Relative Sediment Loading Hazard of Harford County, Maryland

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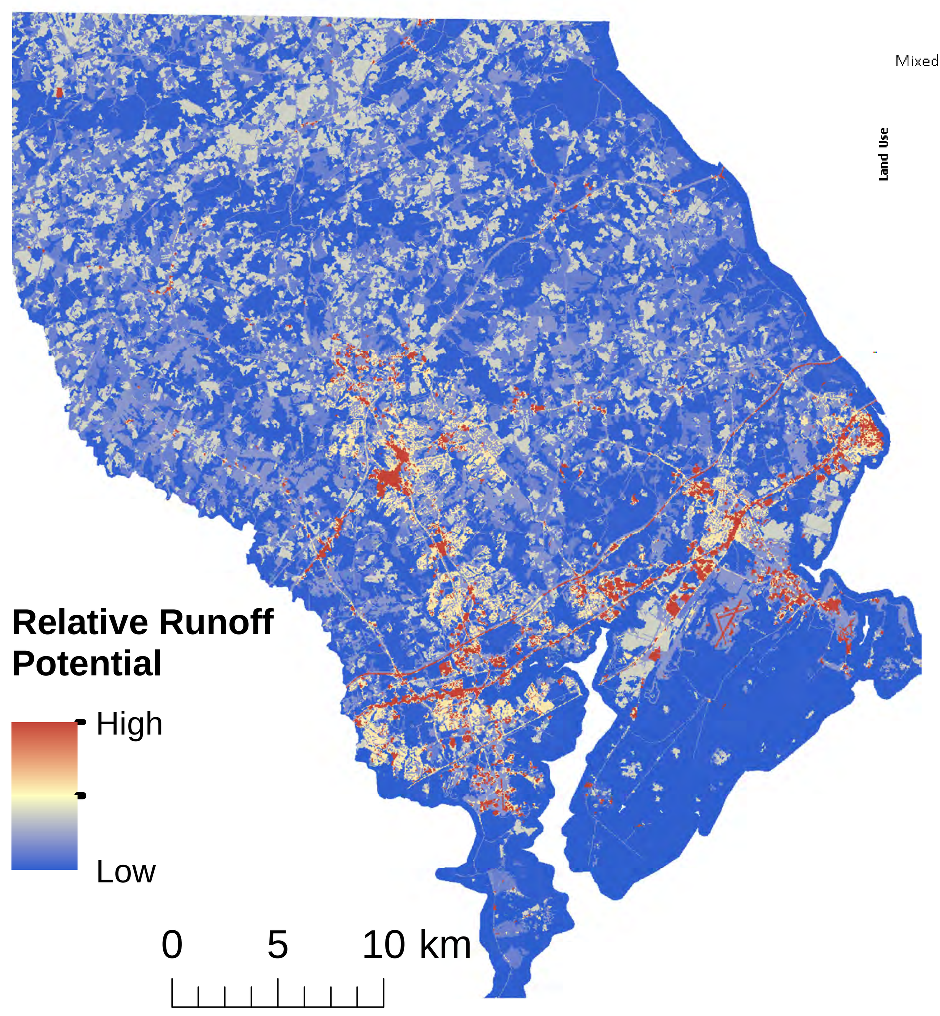
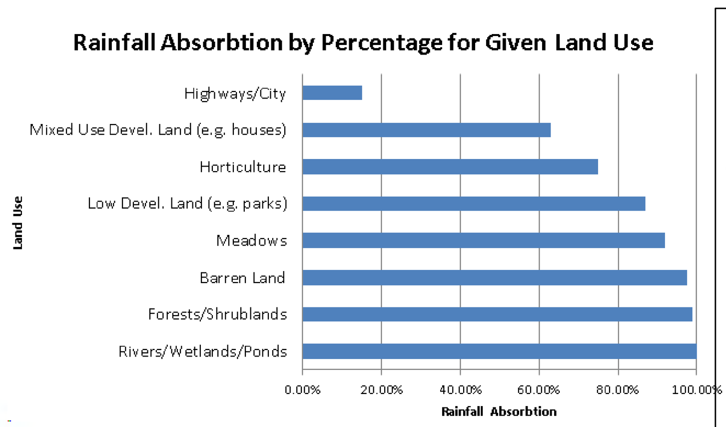




This map shows the relative runoff potential of the study area. This map is based off a land cover map from USDA NRCS. Relative absorption ability of each land use is shown in the above graph. These values were used to calculate runoff potential for the reclassified land uses and scaled to 100.

Problem

The Chesapeake Bay has been severely degraded in the past due to sediment and nutrient loading. Roughly 18.7 billion pounds of sediment enter the Chesapeake Bay each year, This sediment comes from eroding lands and stream banks. Rain events also intensify erosion rates in the watershed.

High levels of suspended particles in water is called turbidity. Turbidity inhibits sunlight from penetrating into waterways, hurting primary producer productivity. Additionally sediment can contain harmful contaminants as well as smother and kill native oyster beds.

Nutrient loading is the other major problem in the Chesapeake Bay. When focusing on nutrient loading, Nitrogen and Phosophorus are the specific nutrients in question. Agricultural operations use these nutrients as fertilizer to bolster crop yields. During rain events this fertilizer is washed off of lands and runs off into waterways. The Chesapeake Bay is the ultimate sink of these accumulated non-point source pollutors. When large enough levels of N and P amass in the bay, it can cause eutriphication. Eutriphication in the bay occurs as massive algal blooms fueled by N and P. When the bloom uses all of the N and P the algae dies. All of this dead life matter is broken down by decomposers via aerobic processes. These decomposers can use all of the oxygen in the water where blooms occurred and cause hypoxic conditions, or oxygen poor water, and even anoxic conditions, oxygen devoid water. Hypoxic and Anoxic zones are extremely detrimental to bay health because they have high impacts on flora and fauna that inhabit the bay.

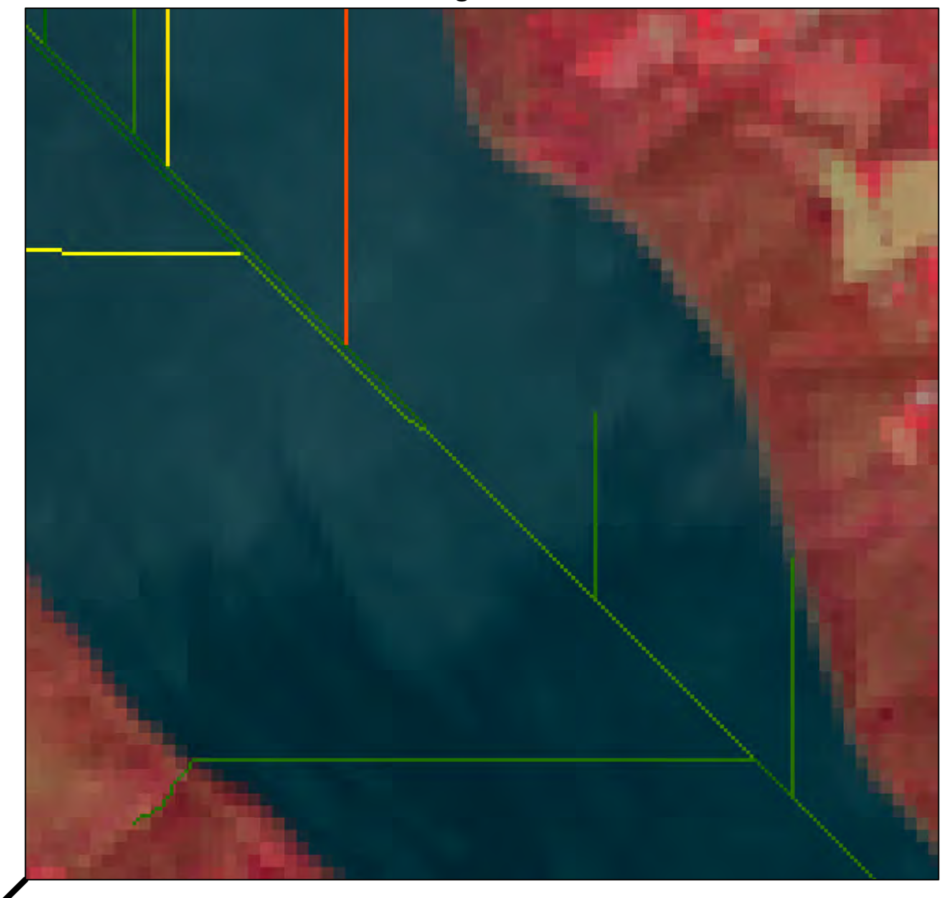
Remediation

In 1987 the Chesapeake Bay Agreement was created to begin restoring the bay. It set precedents to address and reduce non-point and point source nutrient and sediments loads by 40% in major tributaries of the bay by the end of 2000. These reductions were set in order to end anoxic conditions in the bay. While reducing point source pollution was successful, non-point sources were not. In 1997 it was projected that only 19% of phosphorus and 15% of nitrogen from non-point sources was to be reduced. These are much less compared to the 58% reduction point source Phosphorus reduction and 28% reduction for point source Nitrogen. Even more alarming was the fact that a 1991 revaluation found anoxic conditions would only be ended with a 90% reduction in P and N.

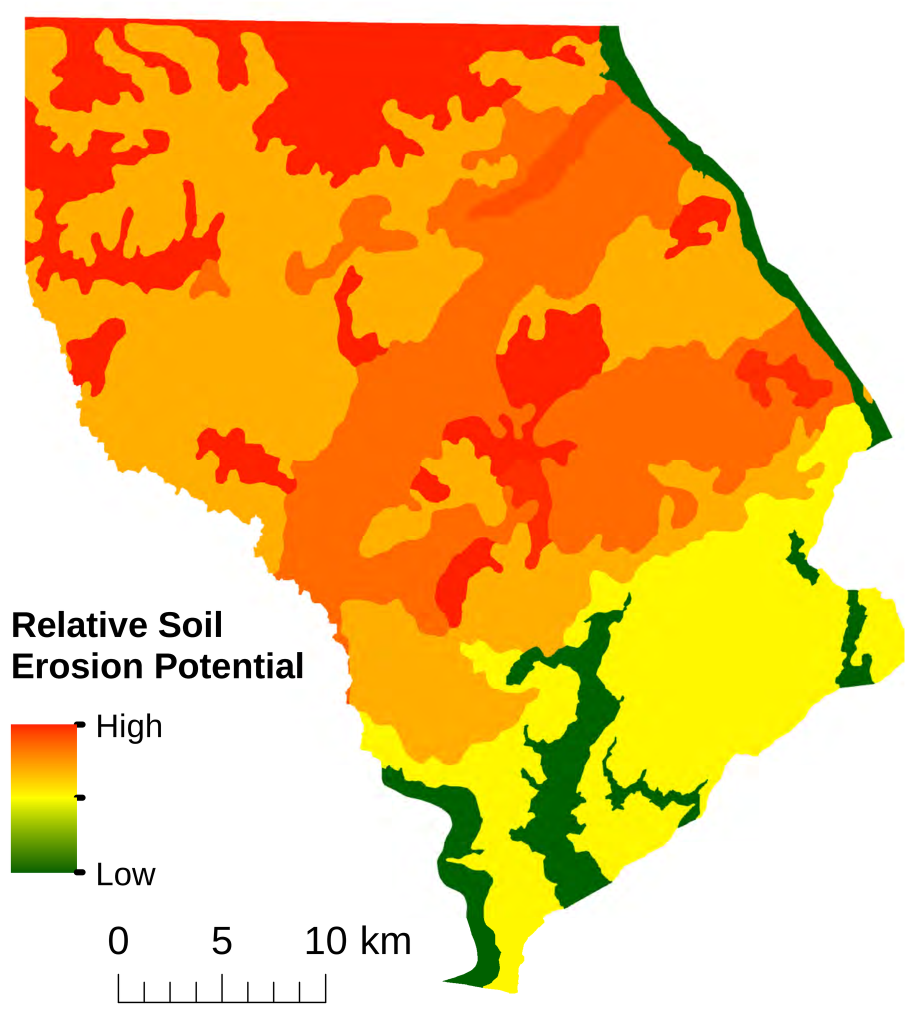
Solutions to non-point source runoff are riparian buffers and constructed/remediated wetlands. Built wetlands in Maryland have successfully been able to remove 68% of nitrogen and 43% total phosphorus from runoff. Riparian buffers retain 50-90% of nitrate loading in groundwater and surface runoff, as well as sediment in runoff. Additionally riparian buffers prevent erosion of streambank which also lowes sediment in the waterways

Areas identified by these maps as locations of high sediment loading, such as those in zooms 3 and 4, indicate potential zones for future remediations.

5, 4, 3 RGB Image from Landsat 8



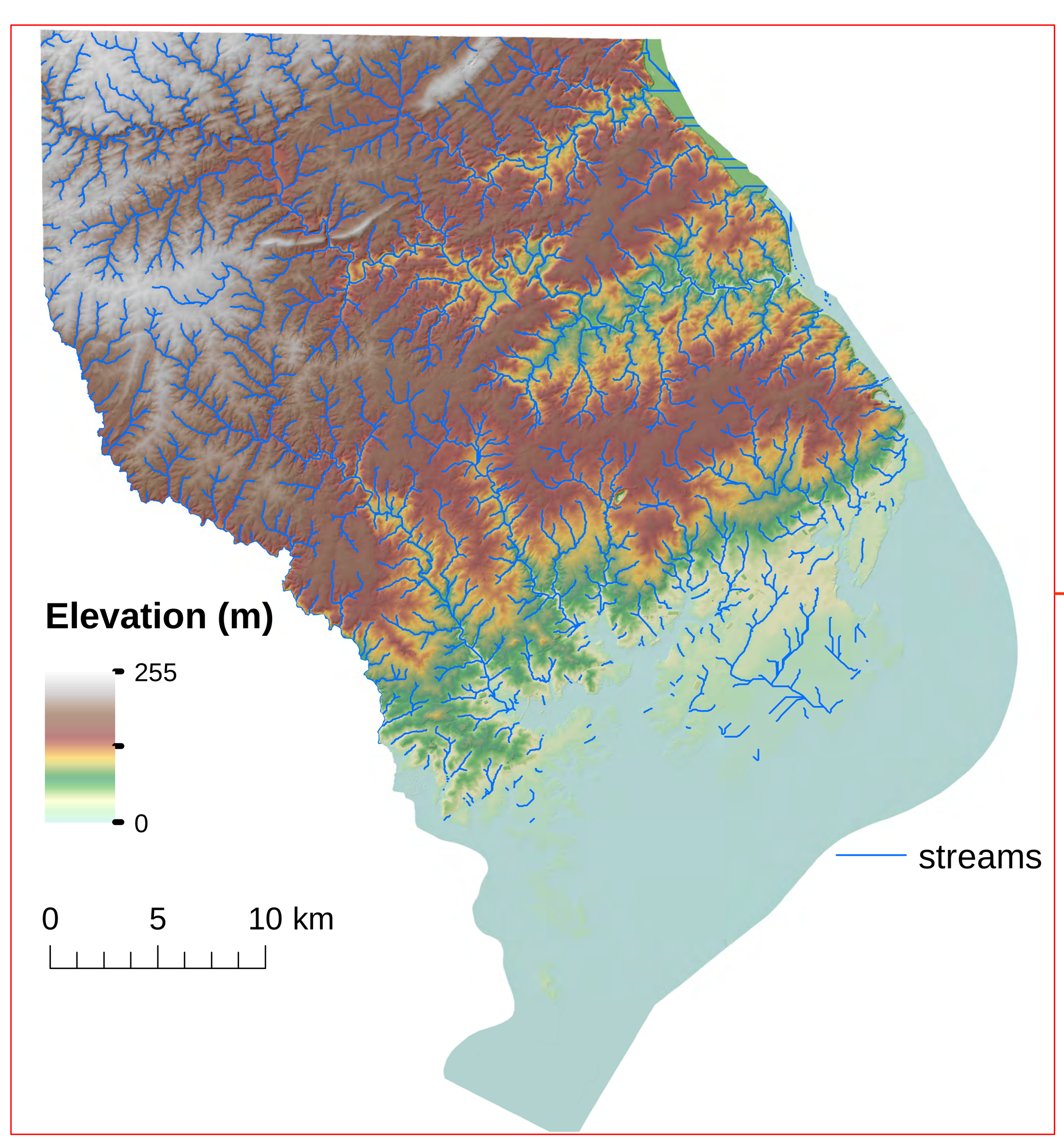
Zoom 1

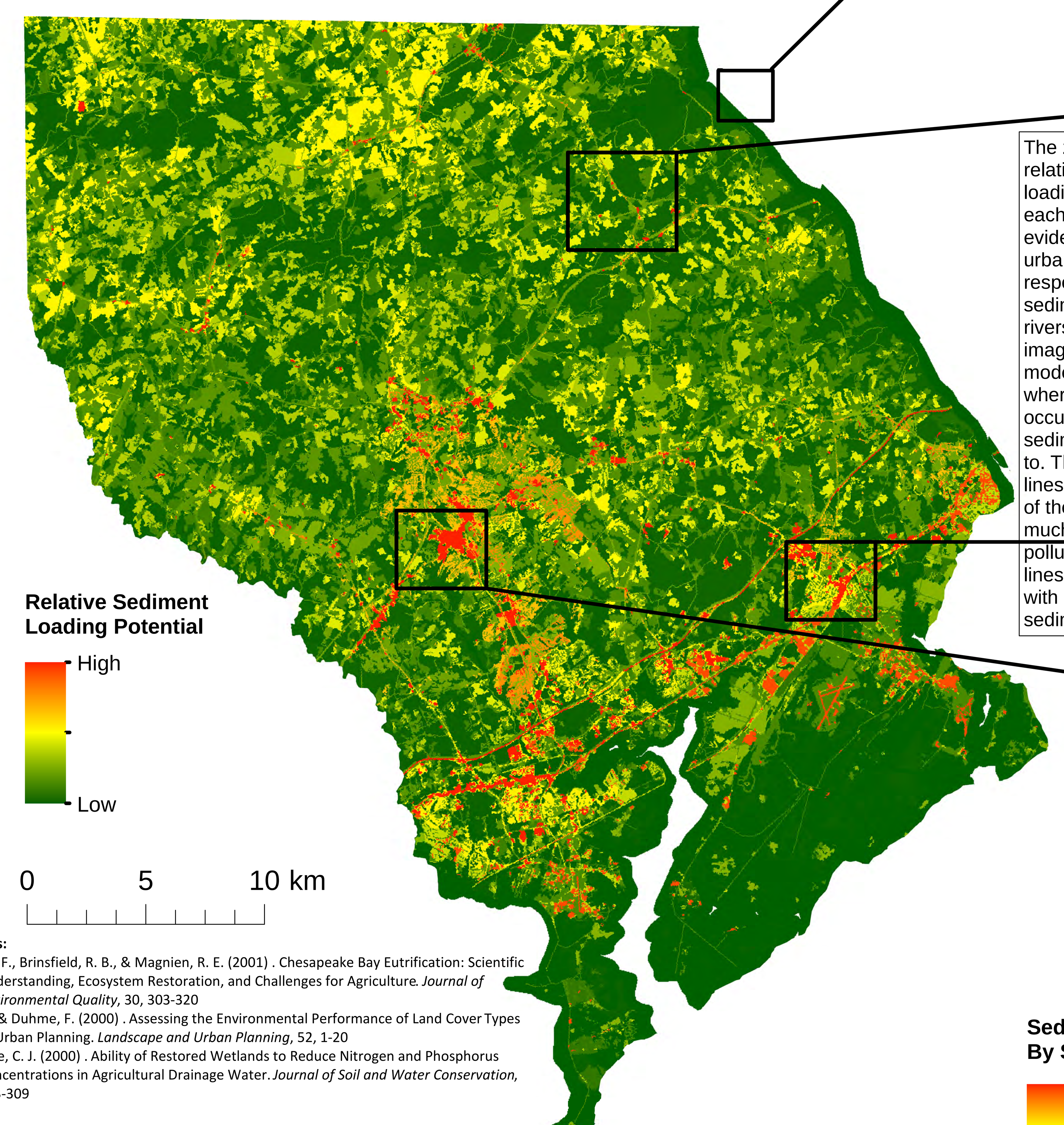


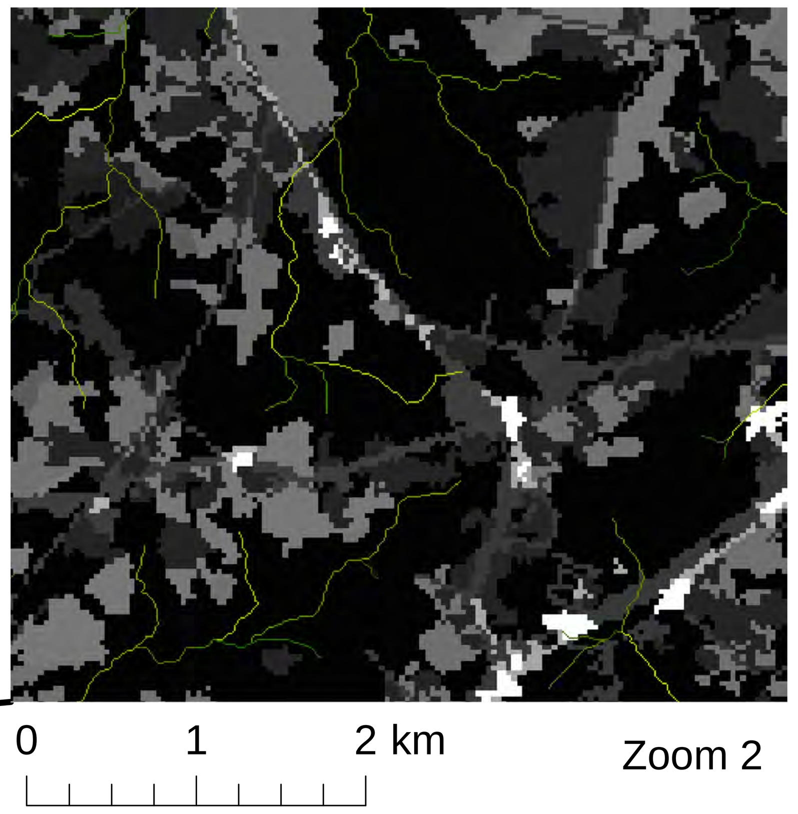
For the soil erosion potential map we first found the different types of soils in the area. Then we created zones of the different soil types for the study area. We then downloaded a soil map from ESRI and used it to randomly sample 20 data points in the different zones for their erosion potential. We averaged the sampled points for each zone and reclassified the soils based on soil erosion potential on a scale to 100.

The remote sensing image was downloaded from Earth Explorer from USGS. The image was taken was 4/21/2013.The image came from Landsat 8. Bands 1, 2, 3, 4, 5, and 7 were then combined into an RGB image using the composite function in the image analysis tab. The bands in the resulting image were then changed to create a 5, 4, 3 RGB image, which helped highlight the sediment in the rivers. In this image, turbid water appears as a lighter shade of blue than clear water.

For the final relative sediment loading potential map, the map of the relative runoff potential and the map of the soil erosion potential were multiplied together. The two maps were multiplied together rather than added because the potential soil loading is dependent on both of the factors being present. For example, a wetland (99% absorption) with high soil erosion potential will not generate much sediment loading because nearly all of the eroded soil is absorbed by the land. Therefore, both factors must be high in order to generate high soil loading potential.

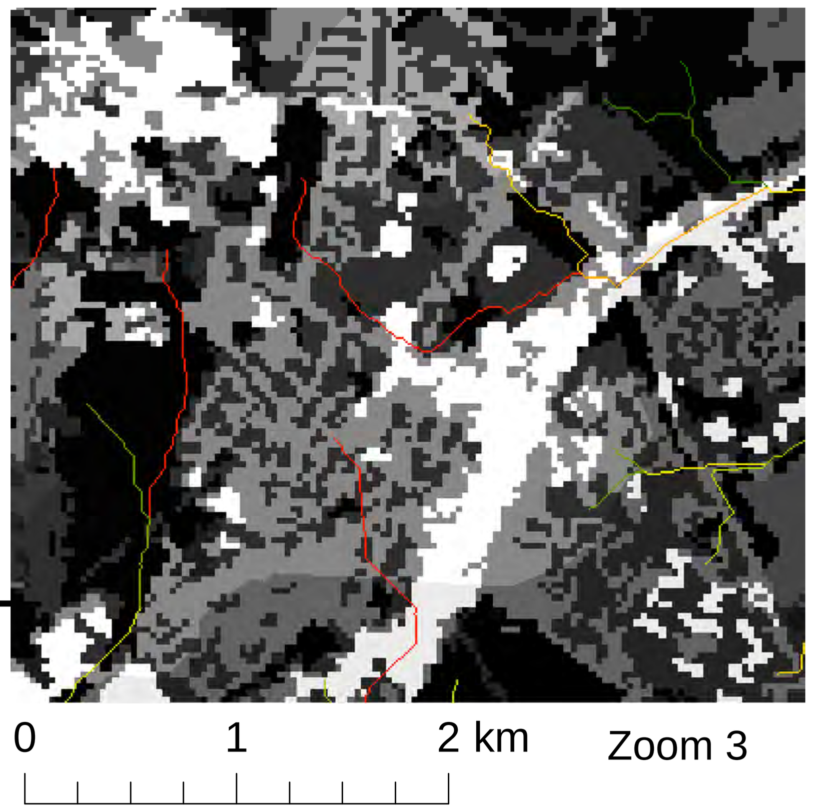






Zoom 2

The zooms show the relative amount of sediment loading by total area of each stream segment. As evident by the zooms the urban areas are responsible for the most sediment loading into the rivers. The remote sensing image shows that the model correctly depicts where the most loading occurs and where the sediment gets transported to. This is shown by the red lines that flow into the part of the river that clearly has much more sediment pollution, and the green lines flow into the areas with significantly less sediment pollution.



Zoom 3

Relative Sediment Loading Potential

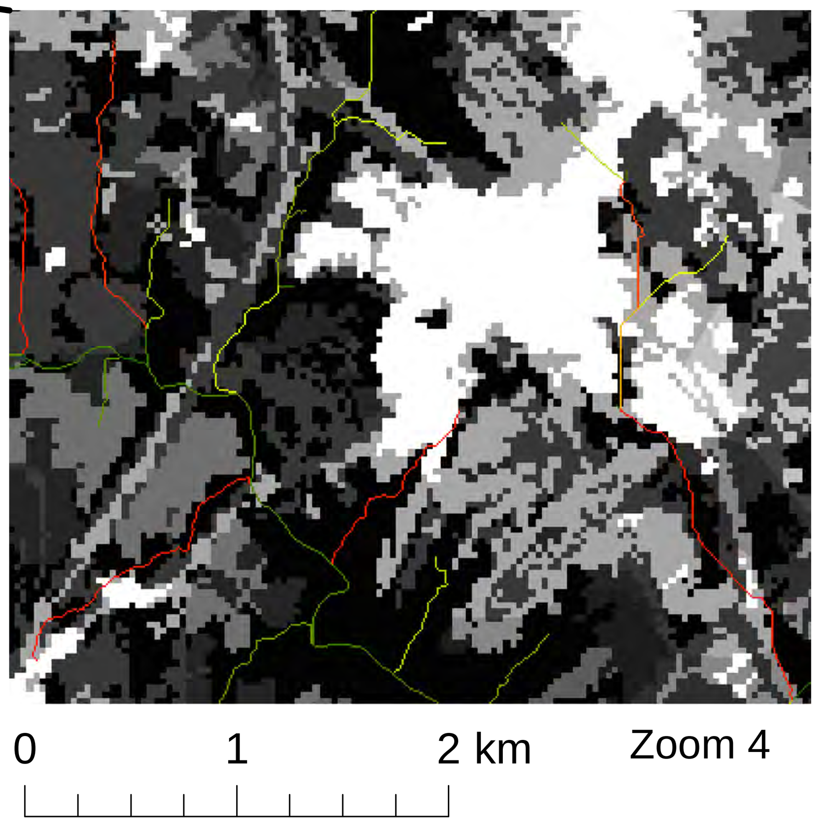
High

Low

Sediment Loading/Area By Stream Segment

High

Low



Zoom 4

References:

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