MBL Biological Discovery in Woods Hole

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PRESS INFORMATION

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Researchers from MBL and WHOI Receive $1.2 Million Grant for Collaborative Salt Marsh Study

WOODS HOLE, MA—Scientists from the Marine Biological Laboratory (MBL) and the Woods Hole Oceanographic Institution (WHOI) were recently awarded a $1.2 million collaborative grant from the National Science Foundation (NSF) for studies on the role of sulfur-oxidizing bacteria in salt marsh nitrogen and carbon cycling. The fieldwork will be conducted at the Plum Island Ecosystem Long-Term Ecological Research (LTER) site on the North Shore of Boston.

Salt marshes are among the most biologically productive habitats on Earth, and they also are heavily influenced by human activities. Excess nitrate from land runoff can degrade water quality and lead to harmful algal blooms and low oxygen zones harmful to fish. Microbes in salt marsh ecosystems play an important role in cleansing marshes of this nitrate runoff, often transforming nitrate in the water to harmless nitrogen gas that is released to the atmosphere – a process called denitrification. But that is not always the fate of nitrate—for reasons not yet completely understood, in some cases microbes use different processes, for example converting nitrate to ammonium, which then remains trapped in the ecosystem.

What determines nitrate's fate? Recent research suggests that one key may be the forms of sulfur and carbon compounds available in marsh sediments, which, in turn, affect types of microbes living in the marsh and their activities. Ultimately Stefan Sievert (WHOI) and Zoe Cardon and Anne Giblin (MBL) hope to better understand the environmental conditions and microbial

activities that determine the fate of nitrate in salt marshes, either cleansing the marsh of nitrate via denitrification, or retaining that nitrate nitrogen in the marsh by transforming it to ammonium, a process called dissimilatory reduction of nitrate to ammonium or DNRA for short.

"A better understanding of these microbes—in particular the microbes that oxidize hydrogen sulfide, which is responsible for the rotten egg-like smell in these systems—is critical to understanding the fate of nitrogen in the marsh," said Sievert, a microbial ecologist and associate scientist at WHOI. "Because these chemosynthetic microbes use energy trapped in reduced sulfur compounds in the sediments to make a living, sulfur-oxidizing microbes can also influence the amount of carbon stored in the ecosystem. We want to find out if sulfur-oxidizing microbes are using nitrate to build new biomass from carbon dioxide, which would lead to more carbon stored in the ecosystem. This has the potential to influence the ability of marshes to keep up with sea level rise."

In addition to the summer fieldwork at the Plum Island Estuary, the project will involve maintaining sediment cores (including rooted plants) at controlled seawater levels in the MBL Research Greenhouse. At WHOI, Sievert and his team will perform microbial community analyses in field sediments and the greenhouse cores, using a variety of molecular tools; at MBL, Giblin, Cardon, and their team will measure microbially-controlled rates of nitrogen and sulfur transformations in sediments, coordinating with Sievert to decipher which types of microbes and processes are dominant under different environmental conditions, and why.

The three researchers note: "Salt marshes provide a variety of ecosystem services to humanity, including nutrient removal and storm protection, but they are under pressure from increasing coastal development and rising sea level. A detailed understanding of marsh microbial function could contribute to restoration efforts, particularly if our research helps us predict whether pollutant nitrogen will most likely be lost (as nitrogen gas) or retained in the ecosystem over time."

This research is scheduled to continue until the end of 2014.

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About Plum Island Ecosystems LTER

The Plum Island Ecosystems long-term ecological research (PIE LTER) was established in 1998 and is led by The Ecosystems Center at the Woods Hole-based Marine Biological Laboratory (MBL). During the course of research, scientists have designed and implemented a comprehensive study of a major, land-estuarine system in the Acadian biogeographic province in eastern New England. Their goal is to develop a predictive understanding of the long-term dynamics of watershed and estuarine ecosystems at the land-sea interface and to apply this knowledge to the wise management and development of policy to protect the natural resources of the coastal zone. The principal study site is the Plum Island Sound estuary, its coupled Parker and Ipswich River basins and the coastal ocean, the Gulf of Maine.

About MBL

The Marine Biological Laboratory (MBL) is dedicated to scientific discovery and improving the human condition

through research and education in biology, biomedicine, and environmental science. Founded in 1888 in Woods Hole, Massachusetts, the MBL is an independent, nonprofit corporation.

About WHOI

The Woods Hole Oceanographic Institution is a private, independent organization in Falmouth, Mass., dedicated to marine research, engineering, and higher education. Established in 1930 on a recommendation from the National Academy of Sciences, its primary mission is to understand the ocean and its interaction with the Earth as a whole, and to communicate a basic understanding of the ocean's role in the changing global environment.