SOLVING THE AGRICULTURAL PHOSPHORUS POLLUTION PUZZLE:

Linking Nutrient Pollution, Value of Ecosystem Services, and Policy

By Dr. Cloé Garnache, Frank Lupi, Joe Herriges, and Jan Stevenson, Michigan State University

THE PROBLEM

Nutrient pollution of rivers, lakes and Great Lakes can lead to eutrophication, algal blooms, altered water clarity, and degradation of valued ecosystem services, including beach recreation, commercial and recreational fisheries, drinking water supplies, and aesthetic amenities.

Despite strides reducing municipal and industrial point sources, reducing nutrient loads from sources such as agriculture and failing septic systems remains challenging. In most freshwater systems, phosphorus is more limiting than nitrogen for algal growth and, therefore, drives eutrophication and harmful algal blooms.

The effective management of nutrient pollution requires an understanding of the interplay between human activities and the surrounding ecosystems. Most aquatic ecosystem services, and thus their value, decrease with severe eutrophication. However, the linkages between eutrophication and ecosystem services are oftentimes complex, highly nonlinear, and sometimes non-monotonic. Exploiting these ecological linkages, coupled human and natural system models can be used to assess the cost-effectiveness of various regulations and incentive-based policies.

NEXT STEPS

Our team will research the linked ecological-economic causes, consequences, and policy solutions for freshwater nutrient problems.

1. We will assess evidence from the economics literature, including issues of risk, input elasticities, and market failures, and contrast this with the common environmental science assertion that farmers "over-apply" phosphorous;
2. We will develop ecological production functions linking nutrient pollution to ecosystem services;
3. We will quantify the economic costs and benefits of reducing nutrient pollution, and assess policy options including payment for environmental service contracts, nutrient taxes, and water quality trading schemes to help inform policy decisions.

CONTACT

Dr. Cloé Garnache
446 W. Circle Drive
East Lansing, MI 48824-1039
(517) 353-1870 | garnache@msu.edu

MORE INFORMATION

To learn more about Dr. Garnache's work, visit www.msu.edu/~garnache/ and www.afre.msu.edu/people/garnache_cloe