Nanticoke Watershed Consultant Report

Background:

The Nanticoke River begins in southern Delaware and flows southwest through Maryland to the Chesapeake Bay. It is one of the Chesapeake's healthiest rivers and its 725,000-acre watershed provides habitat for many threatened plants and animals. It supports excellent fisheries and has the highest concentration of bald eagles in the northeast United States, making it one of the most diverse watersheds in Delmarva.

Nanticoke River

Delaware has recently designated surface and ground waters in the watershed to be of high concern for water quality. This is because the river flows through many agricultural areas and run-off from these areas contain high concentrations of nitrogen and phosphorus. These high nutrient concentrations are generally the main cause of eutrophication in waterways, which is a problem because it decreases the oxygen concentration in water and increases algal blooms, harming aquatic life.

Run-Off:

A huge concern for the Nanticoke River's water quality is the high agricultural activity in its watershed. Approximately 45% of the land in the watershed is used for agriculture, which means large levels of nutrients (nitrogen and phosphorus) reach the river from livestock manure or fertilizer. Recently, the Nanticoke Watershed Alliance has implemented a "flexible buffer" program to combat the run-off issue. Buffers are strips of vegetation (in this case, native grasses) along drainage ditches that capture nutrients before they run-off into the ditches and end up in the smaller, local water systems that lead to the Nanticoke. The Nanticoke Watershed Alliance is aware that the ditches are located on lands that have very important agricultural use and wide buffers on these lands would take up too much room that could be used for planting crops. But, because it is a "flexible" program, a smaller buffer could be used, which is better than no buffer at all.

Strategy:

I would suggest a buffer strategy similar to the one used on the previous web page. An analysis can be performed using ArcGIS. The Nanticoke can first be isolated (Fig. 1), then the sub-basin areas that drain to each stream in the Nanticoke River system can be identified (Fig. 2) using the watershed tool. The percent run-off from agriculture can be obtained by analyzing the amount of agricultural and total flow accumulations in these streams. By doing this one will be able to determine which streams contribute more to agricultural run-off and adjust buffer widths accordingly.

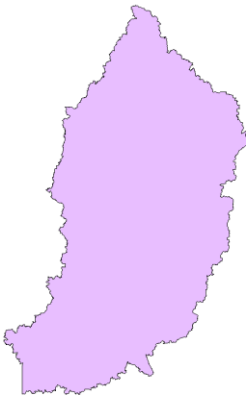

Fig. 1

Vegetative data can also be displayed from satellite imagery. Areas of low roughness of vegetation are displayed in light blue and green in Fig. 3. Using these two parameters, along with terrain slopes (which can be displayed using elevation data), buffers can be calculated. There are two different assumptions that can be made: one, that cells with dense vegetation will intercept more run-off than cells with sparse vegetation and two, that run-off moves faster over steeply-sloped cells, which reduces its interception by vegetation or infiltration. The first assumption gives buffers that are wider where vegetation is sparser, while the second one gives buffers that are wider where the slope is steeper and where run-off is moving faster. The data from the two assumptions can be combined to create a "flexible" buffer system in the Nanticoke (Fig. 4).

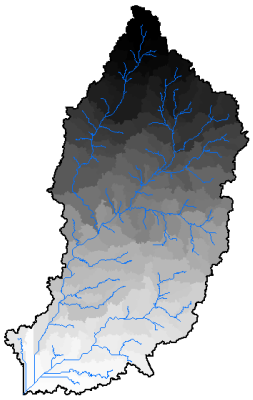

Fig. 2

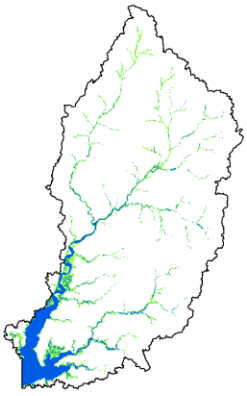

Fig. 4

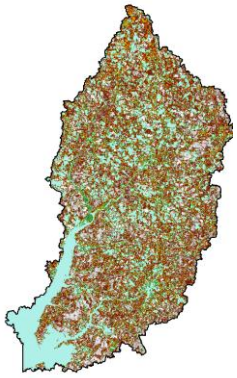

Fig. 3

Regulations, Incentives & Cost:

The EPA has recommended criteria set at between 0.2 mg/L and 2.18 mg/L for nitrogen concentrations in water and between 0.01 mg/L and 0.08 mg/L for phosphorus concentration in water. It is important to remember that these are only recommendations. Limiting regulations need to be established and enforced in order to seriously control the run-off problem in the Nanticoke. With that being said, buffer systems can always help reduce the run-off. Because these buffer systems will affect the amount of land available for farmers to use, it is necessary to have some incentives for them if buffers are to be constructed on their property. Tax incentives, such as the one given to private landowners who have easements for conservation purposes, can be considered. A recent study by the University of Maryland shows that grass buffers, such as the ones suggested in this report, cost anywhere from $168-400 per acre. These costs should be paid for, following the system suggested in Fig. 4, by the EPA or another environmental agency. A deal could be made with the farmers in which they are expected to maintain the buffers on their property in return for their incentive.

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Works Cited:

http://nanticokeriver.org/programs/flexible-agricultural-buffer-monitoring-program/
http://nanticokeriver.org/
http://www.riparianbuffers.umd.edu/PDFs/FS774.pdf