

SSURGO Download Tools for ArcGIS™

Or

Developing State-Tiled gSSURGO

User Guide

Version 1.0

October 2014

National Soil Survey Center

National Geospatial Center of Excellence

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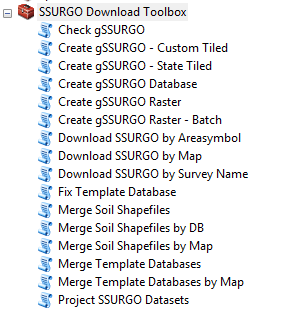
# Introduction or Overview

The SSURGO Download Toolbox contains several ArcGIS™ Tools to facilitate the management of official SSURGO data. The Toolbox requires:

* ArcGIS™ 10.1
* Microsoft Access
* Internet connection

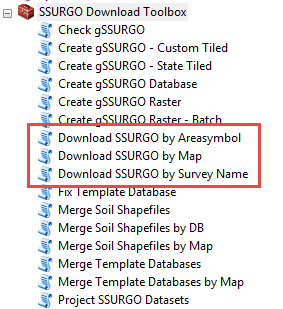
Also, SSURGO datasets for an entire state or region can require a large amount of storage space and computer resources to process.

The SSURGO Download Toolbox tools can be grouped into four functional areas:



1. Downloading SSURGO from Web Soil Survey.
2. Merge attribute or spatial data from the downloaded data into statewide or regional SSURGO datasets.
3. Create gSSURGO which is similar to SSURGO, but in an ESRI file geodatabase format.
4. The ‘Project SSURGO Datasets’ tool allows the user to convert the original SSURGO downloads from GCS WGS 1984 to new datasets with a specified projected coordinate system.

## Download Tools



The purpose of the three **‘Download’** tools are to easily download large numbers of SSURGO datasets from the Web Soil Survey and automatically populate the Microsoft Access template database. The user can choose to download the surveys by Areasymbol, by Map, or Survey Name.

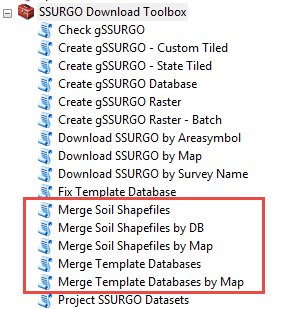
The SSURGO Download tools are designed to download SSURGO without an included Template database. In order for the tabular data to be automatically imported, a special SSURGO Template database, *soildb\_US\_2003\_BatchImport.mdb*, must be used. This database is included with the SSURGO Download Tools.

A Soil Survey Status Map layer is available from the Web Soil Survey at the following URL: <http://websoilsurvey.sc.egov.usda.gov/DataAvailability/SoilDataAvailabilityShapefile.zip>.

The Web Soil Survey archives the SSURGO data using a URL similar to the following: [http://websoilsurvey.sc.egov.usda.gov/DSD/Download/Cache/SSA/wss\_SSA\_AL001\_[2011-07-25].zip](http://websoilsurvey.sc.egov.usda.gov/DSD/Download/Cache/SSA/wss_SSA_AL001_%5b2011-07-25%5d.zip). Each individual SSURGO download will be saved in a local folder named ‘soil\_<areasymbol>, e.g., ‘soil\_de001’. Every complete dataset will have spatial and tabular folders. The spatial folder will contain the original GCS WGS 1984 shapefiles. The tabular folder will contain the Microsoft Access Template database and text files.

**NOTE:** the user must configure the Microsoft Access Trust Center settings to recognize the download folder and all subfolders as trusted sites BEFORE running any of the download tools. If the download folder is located on a network drive or share, there is an additional option that must be set.

## Merge Tools



The purpose of the **‘Merge’** tools are to easily append multiple spatial surveys from the downloaded datasets into a single shapefile or the attribute data into a single Microsoft Access Template database.

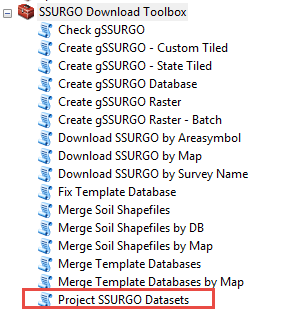
The ‘Merge Soil Shapefiles’ tool is designed to work with the standard SSURGO data structure and shapefile naming convention created by the three Download tools. Each SSURGO dataset exists within its own subfolder whose name begins with ‘soil\_’ and ends with the 5 character Areasymbol value. The tool will search within the specified ‘Input Folder’ for datasets containing the appropriate ‘soilmu\_a’ shapefiles and add them to the ‘Soil Survey’ choice list. Select the desired soil surveys to be merged. There is a 2 gigabyte (GB) limit for both the shapefiles and Microsoft Access database format. A warning is displayed if merging the selected survey shapefiles will create a new shapefile that approaches the 2 GB file size limit. If the estimated output size exceeds the 2 GB limit, the tool will display a red warning and refuse to execute. Also, the user should be aware that slow performance becomes a problem well before the file size limit is reached.

The ‘Merge Soil Shapefiles’ tool does not attempt to validate the input coordinate system of each shapefile to ensure that they all match. The Web Soil Survey provides SSURGO downloads with a Geographic WGS 1984 coordinate system only.

Please note that the ‘Download’ tools and the ‘Merge Databases’ tool require the use of a custom SSURGO Template database. Microsoft Access software must be installed.

The custom database, *soildb\_US\_2003\_BatchImport.mdb,* contains modified VBA code in the ‘Mains and Miscellaneous’ module and a new ‘BatchImport’ macro has been added to facilitate unattended imports. Also, the AUTOEXEC macro has been temporarily disabled. Once the batch import process is complete, the AUTOEXEC macro will be automatically re-enabled by removing the ‘NOT’ from the end of the macro name. This will allow the standard ‘Reports’ menu to automatically display at startup.

## Projection Tools

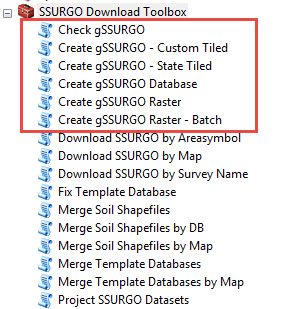


The **‘Project SSURGO Datasets’** tool allows the user to create an entire new group of SSURGO downloads in a new projected coordinate system.

Unlike the Geospatial Data Gateway, the Web Soil Survey provides SSURGO downloads in only GCS WGS 1984. There are no options for downloading SSURGO in a projected coordinate system.

With this tool, the user can manually select polygons in a soil survey boundary layer to project to a specified coordinate system. The appropriate datum transformation for the specified geographic region is automatically determined based on the ‘Geographic Region’ selected.

## gSSURGO Tools



The ‘**Create gSSURGO Tools**’ allows the user to convert the downloaded SSURGO dataset (shapefiles and Microsoft Access Template database) to the new gSSURGO format.

It is important that each SSURGO download maintains the original SSURGO naming convention (with AREASYMBOL) for the gSSURGO tools to operate properly. The ‘**Create gSSURGO Database**’ tool creates a new file geodatabase from the individual feature classes and merges into a new soil feature class. The attribute tables will be merged also. The output coordinate system of the datasets will be an appropriate Albers Equal Area projection and datum that adhere to the gSSURGO standard. The output coordinate system of the gSSURGO dataset is defined by the XML workspace document and the datum transformation set by the ArcTool:

* Lower 48 states – USA Contiguous Albers Equal Area Conic USGS, NAD 1983, using the WGS\_1984\_(ITRF00)\_To\_NAD\_1983 transformation.
* Hawaii and American Samoa – Hawaii Albers Equal Area Conic, WGS 1984.
* Alaska – Alaska Albers Equal Area Conic, WGS 1984 using the.
* Puerto Rico and U.S. Virgin Islands - USA Contiguous Albers Equal Area Conic USGS, NAD 1983, using the WGS\_1984\_(ITRF00)\_To\_NAD\_1983 transformation.
* Pacific Islands – Western Pacific Albers Equal Area Conic, WGS 1984.

The ‘**Create gSSURGO Raster**’ tool is designed to create a raster version of the soil map unit polygon feature class in the gSSURGO file geodatabase. The tool looks for the standard gSSURGO ‘MUPOLYGON’ feature class within the specified geodatabase.

Usually the snap raster option is only required when the output raster needs to align with raster data other than the default USGS NLCD or NASS Cropland data. The tool will automatically align the output grid to the USGS NLCD if a snap raster is not selected.

The output raster can be set to 5, 10, 30, or 90 meter resolution and still maintain alignment with the default snap raster.

Each tool includes built-in help available on the right side of the tool dialog box. It is recommended that these tools run in foreground mode. Users have the option of downloading spatial-only or all surveys.

# Installation - SSURGO Download Toolbox

The SSURGO Download Tools are provided as a zipped collection of:

* Python scripts (.py)
* ArcGIS 10.1 Toolbox file (.tbx)
* XML Workspace Documents (.xml)
* soildb\_US\_2003\_BatchImport database (.mdb)

Copy the zip file to the ArcGIS 10.X custom tools folder. This is normally a folder named MyToolboxes’ e.g., *C:\Users\<your login>\AppData\Roaming\ESRI\Desktop10.X\ArcToolbox\My Toolboxes*.

Unzip the file to the current folder: ‘ My Toolboxes’.

Copy the **soildb\_US\_2003\_BatchImport.mdb** file to a new folder location where it can be easily found for future use. The download tools will ask for the location of this SSURGO Template database when importing the tabular data.

## Processing Strategies

Downloading SSURGO data and using these tools to create gSSURGO or other new datasets can consume a lot of time and computer resources. The following are steps that can be taken to increase the odds for a successful creation of the gSSURGO dataset:

1. A properly configured computer
   1. Windows 7 64-bit operating system
   2. ArcGIS 10.1 or 10.2 with all updates
   3. At least 12 GB of RAM, 16 or even 24 would be better
   4. Plenty of fast, local disk space. Raid 5 or 10 using 10k or 15k SAS drives works well
   5. External, USB drives aren’t usually recommended for geoprocessing
   6. Maintain plenty of free disk space for data and temp files
   7. For ArcGIS, get the CPU with the fastest clock speed that can be afforded. A CPU with a few fast cores is better than several slow ones
   8. Spread the load, setup TEMP and a scratchworkspace on one drive, output data on another drive
   9. When a job is complete, backup the results to another location
   10. Verify that the output folder and its subfolders are set as Trusted Locations in Microsoft Access or the import macro will hang when importing tabular data
   11. Always leave the geoprocessing window in the foreground and uncheck the option to ‘Close this dialog when completed successfully’. The user should always read the resulting messages to make sure the process completed without warnings or errors.
2. Set the geoprocessing environment to use a file geodatabase for the scratchworkspace
   1. When large geoprocessing tasks are being performed, close all other applications. This especially applies to other ArcGIS applications and Microsoft Outlook, PowerPoint, or LiveMeeting. Having other ArcGIS sessions open can cause file-locking issues.
   2. It’s a good idea to occasionally clean out the scratch.gdb database and compact it
3. Let big jobs process overnight or on the weekend
   1. Keep the geoprocessing tool window open to track progress and read error messages. If the process is running in the background it is harder to tell if a process is hung up.
   2. Sometimes a process will hang up with the error message hidden in the background
   3. If repeated failures occur, reboot the system and then double-check the scratchworkspace setting in the geoprocessing environment.
4. The tools are hard-coded to download SSURGO using a URL similar to the following: [http://websoilsurvey.sc.egov.usda.gov/DSD/Download/Cache/SSA/wss\_SSA\_AL003\_soildb\_US\_2003\_[2006-07-18].zip](http://websoilsurvey.sc.egov.usda.gov/DSD/Download/Cache/SSA/wss_SSA_AL003_soildb_US_2003_%5b2006-07-18%5d.zip).

# Important gSSURGO Concepts

* The entire process is driven by the AREASYMBOL (soil survey id). SSURGO datasets, including the shapefiles and the Microsoft Access databases, all incorporate the AREASYMBOL value of the data they contain. Any deviation from the standard naming convention such as renaming folders or shapefiles will adversely disrupt the gSSURGO process.
* The SSURGO download process will **not** need repeated unless new data are available on Web Soil Survey or if the data structure changes.
* Administrative boundary clipping, e.g., state boundaries is not involved.
* All gSSURGO products have the same database structure with differences arising due to geographic extent and soil survey area data content.
* gSSURGO databases can be created for any desired area by manually selecting the boundary polygons in the survey status map layer and activating the appropriate ArcToolbox tool. Currently the tools are limited to creating databases in the Albers Equal Area projection appropriate to the geographic region.

# Introduction to State Tiling Process

The following instructions are designed to assist the user in creating a state-tiled gSSURGO database, using the state of Delaware as an example.

## Creating New Folders for State-Tiling

Identify a single, local folder to store all of the required Web Soil Survey downloads. This step usually is required only once, unless the user decides to create a new archive for each fiscal year.

**Note:** Ensure that at least 85 GB of disk space is available on drive.

Create a local folder for the gSSURGO archival year, e.g., gSSURGO14.

Within this new folder, create a second folder for the downloaded data, e.g.,

SSURGO-Downloads14.

## Set Trusted Locations in Microsoft Access

In order to allow macro execution to automatically import SSURGO tabular data, the folder created in the previous section is required to be under a Microsoft Access Trusted Location.

Open Microsoft Access.

Click the File tab.

Click Options.

Select Trust Center and then Trust Center Settings…

In the Trust Center dialog box, select Trusted Locations.

Select add new location…

Set Path: to the SSURGO-Downloads14 archival year folder created earlier.

Ensure the Subfolders of this location option is also checked.

Click OK and Exit Microsoft Access.

## Download SSURGO Status Map Shapefile

Open Internet Explorer and access Web Soil Survey at:

<http://websoilsurvey.sc.egov.usda.gov>.

 Click on **Start WSS.**

Select **Soil Survey Status.**

Select **Shapefile (zipped).**

At the bottom of the window click the **Save** down arrow and click on **Save as.**

Download to the **gSSURGO14** folder location and use Winzip to extract the

contents (soilsa\_a\_nrcs.shp) to the same location.

## Start ArcMap 10.X and Add SSURGO Download Toolbox

Start ArcMap with a new untitled map.

Select Add Data…

Add the soilsa\_a\_nrcs.shp file.

Retrieve SSURGO\_Download\_tools\_2014\_01\_21 tools from Sharepoint site (Additional clarification/steps needed here)

Open ArcToolbox .

Right click in the ArcToolbox dialog box and select Add Toolbox…

Navigate to Toolboxes\My Tooboxes and add the SSURGO Download Toolbox.

# Download SSURGO by AREASYMBOL

Double-click the **Download SSURGO by Areasymbol** tool.

Set **Search by Areasymbol** to the two letter state abbreviation, e.g., **DE**, set

Output Folder to **SSURGO-Downloads** and check the soil survey areas listed under **Soil Surveys using the Select All button**.

Set Master Database to **soildb\_US\_2003\_BatchImport.mdb**.

Click **OK**.

Messages will be displayed at each step of the download process.

**NOTE:** If a local copy of a survey already exists in the output folder, the survey dates will be compared. If the Web Soil Survey version is more recent, the local copy will be overwritten. It is recommended that users maintain their SSURGO downloads as a type of data archive.

Click **Close** in the Geoprocessing dialog box once the download tool has completed.

**NOTE:** Create or select a folder to contain the new gSSURGO databases. Performance may be enhanced if the input folder containing the download SSURGO is on a different drive than the location where the output gSSURGO will be created.

## Download SSURGO by Map

## Download SSURGO by Survey Name

# Create gSSURGO - State-Tiled

The **Create** **gSSURGO – State Tiled** tool initially merges the spatial layers and then merges the tabular data. Each table is listed as it is imported from the Access database.

Select the **Create gSSURGO – State Tiled** tool.

Set the **SSURGO Downloads** field to the location where the SSURGO downloads have been stored, the **Output Folder** to where the new gSSURGO is to be stored and check the box next to each State that will be converted to gSSURGO.

Check the boxes for **Overwrite output** and **Require All Data**.

Select **OK**

**NOTE:**  Some state tiles include surveys crossing state boundaries. The Create gSSURGO-State Tiled tool uses the LAOVERLAP table to include and identify overlapping surveys. An example of this occurs for survey TN640, whichfollowing the state tiling process, is present in both the TN and NC geodatabases.

Upon completion, all successfully imported surveys will be listed. Any errors that incur will be shown in red type.

Select the **Close** button in the Geoprocessing tool dialog box.

## Create gSSURGO - Custom Tiled

## Create gSSURGO Database

# Create gSSURGO Raster

Select the **Create gSSURGO Raster** tool.

Set the **Input Geodatabase** field to the location of the newly created state

geodatabase. If gaps between survey areas exist, ensure that the **Fill Gaps** option is checked.

**NOTE:** Although selecting the option may result in a performance penalty for raster development, it is useful for preventing ‘NoData’ inclusions from occurring along survey boundaries.

Select **OK**.

After the gSSURGO raster generation process has completed, select **Close**.

## Create gSSURGO Raster – Batch

# Check gSSURGO

# Creating gSSURGO CONUS

I have this written up somewhere in some document already. Now go find it!

Both the CONUS and PAC Basin gSSURGO will be created using the ‘Create gSSURGO by Map’ tool. The user will manually select which survey areas to include in the output geodatabase.

1. Download all available surveys (both spatial and tabular-only)
2. In ArcMap, add the soilsa\_a\_nrcs shapefile to the display
3. Using the Select Feature tool, highlight all of the soil survey boundary polygons in the lower forty-eight states. Make sure that the single survey for Mexico is not selected. Use shift-click to unselect it.
4. Enter ‘CONUS’ in the Featureclass Identifier field
5. Run the **Create gSSURGO by Map tool**

# Citing gSSURGO Data

It is a good scientific practice to cite all the data sources and methods used to conduct the assessment or research study. A section on methods and materials commonly cites other literature sources, which are listed in a reference section.

These gSSURGO and National Value Added Look Up (valu) Table data are anticipated to be released on an annual basis using a Soil Data Mart database snapshot source taken in October (the start of the Federal fiscal year). The metadata (Description tab in ArcCatalog®) provides information about the source date for the gSSURGO product.

The USDA Natural Resources Conservation Service recommends the following citations be used in internal and published documents that describe assessments and studies which used the Gridded SSURGO (gSSURGO) data product and the National Value Added Look Up (valu) Table Database.

## The Citation for gSSURGO

### State Tile

Soil Survey Staff. Gridded Soil Survey Geographic (gSSURGO) Database for *State name*. United States Department of Agriculture, Natural Resources Conservation Service. Available online at <http://datagateway.nrcs.usda.gov/>. *month, day, year* (FY*year* official release).

### Conterminous US Tile

Soil Survey Staff. Gridded Soil Survey Geographic (gSSURGO) Database for the Conterminous United States. United States Department of Agriculture, Natural Resources Conservation Service. Available online at <http://datagateway.nrcs.usda.gov/>. *month, day, year* (FY*year* official release).

### National Collection of Tiles

Soil Survey Staff. Gridded Soil Survey Geographic (gSSURGO) Database for the United States of America and the Territories, Commonwealths, and Island Nations served by the USDA-NRCS. United States Department of Agriculture, Natural Resources Conservation Service. Available online at <http://datagateway.nrcs.usda.gov/>. *month, day, year* (FY*year* official release).

## The Citation for the National Value Added Look Up (valu) Table Database

Soil Survey Staff. National Value Added Look Up (valu) Table Databasefor the Gridded Soil Survey Geographic (gSSURGO) Database for the United States of America and the Territories, Commonwealths, and Island Nations served by the USDA-NRCS. United States Department of Agriculture, Natural Resources Conservation Service. Available online at <http://datagateway.nrcs.usda.gov/>. *month, day, year* (FY*year* official release).

## Citation Examples

The following examples are for the FY2014 gSSURGO dataset for the State of West Virginia. Such citations should appear in the reference section of your document.

### State Tile

*Soil Survey Staff. The Gridded Soil Survey Geographic (SSURGO) Database for West Virginia. United States Department of Agriculture, Natural Resources Conservation Service. Available online at <http://datagateway.nrcs.usda.gov/>. January 15, 2014 (FY2014 official release).*

### Conterminous US Tile

*Soil Survey Staff. Gridded Soil Survey Geographic (gSSURGO) Database for the Conterminous United States. United States Department of Agriculture, Natural Resources Conservation Service. Available online at* [*http://datagateway.nrcs.usda.gov/*](http://datagateway.nrcs.usda.gov/)*. January 15, 2014 (FY2014 official release).*

### National Collection of Tiles

*Soil Survey Staff. Gridded Soil Survey Geographic (gSSURGO) Database for the United States of America and the Territories, Commonwealths, and Island Nations served by the USDA-NRCS. United States Department of Agriculture, Natural Resources Conservation Service. Available online at* [*http://datagateway.nrcs.usda.gov/*](http://datagateway.nrcs.usda.gov/)*. January 15, 2014 (FY2014 official release).*

The following example is for the National Value Added Look Up (valu) Table Database. Such citations should appear in the reference section of your document.

### National Value Added Look Up (valu) Table Database

*Soil Survey Staff. National Value Added Look Up (valu) Table Database for the Gridded Soil Survey Geographic (gSSURGO) Database for the United States of America and the Territories, Commonwealths, and Island Nations served by the USDA-NRCS. United States Department of Agriculture, Natural Resources Conservation Service. Available online at* [*http://datagateway.nrcs.usda.gov/*](http://datagateway.nrcs.usda.gov/)*. January 15, 2014 (FY2014 official release).*

See [<http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/survey/geo/?cid=nrcs142p2_053368>](http://soils.usda.gov/citations.html) for recommended citations for other data provided by the USDA Natural Resources Conservation Service and the National Cooperative Soil Survey.

# Acronyms

aws0150wta Available Water Storage Weighted Average

C Carbon

CDL Cropland Data Layer

CLU Common Land Unit

cm centimeter

cogeomordesc Component Geomorphic Description table

CONUS Conterminous United States

dS decisiemens

ES(D) Ecological Site (Description)

ESRI® Environmental Systems Research Institue, Inc.

FY Federal Fiscal Year (begins October 1 of each year)

Geomfname Geomorphometry Name column in the cogeomordesc table

gSSURGO Gridded Soil Survey Geographic Database

Hydgrpdcd Hydrologic Group, Dominant Condition column in muaggatt table

muaggatt Map Unit Aggregate Attribute Table

MRLC Multi Resolution Land Characteristics

m meter

mm millimeter

mukey Map Unit Key

mupolygon Map Unit Polygon

musym Map Unit Symbol

muname Map Unit Name

NCSS National Cooperative Soil Survey

NED NationalElevationDatabase

NGCE National Geospatial Center of Excellence

NLCD National Land Cover Database

NRCS Natural Resource Conservation Service

NRI National Resources Inventory

sq square

SQL Standard Query Language

SSURGO Soil Survey Geographic Database

USDA United States Department of Agriculture

USGS United States Geological Survey

VALU Value Added Look Up Table

# References

Dobos, Robert R., H. Raymond Sinclair, Jr., and Michael P. Robotham. 2012. National commodity crop productivity index (NCCPI) user guide, Version 2. United States Department of Agriculture, Natural Resources Conservation Service, Lincoln, Nebraska.