Lab 8c: Large woody debris availability for habitat

For the rest of this lab, you will convert the LiDAR data to a variety of hillshades, calculate tree heights, and figure out what the woody debris availability to rivers is.

Due: Sunday 20 November at 11:59 pm

Turn in: The usual for – map(s), letter, and workflow to Blackboard as a single PDF file. Your maps should be addressed to a stream restoration NGO interested in restoring habitat in Plum Creek by the addition of LWD.

Here is a basic overview of what you'll do:

1) Turn your LiDAR LAS datasets into three DEMs: one with the entire point cloud, one for just ground, and one for just trees.
2) Calculate tree heights by subtracting the ground from the trees
3) Figure out how far trees are from the river and whether they are potentially available to the river as large woody debris
4) Analyze all your bits of data
5) Communicate to others

Parts A-D (items 1-4 above): You will be doing this in Python. See the next pages for directions.

Exercise 6

November 2016

By now, you should have explored your LAS dataset, and digitized the banks of Plum Creek. Now you will write a script to process your LAS dataset into a tree heights raster and calculate the number of trees that are potentially available as large woody debris. Here is a basic overview of what your script will do:

1. Create three DEMs from your LiDAR dataset, one with the entire point cloud, one for just the ground, and one for just trees
2. Calculate tree heights by subtracting the ground DEM from the trees
3. Create a raster representing distances from Plum Creek
4. Figure out how far trees are from the river and weather they are tall enough to be available as large woody debris.

First, start out your script by importing the arcpy librarys we will need and checking out the spatial analyst function like so:

```
import arcpy
from arcpy.sa import *
arcpy.CheckOutExtension("Spatial")
```

1 Turn your LiDAR LAS datasets into DEMs

1. Look up the documentation for the LAS dataset to Raster function, the tool you will be using to transform your LiDAR data into a DEM. There are many different optional arguments for this functions, read through them.
2. Before you use this tool in your Python script, first run it in ArcMap to create a DEM for all the LiDAR data. The LAS Dataset to Raster tool uses the current display information for your LAS dataset. So set it to filter all points (it should show everything). Open the LAS Dataset to Raster tool and choose to triangulate points, no point thinning, and set cell size (the sampling value) equal to the point spacing of the LiDAR data (2.5 feet). Run the tool.

3. Look around at your raster. Notice that the Arb ponds look funny. Turn on our LAS dataset again – there were never any points over the ponds or directly over Plum Creek. What does this mean about interpolating elevation data over water bodies?

4. In your script you will need to take two make two DEMs, one for ground points only and one just for trees. However, the tool uses the points that are selected in the filtering preferences of the LiDAR dataset, how can you set that with Python? In the very beginning of the documentation of the LAS Dataset to Raster tool, it tells you that filters can be defined with the Make LAS Dataset Layer tool. Look up the documentation for that tool, and figure out how you can use this tool to just select the certain point categories.

5. In your script you will use the Make LAS Dataset Layer tool to filter your points and then use the resulting layer as an input for the LAS Dataset To Raster tool.

6. When you run the LAS Dataset To Raster tool for the ground points, set `interpolation_type` as `"BINNING AVERAGE LINEAR"`, `sampling_type` as `"CELLSIZE"`, and `sampling_value` as `2.5`.

7. You want your tree heights DEM to have the same cell size and alignment as your ground DEM. To do this you will have to set a snap raster. Look up the documentation for snap raster and set the snap raster to be the ground DEM.

8. When you run the LAS Dataset To Raster tool for the vegetation points, set `interpolation_type` as `"BINNING AVERAGE LINEAR"`, `sampling_type` as `"CELLSIZE"`, and `sampling_value` as `2.5`.

2 Make tree height raster

1. To get a raster representing the tree heights you simply need to subtract the ground DEM from the vegetation DEM. Do this with Map Algebra, in the same way that you made the relief raster.

2. However, the LAS Dataset To Raster tool creates files, before you can use Map Algebra on them you have to make them into ArcPy raster objects with the `Raster` function.

3. Look up the ArcPy raster class to figure out how to do this.

3 Calculating Distances from Plum Creek

1. You will be using the Euclidean Distance tool to create a raster that represents the distance from the banks of Plum Creek. Look up the Euclidean Distance tool to see how it works.

2. You want your output raster to have the same extent and cell size as your minimum tree height raster, so you'll need to set that as your snap raster. Add a line to your script to set the snap raster to be your minimum tree heights raster before you run Euclidean Distance

3. Remember that to be a PLWD, a tree has to be tall enough to reach the channel AND span the channel. Determine an average width for plum creek and use Map Algebra to add the channel width to your Euclidean Distance raster.

4 Determine PLWD

1. What we want to end up with is a raster that has tree heights only if they could be potential large woody debris, or only if tree height is bigger than the minimum height raster you made with Euclidean Distance.

2. You will use Map Algebra to do this as well. The piece of map algebra to use is a conditional statement, or "Con". Look up the documentation for Con.

3. The statement you want to write with Con is
`con(treeheight>minimum_elevation, treeheight)`
(where `treeheight` is the tree height raster and `minimum_elevation` is the minimum tree height raster from 3.

4. Now, run your completed script, and move on to the next part.

Part E: Communicate to others (item 5 on page 1)

Now that you've figured out how much PLWD is available to Plum Creek, you need to determine a way to visualize this and communicate it. You've been asked to do this project by a Non-profit Organization working on restoring Plum Creek aquatic habitat. They want you to provide them with figures for a report on PLWD for Plum Creek.