Background:

Researchers at the University of Maryland are collaborating with the U.S. Department of Energy’s Midwest Regional Carbon Sequestration Partnership (MRCSP)\(^1\) to learn more about carbon sequestration in tidal marshes. This research will add further value to the long-term project already being developed by the U.S. Fish and Wildlife Service to use clean dredged material from the Chesapeake Bay shipping channel to restore up to 20,000 acres of tidal marsh at the Blackwater National Wildlife Refuge and surrounding areas on the Eastern Shore near Cambridge, Maryland.\(^2\)

Many scientists say that dramatic cuts in carbon dioxide and other greenhouse gases will be needed to slow or stop climate change or global warming. The carbon sequestration (or storage) component of the research is part of a strategy aimed at reducing the amount of carbon dioxide in the atmosphere and its associated impact on climate change.

Trees and plants take carbon dioxide out of the air; and carbon, the key ingredient of carbon dioxide, is stored in trees, plants and the soils in which plants grow. Some carbon dioxide could be removed from the atmosphere by finding ways to increase storage in these natural, biological systems. In the carbon sequestration project underway at Blackwater, researchers from the University of Maryland will investigate the potential of reclaimed wetlands for carbon sequestration:

- Wetlands have great potential for carbon sequestration because they have high levels of net primary productivity and low decomposition rates, meaning that a large amount of organic matter is accumulated annually.

\(^{1}\) The Midwest Regional Carbon Sequestration Partnership is one of seven regional partnerships established by the U.S. Department of Energy’s National Energy Technology Laboratory. It includes Maryland, along with Indiana, Kentucky, Michigan, New Jersey, New York, Ohio, Pennsylvania and West Virginia. It is made up of over 30 members including universities, state geologists, many of the major energy regional companies, and state and federal officials. It is led by Battelle, a non-profit research institute headquartered in Ohio, which is a global leader in technology deployment and commercialization. For more information about the MRCSP and carbon sequestration see http://www.mrcsp.org.

\(^{2}\) The University of Maryland is the lead institution on this research, in collaboration with the U.S. Fish and Wildlife Service, the U.S. Geological Survey and the National Aquarium in Baltimore. Primary funding is supplied by the Maryland Department of Natural Resources Power Plant Research Program.
• The continual accretion (i.e., vertical increase of land) from organic matter and waterborne sediments means that there is potential for long-term continual carbon sequestration.

• Further, the predominantly brackish waters of the salt marshes usually prevent significant production of methane, another greenhouse gas of concern.

**Purpose of the Research:**

The purpose is to:

• Determine the rate of carbon sequestration and total amount of carbon that can be sequestered in restored versus natural marshes. It is anticipated that total amounts sequestered in restored marshes could match or exceed natural marshes.

• Examine best management practices to maximize carbon sequestration by maximizing net primary productivity and minimizing decomposition rates.

• Establish a sampling protocol for validation that can be used elsewhere.

• Help scientists better understand marsh sustainability and soil properties, including the effects of different grasses, nutrients and sediment inputs and retention, as well as the biogeochemistry of a marsh, including effects from eutrophication (lack of oxygen) and acidification.

**Marshland at the Blackwater National Wildlife Refuge**

Marshlands have great ecological importance, but have been shrinking in size:

• The Blackwater National Wildlife Refuge is a wetland of international importance, named in the International Convention on Wetlands (Ramsar Convention).

• It is one of six priority wetland areas noted in the North American Waterfowl Management Plan, visited by approximately 250,000 members of the public each year.

• The Nature Conservancy calls it one of the “Last Great Places.” Others have labeled it as the “Everglades of the North.”

• Yet, about 8,000 acres or 12 square miles have been lost, at a rate of 150-400 acres per year.

• Reasons for loss include sea-level rise, subsidence (or sinking), erosion, salt water intrusion, and plant-eating invasive species.
The Disappearing Marsh

Marshes can be restored:

Using clean dredged material from the Chesapeake Bay shipping channel, the U.S. Army Corps of Engineers is able to find a beneficial use to restore the wetlands at the Blackwater Refuge. Volunteers then plant marsh grasses, including Olney’s 3-square (*Schoenoplectus americanus*), salt marsh bulrush (*Schoenoplectus robustus*), and smooth cordgrass (*Spartina alterniflora*), quickly restoring the marsh.
Terrestrial Sequestration Research Plan

The University of Maryland/MRCSP research is increasing knowledge about sequestration potential and of the marshes themselves. Activity highlights include:

- The research team is currently examining two tidal marsh cells – one 5-acre cell, created with dredge material in 2003, and one natural marsh cell. The team plans to add an additional cell, pending a new restoration at the site.
- Researchers have established approximately 45 field plots per cell and laid down feldspar marker horizons, a white powder that delineates the location of the marsh surface in 2006. They are conducting annual soil analyses, including carbon content and bulk density. Plots are also analyzed for vegetation composition and aboveground biomass.
- Data are also being collected on elevation and vegetation dynamics with scientists from the National Aquarium at Blackwater and the U.S. Geological Survey and on porewater chemistry (such as salinity and nutrients) and methane emissions in cooperation with scientists from the Smithsonian Environmental Research Center.

Results to Date:

- Based on the first year of data collection, the researchers have been able to determine that the restored marsh is forming new peat at the soil surface at rates similar to those in natural marshes.
- The researchers have also found that it is difficult to determine the post-restoration carbon content of the marsh, highlighting the need for monitoring data from the initiation of marsh restoration project.

If You Need More Information

Information about the Blackwater research is available from Brian Needelman (bneed@umd.edu), 301-405-8227. See also http://sawgal.umd.edu/Blackwater/blackwater.html.

For information about the Blackwater National Wildlife Refuge, contact Dixie Birch (dixie_birch@fws.gov), 410-228-2692 x.118. See also the following web sites: http://www.fws.gov/blackwater and http://www.friendsofblackwater.org.