Soil Data Assignment

Purpose: To add soil data to the St Paul Campus GIS

Result: Soil data that includes information on relative water holding capacity, which we'll use to scale runoff generation

Note: The lecture slides for this week posted on the class website show figures of some of the steps, and may be helpful to some of you in processing the soils data.

The Natural Resources Conservation Service (NRCS) is responsible for national soil data development. They've conducted a series of soil inventories that have mapped soil patches to series and slope/terrain condition, and call each of these a "map unit." It is the name they give to areas with a more or less consistent set of measured properties. They refer to a standard "map unit symbol" and other variables to specify the set of properties that a particular patch of soil exhibits, and they've organized a set of tables for the scads of variables they've measured for each type of map unit.

The NRCS has created a web application (http://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm) that allows users to download the polygon boundaries of each mapped unit, and to select the tables or table attributes for download. You don't have to use the application, just know it exists, and we used it as a source for the data we provide. The database is a bit complex for newcomers, we'll give you instructions on how to use data we've already downloaded to map the relative ability of soils to store runoff. We admit that this is a very crude, and probably quantitatively incorrect measure of infiltration, but it is a reasonable approximation, given the time constraints and our teaching goals.

The downloaded files are in the Data\Soils directory on our L drive, under spatial and tabular subdirectories.

Find the ***soilmu_a_aoi*** in the spatial subdirectory, and display it in ArcGIS. This should be a set of polygons depicting soil mapping units for the St. Paul Campus.

Load the \Soils\tabular***muaggatt*** tables from the \tabular subdirectory into ArcGIS. This is a text file, and looks something like the figure at right when you view it in a text editor like notebook on a PC or textedit on a Mac.

The column sequence in this text file corresponds to the order of description in the muaggatt _table_description.pdf found in the Data\Soils directory. This describes each column, and contents.

```
"155D"|"Chetek sandy loam, 12 to 25 percent slopes"||16|16||||"None"|"None"|"0"|3.3|6.22|
7.72|9.22|"Somewhat excessively drained"|"Somewhat excessively drained"|"A"||100|"6"|
90|"Very limited"|"Very limited"|"Not rated"|"Very limited"|"Very limited"|"Not
rated"|"Very limited"|"Very limited"|"Very limited"|"Very limited"|"Fair"|"Not
rated"|"Somewhat limited"|0.02|"Severe"|"0"|1|"1677202"
"411"|"Waukegan silt loam, 0 to 2 percent slopes"||1|1||||"None"|"None"|"0"|5.75|11|14.48|
15.98|"Well drained"|"Well drained"|"B"||100|"2"|90|"Not limited"|"Not limited"|"Not
limited"|"Not rated"|"Very limited"|"Not rated"|"Very limited"|"Very limited"|"Very
limited"|"Not limited"|"Fair"|"Not rated"|"Somewhat limited"|0.013|"Slight"|"0"|
1|"1677243"
"411B"|"Waukegan silt loam, 2 to 6 percent slopes"||3|3||||"None"|"None"|"0"|5.75|11|
14.48|15.98|"Well drained"|"Well drained"|"B"||100|"2"|90|"Not limited"|"Not limited"|"Not
limited"|"Not rated"|"Very limited"|"Not rated"|"Very limited"|"Very limited"|"Very
limited"|"Not limited"|"Fair"|"Not rated"|"Somewhat limited"|0.013|"Moderate"|"0"|
1|"1677244"
"857"|"Urban land-Waukegan complex, 0 to 3 percent slopes"||1|1||||"None"|"None"|"0"|5.75|
11|14.48|15.98||"Well drained"|||100||65|"Not rated"|"Not rated"|"Not limited"|"Not
rated"|"Not rated"|"Not rated"|"Very limited"|"Not rated"|"Not rated"|"Not rated"|"Not
rated"|"Not rated"|"Not rated"|0.013|"Not rated"|"0"|1|"1677277"
"857C"|"Urban land-Waukegan complex, 3 to 15 percent slopes"||6|6||||"None"|"None"|"0"|
5.75|11|14.48|15.98||"Well drained"|||100||65|"Not rated"|"Not rated"|"Not limited"|"Not
rated"|"Not rated"|"Not rated"|"Very limited"|"Not rated"|"Not rated"|"Not rated"|"Not
rated"|"Not rated"|"Not rated"|0.013|"Not rated"|"0"|1|"1677278"
"858"|"Urban land-Chetek complex, 0 to 3 percent slopes"||2|2||||"None"|"None"|"0"|3.05|
5.8|7.38|8.88||"Somewhat excessively drained"|||100||65|"Not rated"|"Not rated"|"Not
limited"|"Not rated"|"Not rated"|"Not rated"|"Very limited"|"Not rated"|"Not rated"|"Not
rated"|"Not rated"|"Not rated"|"Not rated"|0.001|"Not rated"|"0"|1|"1677279"
"858C"|"Urban land-Chetek complex, 3 to 15 percent slopes"||6|6||||"None"|"None"|"0"|3.05|
5.48|6.98|8.48||"Somewhat excessively drained"|||100||65|"Not rated"|"Not rated"|"Not
limited"|"Not rated"|"Not rated"|"Not rated"|"Very limited"|"Not rated"|"Not
```

ArcGIS allows you to load a text file as a table, but in this case it often doesn't interpret the columns correctly, and you are left with missing or mixed columns. It has trouble interpreting the text values and placing breaks correctly.

It is better to open the table in Excel and change the column separators from | to commas, delete uninteresting columns, add names, and save the file as a CSV format.

Use Excel to delete un-needed columns. Keep the last column, it contains musym numbers that are typically seven digits (e.g., 1677202), as you will use this column as a key later when you join tables. Also save the first two columns, and the two columns that contain text like "Somewhat excessively drained."

Add column names, and use "Save As" or something similar in Excel to save this table to a .CSV file.

Add this table to your map/project.

Join the ***soilmu_a_aoi*** table with the ***muaggatt*** table via the *musym* attribute. The attribute is labeled in the polygon shapefile, and you can match it to the last column (the 16xxxxxx number) in the muaggatt table by the values.

You should get something that looks like the table below:

soils_wtab

Field: Add Delete Calculate Selection: Zoom To Switch Clear Delete Copy

C	Shape	A	SF	MUS	Ml	mukeylong	Symbol	Name	D1	D2	mukey	Shape_Length	Shape_Area
1	Polygon	M..	3	857	16...	1677277	857	Urban land-Waukegan complex,...	<Null>	Well drained	<Null>	0.002285	0
2	Polygon	M..	3	858C	16...	1677280	858C	Urban land-Chetek complex, 3 to...	<Null>	Somewhat excessivel...	<Null>	0.007514	0.000002
3	Polygon	M..	3	858C	16...	1677280	858C	Urban land-Chetek complex, 3 to...	<Null>	Somewhat excessivel...	<Null>	0.027079	0.00002
4	Polygon	M..	3	411	16...	1677243	411	Waukegan silt loam, 0 to 2 perce...	Well drained	Well drained	<Null>	0.011255	0.000005
5	Polygon	M..	3	411B	16...	1677244	411B	Waukegan silt loam, 2 to 6 perce...	Well drained	Well drained	<Null>	0.011332	0.000006
6	Polygon	M..	3	1027	16...	1677292	1027	Udorthents, wet substratum	<Null>	<Null>	<Null>	0.0182	0.000008
7	Polygon	M..	3	W	16...	1677306	W	Water	<Null>	<Null>	<Null>	0.003707	0.000001
8	Polygon	M..	3	411B	16...	1677244	411B	Waukegan silt loam, 2 to 6 perce...	Well drained	Well drained	<Null>	0.020576	0.00001
9	Polygon	M..	3	411B	16...	1677244	411B	Waukegan silt loam, 2 to 6 perce...	Well drained	Well drained	<Null>	0.007722	0.000001
10	Polygon	M..	3	861C	16...	1677284	861C	Urban land-Kingsley complex, 3 t...	<Null>	Well drained	<Null>	0.00242	0
11	Polygon	M..	3	155D	16...	1677202	155D	Chetek sandy loam, 12 to 25 perc...	Somewhat excessivel...	Somewhat excessivel...	<Null>	0.00539	0.000001
12	Polygon	M..	3	411	16...	1677243	411	Waukegan silt loam, 0 to 2 perce...	Well drained	Well drained	<Null>	0.056408	0.000066
13	Polygon	M..	3	857C	16...	1677278	857C	Urban land-Waukegan complex,...	<Null>	Well drained	<Null>	0.022348	0.000022
14	Polygon	M..	3	858	16...	1677279	858	Urban land-Chetek complex, 0 to...	<Null>	Somewhat excessivel...	<Null>	0.009658	0.000004
15	Polygon	M..	3	857C	16...	1677278	857C	Urban land-Waukegan complex,...	<Null>	Well drained	<Null>	0.002462	0
16	Polygon	M..	3	857	16...	1677277	857	Urban land-Waukegan complex,...	<Null>	Well drained	<Null>	0.030581	0.000028

Note that this still isn't perfect, in that the drainage columns, D1 and D2 here, still don't have complete information. There are many null values, and we don't know how much maximum water the specific drainage classes absorb.

For our purposes, we'll make the gross generalization that descriptions like "somewhat excessively drained" values give us an index of absorption capacity. Note that column I named D2 in my table is more complete (has fewer blank rows), but still has blank rows. We'll first complete this "almost full column," with values, then use this column to fill another column, with the maximum absorption capacity, in cm, for the soils in our study area.

Note that most of the blank rows in our "nearly complete" column are all identified as urban in other columns, so replace the null values with "urban" to the D2 column when there is "Urban" in the name column (your names may be different, but you should be able to match your columns to the intended columns I describe here).

There is one polygon, labeled "udorthents, wet substratum" in the name column, that is fill on a wetland. Label this, as Poorly drained in the D2 column.

Add a column to your data set to hold the maximum soil absorption values (float or double)

Then assign maximum absorption values, in cm according to:

Excessively or somewhat well drained can absorb the first 5.635 cm of rain reaching the ground, all after that is runoff.

Well drained can absorb the first 1.875 cm of rainfall, all after that is runoff

Urban lands can absorb the first 0.9375 cm of rainfall, all after that is runoff

Poorly drained lands or water absorb the first 0.375 cm of rainfall, all after that is runoff.

If you worked such that your soils data is not in your geodatabase (e.g., on the original shapefile, or another geodatabase), import the layer as a feature class in your project geodatabase.

Name the new soil Feature Data Class **soils_*absorption*** in the geodatabase.

Create a map with your study area boundary, and the soil_absorption layer, symbolized with different colors for the different absorption levels found. Export this map and submit it to the class site.