

**PREDICTION AND UNCERTAINTY ANALYSIS OF EUTROPHICATION IN THE NEW RIVER ESTUARY:  
AN INTEGRATED BAYESIAN NETWORK APPROACH**

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**ABSTRACT:** Estuaries are amongst the most heavily populated areas and productive environments on earth due to their semi-enclosed nature, riverine inflow of nutrients, extensive intertidal plant communities, and shallow depth. Human population growth and human activities along the estuaries have accelerated the accumulation of the nutrients, altering estuarine watersheds dynamics throughout the world. High rates of nutrient input into estuaries can contribute to low dissolved oxygen, toxic algal blooms, fish kills, and benthic habitat degradation. The New River Estuary (NRE) located near the largest Marine Corps base in the East Coast of the U.S., in Onslow County, North Carolina is a shallow estuary draining a catchment area of 1436 km<sup>2</sup>. NRE was considered one of the most eutrophic estuaries in the south eastern United States during the 1980s and 1990s; hence it is crucial to develop a better understanding of the scientific and management factors impacting eutrophication in the NRE. This study identifies and quantifies ecosystem-scale effects of regional anthropogenic activities and natural stressors on chlorophyll a concentrations, an indicator of estuarine water quality and ecological condition, using an Integrated Bayesian Network (IBN). A Bayesian Network (BN) consists of a graphical model with probabilistic relationships encoded among variables in a system. The graphical model is built based on an understanding of the causal relationships in a system. Using data from ongoing monitoring and experimental projects along the NRE, we identify the factors affecting chlorophyll a concentrations. The scientific understanding of the NRE is then utilized to build a BN. Decision nodes are then added to the scientific sub-BN. Finally, the IBN is build by combining the scientific and management networks to facilitate management decisions. The IBN will provide a regulatory tool for researchers, managers and policy makers to identify and predict local and regional stressors of ecological condition in the NRE.

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