Name: Ryan J. Albert

Dissertation Year: 2007

Title: The Influence Of Past And Future Urbanization On Watershed Nitrogen Export And Hyrdrology Dynamics In Two Mid-Atlantic Watersheds In Fairfax, Virginia

Dissertation Director: R. Christian Jones
Committee Members: Dawn Parker, Ron Stewart, Jon Cooper

ABSTRACT

This study examines urban land use change and its impact on watershed hydrology and nutrient loading in the Accotink and Pohick watersheds in Fairfax County, Virginia. The dissertation explored the amount of urbanization in the watersheds over the past 30 years and the impact of that urbanization on nitrogen loadings and stream hydrology. Further, it examined different projections of future urban development in the watersheds and how urbanization may affect nitrogen loadings and hydrologic changes. It was hypothesized that deterioration in hydrologic conditions and increases nitrogen loadings would be notable.

Land use was estimated from 1975 to 2004 using a combination of remote sensing and demographic data, which was given the name of the Household Method. Adjusted land use projections from an existing study generated by the SLEUTH model and xvi projections using the household method were used to estimate future land use. These land use estimates were input into several analytical tools, including the hydrologic component of HSPF, L-THIA, and export coefficient-based approaches. Water quality

data collected by George Mason University and the Norman M. Cole Jr. Pollution Control Plant are available at four sites from 1984-1992. Data were also collected on 24 occasions in 2005 at four sites in the watersheds as part of this dissertation. Nitrate-N, ammonia-N, total phosphorus and soluble reactive phosphorus were compared between watersheds using statistical techniques and a multiple regression loading model (LOADEST); focus was given to nitrogen. Physical parameters, including conductivity, dissolved oxygen, pH, and temperature were also analyzed.

Modeled and observed results indicate that significant changes correlated with increased urbanization have occurred to the hydrology of these watersheds. Furthermore, without implementation of effective Best Management Practices (BMPs), significant alterations in hydrology will continue into the future. Nitrogen loadings have also increased and will likely continue to increase without effective BMPs, although the increases in nitrogen loading do not pose a significant a risk to the streams themselves. However, these increased nitrogen loadings may pose a potential risk to the Chesapeake Bay ecosystem.