

WHOI Sea Grant Project Brief

Excess Nitrogen Entering a Coastal System from Vehicle Exhaust

Nitrogen pollution of coastal waters is a large environmental problem, not least because the sources of nitrogen are varied and diffuse. Fertilizers used on fields or home lawns, wastewater treatment or septic tank discharge, effluent from livestock operations, all contribute to the excess. Nitrogen compounds carried to the coast by streams, runoff, or groundwater cause eutrophication, “dead zones”, and degradation of coastal habitats. Atmospheric nitrogen deposition onto land, so-called ‘dry deposition,’ is another large source of nitrogen input to the coast, one that is difficult to measure. In a continuation of Sea Grant-funded work, researchers Robert Howarth and Roxanne Marino (both of Cornell University) and Eric Davidson (Woods Hole Research Center) think that the deposition of nitrogen from vehicle exhaust in urban or seasonally populous areas has been underestimated in past studies. Previous work by these researchers showed high rates of nitrogen deposition near heavily-traveled roadways. This project continues their study of this problem. Howarth, Marino, and Davidson will quantify nitrogen deposition along Cape Cod roadways using three measurements: bulk nitrogen deposition (the nitrogen found in sample buckets, comprising the N in rainfall plus the N from aerial deposition into the buckets during the collection time); “throughfall” (material falling through the tree canopy, which includes the N in rainfall plus nitrogen compounds deposited on the leaves from dry sources and washed off in the rain); and estimates of the dry deposition based on calculations of N gas concentration in the air. Another objective is to measure nitrate in the soil water along gradients away from roads, and relate vehicle volume to estimated amounts of nitrogen that flows downstream into coastal lagoons in the area. Focusing on two of their previous study sites: the watershed leading from a heavily-used highway to a large estuary (Rte 28 to Waquoit Bay), and the watershed from a seasonally high-use roadway to a shallow coastal pond (Woods Hole Rd. to Oyster Pond); as well as other sites in areas where there is a field-to-forest transition without a roadway nearby, to verify the results due to vehicle traffic. The investigators state that this research will help demonstrate how nitrogen deposition from vehicle traffic contributes to nitrogen loads in coastal ecosystems, help alert coastal communities to the problem, and the results may contribute to policy development in areas of vehicle emissions regulation in coastal states.