

NUTRIENT FARMING

THE BUSINESS OF ENVIRONMENTAL MANAGEMENT

DEFINITION

Nutrient farms are constructed wetlands designed, built, and operated for the primary purpose of processing nutrients, trapping sediments, and/or storing floodwaters. These activities produce environmental products (e.g., nutrient removal “credits”) that can be sold to individuals, corporations, or municipal treatment facilities who need to meet water quality standards.

PARTNERS

The Wetlands Initiative, coordinator
Argonne National Laboratory
Bloomington-Normal Water
Reclamation District
Bradley University
Greater Peoria Sanitary District
Iowa State University
Louisiana State University
Metropolitan Water Reclamation
District of Greater Chicago
Northwestern University
Sanitary District of Decatur
Springfield Metro Sanitary District
The Ohio State University
University of Illinois
University of Minnesota
University of Missouri-Columbia
University of Wisconsin

Nitrogen is a powerful nutrient. It can make grass green and dramatically increase corn yields. When too much of it reaches our rivers and streams, however, it threatens human health, chokes out aquatic life, and fouls our coastal waters.

For example, there is abundant scientific evidence that nitrogen contributes to the growing “Dead Zone” in the Gulf of Mexico. In 2001, the U.S. Environmental Protection Agency (EPA) determined that the nation needs to reduce excess nutrients, such as nitrogen, in our streams and rivers.

Currently, state EPAs are mandated by the federal EPA to write and enact water quality standards for nitrogen and phosphorus or to adapt the proposed federal criteria. In response, Illinois water reclamation districts predict¹ it will cost their ratepayers more than \$5 billion to install the best technology available and \$500 million annually to operate—yet even this investment will not produce water that meets the proposed federal criteria. Nor will it address a region’s needs for open space, wildlife habitat, and flood control.

The Wetlands Initiative and its partners have developed an alternative: Restored wetlands, financed by the purchase of nutrient removal credits—either through an open market or through long-term contracts. We call this strategy “nutrient farming.” In addition to removing nutrients, the restored wetlands will provide important environmental benefits for humans and wildlife—benefits that are unavailable through the use of traditional treatment technologies.

The potential market for nitrogen farming credits is huge. For example, if row crop farmers in the United States were required to buy credits to offset the 4 million tons of nitrogen fertilizer estimated to run off their fields, \$2.4 billion per year could be generated.

Another, more immediate market would be industrial and municipal dischargers. Annual operating and maintenance costs at upgraded treatment plants are estimated to be \$4.8 billion nationwide (extrapolated from Illinois per capita costs). This money would be better spent re-creating wetlands, which also provide many other environmental benefits.

Nutrient farming could be conducted throughout the

Mississippi River Basin and other watersheds across the United States where high nutrient concentrations are of concern. The U.S. and Illinois EPAs have endorsed nutrient farming as a means to reach clean water goals.

PROBLEM

The regions with the highest losses of presettlement wetlands are also the areas with highest fertilizer usage and nitrogen yields. In the past 200 years, for example, three Midwestern states (Iowa, Missouri, Illinois) in the Upper Mississippi River Basin drained 85 to 90 percent of their wetlands. More than 4 million acres of wetlands were destroyed in the Illinois River watershed alone. Not surprisingly, these areas also have the highest nitrogen concentrations in their rivers.

The modern, highly modified aquatic ecosystems of the upper Midwest can no longer purge themselves of excess nitrogen. By dredging, channelizing and leveeing off rivers from their backwater lakes and floodplain wetlands, we have crippled the river’s natural ability to denitrify its waters. Today, the nutrient-rich water reaching the Gulf of Mexico’s coastal shelf,

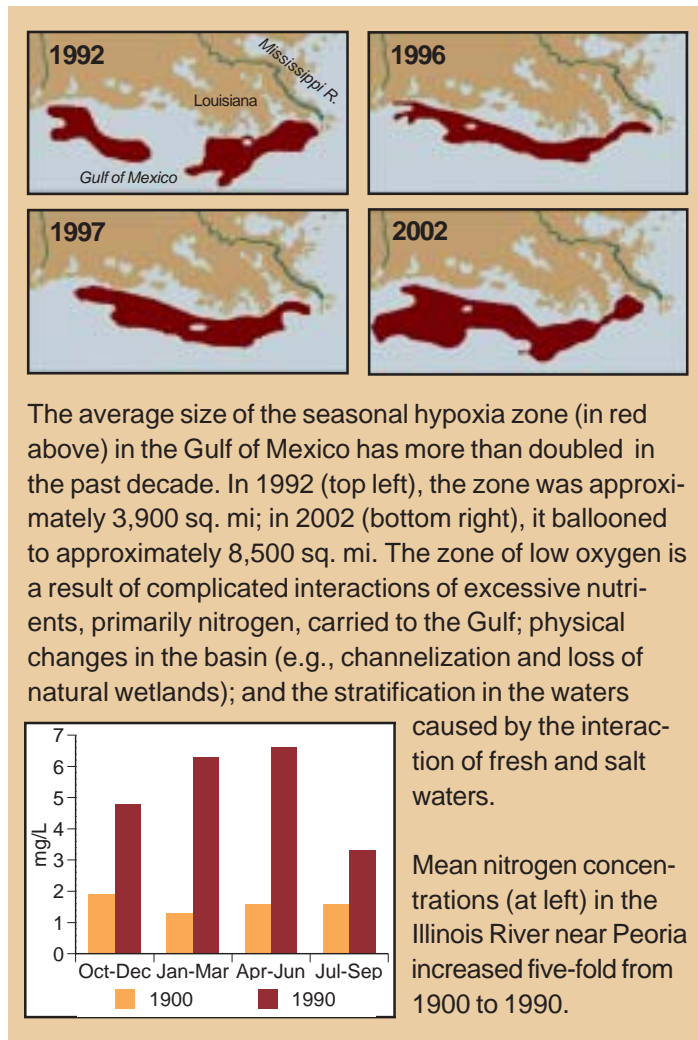
triggers excessive algal growth. This results in low oxygen levels (called hypoxia), causing fish, shrimp, crabs, and zoo-plankton to die. Scientists also have linked excess nitrogen to bladder cancer and blue-baby syndrome.

The altered river systems of today cause billions of dollars in flood damage as well. According to the U.S. Weather Bureau, national flood damages now average \$3.5 billion; earlier in the century (1903-1933), damages averaged \$1.4 billion (both sums are adjusted for inflation). This increase is in spite of—or because of—ever-rising federal expenditures on levees and other control structures.

SOLUTION

Nutrient farming is a control strategy that seeks to optimize the natural chemical and biological reactions in created and restored wetlands to remove nitrogen, phosphorus, and carbon from surface waters. Landowners then sell nutrient reduction credits to other farmers, municipalities, or industries that release excess nutrients to surface waters and cannot cost-effectively remove these nutrients themselves.

The Wetlands Initiative and its partners are developing pilot projects to test and demonstrate the economic efficiency and environmental



benefits of nutrient farming. This new way of managing the quality of our nation's waters will be less costly than conventional treatment methods, reduce demand on energy resources and provide additional benefits for biodiversity and wildlife.

Although scientists know that wetlands can remove nutrients and sediments, there are still unanswered questions regarding nutrient farming:

- Is nutrient storage permanent?

- Will microbial activity produce harmful air emissions?
- What is the most economical way to distribute wetlands throughout a watershed to achieve maximum environmental benefit?
- Will market and governance strategies serve to meet environmental goals?
- Can other wetland values, such as biodiversity, be maintained if nutrient removal is optimized?

Several major institutions (see list of partners on front page) are participating in far-reaching research to answer these and other questions. This interdisciplinary research will integrate knowledge of chemical, physical, and biological processes with the economic mechanisms necessary to support these landscapes.

Although previous research established that wetlands reduce nutrients in surface waters under certain conditions and for certain time periods, scientists do not fully understand the complex interactions that produce this reduction or how to manage these processes. This research program will create a body of knowledge useful for predicting wetland reactions and outcomes over a wide range of conditions. With this fuller scientific understanding of wetland optimization, economists can evaluate the economic feasibility of nutrient farming over that same range of wetland conditions.

Nutrient farming must be viewed as a business enterprise—an economically efficient means to manage environmental problems. This economic efficiency will be established only by using solid biogeochemical and economic data.

¹Consoer Townsend Envirodyne Engineers, Inc. (2002), study conducted for Illinois Association of Wastewater Agencies.

For more information about nutrient farming, pilot projects, or research opportunities, contact:

THE WETLANDS INITIATIVE

Donald L. Hey, Ph.D., Senior Vice President
53 W. Jackson Blvd., Suite 1015, Chicago, IL 60604 • (312) 922-0777, ext. 113 • Fax (312) 922-1823
dhey@wetlands-initiative.org • www.wetlands-initiative.org