# Economics of Water Quality Protection From Nonpoint Sources

## Theory and Practice

### Marc O. Ribaudo
### Richard D. Horan
### Mark E. Smith

## Introduction

The harmful consequences of farm production on water quality include soil erosion; runoff into rivers and streams of fertilizers, animal waste, and pesticides; and leaching into groundwater of nutrients and pesticides. However, agricultural pollution is only one source of water quality problems; others include discharges from industry and municipal sewage treatment plants, urban runoff, and atmospheric deposition (delivery by wind and rain). Still, agriculture is identified as a major contributor to pollution of the Nation's surface waters (EPA, 1998a).

Public concern over the degradation of water resources has led to a number of Federal, State, and local policies and programs for protecting and improving water quality. The response has been multifaceted. Both regulatory and voluntary programs have been administered by a variety of Federal, State, and local agencies. On February 19, 1998, the White House released the Clean Water Action Plan. The plan states that:

> After 25 years of progress, the nation's clean water program is at a crossroads. Implementation of the existing programs will not stop serious new threats to public health, living resources, and the nation's waterways, particularly from polluted runoff. These programs lack the strength, resources, and framework to finish the job of restoring rivers, lakes, and coastal areas. To fulfill the original goal of the Clean Water Act—fishable and swimmable water for every American—the nation must chart a new course to address the pollution problems of the next generation. (EPA, USDA, 1998, pg. i).

Controlling water pollution can follow many courses. Economics has an important, if not vital, role to play in identifying policy strategies that can enhance water quality at least cost. An economic framework can coordinate policy formulation among different levels of government and help to unify policies across regions.

Reducing pollution requires changing the behavior of polluters. Since polluters are already operating within an economic framework (the profit-maximizing one), water quality protection policies can be seen as altering some of the economic variables a polluter considers when making everyday production decisions.

On the other hand, economics also determines the optimal level of water quality protection. Society does not benefit from overly stringent or costly water quality goals. Measuring the benefits of water quality protection to water users in economic terms is often difficult, since many benefits occur outside of easily observable market conditions. Even where water quality impacts on markets are observed, it can be difficult to ascertain just how water pollution affects the ability of a resource to provide economic goods. Nevertheless, information on benefits is essential to developing socially optimal water quality protection policies.

In this report, we review alternative policy tools for addressing nonpoint-source pollution. Much progress

has been made in controlling pollution from point sources, such as factories and municipal sewage treatment plants. However, nonpoint-source pollution is much more complicated and elusive than point-source pollution, and the tools developed for controlling one do not necessarily apply to the other. We first present what is currently known about the quality of the Nation's water resources and agriculture's contributions to existing problems. The second chapter presents some guidelines for efficient policy design. We then review some issues surrounding policy development and implementation, including the characteristics of nonpoint-source pollution and the level of government—Federal or local—best suited to addressing those problems. The next five chapters cover five classes of policy tools: economic incentives, standards, liability, education, and research and development. Finally, we suggest the roles of different policy instruments in a national strategy to control nonpoint-source pollution, and identify additional research needed to improve such a strategy.