**Soil Hydraulic Properties**

Knowledge of Soil Hydraulic properties is important for simulation of water movement (infiltration, conductivity, storage and plant-water relationships) using different physical equations. Water movement in soil occurs under saturated or unsaturated conditions through pores present in soil mass. Hydraulic properties can be obtained from direct laboratory and field measurements. However, those techniques are limited in terms of time consumption and economy. Pedotransfer Functions can be determined from existing soil database of soil hydraulic data and further used to obtain required properties based on existing soil texture. For this purpose, in addition to regression analysis, new techniques like, artificial neural networks, classification and regression tress are increasingly being used.

Soil Texture

Soil Texture is used to describe the relative proportion of different grain sizes of mineral particle present in a soil. Soil separates are typically used for this purpose, which involves grouping of different soil particles according to their particle size (i.e. Sand, Silt, and Clay). Sand are the largest particles and they feel gritty. Silt are medium sized and they feel soft or silky. Clay are the smallest sized particles and they feel sticky. As per USDA convention particles of size, 2.00 to 0.05 mm are Sand separates, 0.05 to 0.002 mm are Silt separates, and those less than 0.002 mm are Clay separates. It is suggested that you read more about Pedotransfer functions in general.
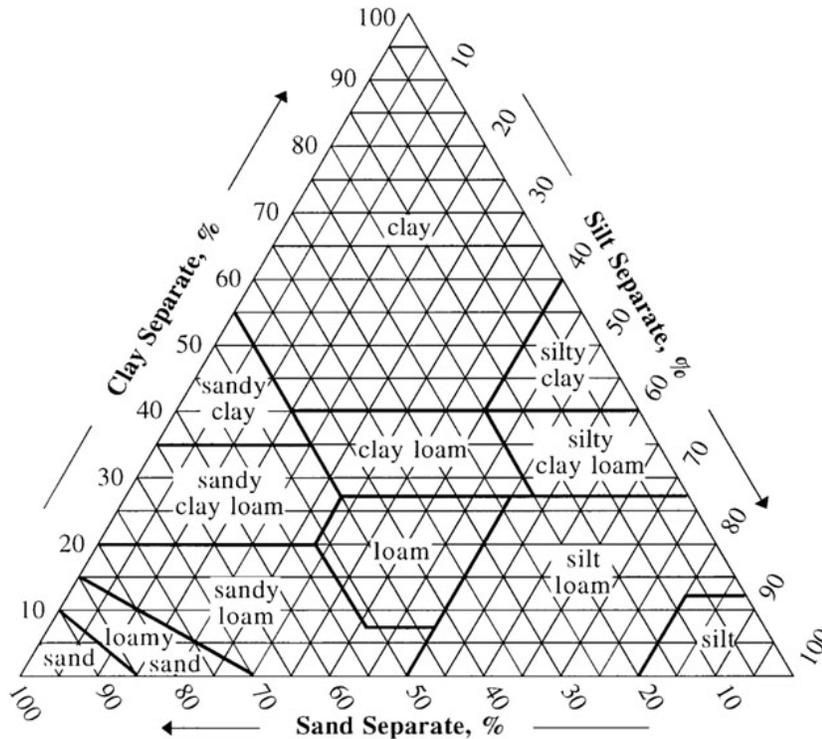
Obtaining Soil Texture

Recall from previous assignment involving downloading soil texture classification from Soil Survey Geographic (SSURGO) database from the Natural Resources Conservation Services data gateway. Here, we will extend that portion of assignment to include related table, which contains information regarding the textural data for each soil classification. Repeat the same step by downloading the data for One County of your interest by using "Quick County(s)" tool.

Quick County
Quick County(s)
Quick State
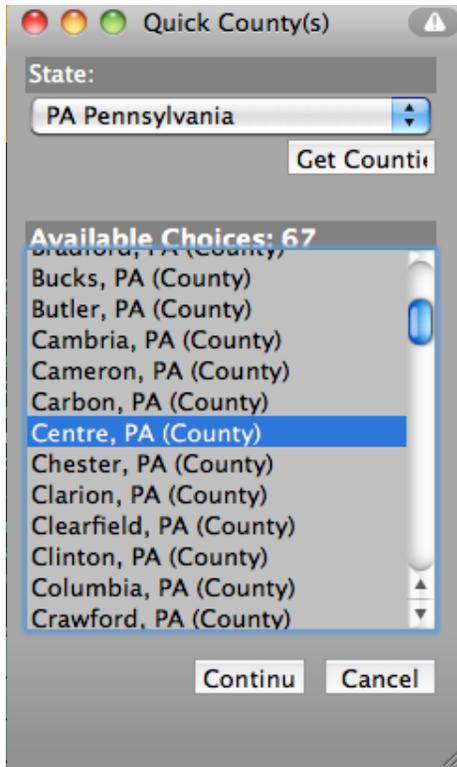
You will need to select "Soil Survey Spatial and Tabular Data (SSURGO) for the product you want to download.
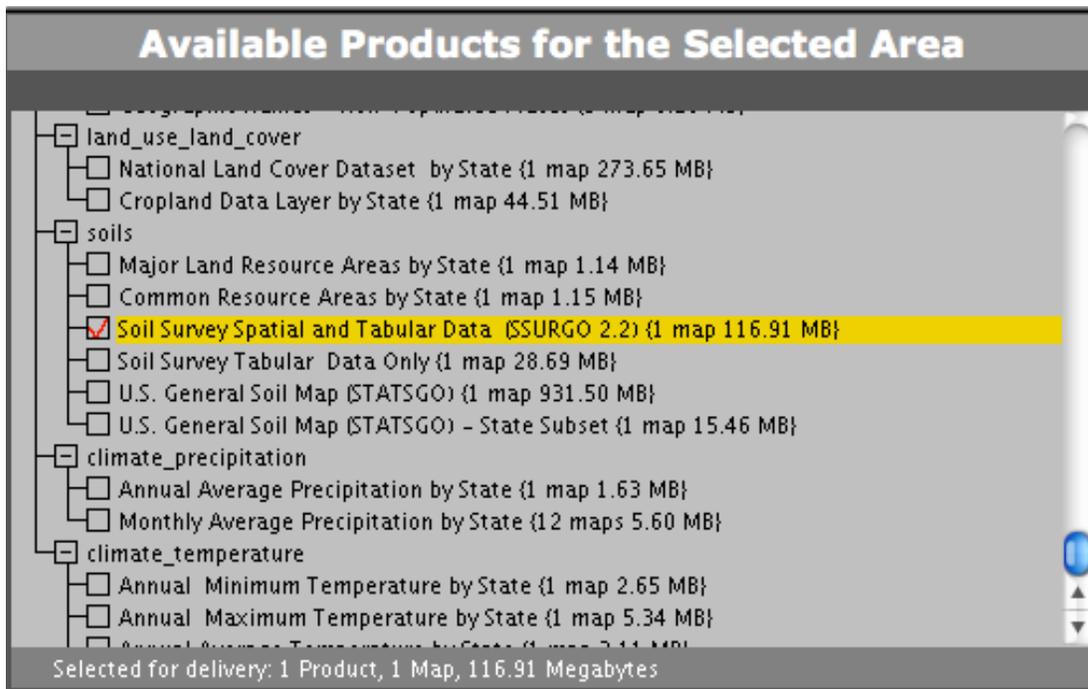
You may leave the data formation selection as default or choose UTM.

Submit your request for download using FTP. If you done this so far already you may skip data download and follow next step and onwards. Don't forget to Click Press Order button in order to submit your request.

When your product is available and you have completed the download extract the folder from the zip file. You should see folder named "spatial" and "tabular" folder. You can load shape files present in spatial folder to qgis viewer using Add Vector Layer tool. The shape file of interest is the one with prefix "soilmu_a_". If you open the attribute table for this shapefile you should be able to see MUKEY as one of the column, which represents the soil classification.

In order to get hydraulic properties for each soil type, we need to obtain sand, silt and clay percentages. These data for each soil type is available in tabular folder. Tabular data is provided as a set of ASCII delimited files. Each file corresponds to table in the SSURGO 2.2 data model. The tabular data isn't particularly useful until it has been imported into an MS Access SSURGO template database. The template database can be downloaded from the following link:

http://soildatamart.nrcs.usda.gov/templates.aspx

State	MS Access Version	Template DB Version	Template DB Name	Size
US	Access 2002	33.1	soildb_US_2002	1.7M
US	Access 2002	33.1	soildb_NPS_2002	2.5M
US	Access 2000	33.1	soildb_US_2002	1.7M
US	Access 97	32	soildb_US_97	1.4M
AK	Access 2002	32.15	soildb_AK_2002	2.5M
CA	Access 2002	33.2	soildb_CA_2003	1.8M
CA	Access 2000	33.2	soildb_CA_2000	1.8M
CA	Access 2002	32.1	soildb_CA_2002	1.8M
CT	Access 2002	32.1	soildb_CT_2002	1.8M
DC	Access 2002	31	soildb_DC_2002	1.7M
DE	Access 2002	31	soildb_DE_2002	1.7M
GA	Access 2002	32	soildb_GA_2002	1.8M
GA	Access 2002	31	soildb_GA_2002	1.5M
GA	Access 97	31	soildb_GA_97	1.3M
ID	Access 2002	33.3	soildb_ID_2003	1.9M
ID	Access 2000	33.3	soildb_ID_2000	1.9M

Description: This is the national SSURGO Template Database for Microsoft Access 2002/2003. This database should be used only when no state specific customized SSURGO Template Database is available. This database is compatible with Soil Data Viewer 5.1.

8-1-07 Three irrigation reports were added for use with 7 new national irrigation rules.
Irrigation - General and Sprinkler
Irrigation - Micro
Irrigation - Surface

Download

After download, extract the database template (.mdb). For information about importing tabular data into a template database, or information about the capabilities of the template database in general, do the following:

1. Open the MS Access SSURGO template database in the appropriate version of MS Access.

2. Click the Reports tab of the Database Window. The Database Window may be behind a form titled "SSURGO Import" or "Soil Reports".

3. Either double-click the report titled "How to Understand and Use this Database", or select this report and then click "Preview".

Next step is to import the tabular data you have downloaded. When you open the database file you will be presented with a dialog like shown below. You will need to provide the full path where tabular text files are located (You must include the folder name "tabular" in the full path). When you press enter Access will import all the data to the template. Sand, Silt, Clay percentages are available in "CHORIZON" table. **You will need to obtain depth average of "representative" percentages. Arrange the data in following TEXT file format:**

One line description about the file				
MUKEY 1	SILT %	CLAY %	ORGANIC MATTER %	BULK DENSITY gram/cm^3
MUKEY 2	SILT %	CLAY %	ORGANIC MATTER %	BULK DENSITY gram/cm^3
…	…	…	…	…

If Organic Matter and Bulk Density data are not available provide -9,99

Use **DataModel Loader >> Generate SoilFile** using PIHMgis **v2.2** to obtain respective soil hydraulic properties.

in.txt

MUKEY	SILT	CLAY	OM	BD
1	42.67	23.16	-9.99	-9.99

out.soil

1
1   0.32002   0.466549   0.01   0.1   0.0357146   1.18009   0.01   32.002

.soil File Format

NumberOfSoilTypes								
Soil ID	Hydraulic Conductivity (m/day)	Porosity	Residual Porosity	Infiltration depth	Alpha-Van Genechten	Beta-Van Genechten	Macropore Area Fraction	Macropore Hydraulic Conductivity
…	…	…	…	…	…	…	…	…
…	…	…	…	…	…	…	…	…