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GES 486

Write-up

This paper repeats what is written on the project page with addition of references.

Vegetated buffers surrounding lakes, rivers and streams have a myriad of benefits to their health. They limit runoff, catch pollutants and sediments, offer a unique transitional environment for the wildlife, protect banks from erosion, and reduce flooding to name a few[1]. The primary goal of this project was to find the extent to which Maryland lakes are actually buffered. Because the streams that feed into lakes carry their pollutants, nutrients, and sediment with them, the health of the lake will be influenced by its streams. It was my initial intention to extend my goal to the buffered area of Maryland's streams and would do so with more time. Maryland defines forest as 10% canopy cover, 120 feet wide, and an acre in area[2]. Maryland also recommends 50 to 100 foot wide buffers[3]. I decided to use 100 foot buffers for this project.

By extension, the primary contributor of harmful substances in lakes and streams is agriculture. Irrigation can lower the base flow of streams. Pesticides are commonly carried by rain into waterbodies and intense cultivation can increase bank erosion[4]. Runoff carrying manure, containing nitrogen and phosphorous, in large concentrations have been known to facilitate dead zones[5]. In an attempt to at least partially account for this I included a bivariate map comparing agricultural workers with the forested buffer area.

Maryland doesn't have a reputation for high quality water. Most of the emphasis is appropriately focused on the Chesapeake Bay. There has also been extensive research on Maryland streams. Maryland ranked 12th of the U.S. states in most violations of the Safe Drinking Water Act in 2015. To find out more on stream water quality in Maryland you can visit the WQP website.

The first map relates several factors. At the bottom is a basemap for spatial reference. Above that is a choropleth map of each county's percent area of lake buffer area that contains forest, or more accurately 10% or more canopy cover. A dark colored county represents one that, for the most part, has vegetation surrounding its lakes. The process by which this was done can be found in the link above. Above that still is a raster file of Maryland canopy cover. It serves as comparison between a county's percentage and shown canopy. The data for this file is unfortunately incomplete, as you can see. Large chunks of data are missing, in some cases because of unaccounted for water but this isn't always the case. A notable missing section extends between Carroll and Baltimore county. The canopy cover data set is also in 30 meter resolution. Lastly, laid on top, are the Maryland lakes. The streams and their buffers were not included so not to cluster the map. The data was retrieved from imap.maryland.gov.

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[1] Freerksen J, 2021. LakeFrontLiving. *The Benefits of Creating Buffer Zone on Your Lake Shoreline.* Retrieved from blog.lakefrontliving.com/benefits-creating-buffer-zone-lake-shoreline

[2] Maryland Department of Natural Resources. Retrieved from dnr.maryland.gov/forests/Pages/Forest-Tree-Data.aspx

[3] Maryland Department of Natural Resources. Retrieved from dnr.maryland.gov/forests/Pages/programapps/ripfbi.aspx

[4] Minnesota Shoreline Management. Retrieved from https://www.shorelandmanagement.org/quick/ea.html

[5] Chesapeake Bay Foundation, 2021. Retrieved from https://www.cbf.org/issues/dead-zones/index.html

The majority of Maryland county lakes appear to have forested buffers. Baltimore City, being the lowest, manages to still have 37% of its lake perimeter area vegetated. The median is 79.1% and the mean is 75.5%. As a general trend the canopy cover becomes more fragmented approaching central Maryland. The western and eastern sides of the state feature large swaths of forest which doesn't appear to have any relation to how much lake perimeter is actually buffered. The counties with the largest forests land in the 60-75% range. In fact, from this map it appears that the central county lakes are the most adequately buffered. This trend may be attributed to the generally larger lakes. These large reservoirs in Baltimore, Montgomery, and Harford county offer more services to larger populations which makes them more valuable. This doesn't necessarily equate to healthier waterbodies though. Remember that streams and rivers have not been included, and no conclusions should be made comparing waterbody health and buffering until they're accounted for.

The following map compares the percent of the working population in agriculture, forestry, and fishery with the percent of lake buffer area that is forested. In reality, it's a compromise. I used census data from social explorer and would have used table B24114 called "Detailed Occupation for the Civilian Employed Population 16 Years or Older" because it separated industries more thoroughly but this data was incomplete. I was forced to use the more general data set: C24010. The goal was to show any trends that might appear between the amount of active farming in a county and how much buffering its lakes have. I don't believe the two variables directly relate but what I did think was valuable was identifying counties with a large amount of farming and little buffering. The map consists of a basemap like earlier and a bivariate map. A green county has low farming and high buffering. A blue county has the opposite. A grey county has low of both. The data is classified in quantiles.

If I were to repeat this map I would replace percent working population in agriculture with percent agricultural land area. A higher number of farmers doesn't necessarily mean more area attributed to farming, which is more relevant to the basis of this project. With values in the majority below 1%, farming, fishing, and forestry aren't particularly in high demand in Maryland. With the exception of Baltimore City, some of the least well buffered counties, specifically Kent, Queen Anne's, Talbot, and Dorchester have some the highest farming. Or perhaps since none of those four counties are landlocked and easily access the bay, it's the fishing that's causing the relationship.

For a closer look, explore each lake in turn with the webmap. You'll notice that the webmap doesn't contain the canopy cover file that I used to find the buffer areas without vegetation. It has been replaced by the ESRI imagery basemap for two reasons. The first is that the raster file was too large and caused a highly delayed response time of any inputs to the system. It made navigating the webmap nearly impossible. I chose to replace it with the ESRI imagery basemap because it serves as an interesting comparison and an accuracy check. There is a visible difference between what the raster file picked up as vegetation and what the imagery shows. It's important to note they aren't exactly equivalent. The raster has a 30 meter resolution and is measuring canopy coverage at 10% or more. Each cell is thus generalized while the imagery is more of an eyeball comparison.

References:

Belt, D, 2017. Patch. Maryland Drinking Water Among Nation's Least Safe: Report. Retrieved from patch.com/maryland/annapolis/maryland-drinking-water-among-nations-least-safe-report

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