The Affects of Agricultural Practices on the Water Quality of the Weeks Bay Watershed

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Abstract

Sediment, pesticide, and nutrient runoff from agricultural non-point sources are a major contributors to water quality degradation of the Weeks Bay watershed in Baldwin County, Alabama. Modifications of conventional agricultural practices can yield positive water quality results. Surface sprinkler irrigation runoff is a primary culprit, carrying agricultural pollutants into waterways. An alternative would be to use sub-surface drip irrigation. To successfully facilitate the adoption of existing conservation practices and encourage the innovation of new agricultural methods, farmer attitudes and risk perceptions must be thoroughly understood. Farmers must have the ability to make management decisions while working collaboratively with policy makers. Research demonstrates that non-regulatory, incentive-based conservation policies are favored by farmers and yield greater levels of adoption (1).

Introduction

Water is vital to sustaining life on Earth. Water pollution, including fertilizers, sediment, and pesticides, is threatening the health of aquatic ecosystems and the quality of life for humankind. On-farm water usage is fundamental for the production of the world's food supply. Maintaining a sustainable water supply is increasingly important due to the current population explosion in Baldwin County. The development and implementation of water management practices can aid in reducing non-point source (NPS) pollution, or pollution coming from sources that are difficult to identify. In our poster we address the impact of agricultural practices on the water quality of the Weeks Bay watershed and how these practices are influenced by agricultural policies. In particular, we ask how farmer attitudes regarding water protection and sustainable agricultural practices influence adoption of conservation techniques? Additionally, how do water management plans, land use policies, and conservation programs influence water quality and agricultural practices?

Methods

We conducted a media content analysis of opinion leading newspapers using the Lexis-Nexis search engine, as well as a scholarly literature review. Through this analysis, we identified the ways in which water quality issues are framed and explained in the media. The literature review of scholarly works and water management plans provided us with current scientific information and research related to our water quality questions.

Results

Our research yielded three key findings relating to the water quality questions. They can be divided into the categories of irrigation, farmer attitudes and practices, and management plans and policies.

Irrigation. Using irrigation is vital to farmer's livelihoods (1, 2, 3, 9). Irrigation increases yields, prevents some diseases, e.g. corn earworm, and is necessary for farmers to receive loans from lending agencies. Agricultural water use represents the major share of water diverted by humans worldwide (3, 7). Thus, farmers are faced with intensifying pressure to improve the efficiency of water, leaving farmers wanting to know how to irrigate in ways that are effective, conservative, efficient, and affordable (3, 7). Common row crops grown in the south such as corn and cotton are primarily irrigated via surface sprinkler (7, 9). However, irrigation water needs to be applied uniformly to match the infiltration rate of the soil to avoid runoff (7, 12). Surface irrigation is a primary culprit of runoff (7, 12). Subsurface drip irrigation (SDI) is one method of water application that is thought to be efficient in row crop production (7, 12). SDI is found to be as effective as surface sprinkler irrigation and more effective in water usage while producing the same yields (12). However, SDI has not been widely adopted in the south because growers feel that it does not sufficiently offset the relatively high cost of instillation (9, 12). Yet SDI is an irrigation technique that reduces runoff of soil, pesticides and the like into local water sources (12).

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Figure 1. Grassy conservation buffers planted between four crop rows reduce runoff.

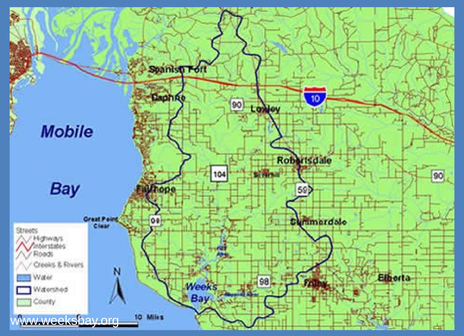

Figure 2. Blue line delineates the Weeks Bay Watershed.

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Figure 3. Sub-surface drip irrigation is piped for each crop row.

Farmer Attitudes and Practices. Two important factors that influence farmers' levels of adoption of conservation practices are their sources of motivation and the risks they perceive. Farmers' motivations and risk attitudes are almost always specific to regions and environmental contexts (6). Research findings that are applicable to the Weeks Bay region are the low rates of farmer understanding of regulations, farmer complaints of government monitoring and regulation of farm practices, and farmer preference for voluntary conservation practices (5). Also, sources of motivation for converting to sustainable agricultural practices include social pressure and internal beliefs (4, 8). Pressure from local citizens, coupled with education, may contribute to a shift in internal beliefs. Intrinsic motivating forces for farmers to adopt conservation practices include personal attachment to the land, a desire to conserve the land for future generations, and concern for the environment (10). Farmer watershed groups create a venue for asserting social pressure and modifying internal beliefs (10). Participation in these groups provides an opportunity for farmers to combine their indigenous knowledge with the technical knowledge of government officials.

Management Plans and Policies. The creation of water management plans and policies is a complex process that includes the interests of multiple and different stakeholders including agricultural producers, government agencies, and environmental conservationists (13). Policies and plans addressing sources of NPS pollution are difficult to formulate and can prove ineffective (1). There are two general types of policies that can be implemented within a region: regulatory and non-regulatory. Regulatory policies limit the activities of individuals and agencies and promote certain behaviors through sanctions or fines. Non-regulatory policies are based on voluntary participation and utilize incentives to encourage participation in conservation practices. Research shows that non-regulatory policies are more widely accepted by farmers and are more effective in reducing NPS pollution than regulatory policies (11). Because the source of the water pollution cannot be traced to an individual, but instead is the sum result of the agricultural practices in the region, non-regulatory policies are more effective. Incentives from non-regulatory policies encourage voluntary participation in conservation programs and do not put farmers at a disadvantage in agricultural markets.

Conclusion

Because water usage is vital for the production of the world's food supply, decreasing pollution from agricultural practices and creating policies to ensure the future health of the watershed are necessary. The principle use of water in agriculture is irrigation. Because sprinkler irrigation contributes to runoff, it is important to expose farmers to information about other irrigation methods such as SDI that decrease water pollution. Farmer attitudes toward their current agricultural practices affect the types and levels of conservation efforts that they adopt. A thorough understanding of barriers and motivations for adoption are necessary for conservation programs to be successful. Farmers are largely in favor of non-regulatory, incentive based conservation policies because they are voluntary and do not place farmers in a position of competing with other growers who are not as highly regulated.

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