Python Toolbox for Managing Hydrologic Soil Data

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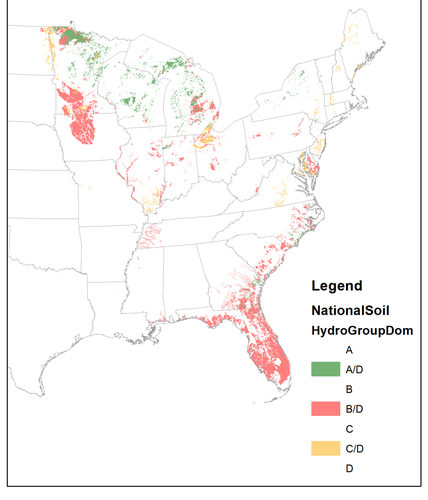
Introduction

As a water runoff crosses different kinds of soil, it collects chemicals from those lands. We've designed a python-based tool that estimates the amount of chemicals that get collected into the water stream. This helps us determine the impact of construction on the water quality of streams in the area.

Now we are creating a python tool to manage the soil data, which is an input to the model.
The hydrologic condition of the soil determines if water infiltrates in, or runs off. The more water that runs off, the more chemistry is transported to the stream, so condition of the soil is a crucial input.

Problem Scope

National STATSGO Soil Map



What Are Hydrologic Soil Groups?

Group A

- sand, loamy sand or sandy loam types of soils;
- **low runoff potential** and **high infiltration rates** even when thoroughly wetted;
- consist of deep, well to excessively drained sands or gravels, have a high rate of water transmission.

Group B

- silt loam or loam;
- **moderate infiltration rate** when thoroughly wetted;
- consists of deep, well drained soils with fine or coarse textures.

Group C

- sandy clay loam;
- low infiltration rates when thoroughly wetted;
- consist chiefly of soils with a layer that impedes downward movement of water and soils with moderately fine structure.

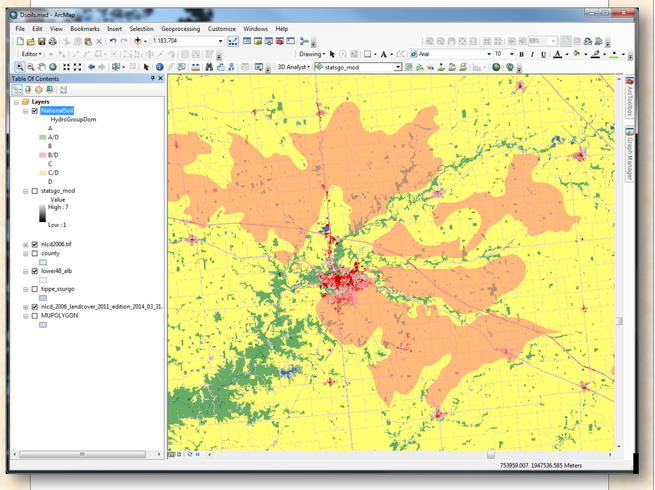
Group D

- clay loam, silty clay loam, sandy clay, silty clay or clay;
- **highest runoff potential**;
- very low infiltration rates when thoroughly wetted; consist chiefly of clay soils with a high swelling potential, soils with a permanent high water table, soils with a claypan or clay layer at or near the surface and shallow soils over nearly impervious material.

Design

A/D or B/C or C/D?

Those series having **two possible classifications** are soils with relatively high water tables so that **artificial drainage** measurably improves their ability to absorb rainfall and thus reduce runoff.
Comparing **soil layer** to **landuse** allows the expression of the **capability**:
High-water table farm fields in the midwest have probably been tile-drained and so now perform as drier component, rather than wetter component.
So, **A/D** is drained to **A** if it is classified as Cropped landuse.



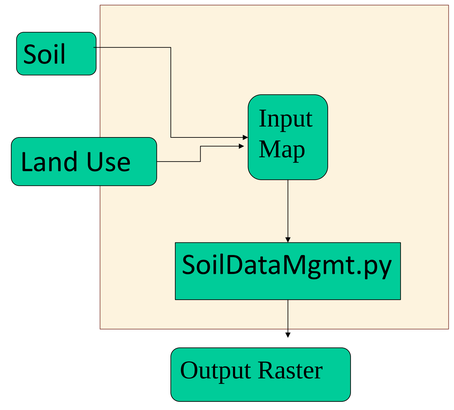
This is a map of variable soils, in Indiana, displayed over the landuse. The yellow is crop land, so most of these orange soils will be tile drained and should be classed as the dry condition “B”, not as “D”.

Implementation

Determining the output based on the matching pixels between layers.

```
# Set local variables

in1 = raw_input("What is the soil file?")                    #ask for the file representing the soil group
while not arcpy.Exists(in1):
    in1 = raw_input("Doesn't exist. What is the soil file?")
in2 = raw_input("What is the landuse?")                      #ask for the file representing the land use
while not arcpy.Exists(in2):
    in2 = raw_input("Doesn't exist. What is the landuse?")
out = raw_input("What is the out raster?")

inRaster1 = Raster(in1) #Raster("soilsrav")
inRaster2 = Raster(in2) #Raster("landusv.tif")

# Check out the ArcGIS Spatial Analyst extension license

arcpy.CheckOutExtension("Spatial")

# Compute the output rasterbased on the itersections of the two innput rasters

outRas = Con(inRaster1 > 4, Con((inRaster2 == 81) & (inRaster2 == 82), (inRaster1 - 4), 4), inRaster1)

# lusemap = [
# [111,100],[112,100],[113,100],[114,100],
# [121,100],[122,100],[123,100],[124,100],
# [181,81],[182,88],[183,91],[184,93],
# [211,39],[212,61],[213,74],[214,80],
# [221,80],[222,87],[223,91],[224,93],
# [2201,54],[2202,70],[2203,80],[2204,85],
# [2211,51],[2212,69],[2213,79],[2214,83],
# [2231,53],[2232,70],[2233,80],[2234,84],
# [2271,46],[2272,65],[2273,77],[2274,82],
# [2281,45],[2282,65],[2283,77],[2284,82],
# [2291,46],[2292,65],[2293,77],[2294,82],
# [231,72],[232,81],[233,87],[234,90],
# [2311,77],[2312,85],[2313,90],[2314,92],
```

A Code Snippet of Soil and Land Use Comparison



Flowchart of the output of the tool

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