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A PERFORMANCE-BASED APPROACH TO AGRI-ENVIRONMENTAL POLICY IN CANADA: DEVELOPMENT AND COMPARATIVE ASSESSMENT

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Growing Forward

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Summary

The environmental effects of agriculture are becoming more apparent to the public. As societal values change over time, there will likely be a corresponding shift in agri-environmental policy. Performance-based agri-environmental policy has been identified as a mechanism to provide payments to agricultural producers for the production of ecosystem goods and services (EG&S). This mechanism bases payments on environmental outcomes (i.e., EG&S), rather than inputs or adoption of specific practices. The payment structure assumes that agricultural producers can 'rent' EG&S to the public and that the public are willing to pay for these benefits and is based on a perception that agricultural landowners hold strong property rights to the land.

This study evaluated: 1) the social context of performance-based policy instruments for water quality implemented elsewhere; 2) the perceptions of agricultural property rights and responsibilities related to water quality from the perspectives of agricultural producers, rural residents and urban residents in southern Alberta, Canada; and 3) the feasibility of implementing a performance-based approach to agri-environmental policy within the study area.

Performance-based policy instruments implemented in Organization for Economic Co-operation and Development (OECD) member countries were identified and a model was created to organize the policy instruments according to the degree of performance incorporated. The model used the payment structure and method of measurement as categorizing variables.

Study of the context surrounding the implementation of performance-based policy instruments identified several common contextual elements separated into enabling conditions and drivers. The most common enabling conditions were the legal and institutional capacity to implement the instruments. For example a physical water quality problem severe enough to trigger a policy response, a recognition of the impact, and importance, of production of EG&S by agriculture, and the ability to model the impacts of specific agricultural practices on water quality with some confidence. Common drivers of performance-based policy instrument implementation include new regulatory measures to improve water quality and the associated fear of further regulation by agricultural landowners, as well as the ability of program administrators/facilitators to create social buy-in to implement the programs.

There are some barriers to implementing performance-based policy instruments in Canada; a lack of legislative capacity is a key concern, as is the lack of understanding of social context of the country, and of the study region in particular.

The investigation of social norms and values of the study area showed that attitudes of most respondents supported a split between the 'beneficiary pays' and 'polluter pays' principles. Specifically there was a willingness to pay for EG&S produced by agricultural landowners given that a minimum standard of water quality is enforced. These social values associated with agricultural production and the environment are closely tied to cross compliance and payments for EG&S (PES) – two policy instruments that can be implemented as performance-based measures. The feasibility of implementing these approaches separately or in combination is being explored.

Introduction and background

Public environmental awareness is growing. A survey issued by The Strategic Council (2009) indicates that 'environmental issues' was rated as the most important concern facing Canadians in 2007[1]; more important than the economy and more important than health care. Agriculture is a land use that has many potentially significant effects on the environment. Of particular public concern is agricultural contamination of water. Water contamination from agricultural sources has resulted in human illness and death. An often-cited example of this is the case of Walkerton, Ontario. The area experienced a major disease outbreak where seven deaths and approximately 2300 illnesses occurred due to drinking water contaminated by *E. coli* bacteria in livestock manure, which significant rain events washed into groundwater. While Walkerton received extensive media attention due to the severity of the problem, there have been several other documented instances where drinking water was contaminated by fecal coliform bacteria arising from agriculture (Schuster, Ellis et al. 2005). In addition, a website-based monitoring system of boil water advisories reported more than 1000 advisories in Canada since 2009 (The Water Chronicles 2010). While the reasons for these advisories are not all agriculture-related, this advisory system illustrates the prevalence of water quality concerns. Agricultural water contamination can also have major impacts on aquatic life. Nutrient loading of Lake Winnipeg from livestock manure is an example that has received much media and research attention. High levels of phosphorus have caused large algal blooms (up to 13,000 km^2) that reduce the oxygen concentrations and produce toxins in large portions of the lake (Salki 2007; Environment Canada 2010). These types of agricultural contamination events have raised public awareness and concern about the impacts of agricultural management practices.

Incentive-based programs, moral suasion, and education have been the primary mechanisms used by governments in Canada to encourage agricultural practices that have a positive impact on water quality. These mechanisms focus on changing management practices; however, the link between practices and environmental outcomes can be weak (Heimlich and Claassen 2004). An alternative to practice-based environmental policy and programs is the performance-based approach, which has garnered significant interest (Greenhaugh, Selman et al. 2006; Weinberg and Claassen 2006). In a performance-based approach, the landowner realizes some type of benefit based on production of ecosystem goods and services (EG&S) (i.e., ecosystem outputs, or performance) rather than on simply adopting a practice. Performance-based instruments focus on *outcomes* rather than particular practices, where producer flexibility is a key component of programs (Keeney and Boody 2005; Weinberg and Claassen 2006; Winsten 2009). Performance-based instruments require that environmental outcomes must be well-defined and program responses (payments or penalties) are conditional on outcome delivery (Wunder, Engel et al. 2008). The expected performance of a particular practice can be estimated based on mechanisms such as models (Lowell, Drohan et al. 2007) and indicators (Weinberg and Claassen 2006), while actual performance can be measured using inspections (Hanley, Whitby et al. 2004) and remote sensing (Cohen and Goward 2004).

[1] This rating dropped to third in 2009, with economic issues becoming increasingly important. This change was likely influenced by the recession that began in 2008.

Performance-based policy instruments

Although there has been little implementation in the agricultural sector, the performance-based approach is recognized as superior to other approaches in terms of cost-effectiveness of improving environmental outcomes over time (Weinberg and Claassen 2006). There are two reasons for this: first, the landowner has the ability to adopt the least-cost strategy to meet a target (Wätzold and Dreschler 2005). Flexibility for the landowner is a key benefit of the performance-based approach (Claassen, Hansen et al. 2001; Weinberg and Claassen 2006) and flexibility in management and marginal payments for environmental outcomes foster technological development and innovation (Jack et al. 2008). Second, funds are directed toward practices that have a demonstrated positive effect on the environment, reducing the potential to pay for practices that are ineffective (Claassen, Hansen et al. 2001).

Performance-based policy instruments that have been implemented elsewhere to manage agricultural water quality include differentiated payments for ecosystem services (PES), water quality trading, and reverse auctions. Each of these instruments uses a different mechanism to promote the improvement of water quality.

Payments for ecosystem services : PES, when implemented as a performance-based instrument, is voluntary and requires that a specific ecosystem service (or expectation of a service based on estimates) is bought from a provider with the condition that the service is indeed provided (Wunder, Engel et al. 2008). PES creates a market for EG&S where the buyer is often a government body and the seller is usually an individual or small group (Wunder, Engel et al. 2008). This instrument has been implemented in several regions, including the EU, Australia, and North and South America.

Water quality trading: Water quality trading or permitting allow high water pollution emitters to buy emission credits from low level emitters. This market-based policy instrument establishes property rights for pollutant discharge and can be implemented where cap and trade regulations have been put in place, or where voluntary demand is great enough to warrant the policy instrument (Lal, Delgado et al. 2009). Water quality trading uses models to predict water quality improvements from specific BMPs. Payments are made based on the magnitude of reduction in pollutants estimated from those models. This instrument has been used in Ontario and the US to manage point-nonpoint source pollution within watersheds.

Reverse auctions: Reverse auctions are a market-based instrument used to reduce the cost of EG&S for buyers, as the minimum price producers are willing to accept is revealed with this instrument (Lowell, Drohan et al. 2007). Agricultural producers 'bid' to provide EG&S for a particular price and buyers may use a number of decision models to accept bids and reject others. Bids may be chosen based on cost-effectiveness, maximum area coverage or bids that will have the greatest environmental impact. This approach has been piloted in Canada but the main region that has implemented this approach is Australia.

Cross-compliance: When implemented as a performance-based instrument, albeit a very weak one, cross-compliance imposes a minimum standard for environmental performance (i.e., production of EG&S) that is required of agricultural producers. With the achievement of the minimum standard, agricultural producers are eligible for various government support and loan programs (Mann 2005;

OECD 2010). The program is voluntary; agricultural producers are not required to meet the standard, but forfeit access to government assistance programs if they choose not to. This mechanism has been used in the US to achieve soil quality and wetland preservation objectives (Claassen, Breneman et al. 2004).

Policy transfer

New policy instruments are implemented as a result of social, political, economic, ecological, and/or institutional contextual conditions that drive and enable change (Dolowitz and Marsh 2000). Often, policies (and policy instruments) are not created 'from scratch', but rather are transferred from one region to another. Policy transfer allows policy-makers to learn and apply lessons from other regions to their own; the term 'policy transfer' encompasses the transfer of policies, policy instruments, structures, and concepts (Dolowitz and Marsh 1996). The successful transfer of a policy instrument from one place to another depends, in large part, on the broader contextual factors that drive and enable it (Dolowitz and Marsh 2000; Mossberger and Wolman 2003; Millennium Ecosystem Assessment 2005). Dwyer and Ellison (2009), in a review of recent policy transfer literature, emphasize the importance of understanding the context surrounding policies prior to policy transfer, and state that there is currently a lack of consideration of policy context.

Social context in particular can have a significant impact on whether a policy instrument can be successfully implemented. An understanding of both the exporting and importing region's social/cultural context is important to assess the similarity, and thereby the transferability, of policy instruments (Rose 1993; Dolowitz 2003; McCourt and Foon 2007; Benson 2009). In general, the more similar the contexts of the importing and exporting countries, the more likely the success of a policy instrument transfer (Rose 1993; Hospers and Beugelsdijk 2002). Failure to understand the historical and current underlying social contexts can result in failure of the policy in the importing region (Tews 2009). A commonly-cited example of this is the transfer of the Child Support Agency (CSA) model from the United States to Britain. The CSA paid welfare payments through the tax system rather than a benefit system and was successful in the US but failed in Britain. According to Dolowitz (2011), there were several reasons for the failure: differing motives, improper transfer of institutional structure, and a major reason cited was differing social and cultural conditions in the two countries. Social norms and values (social context) are deeply embedded within society and are not easily or quickly changed (Roland 2004); therefore, for a successful transfer it is important that the regions involved share similar social contexts.

Social perceptions of agricultural property rights

Policy instruments are tools that relate the social norms and values of society to landowners. That is, the perceived rights and responsibilities of agricultural landowners are reflected in the choice of agri-environmental policy instruments implemented (Hodge 2001). The historical view of property rights is that agricultural producers have the right to do as they please on their land and should be given incentives to change (Hodge 2001; Hart and Latacz-Lohmann 2005; Hodge 2007). This view of property rights is supported by many of Canada's agri-environmental programs to date. For example, agricultural producers have been compensated to some degree for costs associated with adopting beneficial management practices (BMPs). These practices have been developed to improve environmental conditions on agricultural land. In addition, education and technical assistance are offered to agricultural producers free of charge. Agri-environmental incentive programs infer implicitly that landowners have a

right to compensation for providing external benefits by changing their practices or adopting new technology (Tovey 2008); transferring resources from the public to private landowners (MacIntosh and Denniss 2004). Incentive programs imply that the public has the responsibility to ensure that agricultural operations produce environmental benefits and prevent environmental harms.

This study adopts a "social process" view of property rights; that is, property rights change over time with changing cultural norms and values toward acceptable land use practices (Macpherson 1978; Gosnell and Travis 2005). Based on this view of property rights, agricultural landowners' practices should conform to society's perceptions of acceptable practices. The success of a new agri-environmental policy instrument can be impacted by society's perceived property rights of agricultural landowners, and whether the policies conform to society's views (Davies and Hodge 2006). The perception of legitimacy by agricultural landowners in particular will potentially increase adherence (or compliance) to the policy and motivation in relation to the aim of the policy.

Rationale

Efforts have been made to understand the motivations of agricultural producers in adopting BMPs (Banack and Hvenegaard 2010), and barriers to their adoption in Alberta (Alberta Research Council 2006). While these studies are important for the advancement of practice-based programs, they do not provide the needed guidance in the development of a progressive, cost-effective performance-based policy. The authors are unaware of recent literature that provides an understanding of whether perceptions of agricultural property rights have changed or evolved over time in Canada. Before new policy instruments are implemented that have the potential to alter agricultural property rights, the social norms and values, or social context, of the region should be examined for compatibility with the principles of the policy instrument (Davies and Hodge 2006). This study provides an understanding of the range and context of performance-based policy instruments implemented elsewhere in Part I, and then assesses how the study area context, and specifically social norms and values, align with those of other regions where performance-based policy instruments have been implemented in Part II.

PART I : Review and critical assessment of performance-based policy instruments

Theoretical Framework

Within the bounds of what are considered 'performance-based' policy instruments there are a range of performance measurement methods and payment structures. This range of performance-based instruments can be best described as a continuum with the strongest form of performance-based instruments utilizing site-based direct measurements of performance and variable payments. At the other end of the policy instrument continuum only a very weak element of performance is incorporated, and payments are based on inputs (eg. management practices) with no varying degree of incentive or disincentive based on the degree of outcome (Fig. 1). Performance measurement method and payment structure of the policy instruments are not necessarily linked, though they may occupy a similar rank on the continuum.

The performance-based policy instrument continuum developed in this study provides a means to organize policy instruments and is based on methods of measurement and payment, as these are the factors that differentiate performance-based approaches from other policy instruments (Fig. 1). This organizational model will be useful in ranking existing performance-based approaches that have been implemented elsewhere and provide an understanding of how policy instruments compare to one another. The model has further potential to serve as a general approach to categorizing policy instruments and may be useful in other research or policy studies to select appropriate instruments based on measurement or payment structure capabilities, or where a specific level of environmental performance is desired.

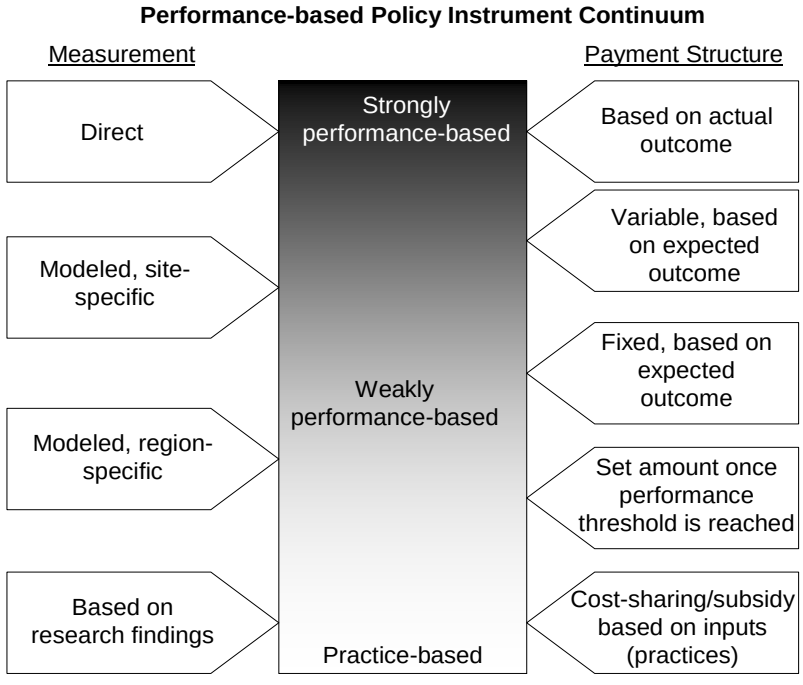

Fig. 1. Performance-based policy instrument continuum: variation in measurement of performance and payment structure.

Using water quality as a focus for discussion of the organizational model, a strongly performance-based policy instrument is one that uses direct water quality measurements to evaluate the potential payment or levy. The major benefit of this type of instrument for the program provider is cost-effectiveness; a high degree of accuracy is ensured and payments are made only for genuine improvements. However, there are several significant disadvantages to strongly performance-based instruments, such as high administrative costs, and a high degree of risk assumed by the producer associated with variable and unpredictable weather events, which may lead to very low adoption rates for a program incorporating this type of policy instrument.

Moving down the continuum, as performance is modelled instead of measured directly, accuracy and cost-effectiveness decreases for the program provider but there is potential for increased landowner program adoption due to decreased risk. Models where site-specific conditions are included (e.g., slope, distance to surface water, crop grown, and soil nutrient levels) are higher on the performance continuum than regional models, where only regional conditions are considered. Payment types can be variable and based on expected outcome from models or else fixed and based on model outcomes (e.g., reaching a set standard of water quality to be eligible for government funding). These types of instruments afford landowners greater security in receiving funding if actions are carried out, regardless of weather and other conditions beyond their control.

Finally, lowest on the policy instrument continuum, outcomes are assessed based on results of research studies related to the benefits of a specific management practice. The programs that incorporate this type of instrument are prescriptive and allow no flexibility for the landowner to adopt practices to his or her particular situation. While some attempt is made to assess whether there will be a positive environmental outcome, it is very weak and assumed to be linked to inputs or management practices. Payment structures for this type of instrument are usually fixed, paid as a cost-share or subsidy for inputs, and measurement is not included other than monitoring of management change compliance. The benefit of this type of instrument is that administrative costs are low. There is no need to develop models or measure site-specific or regional conditions, and this instrument can be applied to a broad landbase. However, there is only an indirect link between environmental performance and payment structure.

Performance-based policy instrument cases

Water Quality Trading

The characteristics of water quality trading make it strongly performance-based in terms of payment structure and moderately performance-based in terms of measurement method. Several water quality trading programs exist for agriculture. Most have been implemented in the United States (US); however, at least one program has been established in Canada, in the South Nation Watershed in Ontario. The Canadian example and a few of the US programs have been successful in establishing a trading scheme, while others have languished due to a lack of drivers.

There are several common enabling conditions and drivers among US and Canadian programs using water quality trading as a policy instrument. The first enabling condition is a physical need for water quality control from agricultural landscapes; that is, water quality conditions have deteriorated to a level that is unacceptable. The second enabling condition is the legal capacity to implement a water quality

trading program. There are two separate aspects to legal capacity. First, the water quality trading policy instrument must be recognized as an acceptable method of reducing non-point source pollution. In the South Nation case, this capacity was not explicit, but the institutional capacity was present and facilitated interpretation of the legislation in a way that created legal capacity. Second, there must be legal entitlement for the non-point source discharge. That is, there must be a “right to pollute” in place and this was the case for all programs reviewed. Finally, the policy instrument must be based on sound and socially-acceptable science. In cases where trading occurred methods of estimating P emission reduction, calculating trading ratios, and monitoring for actual results were important factors in stakeholder buy-in and the long-term viability of the instrument.

Common drivers were also evident among water quality trading programs. An institutional driver (i.e., agency endorsement and encouragement of using the specific policy instrument) was key to actually implementing the water quality trading instrument. Economic drivers were also crucial to the implementation of the policy instrument. In the South Nation watershed, it was the recognition that the cost to taxpayers for improving wastewater treatment was prohibitively high and this triggered the serious consideration of water quality trading. In the US programs, significant grants were provided for start-up of programs; this reduced financial risk for local agencies and created opportunities to implement water quality trading instruments.

Differentiated Payments for Ecosystem Services (PES)

The characteristics of differentiated PES programs position it in the centre of the performance-based policy continuum. PES programs have been established in several countries, but most do not differentiate payments based on environmental outcomes. Thus, the discussion of differentiated PES programs was limited to a prominent pilot project in the US called 'Performance-based Environmental Payments for Agriculture' or PEPA, a group-based payment scheme in the state of Virginia, and a private company PES in Vittel, France. Despite the differences in structure among these three examples, common factors were also present.

There are some important similarities in the differentiated PES programs presented for discussion. All were small-scale projects aimed at individual watersheds. The programs generally required a high degree of involvement by researchers or program proponents and a substantial amount of time to develop relationships and build trust with watershed landholders. Collection of water quality data and use of physical process models were common and necessary elements of all programs.

The most discussed successes of these programs in the literature related to the social capital creation and empowerment of local agricultural landowners who participated in the programs. All programs found that giving the landowners some authority in determining the payment terms and/or managing funding created a stronger program and a desire to learn more and to involve others.

Reverse Auctions

Reverse auctions, in the manner which they have been implemented in the US, are somewhat weak performance-based policy instruments within this discussion. The main auction program example discussed was the Conservation Reserve Program in the US. It is the most established program and has a

vast literature dedicated to understanding a variety of facets of the program. Other reverse auction program examples included pilot projects in Australia, Saskatchewan, and the US.

There are several similarities in the conditions, drivers, and implementation strategies of programs utilizing the reverse auction policy instrument:

1. Presence of an institutional or political driver is required. In all cases, there was a governmental or non-governmental agency with sufficient resources to promote the reverse auction approach to water quality management. Without support from these agencies, this policy instrument would not be utilized, as the administrative and data-gathering costs can be very high (Weinberg and Claassen 2006).

2. Failure of previous policy instruments to address water quality concerns. This similarity was particularly evident for the Australian, Canadian, and US pilot projects. All three studies made reference to other programs in place that had failed to achieve desired outcomes, and the reverse auction was being explored as an alternative, more cost-effective option (Keeney and Boody 2005; Hill, McMaster et al. 2011; Rolfe and Windle 2011).

3. An environmental benefit index is imperative to implementing the reverse auction in a performance-based manner. Though the link between practices and environmental outcomes was weak in the CRP, there was an attempt to tie bid selection to expected outcomes and maximize cost-effectiveness. Site- or farm-specific environmental benefit indices were used in all programs, though the indices were based on models with varying capacities for accurately estimating environmental outcomes.

Cross-compliance

While the objective of programs that use cross-compliance is an environmental outcome, compliance is determined based on the adoption of practices . As such, cross-compliance may be considered a 'hybrid' policy instrument, rather than strictly performance- or practice-based (Weinberg and Claassen 2006). Cross-compliance measures are used in the US, Switzerland and the EU. The UK experience with Nitrate Vulnerable Zones (NVZ) was the focus of this discussion.

A main enabling condition of this type of instrument is existence of substantial agri-environmental payments and/or income support for agricultural producers. Creating conditions where agricultural producers must meet minimum environmental standards to remain eligible for income support provides an important incentive to comply.

A second enabling condition of cross-compliance is an environmental standard, or else a practice-based set of standards linked to expected environmental outcomes. For the UK NVZ scheme, the maximum concentration of nitrate in water provided that standard. In the US conservation compliance program, maintaining highly erodible land under the T value for soil erosion was the environmental standard applied. In the Swiss example, multi-functional agriculture is promoted through Proof of Ecological Performance regulations, including balancing nutrients on individual farms to reduce emissions and improve water quality.

A major shortfall of this instrument noted by Badertscher (2005) is that, once cross-compliance measures have been implemented, there are no further improvements to the production of EG&S

beyond those required for compliance (i.e., this policy instrument does not foster innovation and continuous improvement). Evidence from studies of the impact of NVZ designations in the UK support this potential issue with cross-compliance, as an overall improvement in nitrate levels was not observed (Worrall, Spencer et al. 2009).

Another potential hazard of cross-compliance is level of subsidies and payments available to compliant agricultural producers. Where potential gain is less than the cost of compliance, compliance rates will be low (Claassen, Breneman et al. 2004).

Discussion

The performance-based policy instruments that have been implemented elsewhere in programs to manage agricultural water quality varied in their degree of performance. Based on the programs where these policy instruments were implemented, the instruments can be qualitatively ranked on the continuum for their relative basis in performance (Fig. 2).

Dependent on the context under which the policy instruments are implemented, rankings on the scale may shift higher or lower. For example, if cross-compliance was based on achieving water quality standards, rather than the assumption of that achievement with the adoption of specific practices, then reliable, site-specific models would be required and payments would be based more strongly on performance. This change would raise the ranking of the cross-compliance instrument from very weak to moderately performance-based. The context surrounding implementation of these policy instruments, which influences the capability for measurement of water quality and payment structure, is critical in the degree of cost-effectiveness achieved by performance-based policy instruments.

The potential for policy instruments to shift up or down the performance-based continuum is an important consideration where policy transfer occurs. Context of the exporting and importing regions will invariably differ to some degree. This creates opportunities to improve the degree of performance of a policy instrument where key preconditions ('contingencies') are in place (Rose 1993; Hospers and Beugelsdijk 2002). For example, in its current application in the UK cross-compliance is based almost entirely on agricultural producers adopting specific practices where their land falls within a designated zone, making it a very weak performance-based instrument (Fig. 7). Basing compliance instead on flexible, site-specific practices where physical process models are available to provide reliable estimates of the environmental outcomes of those practices creates a stronger performance-based cross-compliance instrument. Regions where models like this are available may adopt the instrument and some lessons from the specific application of it in the UK, but the outcomes may be substantially improved.

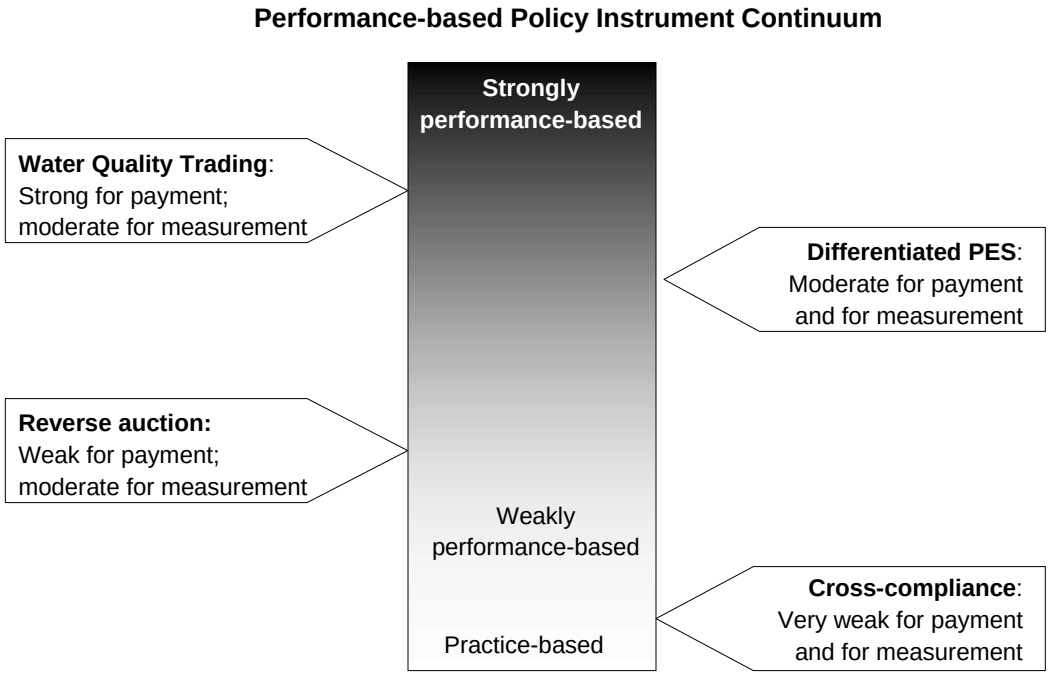

Fig. 2. Relative ranking of performance-based policy instruments based on measurement method and payment structure of the programs where implemented

Social context

There are two facets of social context that can play an important part in the capacity to implement performance-based policy instruments. First the general social context of the region plays an important role in the success of implementing a program with this type of instrument. Second, understanding regional social values and norms provides an important benefit to program administrators in that programs (and policy instruments therein) can be tailored to the specific conditions of the region, leading to greater potential for success (Perrot-Maître 2006). Where performance-based policy instruments have been used to manage water quality successfully, social buy-in is key (Selman, Greenhalgh et al. 2009).

Water quality standards

Implementation, or forthcoming implementation of water quality standards has been an important factor in many of the US-based programs and pilot projects, as well as in the South Nation Watershed in Ontario (Selman, Greenhalgh et al. 2009). The introduction of TMDLs and local or regional pollution caps has driven interest in water quality trading and PES. Even where water quality standards have not been implemented or enforced, the fear of regulation on the basis of water quality standards has created social conditions conducive to the use of performance-based policy instruments. In some cases, agricultural producers recognized a potential for water quality regulation within their watershed and this spurred interest in alternative mechanisms to manage water quality (Winsten 2009).

Estimation methods

Standardized, consistent, and robust estimation methodologies are necessary for successful implementation of performance-based policy instruments (Guiling and St. John 2007; Selman,

Greenhalgh et al. 2008; Selman, Greenhalgh et al. 2009). Current estimation tools employed in existing programs are relatively simple and unlikely to be highly accurate (Winsten 2009). Improvements in accuracy and site specificity would result in an increase in cost-effectiveness of payments for EG&S (Ribaudo, Hoag et al. 2001). These needs likely extend to other regions as well, especially those with less experience in implementing performance-based policy instruments, such as Canada.

Conclusions

The vast majority of OECD member countries have not used performance-based policy instruments in the execution of agri-environmental policies related to water quality, based on available literature (Latacz-Lohmann and Van der Hamsvoort 1997; OECD 2008). However, it is evident from OECD documents that all member countries have several agri-environmental regulations, policies, and programs to manage water pollution that are based on inputs or BMP adoption (OECD 2008). Where performance-based policy instruments have been used, they generally have been piloted but not implemented into longer-term programs. The US, Australia and Canada are the main countries that have applied water quality-based policy instruments that use performance or outcomes rather than inputs as measures for improvements and to calculate payment levels. Other OECD countries have used market-based policy instruments for a number of other issues, but not specifically to manage water quality (OECD 2008).

The contextual conditions of regions where performance-based policy instruments have been implemented show some similarities, particularly in the need for a physical driver, institutional and legislative capacity, and favourable social conditions. There are also noticeable differences among regions with performance-based policy instruments; unique conditions such as government information gathering or private company initiatives create opportunities for specific instruments. General principles can be drawn from the similarities among cases; however, the differences are important reminders that the specific context of a region contributes to the policies, programs, and policy instruments implemented in that region.

Further research related to social context is required for Canada to assess regional social values and norms. Understanding social context is important prior to implementing performance-based policy instruments, as program failure can occur where incomplete information is available (Dolowitz and Marsh 2000). In Alberta there is an imminent need for social context research, as the 'Water for Life' program and the Alberta LUF both encourage the use of market-based policy instruments and endorse payments for EG&S. The institutional and legislative capacity has been created for performance-based policy instruments in this region; however, an understanding of social context will be required for a complete assessment of the potential for specific policy instruments to be successful in the province.

PART II: Social Context of Study Area

Prior to the transfer of policy instruments that have the potential to alter agricultural property rights, the social norms and values, or social context, of the region should be examined for compatibility with the principles of the policy instrument (Davies and Hodge 2006). This study provides an understanding of how values and opinions converge (or diverge) between agricultural producers and the public.

This study investigates the perception of property rights of agricultural landowners from the viewpoints of agricultural landowners, rural residents and urban residents in southern Alberta. The objective of this study was to evaluate the potential to implement performance-based agri-environmental policy instruments by evaluating the prevailing attitudes of water quality stakeholders related to:

1) responsibility for effects of agricultural activities on the environment;
2) agricultural property rights and responsibilities; and
3) preferences for policy instruments.

Methods for Data Collection and Analysis

Study site

Opinions of agricultural landowners representing the range of agricultural activities in Alberta were solicited regarding water quality and agri-environmental policy. To obtain viewpoints of agricultural producers that practice the widest variety of management activities possible, three watersheds were included in this study. The main study site was the Indianfarm Creek Watershed in southern Alberta (Fig. 5). The total area of the watershed is approximately 14,500 ha (Olson and Kalischuk 2009). This watershed was chosen for several reasons: it represents a range of agricultural activities including native and tame pasture, annual and perennial crops, and livestock production; there are existing water quality concerns; and because access to the residents was facilitated by Alberta Agriculture and Rural Development. Additional study sites (Whelp Creek Watershed and Battersea Drain) were included to increase the spectrum of agricultural activities represented.

Data collection

Interviews and surveys were used to collect the opinions of residents in southern Alberta and the three watersheds regarding agricultural landowner rights and responsibilities for water quality. Questions posed to respondents, whether through interview or survey, were identical and most rated how strongly respondents agreed or disagreed with statements using a Likert scale. Interviews were used in the watersheds to gain additional information about agricultural practices, participation in agri-environmental programs, and motivations for participation or reasons for non-participation in those programs. For the broader societal opinions, interviews were not a feasible method to collect respondent views, so surveys were used in selected southern Alberta communities along the Oldman River (as defined by postal code) to obtain urban and rural perspectives. Comprehensive sampling was used in the watersheds and within the selected communities of Brocket, Granum, Nobleford, Monarch, Shaughnessy and six randomly-selected neighborhoods within the city of Lethbridge. The number of surveys sent to each community and response rates are given in Table 1. No completed surveys were returned from Brocket. Canada Post confirmed distribution of the surveys to the community. Inquiries to a local authority regarding possible reasons for the lack of responses went unanswered.

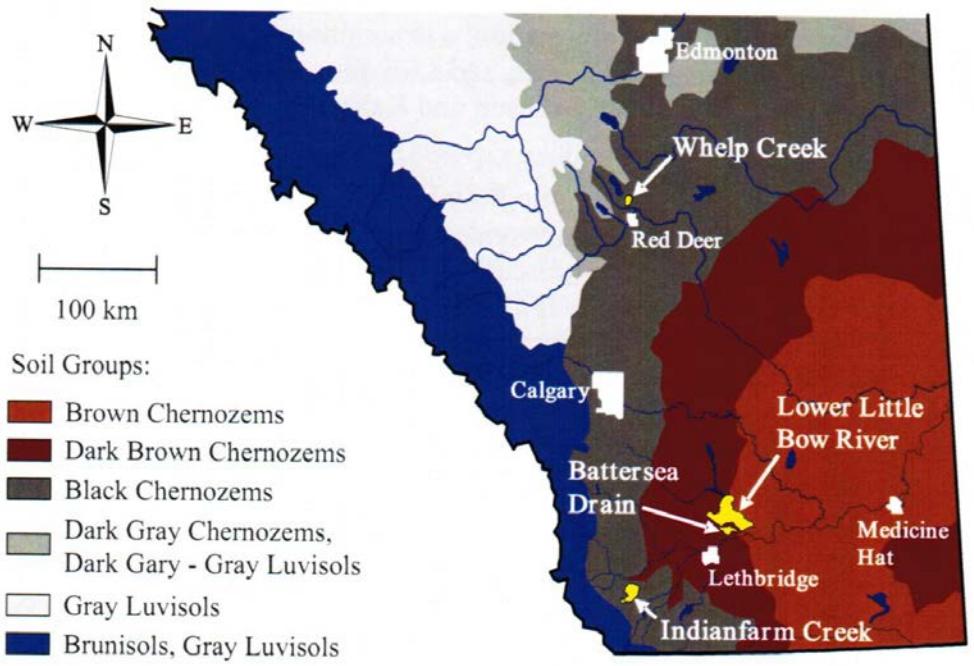

Fig. 5. Location of Indianfarm Creek, Battersea Drain and Whelp Creek watersheds in Alberta (source: Alberta Agriculture and Rural Development).

Table 1. Survey and interview response rates

Location	Number of surveys delivered	Number of responses	Response rate (%)	**Proportion of total responses (%)**
Watersheds[1]	120[2]	19	16	**6**
Brocket	228	0	0	**0**
Granum	190	17	9	**7**
Monarch	156	20	13	**8**
Nobleford	293	27	9	**10**
Shaughnessy	134	11	8	**4**
Lethbridge	2260	174	8	**66**

[1] Includes interviewees from Indianfarm Creek (*n*=15), Whelp Creek (*n*=1) and Battersea Drain (*n*=3) watersheds

[2] Number of residents contacted by mail in all three watersheds

Analysis

Respondents were split into three groups for comparisons: 1) agricultural producers (watershed residents plus survey respondents who identified themselves as producers), 2) rural residents (respondents from the five rural communities who did not identify themselves as producers), and 3) urban residents (all respondents from Lethbridge who did not identify themselves as producers). This approach was used to assess potential attitudinal differences between groups at varying social distances from agricultural activities (Vera-Toscano, Gómez-Limón et al. 2007).

Principal components analysis was performed using PASW Statistics 18 (SPSS, Inc.) for exploratory data analysis to determine how respondents were grouped according to their priorities for water quality program outcomes; social, economic, and environmental. Principal components analysis was used to explain the variance in respondents' responses to a number of questions with a reduced number of components (Field 2005; Moran, McVittie et al. 2007). The PASW Statistical software was also used for descriptive statistics for responses to many of the Likert scale questions.

The open-ended questions in the interviews and comments were evaluated to identify themes using content analysis (Gillham 2008). The software package NVivo 8 (QSR International, Inc.) was used for this purpose. Comments provided by watershed residents in interviews and by survey respondents were queried and coded into categories describing commonalities called 'nodes'. Some of the nodes, such as reasons for and against participation in agri-environmental programs, were developed *a priori*. Others developed as content was reviewed.

Results

Response rates

The response rate varied between 8 and 13% for most locations, with a total of 19 interviews conducted (30 residents contacted) and 249 completed surveys returned (3261 surveys delivered). Canada Post's unaddressed nature of the mail service may have reduced the response rate, and the number of surveys that were undeliverable or delivered to vacant households cannot be determined.

Water quality perceptions

Agricultural producers and urban residents felt that surface water quality in the area was 'somewhat good', while rural residents gave water quality a lower 'neutral' rating. A Kruskal Wallis test using SPSS was used to compare the median ratings and a significant difference was found (sig. level of 0.05) among median ratings of water quality. Further investigation of how each community rated water quality showed that respondents from the rural community of Shaughnessy rated water quality the poorest (median rating was 'somewhat poor', while the median rating at other locations was 'good').

Responsibility and property rights

Many ratings related to perceptions about responsibility were similar between groups. All groups agreed that agricultural producers and governments have the most responsibility for water quality on agricultural lands, followed by the public and non-governmental organizations (NGOs). Agricultural producers were less willing to give governments a 'very responsible' rating than other groups (Fig 6). Most interview respondents acknowledged the need for government involvement at some level, and that governments should act as an authority to oversee water quality. Interview respondents identified establishing standards as important for controlling abuse of the watershed. Many respondents made comments that if governments expected improvements beyond a minimum standard, there should be a compensation mechanism. One producer noted that giving governments responsibility did not mean that they had the right to dictate management decisions for producers (what this respondent termed "over-legislating").

Agricultural producers were generally willing to accept responsibility for the environmental effects of the management practices they use, though the median response by agricultural producers was one rating lower (agree) than for the other two groups (strongly agree). The difference between the responses was significant at the 0.10 confidence level. Respondents also felt agricultural producers should not be able to use whatever management practice they want; the median rating was 'disagree' for this statement. Some respondents preferred instead that a condition be placed on producers to adhere to a certain standard. In fact, some respondents from all groups qualified their responses to the question of responsibility with the suggestion that agricultural producers must use "appropriate" or "good" management practices and as long as that condition is satisfied, they can choose their practices.

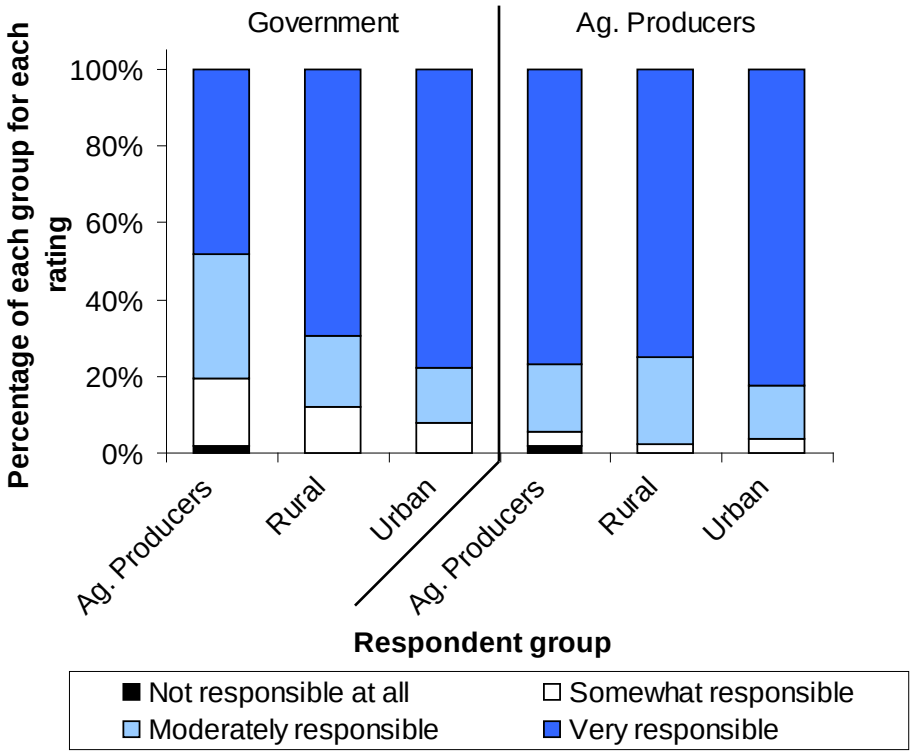

Fig. 6. Responsibility of governments and agricultural producers for water quality by respondent group.

Approximately half of watershed interview respondents made a comment concerning using 'proper' management. They stated, in some form, that agricultural producers should not be forced to participate in agri-environmental programs, as long as they used appropriate management practices. One producer commented that 'landowners should have the freedom to manage'. Most of the other comments relating to producer responsibility confirmed this opinion on property rights. Other statements related to property rights included: 'farmers own the land', 'farmers should be rewarded for good management', 'ranchers should receive rewards for not polluting', and 'if people like things a certain way, they should pay'. Some interview respondents commented that regulations would not work, as enforcement would be too difficult, while others thought 'bad' farmers should be regulated, but again, only to a reasonable standard. Several rural and urban respondents agreed that regulation was necessary, as several comments were made in the surveys suggesting that bad practices be penalized and good practices rewarded, and that there should be standards in place to ensure water quality is not degraded by agricultural practices.

The reluctance of involving government in agri-environmental matters by agricultural producers was reinforced by responses to other survey questions and comments. For example, agricultural producers rated the idea that governments should create agricultural water quality programs significantly lower than the other groups (significant at 0.01 confidence level). One producer commented that they made management decisions related to the environment that were "common sense", and did not need the government to provide money for that purpose.

Society's willingness to grant landowners property rights to manage the land as they see fit was addressed by asking respondents whether agricultural landowners should be able to use whatever management practice they want. No group felt that producers should have no restrictions on their management decisions, but groups were relatively neutral overall on the topic of whether agricultural programs should be voluntary' Despite the high degree of concern expressed by some respondents about agricultural practices and water quality, there were an equivalent number of responses that favoured voluntary measures such as incentives and providing education to producers to responses favouring regulation. Overall, agricultural producers rated maintaining voluntary participation in agri-environmental programs significantly more favourably than rural and urban respondents (Fig. 7).

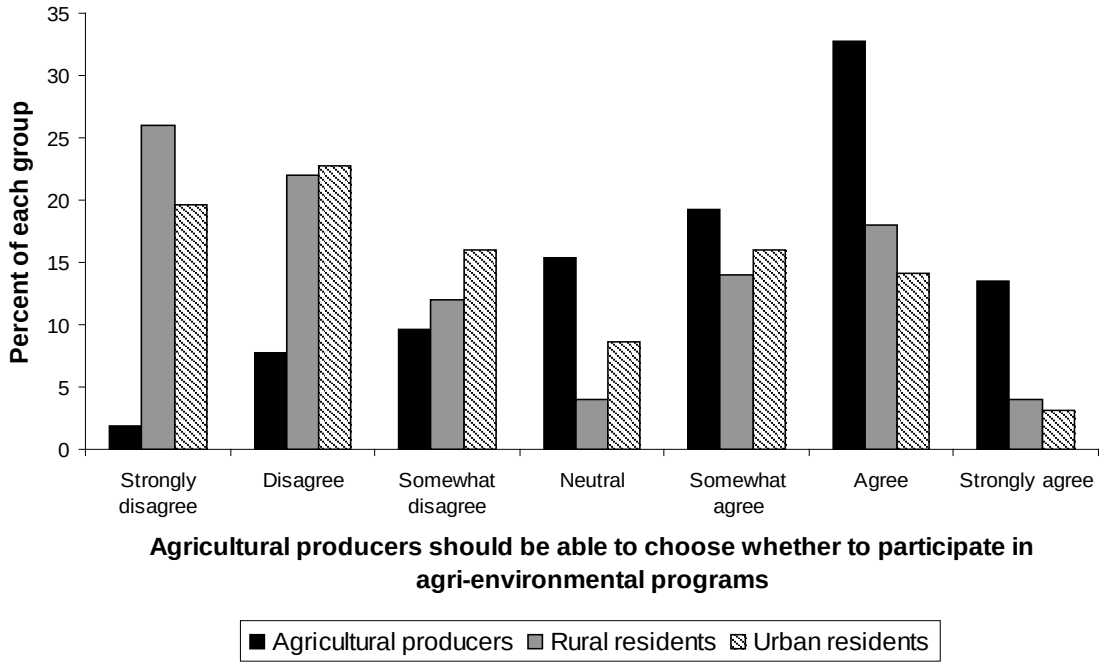

Fig. 7. Respondent ratings by group for maintaining the voluntary nature of agri-environmental programs.

Policy and programs for agricultural producers

A number of options were proposed to respondents around payments for EG&S (particularly those pertaining to water quality). A range of questions related to the structure of a payment program for EG&S were asked of respondents. Median responses were generally in the neutral to moderate agreement range for several of the proposed mechanisms, including tax increases and higher food prices. Further investigation revealed that the number of respondents who agreed and disagreed with tax increases was equivalent, with few ambivalent respondents. However, increased food prices generated little support or opposition, with most responses in the range of 'somewhat disagree' to 'somewhat agree'. Urban respondents seemed more willing to pay more for food, and agricultural producers tended to agree with the concept, while rural respondents were less enthusiastic. A

significant difference was observed between agricultural producers and rural respondents at the 0.05 confidence level.

There was support for a performance-based program, such as payments for EG&S. Agricultural producers were the group most in favour of this type of payment structure, though their level of approval for it was less than for practice-based incentive programs. The distribution of ratings for performance-based payments shows that 80% of agricultural producers agreed to some degree, while 55% of rural respondents and 60% of urban respondents agreed (Fig. 8). Respondents' comments from all groups added the comment that this type of payment structure was unlikely to work. This sentiment may have resulted in the cautious agreement to this mechanism. Many interviewees commented that this type of program would be nice, but was not feasible. The main concerns about this type of program were difficulty in measuring water quality output and monitoring and enforcement.

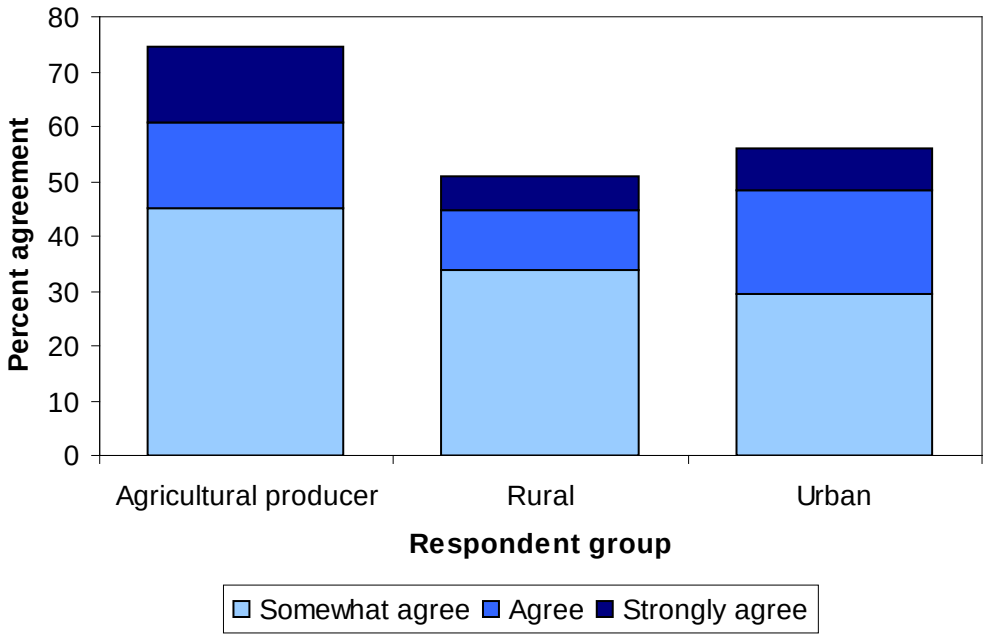

Fig. 8. Response distribution related to performance-based payments for ecological goods and services by respondent group.

In general, urban and rural residents did not display a strong opinion on most policy instruments proposed by the survey. This is unlikely a result of a lack of concern for water quality, as over 80% of both groups indicated they were at least 'somewhat concerned' about water quality.

Policy priorities

Respondents were asked to rate the importance of a variety of economic, ecological and social priorities for agri-environmental policy. Social priorities, such as sustaining rural communities and ensuring water quality for future generations, were ranked the most important for all groups, followed closely by cost-effectiveness of the program. Financial incentives were ranked higher by agricultural producers than other respondents. All groups seemed to accept that some negative financial impact could occur to agricultural producers that participate in agri-environmental programs, as this characteristic was ranked

near the bottom of the list of priorities. Respondents from all groups also acknowledged that implementing programs at the lowest possible cost to the taxpayer was not an important priority in relation to the other characteristics presented.

Social, economic and environmental priorities of respondents related to agri-environmental programs (variable *n* = 10) described in the previous paragraph were used to create groups of respondents defined by their priorities using Principal Components Analysis (PCA). A PCA reduces the number of variables needed to describe respondents using variance in values around theoretical means (components) applied to the data. The respondents could be described by two groups (or two components): those who valued social and ecological priorities more highly (referred to as the socio-ecological group hereafter) and those who valued agricultural property rights and economic priorities more highly (referred to as the agri-economic group hereafter).

The PCA was performed for two reasons: 1) to understand the balance of priorities of the respondents; and 2) to examine the demographics of each quadrant to identify trends in age, occupation, and location. Component coefficient scores, calculated for each respondent as part of the PCA, were plotted on axes that represented the two components to assess how priorities varied among and between groups at varying social distances from agriculture (Fig. 9). The further from the mean in a positive direction, the more strongly the respondent felt about one or both sets of priorities. The further from the mean in a negative direction, the less strongly the respondent felt. More respondents fell within the upper right quadrant, which indicates that they felt strongly about both sets of priorities (Fig. 9).

Discussion

Response rates for the survey portion of data collection were low. There are two potential reasons for these response rates: 1) the survey was sent as unaddressed mail, so it was a significant challenge to entice recipients to open the mail and read the contents; and 2) survey fatigue may have played a role, as the study region has been used by previous researchers. Low response rates have been reported by other researchers in southern Alberta. Nicol et al. (2011) conducted telephone interviews with randomly selected farmers in southern Alberta in 2007 and achieved a response rate of 11.5%. Johnston et al. (2010) sent addressed mail surveys to irrigation districts in southern Alberta in 1998-99 and achieved a response rate of 36%. These surveys, along with several government agencies and non-governmental organizations conducting research in the study area(AAFC 2008; Olson and Kalischuk 2009) may have led to survey respondent fatigue.

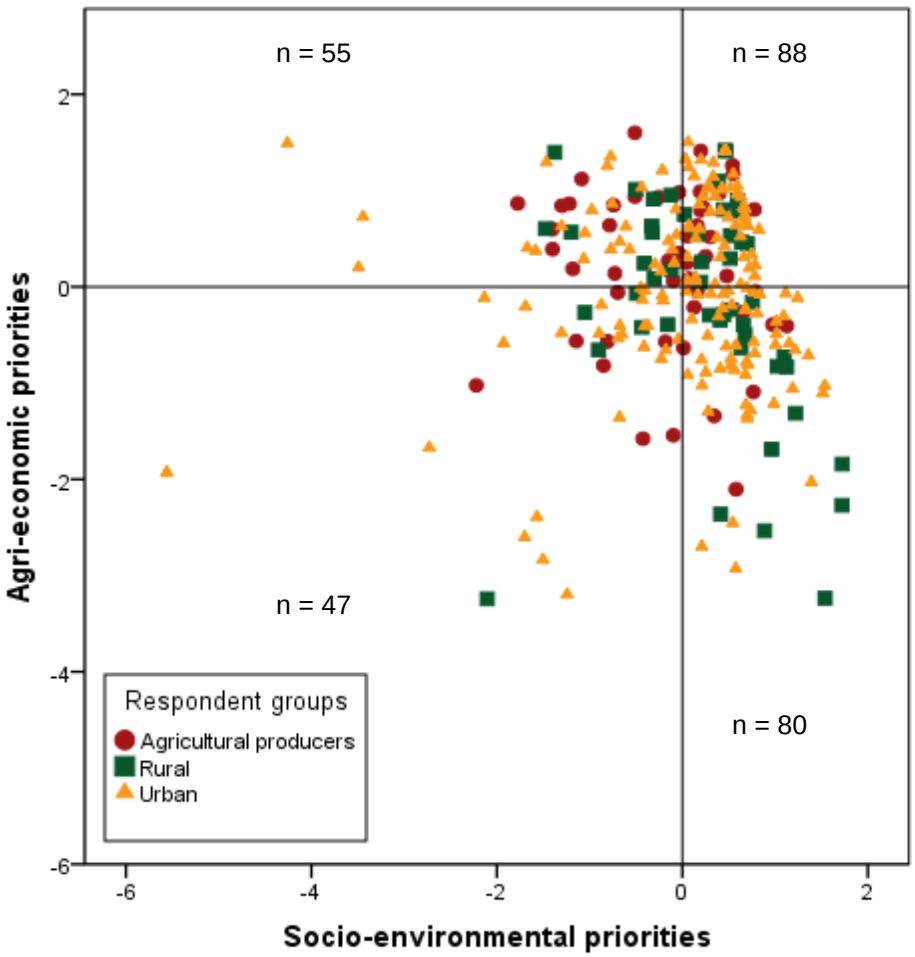

Fig. 9. Principal components analysis coefficient scores for respondents. The line of origin represents the mean coefficient score for each component.

Table 2. Demographics of respondents compared to total sample demographics. Quadrant groups are based on rankings of social, economic, and environmental priorities and calculated by PCA

	Characteristics		
Quadrant	**Proximity to agriculture**	**Age**	**Occupations**
Upper right (n=88) (All priorities important)	Lower proportion of respondents with farm income		
Upper left (n=55) (Agri-economic group)	Higher proportion of rural respondents and farmers and ranchers	More 18-25 year olds	
Lower right (n=80) (Socio-environmental group)	Lower proportion of farmers and ranchers	Lower proportion of 76+ age group	Higher proportion of professionals and tradespeople
Lower left (n=47) (Lower rating of all priorities)		High proportion of 65+ age groups, lower proportion of 18-25 year olds	Higher proportion of unemployed, more respondents with children

Water quality concern

Concern was generally high for water quality in the study area. Many emotional comments related to water quality were made, demonstrating the importance of the water quality issue to southern Albertans:

"The water [is] being contaminated with no thought, other than profit!" (4L)

"The people on this planet right now who have the most influence on the water quality don't care what condition they are leaving the water in for their grand children!" (5S)

"While I recognize there will be a financial cost in implementing any program, I do not feel programs and policies on something as essential as water should be limited or guided, first and foremost, by cost. The bigger cost would be the loss or contamination of vital resources for years or generations to come. We are ethically responsible for our planet's health!" (23L)

"Water is one of our most important natural resources. Taking care of it should be top priority! It should not become a dumping ground for garbage and harmful chemicals. We have a new generation of children to inherit our earth and let's hope it's worth inheriting." (53L)

Property rights perceptions

This element of respondents' attitudes toward agricultural producer responsibility indicates that there has been a shift from a traditional property rights perspective (where society believes that agricultural producers are making the best environmental decisions possible given their circumstances) to one where the producer has some responsibilities to manage land in a way where environmental damage is reduced and EG&S are produced. So, the viewpoints of respondents take on elements of the 'beneficiary pays' principle, but their views are strongly based in the 'polluter pays' principle, where the agricultural producers must pay to mitigate or prevent the environmental damage caused by agricultural activities (Grossman 2007; OECD 2010) (Fig. 10). The extent to which agricultural property rights are socially limited is unclear, as what constitutes the "minimum standard" is uncertain from the survey results.

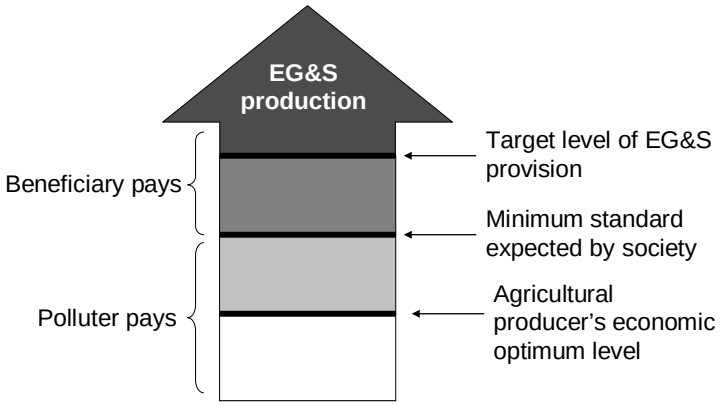

Fig. 10. Use of the polluter pays and beneficiary pays principles for societal expectations of EG&S production by agricultural producers. Adapted from the Organization for Economic Cooperation and Development (OECD)(2010) .

The polluter pays principle was first articulated by the OECD in 1972 and in 1990 it was applied by the OECD as an important principle in agricultural policy (OECD 2010). The principle is based on the notion that polluters should bear the cost of preventing or mitigating environmental damage to ensure the environment is maintained in an acceptable state (OECD 1972). The principle explicitly describes an environmental reference level, or minimum standard that should be met by polluters without subsidization. The findings of the social perceptions of agricultural rights and responsibilities pertaining to water quality fall directly in line with the polluter pays principle. However, a common theme in the responses was a willingness to pay for EG&S provided beyond compliance with the minimum standard. The willingness to pay for EG&S provision 'above and beyond' requirements demonstrates that the majority of respondents also share the view that the 'beneficiary pays' principle applied beyond the minimum standard (Fig. 10) . That is, the public (the beneficiaries of the EG&S provided by agriculture) are willing to pay agricultural producers to make changes that improve the output of EG&S.

The concept of a minimum standard of care, or reference level, or good agricultural practices, is well-established in the literature (OECD 1997; Claassen, Hansen et al. 2001). The concept has been applied through codes of practice in the European Union and through cross-compliance measures in the US (OECD 2010). Incorporating a minimum environmental standard or reference level may be socially acceptable, as respondents from all groups expressed a desire for this approach to agri-environmental

policy. Further research is required to evaluate the appropriate level of EG&S provision, or specific practices, expected by the public to implement this type of instrument.

The responses to questions related to responsibility and property rights indicate that agricultural producers, rural residents and urban residents share the opinion that producers do have a high degree of responsibility for the effects of their production methods on others. However, when changes to the perceived suite of property rights afforded to agricultural landowners was suggested, agricultural landowners exhibited strong opposition to any change that reduced it. Property rights are held in high regard by agricultural landowners and any challenge to those rights is strongly opposed by them (Bromley and Hodge 1990).

Agricultural producers were not enthusiastic about the possibility of regulatory measures to manage water quality. In their responses, agricultural producers tended to equate regulation with additional pressure, a loss of autonomy in their business and on their land, and further economic hardship. This attitude is shared by agricultural producers in other regions; farmers in a US watershed expressed similar sentiments when faced with potential regulation (Morton 2008). In a paper devoted to environmental justice in rural Canada, Hanson (2007) stated that farmers have lost their ability to make decisions about their operations and lost flexibility in changing practices that could improve environmental sustainability. She argued that the increasingly industrial nature of agriculture has created this situation for farmers. This was echoed by many of the agricultural respondents.

Respondents displayed ambivalence toward novel policy instruments. A likely reason is that the public does not have well-formed opinions about, or knowledge of, water quality policy (Moran, McVittie et al. 2007) and what their rights and responsibilities should be related to EG&S (Hall, McVittie et al. 2004). We can infer which policy instruments may garner the most support from respondent groups; however, through their attitudes toward agricultural practices, property rights and concern for water quality. Respondents' opinions align with the foundations of some performance-based measures. Payments for ecosystem services (PES) and cross-compliance are policy instruments that have been implemented in other regions (Claassen 2005; Keeney and Boody 2005; Wunder, Engel et al. 2008; OECD 2010) and that may be appropriate for the area based on the responses. Payments for ecosystem services and cross-compliance require that the public pay, in some capacity, based on environmental outcomes that benefit the public. Payments for ecosystem services is a payment scheme that links payments to environmental outcomes, while cross-compliance requires that agricultural landowners demonstrate they have achieved a standard of environmental quality before becoming eligible for government payments or loans. The views of respondents support these policy instruments as most respondents felt that payments to agricultural producers for the production of EG&S were acceptable.

The responses to priorities for policy reinforced findings from many of the other questions; most indicated that social and environmental objectives were important, but that maintaining payments to agricultural producers was also an important factor to consider. The demographic breakdown of how groups ranked priorities was not surprising in many cases; agricultural producers were more likely to rank priorities related to payments and maintaining strong property rights more highly than respondents of other occupations, while respondents with a potentially higher level of education were more concerned with social and environmental priorities. It is interesting to note that, in a largely agricultural region, most respondents ranked social and ecological goals above agricultural and

economic goals for agri-environmental policy. This finding, together with findings from questions related to agricultural property rights and responsibilities confirms the reports that there is an understanding and high degree of concern for the environmental impacts of agricultural production. There may be a shift in public opinion from granting agricultural landowners full discretion in managing the land to the use of a more critical lens to view agricultural activities, based on responses from residents in southern Alberta.

Conclusions and preliminary recommendations

This study evaluated the attitudes of agricultural producers and rural and urban residents related to agri-environmental policy for water quality, and to assess whether these attitudes were aligned with the implementation of performance-based policy instruments. Based on the responses, a general program framework can be developed for agricultural water quality in southern Alberta. A summary of the findings indicates that all groups call for a water quality standard of care that is reasonable. This finding has been described by other social studies of environment and agriculture.

This study was performed at a significant time in Alberta's land use policy development. Water quality is an important concern in the study area and the Alberta Land Use Framework is facilitating regional plans where consideration and development of new approaches for the provision of EG&S is explicitly incorporated into the framework (Government of Alberta 2008). Based on the responses to the surveys and interviews, respondents felt that incorporating payments for EG&S was an acceptable means to manage environmental quality on agricultural land.

The main findings that will create the basis for policy instrument recommendations are:

1) Many respondents called for a minimum standard of care for water quality. This standard (also referred to as a reference level or code of practice) has been documented in the literature and implemented in other regions.; and

2) There is a willingness to pay agricultural producers for the production of EG&S above and beyond the minimum standard of care expected.

These findings will guide the selection of policy instruments, or suite of instruments, best-suited to the study area given the social context and with consideration of other contextual factors. From the analysis of survey and interview responses, a mixture of cross-compliance and payments for EG&S are likely to fit best with the context of the region.

As public knowledge and concerns change, the expectations placed on agricultural producers will undoubtedly change as well. At present, the public are generally willing to provide aid to agricultural producers for the provision of EG&S, supporting a performance-based agri-environmental policy. Maintaining and incorporating a current understanding of how all stakeholders view agricultural and public rights and responsibilities into policy development and adaptive management will improve the success of new policies.

Literature Cited

AAFC (2008). Watershed Evaluation of Beneficial Management Practices (WEBs), Agriculture and Agri-Food Canada,.

AFGA. (2011). "Conservation: Parkland stewardship program." Retrieved April 12, 2011, from http://www.afga.org//content.html?identifier=parklandstewardship.

Alberta Research Council (2006). Study on identifying rural sociological barriers to adoption. Alberta Research Council, Agriculture and Agri-Food Canada, Alberta Agriculture and Rural Development and The Alberta Farm Plan Company. Edmonton, AB.

Badertscher, R. (2005). Evaluation of Agri-Environmental Measures in Switzerland. Evaluating Agri-Environmental Policies: Design, Practice, and Results. Paris, France, Organization for Economic Co-operation and Development**:** 223-230.

Banack, S. A. and G. T. Hvenegaard (2010). "Motivations of landowners to engage in biodiversity-friendly farming practices in Alberta's Central Parkland Region." Human Dimensions in Wildlife **15**: 67-69.

Benson, D. (2009). Review article: constraints on policy transfer, CSERGE.

Bromley, D. W. and I. Hodge (1990). "Private property rights and presumptive policy entitlements: Reconsidering the premises of rural policy." European Review of Agricultural Economics **17**: 197-214.

Claassen, R. (2005). Has conservation compliance reduced soil erosion on US cropland? Evaluating Agri-Environmental Policies: Design, Practice and Results. OECD. Paris, OECD Publishing.

Claassen, R., V. Breneman, et al. (2004). Environmental compliance in US agricultural policy: past performance and future potential, USDA Economic Research Services.

Claassen, R., L. Hansen, et al. (2001). Agri-environmental policy at the crossroads: Guideposts on a changing landscape. U. E. R. Services.

Cohen, W. B. and S. N. Goward (2004). "Landsat's role in ecological applications of remote sensing." BioScience **54**: 535-545.

Davies, B. B. and I. D. Hodge (2006). "Farmers' preferences for new environmental policy instruments: determining the acceptability of cross compliance for biodiversity benefits." Journal of Agricultural Economics **57**(3): 393-414.

Dolowitz, D. and D. Marsh (1996). "Who learns what from whom: a review of the policy transfer literature." Political Studies **44**: 343-357.

Dolowitz, D. P. (2003). "A policy-maker's guide to policy transfer." Political Quarterly **74**: 101-109.

Dolowitz, D. P. and D. Marsh (2000). "Learning from abroad: the role of policy transfer in contemporary policy-making." Governance: An International Journal of Policy and Administration **13**: 5-23.

Dwyer, P. and N. Ellison (2009). "'We nicked stuff from all over the place': policy transfer or muddling through?" Policy and Politics **37**(3): 389-407.

Environment Canada. (2010). "Cleaning up Lake Winnipeg: Part of the Government of Canada's Action Plan for Clean Water." Retrieved April 27, 2010, from http://www.ec.gc.ca/paae-apcw/default.asp?lang=En&n=61284017-1.

Field, A. (2005). Discovering Statistics Using SPSS. London, Sage Publications.

Gillham, B. (2008). Small-Scale Social Survey Methods. London, Continuum International Publishing Group.

Gosnell, H. and W. R. Travis (2005). "Ranchland ownership dynamics in the Rocky Mountain West." Rangeland Ecology and Management **58**(2).

Government of Alberta (2008). Land-Use Framework. G. o. Alberta**:** 58.

Greenhaugh, S., M. Selman, et al. (2006). Paying for environmental performance: investing in farmers and the environment. Environmental Markets: Farm Bill Conservation Programs. Washington, D.C., World Resources Institute.

Grossman, M. R. (2007). "Agriculture and the polluter pays principle." Electronic Journal of Comparative Law **11**: 1-66.
Guiling, J. and J. St. John (2007). Paying for environmental performance: estimating the environmental outcomes of agricultural best management practices, World Resources Institute.
Hall, C., A. McVittie, et al. (2004). "What does the public want from agriculture and the countryside? A review of evidence and methods." Journal of Rural Studies **20**: 211-225.
Hanley, N., M. Whitby, et al. (2004). Assessing the success of agri-environmental policy in the UK. The Economics of Agri-Environmental Policy. S. S. Batie and R. D. Horan. Burlington, VT**:** 30-44.
Hanson, L. L. (2007). "Environmental justice across the rural Canadian Prairies: Agricultural restructuring, seed production and the farm crisis." Local Environment **12**(6): 599-611.
Hart, R. and U. Latacz-Lohmann (2005). "Combating moral hazard in agri-environmental schemes: a multiple-agent approach." European Review of Agricultural Economics **32**(1): 75-91.
Heimlich, R. E. and R. Claassen (2004). Agricultural conservation policy at a crossroads The Economics of Agri-Environmental Policy. S. S. Batie and R. D. Horan. Burlington, VT, Ashgate Publishing Company**:** 17-30.
Hill, M. R. J., D. G. McMaster, et al. (2011). "A reverse auction for wetland restoration in the Assiniboine River Watershed, Saskatchewan." Canadian Journal of Agricultural Economics **59**(2): 245-259.
Hodge, I. (2001). "Beyond agri-environmental policy: towards an alternative model of rural environmental governance." Land Use Policy **18**: 99-111.
Hodge, I. (2007). "The governance of rural land in a liberalised world." Journal of Agricultural Economics **58**(3): 409-432.
Hospers, G.-J. and S. Beugelsdijk (2002). "Regional cluster policies: Learning by comparing?" Kyklos **55**: 381-401.
Keeney, D. and G. Boody (2005). Performance-based approaches to agricultural conservation programs dealing with non-point source pollution, including utilization of the provisions of the Conservation Security Program. The Workshop On Performance-Based Farm Policies. Ames, Iowa**:** 1-19.
Lal, H., J. A. Delgado, et al. (2009). "Market-based approaches and tools for improving water and air quality." Environmental Science and Policy **12**: 1028-1039.
Latacz-Lohmann, U. and C. Van der Hamsvoort (1997). "Auctioning conservation contracts: A theoretical analysis and an application." American Journal of Agricultural Economics **79**(2): 407-418.
Lowell, K., J. Drohan, et al. (2007). "A science-driven market-based instrument for determining the cost of environmental services: a comparison of two catchments in Australia." Ecological Economics **64**: 61-69.
MacIntosh, A. and R. Denniss (2004). Property rights and the environment: should farmers have a right to compensation?, The Australia Institute.
Macpherson, C. B., Ed. (1978). Property. Toronto, University of Toronto Press.
Mann, S. (2005). "Different perspectives on cross-compliance." Environmental Values **14**: 471-482.
McCourt, W. and L. M. Foon (2007). "Malaysia as a model." Public Management Review **9**: 211-229.
Millennium Ecosystem Assessment (2005). Drivers of change in ecosystems and their services. Millennium Ecosystem Assessment.
Moran, D., A. McVittie, et al. (2007). "Quantifying public preferences for agri-environmental policy in Scotland: A comparison of methods." Ecological Economics **63**: 42-53.
Morton, L. W. (2008). "The role of civic structure in achieving performance-based watershed management." Society and Natural Resources **21**: 751-766.
Mossberger, K. and H. Wolman (2003). "Policy transfer as a form of prospective policy evaluation: challenges and recommendations." Public Administration Review **63**(4): 428-440.
OECD (1972). Guiding principles concerning international economic aspects of environmental policies. Paris, Organization for Economic Co-operation and Development.

OECD (1997). Helsinki Seminar on Environmental Benefits from Agriculture: Country Case Studies. Paris, Organization for Economic Co-operation and Development,**:** 257.

OECD. (2008). "Inventory of policy measures addressing environmental issues in agriculture." Retrieved February 6, 2008, from http://www.oecd.org/countrylist/0,3349,en_2649_33791_34691514_1_1_1_1,00.html

OECD (2010). Environmental cross compliance in agriculture, Organization for Economic Cooperation and Development**:** 45.

OECD (2010). Guidelines for Cost-effective Agri-environmental Policy Measures, OECD Publishing.

Olson, B. M. and A. R. Kalischuk, Eds. (2009). Nutrient Beneficial Management Practices Evaluation Project 2007 to 2011: 2008 Progress Report. Lethbridge, Alberta, Canada, Alberta Agriculture and Rural Development.

PCAB. (2011). "FAQ." Retrieved April 16, 2011, from http://saskpcab.com/farm-stewardship/faq/.

Perrot-Maître, D. (2006). The Vittel payments for ecosystem services: a "perfect" PES case? London, UK, International Institute for Environment and Development.

Ribaudo, M. O., D. L. Hoag, et al. (2001). "Environmental indices and the politics of the Conservation Reserve Program." Ecological Indicators **1**(1): 11-20.

Roland, G. (2004). "Understanding institutional change: fast-moving and slow-moving institutions." Studies in Comparative International Development **38**(4): 109-131.

Rolfe, J. and J. Windle (2011). "Using auction mechanisms to reveal costs for water quality improvements in the Great Barrier Reef catchments in Australia." Agricultural Water Management **98**(4): 493-501.

Rose, R. (1993). Lesson-Drawing in Public Policy. Chatham, New Jersey, Chatham House Publishers, Inc.

Salki, A. (2007). "Lake Winnipeg." Retrieved April 27, 2010, from http://www.climatechangeconnection.org/impacts/LakeWinnipeg.htm.

Schuster, C. J., A. G. Ellis, et al. (2005). "Infectious disease outbreaks related to drinking water in Canada, 1974-2001." Canadian Journal of Public Health **96**(4): 254-258.

Selman, M., S. Greenhalgh, et al. (2009). Water quality trading programs: an international overview. Washington, D.C., World Resources Institute. **1**.

Selman, M., S. Greenhalgh, et al. (2008). Paying for environmental performance: Potential cost savings using a reverse auction in program sign-up. WRI Policy Note Environmental Markets No. 5. Washington, D.C., World Resources Institute.

Tews, K. (2009). "The environmental dimension of the EU accession process - challenges, risks and chances for the SEE countries." Environmental Policy and Governance **19**: 130-139.

The Strategic Council. (2009). "Most important issue facing Canada today." Retrieved April 23, 2010, from http://www.thestrategiccounsel.com/our_news/polls/Most%20Imporant%20Issue%20Facing%20Canadians.pdf.

The Water Chronicles. (2010). "National water advisory map." Retrieved April 23, 2010, from http://www.water.ca/map-graphic.asp.

Tovey, J. P. (2008). "Whose rights and who's right? Valuing ecosystem services in Victoria, Australia." Landscape Research **33**(2): 197-209.

Vera-Toscano, E., J. A. Gómez-Limón, et al. (2007). "Individuals' opinion on agricultural multifunctionality." Spanish Journal of Agricultural Research **5**(3): 271-284.

Wätzold, F. and M. Dreschler (2005). "Spatially uniform versus spatially heterogeneous compensation payments for biodiversity-enhancing land-use measures." Environmental & Resource Economics **31**: 73-93.

Weinberg, M. and R. Claassen (2006). Rewarding farm practices versus environmental performance, United States Department of Agriculture Economic Research Service.

Winsten, J. R. (2009). "Improving the cost-effectiveness of agricultural pollution control: The use of performance-based incentives." Journal of Soil and Water Conservation **64**(3): 88a-93a.

Worrall, F., E. Spencer, et al. (2009). "The effectiveness of nitrate vulnerable zones for limiting surface water concentrations." Journal of Hydrology **370**(1): 21-28.
Wunder, S., S. Engel, et al. (2008). "Taking stock: a comparative analysis of payments for environmental services programs in developed and developing countries." Ecological Economics **65**: 834-852.