Porché L. Spence
spence.porche@epa.gov
ORISE Post Doctoral Fellow, US Environmental Protection Agency, National Health Effects and Environmental Research Laboratory (NHEERL), Gulf Ecology Division (GED), Gulf Breeze, FL 32561

Stephen J. Jordan
Jordan.Steve@epa.gov
US Environmental Protection Agency, National Health Effects and Environmental Research Laboratory (NHEERL), Gulf Ecology Division (GED), Gulf Breeze, FL 32561

Abstract Title: Using Bayesian Belief Networks to Explore the Effects of Nitrogen Inputs on Wetland Ecosystem Services

Increased reactive nitrogen (Nr) inputs to freshwater wetlands resulting from infrastructure development due to population growth along with intensive agricultural practices associated with food production can threaten regulating (i.e. climate change, water purification, and waste treatment) and supporting (i.e. nutrient cycling) ecosystem services. Wetlands generally respond both by sequestering Nr (i.e. soil accumulation and biomass assimilation) and converting Nr into inert gaseous forms via biogeochemical processes. It is important for wetlands to be efficient in removing excessive Nr inputs from polluted waters to reduce eutrophication in downstream receiving water bodies while producing negligible amounts of nitrous oxide (N_2O), a potent greenhouse gas, which results from incomplete denitrification. Wetlands receiving excessive Nr lose their ability to provide a constant balance between regulating water quality and mitigating climate change. The purpose of this study is to explore the effects of Nr inputs on ecosystem services provided by wetlands using a Bayesian Belief Network (BBN). The network was developed from established relationships between a variety of wetland function indicators and biogeochemical process associated with Nr removal. Empirical data for 34 freshwater wetlands were gathered from a comprehensive review of published peer-reviewed and gray literature. The BBN was trained using 30 wetlands (88% of the freshwater wetland case file) and tested using 4 wetlands (12% of the freshwater wetland case file). Sensitivity analysis suggested that Nr removal, water quality, soil Nr accumulation and N_2O emissions had the greatest influence on ecosystem service tradeoffs. The magnitude of Nr inputs did not affect ecosystem services. The network implies that Nr removal efficiency has a greater influence on final ecosystem services associated with water quality impairment and atmospheric pollution. A very low error rate, which was based on 4 wetland cases, indicated that a larger dataset is required to provide robust predictions. These findings are considered preliminary and could change as the model is updated.