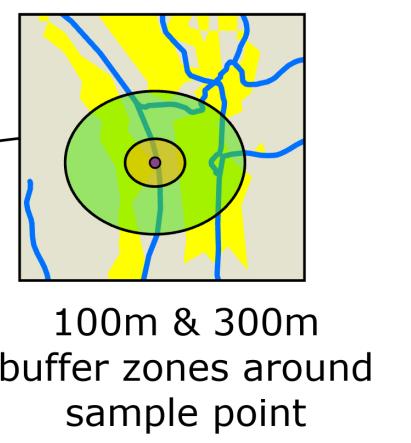
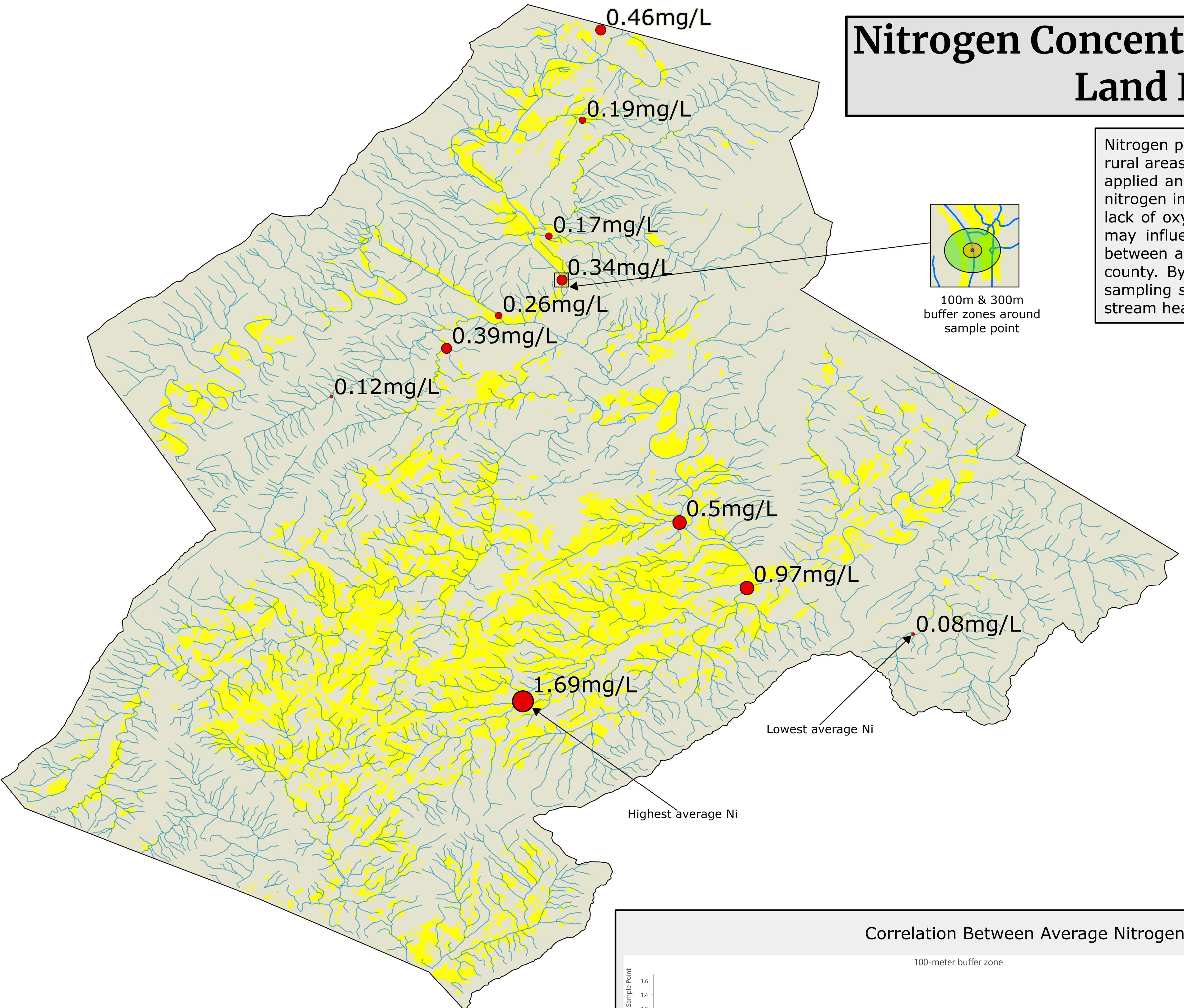


Nitrogen Concentrations in Streams Relative to Agricultural Land In Botetourt County, VA - 2021



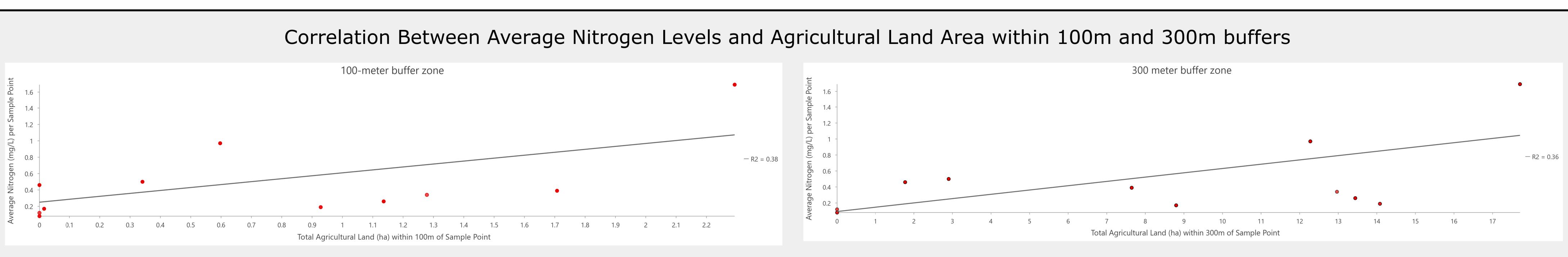
Nitrogen pollution from agricultural runoff is a well-known contributor to water quality degradation, particularly in rural areas with significant farming activity. The EPA estimates that "approximately 12 million tons of nitrogen are applied annually to crops in the continental United States" (U.S. Environmental Protection Agency, n.d.). Excess nitrogen in groundwater can lead to clogged water intakes, decomposed matter, and can result in fish kills due to lack of oxygen (U.S. Geological Survey, n.d.). In Botetourt County, Virginia, agricultural practices near streams may influence the concentration of nitrogen in surface water. This project seeks to analyze the relationship between agricultural land cover and nitrogen concentrations in water samples collected from streams within the county. By spatially analyzing nitrogen levels in relation to the proximity and extent of agricultural land near sampling sites, this study aims to identify potential areas of concern where agricultural runoff may be affecting stream health.

Water quality data, specifically nitrogen compounds, were obtained from the EPA for samples taken within Botetourt County, VA in 2021. Land use imagery data was obtained from the USGS National Land Cover Database (NLCD) and filtered to only show areas of hay/pasture and cultivated crop areas. Finally, stream data was obtained from the USGS National Hydrography Dataset (NHD).

The nitrogen samples were averaged at each monitoring location to represent mean nitrogen concentrations per site and summarized using the Natural Breaks method. A 100-meter and 300-meter buffer was applied around each nitrogen sampling point to capture nearby agricultural land that may influence runoff into streams. Agricultural land was clipped to these buffer zones and the total area of agricultural land within each buffer was calculated using the Calculate Geometry tool. A spatial join was performed to relate the nitrogen sample points with the agricultural land cover within the defined buffer zones.

The spatial analysis revealed that the sample points with the highest nitrogen concentrations were located in areas with significant agricultural land cover within the 100m and 300m buffers. Note the location of the highest and lower average nitrogen samples in relation to nearby agricultural land. As shown in the graphs below, a positive correlation was observed between nitrogen levels and the amount of agricultural land surrounding the sampling locations indicating potential runoff contributions from nearby farming practices.

The results of this analysis suggest a link between agricultural land use and elevated nitrogen concentrations in Botetourt County's streams. The spatial distribution of nitrogen levels highlights areas where agricultural runoff may be impacting water quality. However, further research would be required to account for other sources of nitrogen including other land uses. Further, temporal variables of runoff, rainfall, or agricultural practices may also affect nitrogen levels. Further analysis of data in future years may provide more stronger evidence. Nonetheless, these findings support the hypothesis that agricultural practices near streams are contributing to increased nitrogen pollution in local waterways.



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