Using DEM Reconditioning (AGREE) in an Urban Watershed with LIDAR Data

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Abstract

GIS software can automatically delineate watersheds by simulating the flow of virtual rainwater on a Digital Elevation Model (DEM). But if you have access to data that displays the actual locations of streamflow there are several techniques to use this data to better simulate the flow of virtual water. One of these techniques, DEM reconditioning with AGREE, was used to delineate urban watersheds on a LIDAR derived DEM of Tryon Creek, Portland OR. The watershed delineation process takes too long to compute at the 3ft resolution the LIDAR data was collected in, so it was resampled to 30ft for the whole watershed, but a subwatershed within Tryon Creek was examined at the highest possible resolution in order to evaluate AGREEs effectiveness on both large and small scale spatial resolutions. A model was built to automate the 6 steps of the watershed delineation process (fill sinks, calculate flow direction, calculate flow accumulation, identify streams/pour points, link streams, and finally delineate watersheds) and both a control DEM and a reconditioned DEM were fed through on two scales each. The outputs showed that the largest urban interference with the model was from majors roads and that the AGREE method was method was most effective on the higher resolution DEM.

Challenges

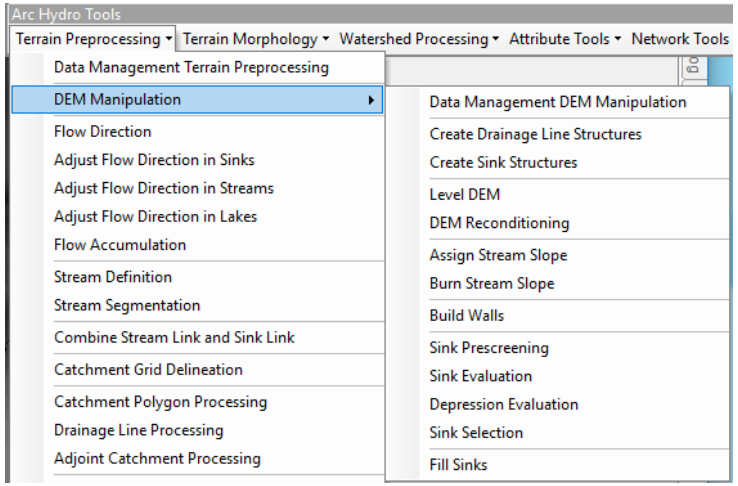
- The LIDAR data was too high resolution to do a flow accumulation on so I had to choose whether to reduce my resolution or my study area, I decided to do both.
- I was hesitant to use a sub-watershed because I didn't know how it should look ahead of time.
- Flow accumulation really doesn't like LIDAR data.

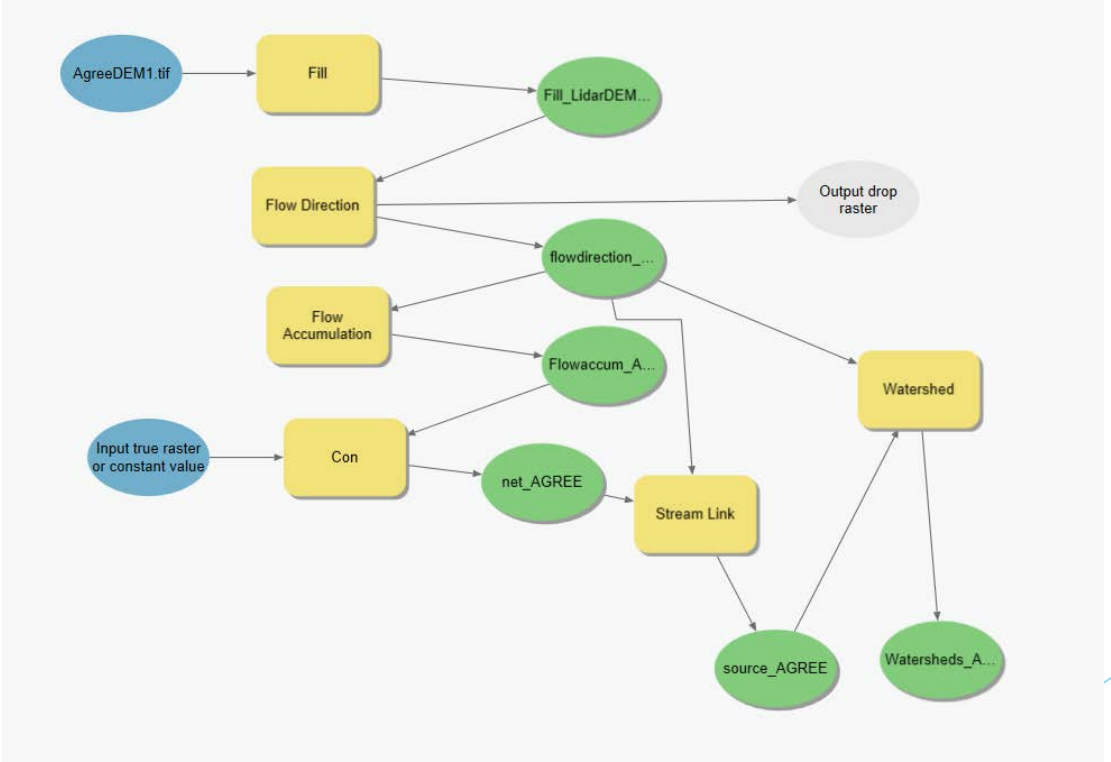
Methods

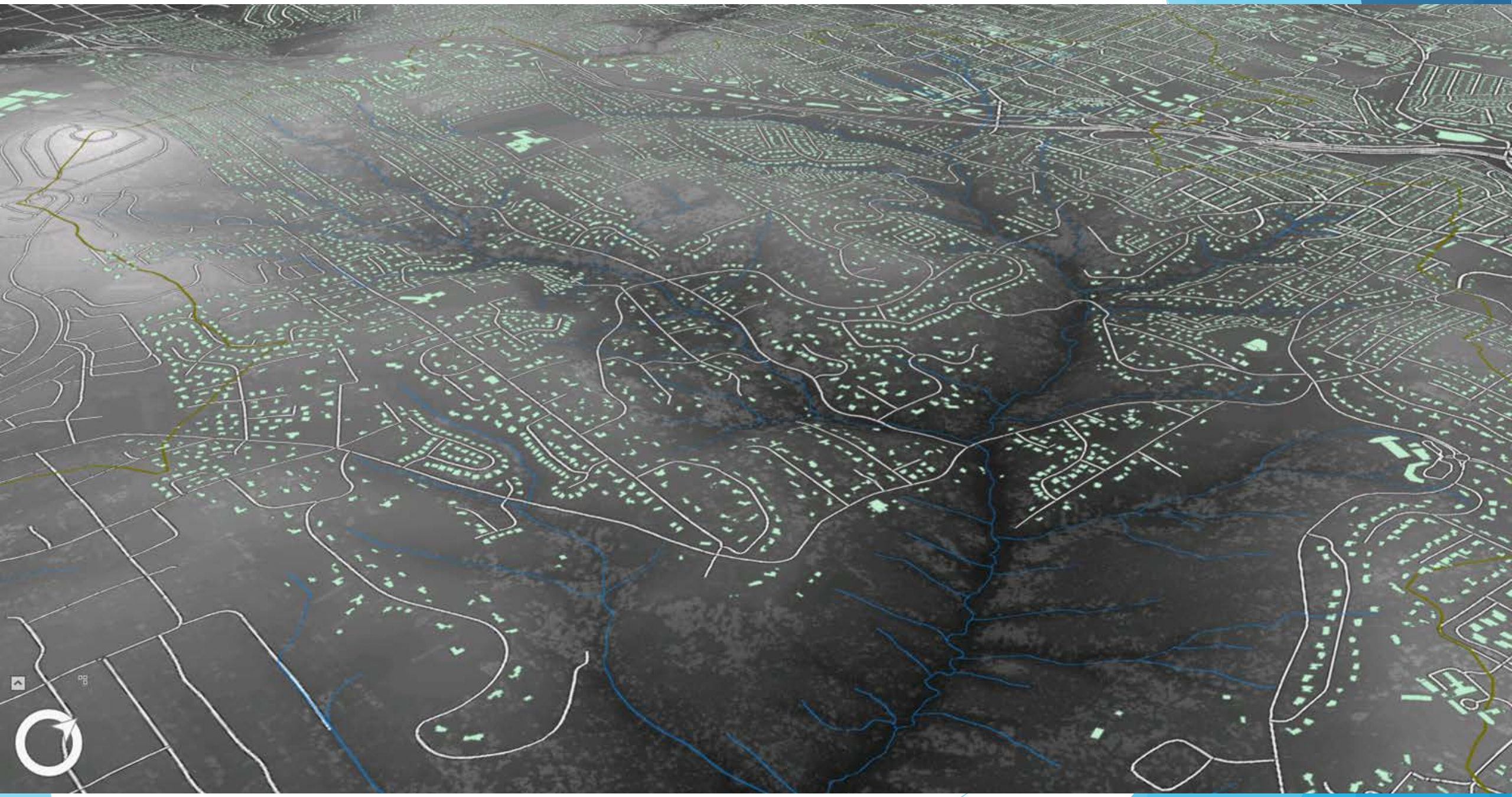
- I Built a model in the model builder to perform the entire watershed delineation process at once.
- I only things I had to change were the input DEMs, the output file names, and the resample if I didn't need it.
- Then I created a series of modified Lidar DEMs to run through the model.

Methods

Arc Hydro Toolset was used for the DEM reconditioning.

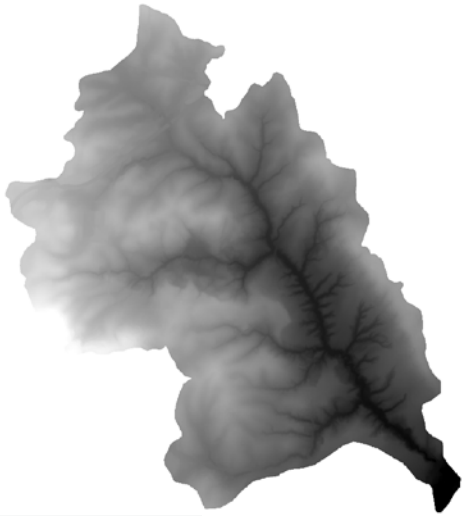


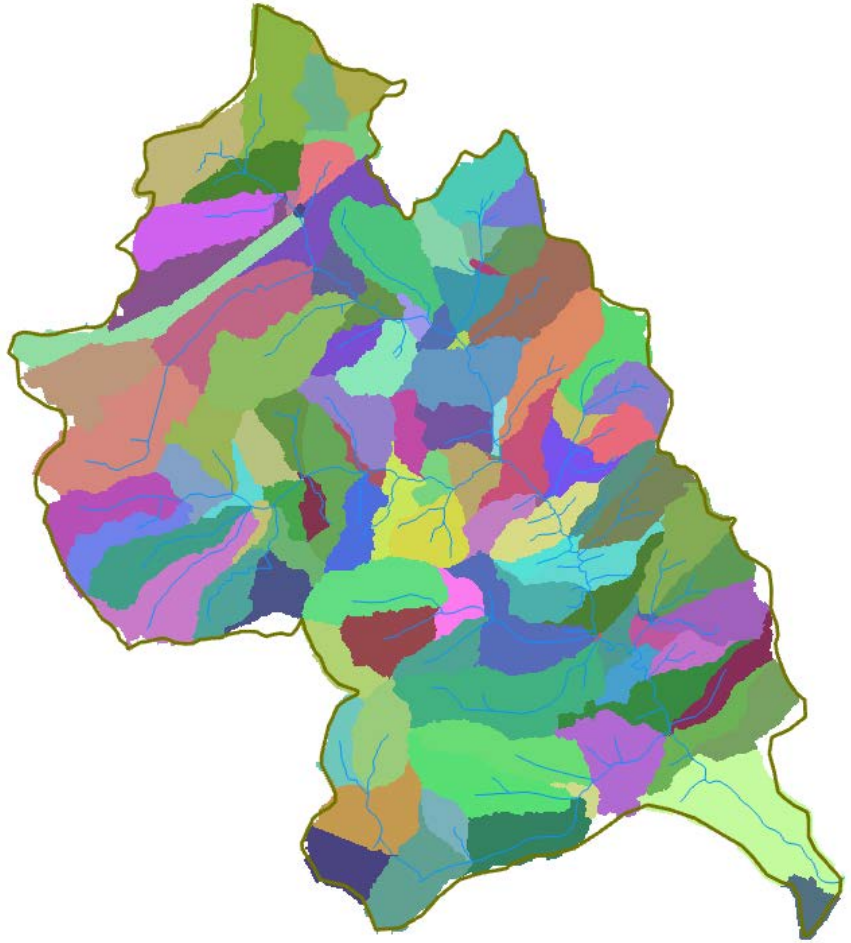




Unassisted automatic delineation

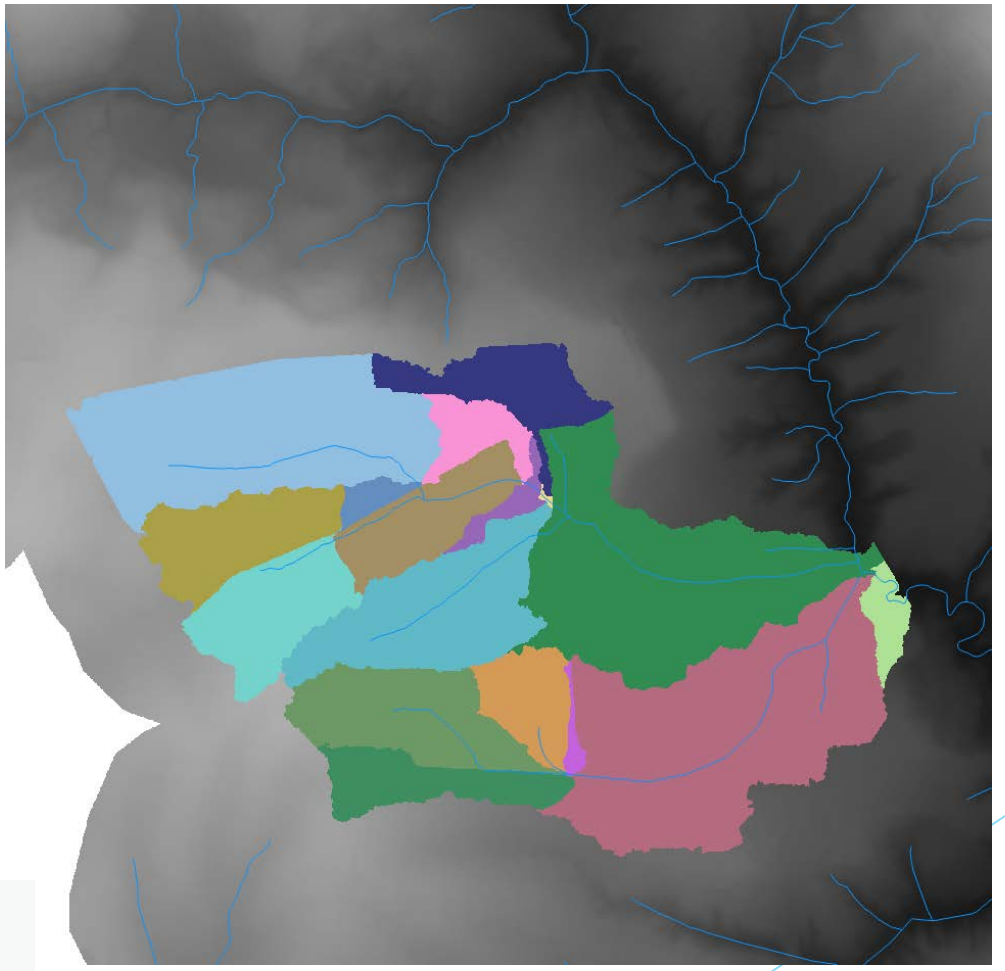
- 112 watersheds

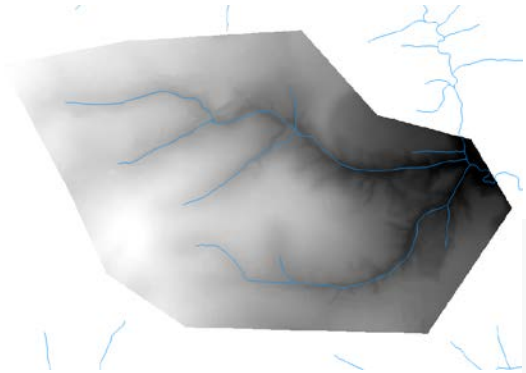




Subwatershed with 3ft LIDAR Resolution

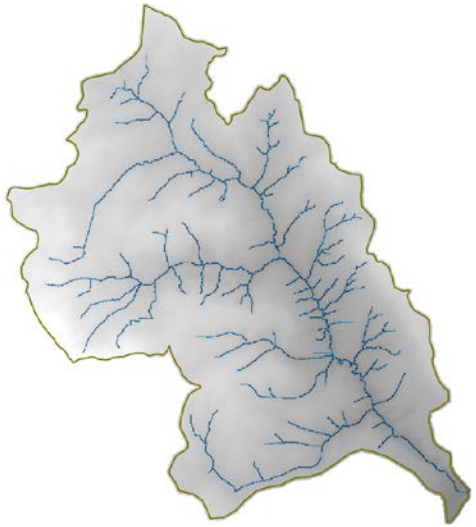
- 17 watersheds

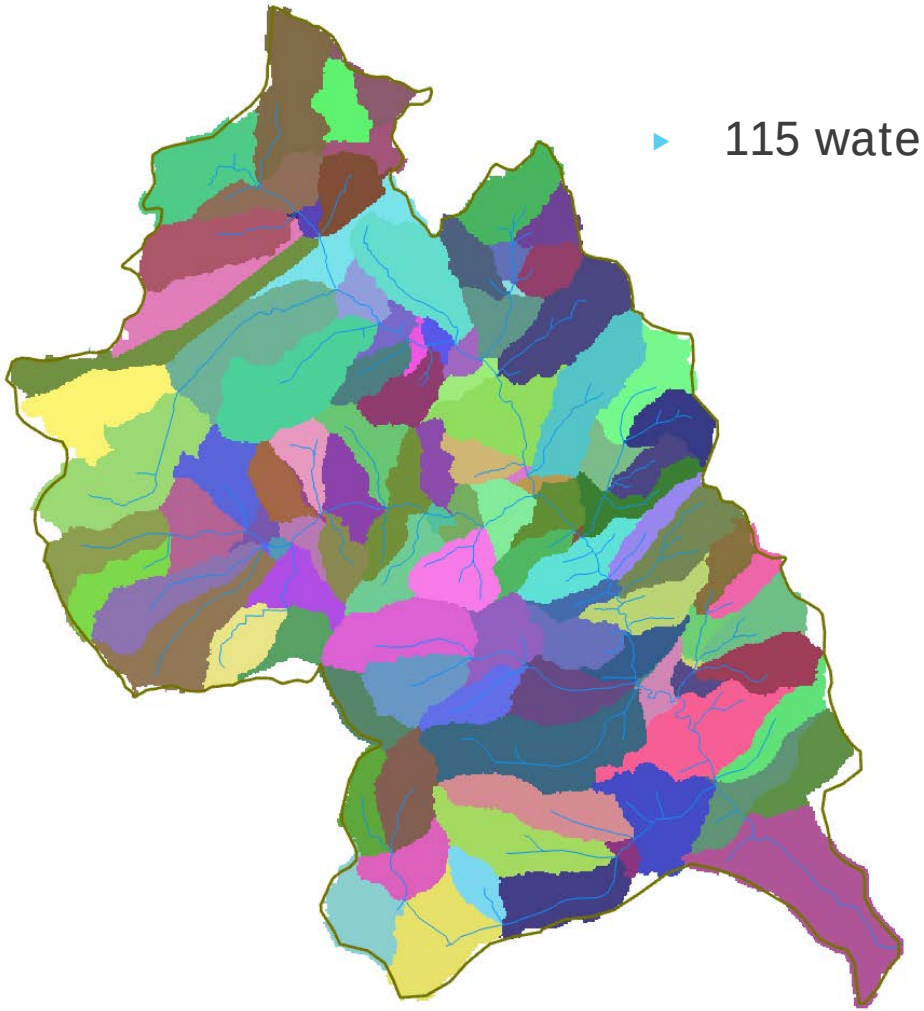




AGREE

- Used the archydro toolbar to perform DEM conditioning with AGREE.

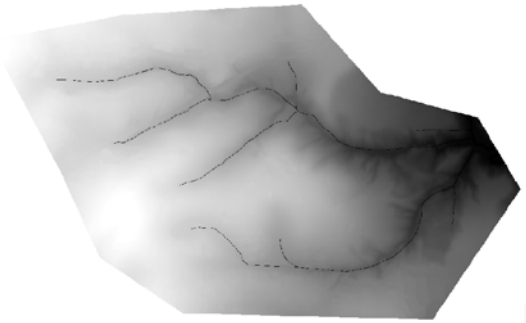




- 115 watersheds

AGREE on a 3ft subwatershed

- 13 watersheds



Conclusion

- Major roads are a problem.
- Hydrology tools can take a crazy long time.
- DEM conditioning with AGREE is more helpful on a smaller scale and higher resolution.

Questions?

resources

Baker, M. E., Weller, D. E., and Jordan, T. E. 2006. Comparison of automated watershed delineations: Effects on land cover areas, percentages, and relationships to nutrient discharge. *Photogrammetric Engineering & Remote Sensing*, 72(2): 159-168.

Duh, Geoffrey GEOG 493 Lecture slides retrieved from http://web.pdx.edu/~jduh/

Esri help online at http://pro.arcgis.com/en/pro-app/tool-reference/

Data from PSU GIS resources 2017