
The Role of Land Use and Land Cover in the Delivery of Nutrients to Delaware's Inland Bays

**Jennifer Jennings, DWRC 2000 – 2003 Fellow
Dr. William Ullman and Mr. Joseph Scudlark,
Advisors, College of Marine Studies
University of Delaware**

Photos by Jonathan Cox

Two years into her **DWRC** graduate fellowship project spanning 2000 – 2003, Jenn Jennings remains enthusiastic about future applications and development of her research. "As a native Delawarean, I was attracted to the idea of working on a project that would one day lead to an improvement in our waters and ecosystems," Jennings says. "I was further interested in the idea of exploring how, or if, changes in the land use brought about by human encroachment in [the] coastal area [of Delaware's Inland Bays] were affecting the nutrient levels there, and if this rising trend could be reversed by improved land management practices."



The fellowship project, one of three currently funded by the **DWRC**, will determine baseflow and storm nutrient loads, their seasonal variability, and the role of surrounding land use and land cover in the attenuation and delivery of nutrients to the estuary. The research builds on efforts conducted by the University of Delaware's College of Marine Studies, Delaware Department of Natural Resources and Environmental Control (**DNREC**) and the U.S. Environmental Protection Agency (**USEPA**) Coastal Intensive Site Network (**CISNet**) program.

Jennings was no stranger to water monitoring when she applied to the new **DWRC** fellowship program. She explains, "As a UD undergraduate in Chemistry, I conducted research with Dr. Tom Church on the environmental fate of arsenic and other metals. Part of that research effort, collecting and analyzing water samples from the White and Red Clay Creeks in New Castle County, expanded to include sampling of the Inland Bays and their tributaries. I then met Dr. Bill Ullman who explained to me his analyses of the Bays' water for another purpose – evaluating the effects of nutrient over-enrichment on declining water quality."

Nutrient over-enrichment, or "eutrophication", is caused by elevated nutrient loadings from domestic,

municipal, industrial, and agricultural practices in the Inland Bays' surrounding watersheds. The phenomenon has led to excess nitrogen and phosphorus fertilization of estuarine plants, changes in phytoplankton species, and noxious and toxic algal blooms. Other effects of eutrophication on the ecosystem include increases in turbidity and decreases in dissolved oxygen concentrations, both causing reductions in biodiversity, habitat, and fish and shellfish viability.

In the coming year, Jennings (below, at the Inland Bays' Bundicks Branch sub-watershed monitoring site) will calculate actual loads for her sampling periods, analyze a large existing database to derive loads for past years, and finally develop a model for estimating total annual storm loads. "The main objective of my research," she states, "is to use these actual water measurements to calculate the total nitrogen load to the Inland Bays and compare my results to levels estimated by Horsley & Witten, Inc., an environmental consulting firm, in a 1998 report prepared for the *Center for the Inland Bays*."



By applying her findings to other sub-watersheds of the Inland Bays Basin, Jennings hopes to provide environmental managers with a better understanding of nutrient cycles and trends to permit development and improvement of watershed land use practices, thereby reducing the occurrence and severity of eutrophic events.

(See next page for preliminary findings)

(Jennifer Jennings, continued from page 5)

Of some preliminary findings (below), she says "A hydrological balance suggests that a substantial fraction of the water from the Bundicks Branch watershed discharges through the groundwater below our surface water gauging station. As a result, measured nitrogen loads at the gauging station underestimate the true measured nitrogen loads from the watershed to the Inland Bays, which may be comparable to the Horsley & Witten estimates." For more information, contact Jennings at jenjen@udel.edu.

Daily Nitrogen Loads at Bundicks Branch

