



# Agricultural landowners' willingness to participate in a filter strip program for watershed protection



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## ABSTRACT

Non point source (NPS) pollution remains a challenge to communities meeting watershed management objectives around the world. Installing agricultural best management practices (BMPs) such as filter strips is a widely accepted mechanism to control NPS pollution and agricultural runoff. Government programs in the form of payment for environmental services (PES) have been introduced to encourage BMP adoption for watershed protection. However, the voluntary nature of these programs makes landowners' decision to participate in them critical to achieving program goals. Understanding the drivers behind landowners' decisions to participate in watershed protection programs is essential for designing effective and efficient programs. This study examines agricultural landowners' decisions to participate in a conservation program involving filter strips. Using responses from a survey of agricultural landowners in Michigan's Saginaw Bay watershed, the study examines key programmatic, socio-psychological, and demographic determinants of landowners' participation decisions. The study results suggest that making contract durations shorter with enhanced rental payments, and educating landowners about program efficacy as well as on- and off-farm benefits of the conservation practice would enhance participation.

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## 1. Introduction

Agricultural non-point source pollution remains a key challenge to communities meeting watershed management objectives in the United States and worldwide (Duncan, 2014; Ma et al., 2014; Organisation for Economic Co-operation and Development, 2001; Stuart et al., 2014). Nutrients, sediments, pesticides and pathogens, especially from agricultural sources, impact aquatic ecosystems with adverse effects on water quality and wildlife habitat. In the United States, the National Water Quality Inventory identified agricultural non point source pollution as the leading source of water quality impacts to surveyed rivers and lakes, the third largest source of impairments to surveyed estuaries, and a major contributor to ground water contamination and wetlands degradation (US EPA, 2012b). The Organization of Economic Co-operation for Development (2001) also estimates that agriculture in the

European Union contributes about 40–80% of the nitrogen and 20–40% of phosphorus entering surface waters. Similar trends of pollution from agricultural non point source pollution have also been reported in other parts of the world (Agrawal, 1999; Duncan, 2014; Li and Zhang, 1999; Novotny, 1999). With climate change predicted to increase the incidence of severe storm events, water resources are likely to be in further decline if the transport of agricultural pollutants is not adequately checked (Jeppesen et al., 2009; Milly et al., 2005).

Agricultural best management practices (BMPs) are widely accepted among scholars and resource managers as a way to address the issue of nonpoint source pollution and agricultural runoff (Bratt, 2002; Giri et al., 2012; Ryan et al., 2003). Practices such as filter strips and cover crops have proven to be successful measures to control agricultural pollution and improve overall environmental quality (Giri et al., 2012; Shan et al., 2014; Zhang et al., 2010). Recognizing the relevance of BMPs to NPS control, various government programs in the form of payment for environmental services (PES) have been introduced worldwide to encourage BMP adoption. Many of these PES programs target land use and BMPs for agricultural landowners (Asquith et al., 2008; Chen et al., 2009a; Kaplowitz et al., 2012). For instance, Ecuador's SocioPáramo program, the Rural Environment Protection

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Scheme in Ireland, and several other agri-environmental schemes in Europe and Australia have all been used to incentivize landowners to implement BMPs to protect water and land-based resources (Bremer et al., 2014; Burton and Schwarz, 2013; Greiner and Gregg, 2011; Murphy et al., 2014). Likewise, in the United States, programs like the USDA Natural Resource Conservation Service's Environmental Quality Incentive Program (EQIP), Conservation Reserve Program (CRP), and Conservation Stewardship Program (CSP) have encouraged, with varying degrees of success, landowners to adopt various BMPs by offering financial and technical assistance to participants with eligible agricultural lands (Baylis et al., 2008).

Recently, the US Agricultural Act of 2014 (commonly referred to as the "farm bill") maintained conservation on working lands as a top priority. The Farm Bill consolidates some existing conservation programs, links crop insurance subsidies to conservation compliance, and provides more than \$1 billion of funding for PES programs to boost participation in the conservation programs (Natural Resource Conservation Service, 2014). The implementation of BMPs by agricultural landowners is at the heart of the Act's focus on conservation programs. In the United States, national agricultural and environmental protection efforts are often implemented in conjunction with state partners. For example, in 2000, the state of Michigan in partnership with the federal government and some private organizations introduced the Conservation Reserve Enhancement Program (CREP) to help control soil erosion, improve water quality, and enhance wildlife habitat in priority watersheds. Modeled after the US Department of Agriculture's Conservation Reserve Program (CRP), CREP offers agricultural landowners enhanced monetary incentives including annual rental payments for the length of the contract and cost-share assistance to establish select BMPs on their lands for watershed protection. The voluntary nature of this scheme makes agricultural landowners' decisions to enroll their lands critical to achieving policy goals. As a number of the original CREP contracts approach their end dates and enrollment rates in Michigan's CREP declines, policymakers are interested in ways to organize the program to help attract new enrollment while encouraging current participants to reenroll their lands when their current contract expires.

This paper uses an examination of the willingness of agricultural landowners in the Saginaw Bay watershed to participate in CREP to explore how programmatic, socio-psychological, and demographic factors impact agricultural landowners' decision to participate in government-sponsored BMP programs. Although the CREP program includes other eligible BMP, this study focuses on enrollment in filter strips which is the most widely adopted practice under CREP in Michigan and because of filter strips' demonstrated effectiveness as a pollutant reduction practice even with minimal width (Abu-Zreig et al., 2004; Zhang et al., 2010).

## 2. Background

### 2.1. Agricultural landowners and conservation programs

The literature is replete with studies assessing factors believed to influence farmer's adoption of conservation practices (See reviews from Baumgart-Getz et al., 2012; Knowler and Bradshaw, 2007; Prokopy et al., 2008; Hynes and Garvey, 2009). Some of this literature has specifically explored farmers' willingness to participate in agri-environmental programs (Ma et al., 2012; Mishra and Khanal, 2013; Vanslebrouck et al., 2002). Nevertheless, most of these studies have focused on farmer and farm-level factors to explain adoption of conservation practices or willingness to participate in agri-environmental schemes offering no monetary incentives for participation. Generally, this line of literature suggests willingness to participate in agri-environmental programs

is positively related to farm size, educational attainment, farmer's interest and/or experience with conservation, environmental attitudes, access to and quality of information, perceived financial and farm-level related benefits, but negatively related to farmer's age. While such factors influence participation, they are less amenable to policy changes besides providing avenues for targeting potential participants. In recent years, a few studies, mostly from Europe, have explored the role of programmatic factors as determinants of participation in agri-environmental programs (Christensen et al., 2011; Espinosa-Goded et al., 2010; Mettepenningen et al., 2013; Ruto and Garrod, 2009). For instance, Ruto and Garrod (2009) used a choice experiment approach to investigate the role of program design characteristics on participation in agri-environmental schemes among farmers from ten European countries. They found that farmers would require greater financial incentives to participate in schemes with longer contracts or that offer less flexibility or higher levels of paperwork. Similarly, in a comparative study of Belgium and American farmers, Mettepenningen et al. (2013) noted farmers' preferences for flexible approaches toward agri-environmental schemes, in which they have the freedom to decide on contract terms and the related payments. Nonetheless, the effect on participation of programmatic rules and payments, which influence the economic attractiveness of agri-environmental programs remain largely understudied especially in the United States.

At the same time, a few studies have explored farmers' preferences for agri-environmental programs involving filter strips (Howard and Roe, 2013; Lant et al., 1995; Loftus and Kraft, 2003; Purvis et al., 1989). Purvis et al. (1989) examined farmers' willingness to participate in a filter strip program and showed that their decisions are determined by the yearly payments, perceptions of environmental change, and farm opportunity cost. Loftus and Kraft (2003) also reported that farmers who rely less on farm-generated income as a percentage of total household income, and those informed about the eligibility of their land for the program tend to be more willing to participate in CRP involving filter strips. Nevertheless, a high proportion of the previous studies on filter strips involve hypothetical agri-environmental programs (e.g. Howard and Roe, 2013). Those studies exploring specific agri-environmental programs do not consider the role of program specific factors in the farmers' enrollment decision making (Loftus and Kraft, 2003). This study addresses this gap by exploring how program participation is affected by the program characteristics of an existing agri-environmental program involving filter strips. Insights into the contribution of program characteristics on participation will allow resource managers to reorganize the program to reflect landowners' preferences and boost participation.

In addition to the above literature, a number of studies have demonstrated the role of non-economic concerns as determinants of landowners' decision-making regarding conservation programs (Greiner and Gregg, 2011; Januchowski-Hartley et al., 2012; Kvakkestad et al., 2015). Socio-psychological factors including landowners' social and moral concerns and their attitude toward the environment and government-run conservation programs have been shown to influence participation (Dupraz et al., 2003; Larson and Lach, 2008; Mzoughi, 2011). Conservation practices differ in land and management requirements, as well as aesthetics, and thus may elicit different adoption rates or participation in programs involving them (Prokopy et al., 2008; Ryan et al., 2003). In addition to being compatible with existing farming practices, the degree to which landowners perceive the conservation practice to offer environmental, social, and private benefits as well as the risk, time, and effort required to implement the targeted practice have been shown to be closely related to adoption (Ma et al., 2012; Sattler and Nagel, 2010; Wauters et al., 2010). In a qualitative study exploring the role of social factors and expected private benefits as a determinant of participation in

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