditionally looking for supporting files.
10. SRTS()
    - Declares variables and weights for the linear program.
    - Reads in the PRJ file.
    - Sums across sub-regions to obtain total removals by owner, total removals, and total inventory.
    - Calculates percent of total harvest by owner.
    - Imposes market equilibrium constraints and employs an equilibrium price search loop.
    - Prints the GPG file and additional output files.
11. PCutLimit() – deprecated(?)
12. Stocking()
    - Calculates volume per acre by species, region, owner, management type, age class, planting year
13. SumAgeClass()
    - Aggregates annual data age classes
    - Grows inventory volume by age class
14. SumPrint()
    - Prints the harvout.dat file.

4.5.5 SaFrontmip – safrontmip.bas

Declares functions and variables for the linear programming solution. References *Frontmip.DLL*.

Chapter 5

Publications

The following is a list of papers and publications which have used the Sub-Regional Timber Supply (SRTS) model. This section is currently a work in progress and not exhaustive.

Abt, R.C., Abt, K.L., Cubbage, F.W., Henderson, J.D., 2010. Effect of policy-based bioenergy demand on southern timber markets: A case study of North Carolina. Biomass and Bioenergy. https://doi.org/10.1016/j.biombioe.2010.05.007

Abt, R.C., Galik, C.S., Henderson, J.D., 2010. The Near-Term Market and Greenhouse Gas Implications of Forest Biomass Utilization in the Southeastern United States. Durham, NC.

Murray, B.C., Abt, R.C., 2001. Estimating price compensation requirements for eco-certified forestry. Ecol. Econ. 36, 149–163. https://doi.org/10.1016/S0921-8009(00)00224-X

Rossi, F.J., Carter, D.R., Abt, R.C., 2010. Woody Biomass for Electricity Generation in Florida: Bioeconomic Impacts under a Proposed Renewable Portfolio Standard (RPS) Mandate Final Report.

Guo, Z., Hodges, D.G., Abt, R.C., 2011. Forest Biomass Supply for Bioenergy Production and Its Impacts on Roundwood Markets in Tennessee. South. J. Appl. For. 35, 80–86. https://doi.org/10.1093/sjaf/35.2.80

Young, T.M., Hodges, D.G., Abt, R.C., Hartsell, A.J., Perdue, J.H., 2009. Regional Comparative Advantage for Woody Biofuels Production. Final Rep. US DOT Southeast. Sun Grant Center. Univ. Tennessee, Knoxville. 167p. 1–167.

Bingham, M.F.., Prestemon, J.P.., MacNair, D.J.., Abt, R.C.., 2003. Market structure in U.S. southern pine roundwood. J. For. Econ. 9, 97–117. https://doi.org/10.1078/1104-6899-00025

EPA, 2014. Revised framework for assessing biogenic CO2 from stationary sources.

Duden, A.S., Verweij, P.A., Junginger, H.M., Abt, R.C., Henderson, J.D., Dale, V.H., Kline, K.L., Karssenberg, D., Verstegen, J.A., Faaij, A.P.C., van der Hilst, F., 2017. Modeling the impacts of wood pellet demand on forest dynamics in southeastern United States. Biofuels, Bioprod. Biorefining. https://doi.org/10.1002/bbb.1803

Galik, C.S., Abt, R.C., Latta, G., Méley, A., Henderson, J.D., 2016. Meeting renewable energy and land use objectives through public-private biomass supply partnerships. Appl. Energy. https://doi.org/10.1016/j.apenergy.2016.03.047

Galik, C.S., Abt, R.C., 2016. Sustainability guidelines and forest market response: an assessment of European Union pellet demand in the southeastern United States. GCB Bioenergy 8, 658–669. https://doi.org/10.1111/gcbb.12273

Pattanayak, S.K., Abt, R.C., Sommer, A.J., Cubbage, F., Murray, B.C., Yang, J.C., Wear, D., Ahn, S.E., 2004. Forest forecasts: Does individual heterogeneity matter for market and landscape outcomes? For. Policy Econ. 6, 243–260. https://doi.org/10.1016/j.forpol.2004.03.017

Rafal, C., Abt, R.C., Jonsson, R., Prestemon, J.P., Cubbage, F.W., 2013. Modeling the Impacts of EU Bioenergy Demand on the Forest Sector of the Southeast U.S. J. Energy Power Eng. 7, 1073–1081.

Galik, C.S., Abt, R.C., Latta, G., Vegh, T., 2015. The environmental and economic effects of regional bioenergy policy in the southeastern U.S. Energy Policy 85, 335–346. https://doi.org/10.1016/J.ENPOL.2015.05.018

Guo, Z., Hodges, D.G., Abt, R.C., n.d. Supply for Bioenergy Production in Tennessee Forest Biomass Supply for Bioenergy Production in Tennessee.

Chapter 6

Appendix

This appendix provides supplementary data tables.

6.1 Eco-Regions

Note: these data are available in Excel form: srts_ecorgns.xlsx.

STATE	COUNTY	FIPS	STATION	MTN	PROVINCE	UNIT	SRTS_ECO_RGN
AL	Baldwin	1003	41	1	232	1	1
AL	Covington	1039	41	1	232	1	1
AL	Escambia	1053	41	1	232	1	1
AL	Mobile	1097	41	1	232	1	1
AL	Washington	1129	41	1	232	1	1
AL	Choctaw	1023	41	1	231	2	1
AL	Clarke	1025	41	1	231	2	1
AL	Conecuh	1035	41	1	232	2	1
AL	Marengo	1091	41	1	231	2	1
AL	Monroe	1099	41	1	232	2	1
AL	Sumter	1119	41	1	231	2	1
AL	Wilcox	1131	41	1	231	2	1
AL	Autauga	1001	41	1	231	3	1
AL	Barbour	1005	41	1	231	3	1
AL	Bullock	1011	41	1	231	3	1
AL	Butler	1013	41	1	231	3	1
AL	Chambers	1017	41	1	231	3	1
AL	Chilton	1021	41	1	231	3	1
AL	Coffee	1031	41	1	232	3	1
AL	Crenshaw	1041	41	1	231	3	1
AL	Dale	1045	41	1	231	3	1
AL	Dallas	1047	41	1	231	3	1
AL	Elmore	1051	41	1	231	3	1
AL	Geneva	1061	41	1	232	3	1
AL	Henry	1067	41	1	231	3	1
AL	Houston	1069	41	1	232	3	1
AL	Lee	1081	41	1	231	3	1
AL	Lowndes	1085	41	1	231	3	1
AL	Macon	1087	41	1	231	3	1
AL	Montgomery	1101	41	1	231	3	1
AL	Pike	1109	41	1	231	3	1

AL	Russell	1113	41	1	231	3	1
AL	Tallapoosa	1123	41	1	231	3	1
AL	Bibb	1007	41	1	231	4	4
AL	Fayette	1057	41	1	231	4	4
AL	Greene	1063	41	1	231	4	4
AL	Hale	1065	41	1	231	4	4
AL	Lamar	1075	41	1	231	4	4
AL	Marion	1093	41	1	231	4	4
AL	Perry	1105	41	1	231	4	4
AL	Pickens	1107	41	1	231	4	4
AL	Tuscaloosa	1125	41	1	231	4	4
AL	Blount	1009	41	1	231	5	4
AL	Calhoun	1015	41	1	231	5	4
AL	Cherokee	1019	41	1	231	5	4
AL	Clay	1027	41	1	231	5	4
AL	Cleburne	1029	41	1	231	5	4
AL	Coosa	1037	41	1	231	5	4
AL	Cullman	1043	41	1	231	5	4
AL	Etowah	1055	41	1	231	5	4
AL	Jefferson	1073	41	1	231	5	4
AL	Randolph	1111	41	1	231	5	4
AL	St. Clair	1115	41	1	231	5	4
AL	Shelby	1117	41	1	231	5	4
AL	Talladega	1121	41	1	231	5	4
AL	Walker	1127	41	1	231	5	4
AL	Winston	1133	41	1	231	5	4
AL	Colbert	1033	41	1	231	6	3
AL	De Kalb	1049	41	1	231	6	3
AL	Franklin	1059	41	1	231	6	3
AL	Jackson	1071	41	1	221	6	3
AL	Lauderdale	1077	41	1	222	6	3
AL	Lawrence	1079	41	1	222	6	3
AL	Limestone	1083	41	1	222	6	3
AL	Madison	1089	41	1	222	6	3
AL	Marshall	1095	41	1	231	6	3
AL	Morgan	1103	41	1	231	6	3
AR	Arkansas	5001	41	1	234	1	2
AR	Chicot	5017	41	1	234	1	2
AR	Desha	5041	41	1	234	1	2
AR	Jefferson	5069	41	1	234	1	2
AR	Lee	5077	41	1	234	1	2
AR	Lincoln	5079	41	1	234	1	2
AR	Lonoke	5085	41	1	234	1	2
AR	Monroe	5095	41	1	234	1	2
AR	Phillips	5107	41	1	234	1	2
AR	Prairie	5117	41	1	234	1	2
AR	Clay	5021	41	1	234	2	2
AR	Craighead	5031	41	1	234	2	2
AR	Crittenden	5035	41	1	234	2	2
AR	Cross	5037	41	1	234	2	2
AR	Greene	5055	41	1	234	2	2
AR	Jackson	5067	41	1	234	2	2
AR	Lawrence	5075	41	1	234	2	2
AR	Mississippi	5093	41	1	234	2	2

AR	Poinsett	5111	41	1	234	2	2
AR	St. Francis	5123	41	1	234	2	2
AR	Woodruff	5147	41	1	234	2	2
AR	Ashley	5003	41	1	234	3	4
AR	Bradley	5011	41	1	231	3	4
AR	Calhoun	5013	41	1	231	3	4
AR	Clark	5019	41	1	231	3	4
AR	Cleveland	5025	41	1	231	3	4
AR	Columbia	5027	41	1	231	3	4
AR	Dallas	5039	41	1	231	3	4
AR	Drew	5043	41	1	231	3	4
AR	Grant	5053	41	1	231	3	4
AR	Hempstead	5057	41	1	231	3	4
AR	Hot Spring	5059	41	2	231	3	4
AR	Howard	5061	41	2	231	3	4
AR	Lafayette	5073	41	1	231	3	4
AR	Little River	5081	41	1	231	3	4
AR	Miller	5091	41	1	231	3	4
AR	Nevada	5099	41	1	231	3	4
AR	Ouachita	5103	41	1	231	3	4
AR	Pike	5109	41	2	231	3	4
AR	Sevier	5133	41	1	231	3	4
AR	Union	5139	41	1	231	3	4
AR	Garland	5051	41	2	231	4	4
AR	Logan	5083	41	1	231	4	4
AR	Montgomery	5097	41	2	231	4	4
AR	Perry	5105	41	1	231	4	4
AR	Polk	5113	41	2	231	4	4
AR	Pulaski	5119	41	2	231	4	4
AR	Saline	5125	41	2	231	4	4
AR	Scott	5127	41	1	231	4	4
AR	Sebastian	5131	41	1	231	4	4
AR	Yell	5149	41	1	231	4	4
AR	Baxter	5005	41	1	222	5	3
AR	Benton	5007	41	1	222	5	3
AR	Boone	5009	41	1	222	5	3
AR	Carroll	5015	41	1	222	5	3
AR	Cleburne	5023	41	2	222	5	3
AR	Conway	5029	41	1	231	5	3
AR	Crawford	5033	41	2	222	5	3
AR	Faulkner	5045	41	1	231	5	3
AR	Franklin	5047	41	2	222	5	3
AR	Fulton	5049	41	1	222	5	3
AR	Independence	5063	41	1	222	5	3
AR	Izard	5065	41	1	222	5	3
AR	Johnson	5071	41	2	222	5	3
AR	Madison	5087	41	2	222	5	3
AR	Marion	5089	41	1	222	5	3
AR	Newton	5101	41	2	222	5	3
AR	Pope	5115	41	2	222	5	3
AR	Randolph	5121	41	1	222	5	3
AR	Searcy	5129	41	1	222	5	3
AR	Sharp	5135	41	1	222	5	3
AR	Stone	5137	41	1	222	5	3

AR	Van Buren	5141	41	2	222	5	3
AR	Washington	5143	41	1	222	5	3
AR	White	5145	41	1	231	5	3
DC	Washington	11001	12	1	231		
FL	Alachua	12001	42	1	232	1	1
FL	Baker	12003	42	1	232	1	1
FL	Bradford	12007	42	1	232	1	1
FL	Clay	12019	42	1	232	1	1
FL	Columbia	12023	42	1	232	1	1
FL	Dixie	12029	42	1	232	1	1
FL	Duval	12031	42	1	232	1	1
FL	Flagler	12035	42	1	232	1	1
FL	Gilchrist	12041	42	1	232	1	1
FL	Hamilton	12047	42	1	232	1	1
FL	Lafayette	12067	42	1	232	1	1
FL	Levy	12075	42	1	232	1	1
FL	Madison	12079	42	1	232	1	1
FL	Marion	12083	42	1	232	1	1
FL	Nassau	12089	42	1	232	1	1
FL	Putnam	12107	42	1	232	1	1
FL	St. Johns	12109	42	1	232	1	1
FL	Suwannee	12121	42	1	232	1	1
FL	Taylor	12123	42	1	232	1	1
FL	Union	12125	42	1	232	1	1
FL	Volusia	12127	42	1	232	1	1
FL	Bay	12005	42	1	232	2	1
FL	Calhoun	12013	42	1	232	2	1
FL	Escambia	12033	42	1	232	2	1
FL	Franklin	12037	42	1	232	2	1
FL	Gadsden	12039	42	1	232	2	1
FL	Gulf	12045	42	1	232	2	1
FL	Holmes	12059	42	1	232	2	1
FL	Jackson	12063	42	1	232	2	1
FL	Jefferson	12065	42	1	232	2	1
FL	Leon	12073	42	1	232	2	1
FL	Liberty	12077	42	1	232	2	1
FL	Okaloosa	12091	42	1	232	2	1
FL	Santa Rosa	12113	42	1	232	2	1
FL	Wakulla	12129	42	1	232	2	1
FL	Walton	12131	42	1	232	2	1
FL	Washington	12133	42	1	232	2	1
FL	Brevard	12009	42	1	232	3	1
FL	Citrus	12017	42	1	232	3	1
FL	De Soto	12027	42	1	232	3	1
FL	Hardee	12049	42	1	232	3	1
FL	Hernando	12053	42	1	232	3	1
FL	Highlands	12055	42	1	232	3	1
FL	Hillsborough	12057	42	1	232	3	1
FL	Indian River	12061	42	1	232	3	1
FL	Lake	12069	42	1	232	3	1
FL	Manatee	12081	42	1	232	3	1
FL	Okeechobee	12093	42	1	232	3	1
FL	Orange	12095	42	1	232	3	1
FL	Osceola	12097	42	1	232	3	1

FL	Pasco	12101	42	1	232	3	1
FL	Pinellas	12103	42	1	232	3	1
FL	Polk	12105	42	1	232	3	1
FL	St. Lucie	12111	42	1	232	3	1
FL	Sarasota	12115	42	1	232	3	1
FL	Seminole	12117	42	1	232	3	1
FL	Sumter	12119	42	1	232	3	1
FL	Broward	12011	42	1	411	4	1
FL	Charlotte	12015	42	1	232	4	1
FL	Collier	12021	42	1	411	4	1
FL	Dade	12025	42	1	411	4	1
FL	Glades	12043	42	1	232	4	1
FL	Hendry	12051	42	1	232	4	1
FL	Lee	12071	42	1	232	4	1
FL	Martin	12085	42	1	232	4	1
FL	Monroe	12087	42	1	411	4	1
FL	Palm Beach	12099	42	1	411	4	1
GA	Appling	13001	42	1	232	1	1
GA	Atkinson	13003	42	1	232	1	1
GA	Bacon	13005	42	1	232	1	1
GA	Brantley	13025	42	1	232	1	1
GA	Bryan	13029	42	1	232	1	1
GA	Bulloch	13031	42	1	232	1	1
GA	Camden	13039	42	1	232	1	1
GA	Candler	13043	42	1	232	1	1
GA	Charlton	13049	42	1	232	1	1
GA	Chatham	13051	42	1	232	1	1
GA	Clinch	13065	42	1	232	1	1
GA	Coffee	13069	42	1	232	1	1
GA	Dodge	13091	42	1	232	1	1
GA	Echols	13101	42	1	232	1	1
GA	Effingham	13103	42	1	232	1	1
GA	Emanuel	13107	42	1	232	1	1
GA	Evans	13109	42	1	232	1	1
GA	Glynn	13127	42	1	232	1	1
GA	Jeff Davis	13161	42	1	232	1	1
GA	Jenkins	13165	42	1	232	1	1
GA	Johnson	13167	42	1	232	1	1
GA	Laurens	13175	42	1	232	1	1
GA	Liberty	13179	42	1	232	1	1
GA	Long	13183	42	1	232	1	1
GA	McIntosh	13191	42	1	232	1	1
GA	Montgomery	13209	42	1	232	1	1
GA	Pierce	13229	42	1	232	1	1
GA	Screven	13251	42	1	232	1	1
GA	Tattnall	13267	42	1	232	1	1
GA	Telfair	13271	42	1	232	1	1
GA	Toombs	13279	42	1	232	1	1
GA	Treutlen	13283	42	1	232	1	1
GA	Ware	13299	42	1	232	1	1
GA	Wayne	13305	42	1	232	1	1
GA	Wheeler	13309	42	1	232	1	1
GA	Baker	13007	42	1	232	2	1
GA	Ben Hill	13017	42	1	232	2	1

GA	Berrien	13019	42	1	232	2	1
GA	Brooks	13027	42	1	232	2	1
GA	Colquitt	13071	42	1	232	2	1
GA	Cook	13075	42	1	232	2	1
GA	Crisp	13081	42	1	232	2	1
GA	Decatur	13087	42	1	232	2	1
GA	Dooly	13093	42	1	232	2	1
GA	Early	13099	42	1	232	2	1
GA	Grady	13131	42	1	232	2	1
GA	Irwin	13155	42	1	232	2	1
GA	Lanier	13173	42	1	232	2	1
GA	Lowndes	13185	42	1	232	2	1
GA	Miller	13201	42	1	232	2	1
GA	Mitchell	13205	42	1	232	2	1
GA	Seminole	13253	42	1	232	2	1
GA	Thomas	13275	42	1	232	2	1
GA	Tift	13277	42	1	232	2	1
GA	Turner	13287	42	1	232	2	1
GA	Wilcox	13315	42	1	232	2	1
GA	Worth	13321	42	1	232	2	1
GA	Baldwin	13009	42	1	231	3	4
GA	Bibb	13021	42	1	231	3	4
GA	Bleckley	13023	42	1	231	3	4
GA	Burke	13033	42	1	232	3	4
GA	Butts	13035	42	1	231	3	4
GA	Calhoun	13037	42	1	232	3	4
GA	Chattahoochee	13053	42	1	231	3	4
GA	Clay	13061	42	1	231	3	4
GA	Columbia	13073	42	1	231	3	4
GA	Crawford	13079	42	1	231	3	4
GA	Dougherty	13095	42	1	232	3	4
GA	Glascock	13125	42	1	231	3	4
GA	Greene	13133	42	1	231	3	4
GA	Hancock	13141	42	1	231	3	4
GA	Harris	13145	42	1	231	3	4
GA	Houston	13153	42	1	231	3	4
GA	Jasper	13159	42	1	231	3	4
GA	Jefferson	13163	42	1	231	3	4
GA	Jones	13169	42	1	231	3	4
GA	Lamar	13171	42	1	231	3	4
GA	Lee	13177	42	1	232	3	4
GA	Lincoln	13181	42	1	231	3	4
GA	McDuffie	13189	42	1	231	3	4
GA	Macon	13193	42	1	231	3	4
GA	Marion	13197	42	1	231	3	4
GA	Monroe	13207	42	1	231	3	4
GA	Morgan	13211	42	1	231	3	4
GA	Muscogee	13215	42	1	231	3	4
GA	Peach	13225	42	1	231	3	4
GA	Pike	13231	42	1	231	3	4
GA	Pulaski	13235	42	1	232	3	4
GA	Putnam	13237	42	1	231	3	4
GA	Quitman	13239	42	1	231	3	4
GA	Randolph	13243	42	1	231	3	4

GA	Richmond	13245	42	1	231	3	4
GA	Schley	13249	42	1	231	3	4
GA	Stewart	13259	42	1	231	3	4
GA	Sumter	13261	42	1	231	3	4
GA	Talbot	13263	42	1	231	3	4
GA	Taliaferro	13265	42	1	231	3	4
GA	Taylor	13269	42	1	231	3	4
GA	Terrell	13273	42	1	232	3	4
GA	Twiggs	13289	42	1	231	3	4
GA	Upson	13293	42	1	231	3	4
GA	Warren	13301	42	1	231	3	4
GA	Washington	13303	42	1	231	3	4
GA	Webster	13307	42	1	231	3	4
GA	Wilkes	13317	42	1	231	3	4
GA	Wilkinson	13319	42	1	231	3	4
GA	Banks	13011	42	1	231	4	4
GA	Barrow	13013	42	1	231	4	4
GA	Carroll	13045	42	1	231	4	4
GA	Clarke	13059	42	1	231	4	4
GA	Clayton	13063	42	1	231	4	4
GA	Cobb	13067	42	1	231	4	4
GA	Coweta	13077	42	1	231	4	4
GA	De Kalb	13089	42	1	231	4	4
GA	Douglas	13097	42	1	231	4	4
GA	Elbert	13105	42	1	231	4	4
GA	Fayette	13113	42	1	231	4	4
GA	Forsyth	13117	42	1	231	4	4
GA	Franklin	13119	42	1	231	4	4
GA	Fulton	13121	42	1	231	4	4
GA	Gwinnett	13135	42	1	231	4	4
GA	Hall	13139	42	1	231	4	4
GA	Haralson	13143	42	1	231	4	4
GA	Hart	13147	42	1	231	4	4
GA	Heard	13149	42	1	231	4	4
GA	Henry	13151	42	1	231	4	4
GA	Jackson	13157	42	1	231	4	4
GA	Madison	13195	42	1	231	4	4
GA	Meriwether	13199	42	1	231	4	4
GA	Newton	13217	42	1	231	4	4
GA	Oconee	13219	42	1	231	4	4
GA	Oglethorpe	13221	42	1	231	4	4
GA	Paulding	13223	42	1	231	4	4
GA	Polk	13233	42	1	231	4	4
GA	Rockdale	13247	42	1	231	4	4
GA	Spalding	13255	42	1	231	4	4
GA	Troup	13285	42	1	231	4	4
GA	Walton	13297	42	1	231	4	4
GA	Bartow	13015	42	1	231	5	3
GA	Catoosa	13047	42	1	231	5	3
GA	Chattooga	13055	42	1	231	5	3
GA	Cherokee	13057	42	2	221	5	3
GA	Dade	13083	42	1	221	5	3
GA	Dawson	13085	42	2	221	5	3
GA	Fannin	13111	42	2	221	5	3

GA	Floyd	13115	42	1	231	5	3
GA	Gilmer	13123	42	2	221	5	3
GA	Gordon	13129	42	1	231	5	3
GA	Habersham	13137	42	2	221	5	3
GA	Lumpkin	13187	42	2	221	5	3
GA	Murray	13213	42	1	231	5	3
GA	Pickens	13227	42	2	221	5	3
GA	Rabun	13241	42	2	221	5	3
GA	Stephens	13257	42	2	221	5	3
GA	Towns	13281	42	2	221	5	3
GA	Union	13291	42	2	221	5	3
GA	Walker	13295	42	1	231	5	3
GA	White	13311	42	2	221	5	3
GA	Whitfield	13313	42	1	231	5	3
KY	Floyd	21071	41	1	221	1	3
KY	Harlan	21095	41	1	221	1	3
KY	Knott	21119	41	1	221	1	3
KY	Leslie	21131	41	1	221	1	3
KY	Letcher	21133	41	1	221	1	3
KY	Martin	21159	41	1	221	1	3
KY	Perry	21193	41	1	221	1	3
KY	Pike	21195	41	2	221	1	3
KY	Boyd	21019	41	1	221	2	3
KY	Carter	21043	41	1	221	2	3
KY	Elliott	21063	41	1	221	2	3
KY	Greenup	21089	41	1	221	2	3
KY	Johnson	21115	41	1	221	2	3
KY	Lawrence	21127	41	1	221	2	3
KY	Lewis	21135	41	1	221	2	3
KY	Magoffin	21153	41	1	221	2	3
KY	Menifee	21165	41	1	221	2	3
KY	Morgan	21175	41	1	221	2	3
KY	Powell	21197	41	1	221	2	3
KY	Rowan	21205	41	1	221	2	3
KY	Wolfe	21237	41	1	221	2	3
KY	Bell	21013	41	1	221	3	3
KY	Breathitt	21025	41	1	221	3	3
KY	Clay	21051	41	1	221	3	3
KY	Estill	21065	41	1	221	3	3
KY	Jackson	21109	41	1	221	3	3
KY	Knox	21121	41	1	221	3	3
KY	Laurel	21125	41	1	221	3	3
KY	Lee	21129	41	1	221	3	3
KY	McCreary	21147	41	1	221	3	3
KY	Owsley	21189	41	1	221	3	3
KY	Rockcastle	21203	41	1	221	3	3
KY	Whitley	21235	41	1	221	3	3
KY	Anderson	21005	41	1	222	4	3
KY	Bath	21011	41	1	222	4	3
KY	Boone	21015	41	1	222	4	3
KY	Bourbon	21017	41	1	222	4	3
KY	Boyle	21021	41	1	222	4	3
KY	Bracken	21023	41	1	222	4	3
KY	Campbell	21037	41	1	222	4	3

KY	Carroll	21041	41	1	222	4	3
KY	Clark	21049	41	1	222	4	3
KY	Fayette	21067	41	1	222	4	3
KY	Fleming	21069	41	1	222	4	3
KY	Franklin	21073	41	1	222	4	3
KY	Gallatin	21077	41	1	222	4	3
KY	Garrard	21079	41	1	222	4	3
KY	Grant	21081	41	1	222	4	3
KY	Harrison	21097	41	1	222	4	3
KY	Henry	21103	41	1	222	4	3
KY	Jefferson	21111	41	1	222	4	3
KY	Jessamine	21113	41	1	222	4	3
KY	Kenton	21117	41	1	222	4	3
KY	Lincoln	21137	41	1	222	4	3
KY	Madison	21151	41	1	222	4	3
KY	Mason	21161	41	1	222	4	3
KY	Mercer	21167	41	1	222	4	3
KY	Montgomery	21173	41	1	222	4	3
KY	Nicholas	21181	41	1	222	4	3
KY	Oldham	21185	41	1	222	4	3
KY	Owen	21187	41	1	222	4	3
KY	Pendleton	21191	41	1	222	4	3
KY	Robertson	21201	41	1	222	4	3
KY	Scott	21209	41	1	222	4	3
KY	Shelby	21211	41	1	222	4	3
KY	Spencer	21215	41	1	222	4	3
KY	Trimble	21223	41	1	222	4	3
KY	Washington	21229	41	1	222	4	3
KY	Woodford	21239	41	1	222	4	3
KY	Adair	21001	41	1	222	5	3
KY	Breckinridge	21027	41	1	222	5	3
KY	Bullitt	21029	41	1	222	5	3
KY	Casey	21045	41	1	222	5	3
KY	Clinton	21053	41	1	222	5	3
KY	Cumberland	21057	41	1	222	5	3
KY	Grayson	21085	41	1	222	5	3
KY	Green	21087	41	1	222	5	3
KY	Hancock	21091	41	1	222	5	3
KY	Hardin	21093	41	1	222	5	3
KY	Hart	21099	41	1	222	5	3
KY	Larue	21123	41	1	222	5	3
KY	Marion	21155	41	1	222	5	3
KY	Meade	21163	41	1	222	5	3
KY	Metcalfe	21169	41	1	222	5	3
KY	Nelson	21179	41	1	222	5	3
KY	Pulaski	21199	41	1	222	5	3
KY	Russell	21207	41	1	222	5	3
KY	Taylor	21217	41	1	222	5	3
KY	Wayne	21231	41	1	222	5	3
KY	Allen	21003	41	1	222	6	3
KY	Barren	21009	41	1	222	6	3
KY	Butler	21031	41	1	222	6	3
KY	Caldwell	21033	41	1	222	6	3
KY	Christian	21047	41	1	222	6	3

KY	Crittenden	21055	41	1	222	6	3
KY	Daviess	21059	41	1	222	6	3
KY	Edmonson	21061	41	1	222	6	3
KY	Henderson	21101	41	1	222	6	3
KY	Hopkins	21107	41	1	222	6	3
KY	Logan	21141	41	1	222	6	3
KY	McLean	21149	41	1	222	6	3
KY	Monroe	21171	41	1	222	6	3
KY	Muhlenberg	21177	41	1	222	6	3
KY	Ohio	21183	41	1	222	6	3
KY	Simpson	21213	41	1	222	6	3
KY	Todd	21219	41	1	222	6	3
KY	Union	21225	41	1	222	6	3
KY	Warren	21227	41	1	222	6	3
KY	Webster	21233	41	1	222	6	3
KY	Ballard	21007	41	1	222	7	3
KY	Calloway	21035	41	1	222	7	3
KY	Carlisle	21039	41	1	222	7	3
KY	Fulton	21075	41	1	234	7	3
KY	Graves	21083	41	1	222	7	3
KY	Hickman	21105	41	1	222	7	3
KY	Livingston	21139	41	1	222	7	3
KY	Lyon	21143	41	1	222	7	3
KY	McCracken	21145	41	1	222	7	3
KY	Marshall	21157	41	1	222	7	3
KY	Trigg	21221	41	1	222	7	3
LA	Cameron	22023	41	1	232	0	2
LA	Jefferson	22051	41	1	232	0	2
LA	Orleans	22071	41	1	232	0	2
LA	Plaquemines	22075	41	1	232	0	2
LA	St. Bernard	22087	41	1	232	0	2
LA	Catahoula	22025	41	1	234	1	2
LA	Concordia	22029	41	1	234	1	2
LA	East Carroll	22035	41	1	234	1	2
LA	Franklin	22041	41	1	234	1	2
LA	Madison	22065	41	1	234	1	2
LA	Morehouse	22067	41	1	234	1	2
LA	Richland	22083	41	1	234	1	2
LA	Tensas	22107	41	1	234	1	2
LA	West Carroll	22123	41	1	234	1	2
LA	Acadia	22001	41	1	232	2	2
LA	Ascension	22005	41	1	234	2	2
LA	Assumption	22007	41	1	234	2	2
LA	Avoyelles	22009	41	1	234	2	2
LA	Iberia	22045	41	1	234	2	2
LA	Iberville	22047	41	1	234	2	2
LA	Lafayette	22055	41	1	232	2	2
LA	LaFourche	22057	41	1	232	2	2
LA	Pointe Coupee	22077	41	1	234	2	2
LA	St. Charles	22089	41	1	232	2	2
LA	St. James	22093	41	1	234	2	2
LA	St. John the Baptist	22095	41	1	234	2	2
LA	St. Landry	22097	41	1	234	2	2
LA	St. Martin	22099	41	1	234	2	2

LA	St. Mary	22101	41	1	232	2	2
LA	Terrebonne	22109	41	1	232	2	2
LA	Vermilion	22113	41	1	232	2	2
LA	West Baton Rouge	22121	41	1	234	2	2
LA	West Feliciana	22125	41	1	234	2	2
LA	Allen	22003	41	1	232	3	1
LA	Beauregard	22011	41	1	232	3	1
LA	Calcasieu	22019	41	1	232	3	1
LA	Evangeline	22039	41	1	232	3	1
LA	Grant	22043	41	1	234	3	1
LA	Jefferson Davis	22053	41	1	232	3	1
LA	La Salle	22059	41	1	232	3	1
LA	Natchitoches	22069	41	1	232	3	1
LA	Rapides	22079	41	1	232	3	1
LA	Sabine	22085	41	1	232	3	1
LA	Vernon	22115	41	1	232	3	1
LA	East Baton Rouge	22033	41	1	234	4	1
LA	East Feliciana	22037	41	1	231	4	1
LA	Livingston	22063	41	1	232	4	1
LA	St. Helena	22091	41	1	231	4	1
LA	St. Tammany	22103	41	1	232	4	1
LA	Tangipahoa	22105	41	1	232	4	1
LA	Washington	22117	41	1	232	4	1
LA	Bienville	22013	41	1	231	5	4
LA	Bossier	22015	41	1	234	5	4
LA	Caddo	22017	41	1	231	5	4
LA	Caldwell	22021	41	1	232	5	4
LA	Claiborne	22027	41	1	231	5	4
LA	De Soto	22031	41	1	231	5	4
LA	Jackson	22049	41	1	231	5	4
LA	Lincoln	22061	41	1	231	5	4
LA	Ouachita	22073	41	1	231	5	4
LA	Red River	22081	41	1	234	5	4
LA	Union	22111	41	1	231	5	4
LA	Webster	22119	41	1	231	5	4
LA	Winn	22127	41	1	232	5	4
MS	Bolivar	28011	41	1	234	1	2
MS	Coahoma	28027	41	1	234	1	2
MS	Holmes	28051	41	1	231	1	
MS	Humphreys	28053	41	1	234	1	2
MS	Issaquena	28055	41	1	234	1	2
MS	Leflore	28083	41	1	234	1	2
MS	Quitman	28119	41	1	234	1	2
MS	Sharkey	28125	41	1	234	1	2
MS	Sunflower	28133	41	1	234	1	2
MS	Tallahatchie	28135	41	1	234	1	2
MS	Tunica	28143	41	1	234	1	2
MS	Warren	28149	41	1	234	1	2
MS	Washington	28151	41	1	234	1	2
MS	Yazoo	28163	41	1	231	1	2
MS	Alcorn	28003	41	1	231	2	4
MS	Benton	28009	41	1	231	2	4
MS	Calhoun	28013	41	1	231	2	4
MS	Carroll	28015	41	1	231	2	4

MS	Chickasaw	28017	41	1	231	2	4
MS	Choctaw	28019	41	1	231	2	4
MS	Clay	28025	41	1	231	2	4
MS	De Soto	28033	41	1	234	2	4
MS	Grenada	28043	41	1	231	2	4
MS	Itawamba	28057	41	1	231	2	4
MS	Lafayette	28071	41	1	231	2	4
MS	Lee	28081	41	1	231	2	4
MS	Lowndes	28087	41	1	231	2	4
MS	Marshall	28093	41	1	231	2	4
MS	Monroe	28095	41	1	231	2	4
MS	Montgomery	28097	41	1	231	2	4
MS	Oktibbeha	28105	41	1	231	2	4
MS	Panola	28107	41	1	231	2	4
MS	Pontotoc	28115	41	1	231	2	4
MS	Prentiss	28117	41	1	231	2	4
MS	Tate	28137	41	1	231	2	4
MS	Tippah	28139	41	1	231	2	4
MS	Tishomingo	28141	41	1	231	2	4
MS	Union	28145	41	1	231	2	4
MS	Webster	28155	41	1	231	2	4
MS	Yalobusha	28161	41	1	231	2	4
MS	Attala	28007	41	1	231	3	4
MS	Clarke	28023	41	1	231	3	4
MS	Jasper	28061	41	1	231	3	4
MS	Kemper	28069	41	1	231	3	4
MS	Lauderdale	28075	41	1	231	3	4
MS	Leake	28079	41	1	231	3	4
MS	Neshoba	28099	41	1	231	3	4
MS	Newton	28101	41	1	231	3	4
MS	Noxubee	28103	41	1	231	3	4
MS	Rankin	28121	41	1	231	3	4
MS	Scott	28123	41	1	231	3	4
MS	Simpson	28127	41	1	231	3	4
MS	Smith	28129	41	1	231	3	4
MS	Winston	28159	41	1	231	3	4
MS	Covington	28031	41	1	231	4	1
MS	Forrest	28035	41	1	232	4	1
MS	George	28039	41	1	232	4	1
MS	Greene	28041	41	1	232	4	1
MS	Hancock	28045	41	1	232	4	1
MS	Harrison	28047	41	1	232	4	1
MS	Jackson	28059	41	1	232	4	1
MS	Jefferson Davis	28065	41	1	232	4	1
MS	Jones	28067	41	1	232	4	1
MS	Lamar	28073	41	1	232	4	1
MS	Lawrence	28077	41	1	231	4	1
MS	Marion	28091	41	1	232	4	1
MS	Pearl River	28109	41	1	232	4	1
MS	Perry	28111	41	1	232	4	1
MS	Stone	28131	41	1	232	4	1
MS	Walthall	28147	41	1	232	4	1
MS	Wayne	28153	41	1	232	4	1
MS	Adams	28001	41	1	234	5	4

MS	Amite	28005	41	1	231	5	4
MS	Claiborne	28021	41	1	231	5	4
MS	Copiah	28029	41	1	231	5	4
MS	Franklin	28037	41	1	231	5	4
MS	Hinds	28049	41	1	231	5	4
MS	Jefferson	28063	41	1	231	5	4
MS	Lincoln	28085	41	1	231	5	4
MS	Madison	28089	41	1	231	5	4
MS	Pike	28113	41	1	232	5	4
MS	Wilkinson	28157	41	1	234	5	4
NC	Bladen	37017	42	1	232	1	1
NC	Brunswick	37019	42	1	232	1	1
NC	Columbus	37047	42	1	232	1	1
NC	Cumberland	37051	42	1	232	1	1
NC	Duplin	37061	42	1	232	1	1
NC	Greene	37079	42	1	232	1	1
NC	Harnett	37085	42	1	231	1	1
NC	Hoke	37093	42	1	231	1	1
NC	Johnston	37101	42	1	232	1	1
NC	Jones	37103	42	1	232	1	1
NC	Lee	37105	42	1	231	1	1
NC	Lenoir	37107	42	1	232	1	1
NC	Moore	37125	42	1	231	1	1
NC	New Hanover	37129	42	1	232	1	1
NC	Onslow	37133	42	1	232	1	1
NC	Pender	37141	42	1	232	1	1
NC	Richmond	37153	42	1	231	1	1
NC	Robeson	37155	42	1	232	1	1
NC	Sampson	37163	42	1	232	1	1
NC	Scotland	37165	42	1	231	1	1
NC	Wayne	37191	42	1	232	1	1
NC	Beaufort	37013	42	1	232	2	1
NC	Bertie	37015	42	1	232	2	1
NC	Camden	37029	42	1	232	2	1
NC	Carteret	37031	42	1	232	2	1
NC	Chowan	37041	42	1	232	2	1
NC	Craven	37049	42	1	232	2	1
NC	Currituck	37053	42	1	232	2	1
NC	Dare	37055	42	1	232	2	1
NC	Edgecombe	37065	42	1	232	2	1
NC	Gates	37073	42	1	232	2	1
NC	Halifax	37083	42	1	232	2	1
NC	Hertford	37091	42	1	232	2	1
NC	Hyde	37095	42	1	232	2	1
NC	Martin	37117	42	1	232	2	1
NC	Nash	37127	42	1	231	2	1
NC	Northampton	37131	42	1	232	2	1
NC	Pamlico	37137	42	1	232	2	1
NC	Pasquotank	37139	42	1	232	2	1
NC	Perquimans	37143	42	1	232	2	1
NC	Pitt	37147	42	1	232	2	1
NC	Tyrrell	37177	42	1	232	2	1
NC	Washington	37187	42	1	232	2	1
NC	Wilson	37195	42	1	232	2	1

NC	Alamance	37001	42	1	231	3	4
NC	Alexander	37003	42	1	231	3	4
NC	Anson	37007	42	1	231	3	4
NC	Cabarrus	37025	42	1	231	3	4
NC	Caswell	37033	42	1	231	3	4
NC	Catawba	37035	42	1	231	3	4
NC	Chatham	37037	42	1	231	3	4
NC	Cleveland	37045	42	1	231	3	4
NC	Davidson	37057	42	1	231	3	4
NC	Davie	37059	42	1	231	3	4
NC	Durham	37063	42	1	231	3	4
NC	Forsyth	37067	42	1	231	3	4
NC	Franklin	37069	42	1	231	3	4
NC	Gaston	37071	42	1	231	3	4
NC	Granville	37077	42	1	231	3	4
NC	Guilford	37081	42	1	231	3	4
NC	Iredell	37097	42	1	231	3	4
NC	Lincoln	37109	42	1	231	3	4
NC	Mecklenburg	37119	42	1	231	3	4
NC	Montgomery	37123	42	1	231	3	4
NC	Orange	37135	42	1	231	3	4
NC	Person	37145	42	1	231	3	4
NC	Polk	37149	42	2	221	3	4
NC	Randolph	37151	42	1	231	3	4
NC	Rockingham	37157	42	1	231	3	4
NC	Rowan	37159	42	1	231	3	4
NC	Rutherford	37161	42	1	231	3	4
NC	Stanly	37167	42	1	231	3	4
NC	Stokes	37169	42	1	231	3	4
NC	Surry	37171	42	2	221	3	4
NC	Union	37179	42	1	231	3	4
NC	Vance	37181	42	1	231	3	4
NC	Wake	37183	42	1	231	3	4
NC	Warren	37185	42	1	231	3	4
NC	Yadkin	37197	42	1	231	3	4
NC	Alleghany	37005	42	2	221	4	3
NC	Ashe	37009	42	2	221	4	3
NC	Avery	37011	42	2	221	4	3
NC	Buncombe	37021	42	2	221	4	3
NC	Burke	37023	42	2	221	4	3
NC	Caldwell	37027	42	2	221	4	3
NC	Cherokee	37039	42	2	221	4	3
NC	Clay	37043	42	2	221	4	3
NC	Graham	37075	42	2	221	4	3
NC	Haywood	37087	42	2	221	4	3
NC	Henderson	37089	42	2	221	4	3
NC	Jackson	37099	42	2	221	4	3
NC	McDowell	37111	42	2	221	4	3
NC	Macon	37113	42	2	221	4	3
NC	Madison	37115	42	2	221	4	3
NC	Mitchell	37121	42	2	221	4	3
NC	Swain	37173	42	2	221	4	3
NC	Transylvania	37175	42	2	221	4	3
NC	Watauga	37189	42	2	221	4	3

NC	Wilkes	37193	42	2	221	4	3
NC	Yancey	37199	42	2	221	4	3
OK	Atoka	40005	41	1	255	1	4
OK	Bryan	40013	41	1	255	1	4
OK	Choctaw	40023	41	1	255	1	4
OK	Coal	40029	41	1	255	1	4
OK	Haskell	40061	41	1	255	1	4
OK	Latimer	40077	41	1	231	1	4
OK	Le Flore	40079	41	1	231	1	4
OK	McCurtain	40089	41	2	231	1	4
OK	Pittsburg	40121	41	1	255	1	3
OK	Pushmataha	40127	41	2	231	1	4
OK	Adair	40001	41	1	222	2	3
OK	Cherokee	40021	41	1	222	2	3
OK	Delaware	40041	41	1	222	2	3
OK	McIntosh	40091	41	1	255	2	3
OK	Mayes	40097	41	1	251	2	3
OK	Muskogee	40101	41	1	251	2	3
OK	Ottawa	40115	41	1	251	2	3
OK	Sequoyah	40135	41	2	222	2	3
SC	Aiken	45003	42	1	231	1	1
SC	Allendale	45005	42	1	232	1	1
SC	Bamberg	45009	42	1	232	1	1
SC	Barnwell	45011	42	1	232	1	1
SC	Beaufort	45013	42	1	232	1	1
SC	Calhoun	45017	42	1	232	1	1
SC	Colleton	45029	42	1	232	1	1
SC	Dorchester	45035	42	1	232	1	1
SC	Hampton	45049	42	1	232	1	1
SC	Jasper	45053	42	1	232	1	1
SC	Lexington	45063	42	1	231	1	1
SC	Orangeburg	45075	42	1	232	1	1
SC	Berkeley	45015	42	1	232	2	1
SC	Charleston	45019	42	1	232	2	1
SC	Chesterfield	45025	42	1	231	2	1
SC	Clarendon	45027	42	1	232	2	1
SC	Darlington	45031	42	1	232	2	1
SC	Dillon	45033	42	1	232	2	1
SC	Florence	45041	42	1	232	2	1
SC	Georgetown	45043	42	1	232	2	1
SC	Horry	45051	42	1	232	2	1
SC	Kershaw	45055	42	1	231	2	1
SC	Lee	45061	42	1	232	2	1
SC	Marion	45067	42	1	232	2	1
SC	Marlboro	45069	42	1	232	2	1
SC	Richland	45079	42	1	231	2	1
SC	Sumter	45085	42	1	232	2	1
SC	Williamsburg	45089	42	1	232	2	1
SC	Abbeville	45001	42	1	231	3	4
SC	Anderson	45007	42	1	231	3	4
SC	Cherokee	45021	42	1	231	3	4
SC	Chester	45023	42	1	231	3	4
SC	Edgefield	45037	42	1	231	3	4
SC	Fairfield	45039	42	1	231	3	4

SC	Greenville	45045	42	1	231	3	4
SC	Greenwood	45047	42	1	231	3	4
SC	Lancaster	45057	42	1	231	3	4
SC	Laurens	45059	42	1	231	3	4
SC	McCormick	45065	42	1	231	3	4
SC	Newberry	45071	42	1	231	3	4
SC	Oconee	45073	42	2	221	3	4
SC	Pickens	45077	42	2	221	3	4
SC	Saluda	45081	42	1	231	3	4
SC	Spartanburg	45083	42	1	231	3	4
SC	Union	45087	42	1	231	3	4
SC	York	45091	42	1	231	3	4
TN	Carroll	47017	41	1	222	1	3
TN	Chester	47023	41	1	222	1	3
TN	Crockett	47033	41	1	222	1	3
TN	Dyer	47045	41	1	222	1	3
TN	Fayette	47047	41	1	231	1	3
TN	Gibson	47053	41	1	222	1	3
TN	Hardeman	47069	41	1	222	1	3
TN	Haywood	47075	41	1	222	1	3
TN	Henderson	47077	41	1	222	1	3
TN	Henry	47079	41	1	222	1	3
TN	Lake	47095	41	1	234	1	3
TN	Lauderdale	47097	41	1	222	1	3
TN	McNairy	47109	41	1	222	1	3
TN	Madison	47113	41	1	222	1	3
TN	Obion	47131	41	1	222	1	3
TN	Shelby	47157	41	1	231	1	3
TN	Tipton	47167	41	1	231	1	3
TN	Weakley	47183	41	1	222	1	3
TN	Benton	47005	41	1	222	2	3
TN	Decatur	47039	41	1	222	2	3
TN	Hardin	47071	41	1	222	2	3
TN	Hickman	47081	41	1	222	2	3
TN	Houston	47083	41	1	222	2	3
TN	Humphreys	47085	41	1	222	2	3
TN	Lawrence	47099	41	1	222	2	3
TN	Lewis	47101	41	1	222	2	3
TN	Perry	47135	41	1	222	2	3
TN	Stewart	47161	41	1	222	2	3
TN	Wayne	47181	41	1	231	2	3
TN	Bedford	47003	41	1	222	3	3
TN	Cannon	47015	41	1	222	3	3
TN	Cheatham	47021	41	1	222	3	3
TN	Clay	47027	41	1	222	3	3
TN	Coffee	47031	41	1	222	3	3
TN	Davidson	47037	41	1	222	3	3
TN	De Kalb	47041	41	1	222	3	3
TN	Dickson	47043	41	1	222	3	3
TN	Giles	47055	41	1	222	3	3
TN	Jackson	47087	41	1	222	3	3
TN	Lincoln	47103	41	1	222	3	3
TN	Macon	47111	41	1	222	3	3
TN	Marshall	47117	41	1	222	3	3

TN	Maury	47119	41	1	222	3	3
TN	Montgomery	47125	41	1	222	3	3
TN	Moore	47127	41	1	222	3	3
TN	Robertson	47147	41	1	222	3	3
TN	Rutherford	47149	41	1	222	3	3
TN	Smith	47159	41	1	222	3	3
TN	Sumner	47165	41	1	222	3	3
TN	Trousdale	47169	41	1	222	3	3
TN	Williamson	47187	41	1	222	3	3
TN	Wilson	47189	41	1	222	3	3
TN	Bledsoe	47007	41	1	221	4	3
TN	Campbell	47013	41	1	221	4	3
TN	Cumberland	47035	41	1	221	4	3
TN	Fentress	47049	41	1	221	4	3
TN	Franklin	47051	41	1	222	4	3
TN	Grundy	47061	41	1	221	4	3
TN	Marion	47115	41	1	221	4	3
TN	Morgan	47129	41	1	221	4	3
TN	Overton	47133	41	1	222	4	3
TN	Pickett	47137	41	1	222	4	3
TN	Putnam	47141	41	1	222	4	3
TN	Scott	47151	41	1	221	4	3
TN	Sequatchie	47153	41	1	221	4	3
TN	Van Buren	47175	41	1	221	4	3
TN	Warren	47177	41	1	222	4	3
TN	White	47185	41	1	222	4	3
TN	Anderson	47001	41	1	221	5	3
TN	Blount	47009	41	1	221	5	3
TN	Bradley	47011	41	1	221	5	3
TN	Carter	47019	41	2	221	5	3
TN	Claiborne	47025	41	1	221	5	3
TN	Cocke	47029	41	1	221	5	3
TN	Grainger	47057	41	1	221	5	3
TN	Greene	47059	41	2	221	5	3
TN	Hamblen	47063	41	1	221	5	3
TN	Hamilton	47065	41	1	221	5	3
TN	Hancock	47067	41	1	221	5	3
TN	Hawkins	47073	41	1	221	5	3
TN	Jefferson	47089	41	1	221	5	3
TN	Johnson	47091	41	2	221	5	3
TN	Knox	47093	41	1	221	5	3
TN	Loudon	47105	41	1	221	5	3
TN	McMinn	47107	41	1	221	5	3
TN	Meigs	47121	41	1	221	5	3
TN	Monroe	47123	41	1	221	5	3
TN	Polk	47139	41	1	221	5	3
TN	Rhea	47143	41	1	221	5	3
TN	Roane	47145	41	1	221	5	3
TN	Sevier	47155	41	1	221	5	3
TN	Sullivan	47163	41	2	221	5	3
TN	Unicoi	47171	41	2	221	5	3
TN	Union	47173	41	1	221	5	3
TN	Washington	47179	41	2	221	5	3
TX	Angelina	48005	41	1	231	1	1

TX	Chambers	48071	41	1	231	1	1
TX	Grimes	48185	41	1	255	1	1
TX	Hardin	48199	41	1	231	1	1
TX	Harris	48201	41	1	255	1	1
TX	Houston	48225	41	1	231	1	1
TX	Jasper	48241	41	1	232	1	1
TX	Jefferson	48245	41	1	231	1	1
TX	Leon	48289	41	1	255	1	1
TX	Liberty	48291	41	1	231	1	1
TX	Madison	48313	41	1	255	1	1
TX	Montgomery	48339	41	1	231	1	1
TX	Newton	48351	41	1	232	1	1
TX	Orange	48361	41	1	232	1	1
TX	Polk	48373	41	1	231	1	1
TX	Sabine	48403	41	1	232	1	1
TX	San Augustine	48405	41	1	231	1	1
TX	San Jacinto	48407	41	1	231	1	1
TX	Trinity	48455	41	1	231	1	1
TX	Tyler	48457	41	1	231	1	1
TX	Walker	48471	41	1	231	1	1
TX	Waller	48473	41	1	255	1	1
TX	Anderson	48001	41	1	255	2	4
TX	Bowie	48037	41	1	231	2	4
TX	Camp	48063	41	1	231	2	4
TX	Cass	48067	41	1	231	2	4
TX	Cherokee	48073	41	1	231	2	4
TX	Franklin	48159	41	1	255	2	4
TX	Gregg	48183	41	1	231	2	4
TX	Harrison	48203	41	1	231	2	4
TX	Henderson	48213	41	1	255	2	4
TX	Marion	48315	41	1	231	2	4
TX	Morris	48343	41	1	231	2	4
TX	Nacogdoches	48347	41	1	231	2	4
TX	Panola	48365	41	1	231	2	4
TX	Red River	48387	41	1	255	2	4
TX	Rusk	48401	41	1	231	2	4
TX	Shelby	48419	41	1	231	2	4
TX	Smith	48423	41	1	231	2	4
TX	Titus	48449	41	1	255	2	4
TX	Upshur	48459	41	1	231	2	4
TX	Van Zandt	48467	41	1	255	2	4
TX	Wood	48499	41	1	255	2	4
VA	Accomack	51001	42	1	232	1	1
VA	Brunswick	51025	42	1	231	1	1
VA	Caroline	51033	42	1	232	1	1
VA	Charles City	51036	42	1	232	1	1
VA	Chesterfield	51041	42	1	231	1	1
VA	Dinwiddie	51053	42	1	231	1	1
VA	Essex	51057	42	1	232	1	1
VA	Gloucester	51073	42	1	232	1	1
VA	Greensville	51081	42	1	232	1	1
VA	Hanover	51085	42	1	231	1	1
VA	Henrico	51087	42	1	232	1	1
VA	Isle of Wight	51093	42	1	232	1	1

VA	James City	51095	42	1	232	1	1
VA	King and Queen	51097	42	1	232	1	1
VA	King George	51099	42	1	232	1	1
VA	King William	51101	42	1	232	1	1
VA	Lancaster	51103	42	1	232	1	1
VA	Mathews	51115	42	1	232	1	1
VA	Middlesex	51119	42	1	232	1	1
VA	New Kent	51127	42	1	232	1	1
VA	Northampton	51131	42	1	232	1	1
VA	Northumberland	51133	42	1	232	1	1
VA	Prince George	51149	42	1	232	1	1
VA	Richmond	51159	42	1	232	1	1
VA	Southampton	51175	42	1	232	1	1
VA	Surry	51181	42	1	232	1	1
VA	Sussex	51183	42	1	232	1	1
VA	Westmoreland	51193	42	1	232	1	1
VA	York	51199	42	1	232	1	1
VA	Chesapeake	51550	42	1	232	1	1
VA	Hampton	51650	42	1	232	1	1
VA	Newport News	51700	42	1	232	1	1
VA	Suffolk	51800	42	1	232	1	1
VA	Virginia Beach	51810	42	1	232	1	1
VA	Amelia	51007	42	1	231	2	4
VA	Appomattox	51011	42	1	231	2	4
VA	Bedford	51019	42	2	221	2	4
VA	Buckingham	51029	42	1	231	2	4
VA	Campbell	51031	42	1	231	2	4
VA	Charlotte	51037	42	1	231	2	4
VA	Cumberland	51049	42	1	231	2	4
VA	Franklin	51067	42	1	231	2	4
VA	Halifax	51083	42	1	231	2	4
VA	Henry	51089	42	1	231	2	4
VA	Lunenburg	51111	42	1	231	2	4
VA	Mecklenburg	51117	42	1	231	2	4
VA	Nottoway	51135	42	1	231	2	4
VA	Patrick	51141	42	2	221	2	4
VA	Pittsylvania	51143	42	1	231	2	4
VA	Powhatan	51145	42	1	231	2	4
VA	Prince Edward	51147	42	1	231	2	4
VA	Albemarle	51003	42	2	221	3	4
VA	Amherst	51009	42	2	221	3	4
VA	Arlington	51013	42	1	231	3	4
VA	Culpeper	51047	42	1	231	3	4
VA	Fairfax	51059	42	1	231	3	4
VA	Fauquier	51061	42	1	231	3	4
VA	Fluvanna	51065	42	1	231	3	4
VA	Goochland	51075	42	1	231	3	4
VA	Greene	51079	42	2	221	3	4
VA	Loudoun	51107	42	2	221	3	4
VA	Louisa	51109	42	1	231	3	4
VA	Madison	51113	42	2	221	3	4
VA	Nelson	51125	42	2	221	3	4
VA	Orange	51137	42	1	231	3	4
VA	Prince William	51153	42	1	231	3	4

VA	Rappahannock	51157	42	2	221	3	4
VA	Spotsylvania	51177	42	1	231	3	4
VA	Stafford	51179	42	1	231	3	4
VA	Alleghany	51005	42	2	221	4	3
VA	Augusta	51015	42	2	221	4	3
VA	Bath	51017	42	2	221	4	3
VA	Botetourt	51023	42	2	221	4	3
VA	Clarke	51043	42	2	221	4	3
VA	Craig	51045	42	2	221	4	3
VA	Frederick	51069	42	2	221	4	3
VA	Highland	51091	42	2	221	4	3
VA	Page	51139	42	2	221	4	3
VA	Roanoke	51161	42	2	221	4	3
VA	Rockbridge	51163	42	2	221	4	3
VA	Rockingham	51165	42	2	221	4	3
VA	Shenandoah	51171	42	2	221	4	3
VA	Warren	51187	42	2	221	4	3
VA	Bland	51021	42	2	221	5	3
VA	Buchanan	51027	42	2	221	5	3
VA	Carroll	51035	42	2	221	5	3
VA	Dickenson	51051	42	2	221	5	3
VA	Floyd	51063	42	2	221	5	3
VA	Giles	51071	42	2	221	5	3
VA	Grayson	51077	42	2	221	5	3
VA	Lee	51105	42	1	221	5	3
VA	Montgomery	51121	42	2	221	5	3
VA	Pulaski	51155	42	2	221	5	3
VA	Russell	51167	42	2	221	5	3
VA	Scott	51169	42	2	221	5	3
VA	Smyth	51173	42	2	221	5	3
VA	Tazewell	51185	42	2	221	5	3
VA	Washington	51191	42	2	221	5	3
VA	Wise	51195	42	2	221	5	3
VA	Wythe	51197	42	2	221	5	3