LEARN
Linking Environment & Agriculture Research Network

LINKING ENVIRONMENT AND AGRICULTURE RESEARCH NETWORK
ANNUAL REPORT 2009-2010

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Network Annual Report
April 2010

Canada

UNIVERSITY OF ALBERTA
DEPARTMENT OF RESOURCE ECONOMICS
AND ENVIRONMENTAL SOCIOLOGY

Growing Forward

An Introduction from the Network Leader

This year was the inaugural year for the Linking Environment and Agriculture Research Network (LEARN).[1] There was much organizational activity to be done. In particular the monumental task of establishing the administrative linkages at the University of Alberta Research Services Office consumed much time, and was only completed by the second or third week in March 2010. The addition of Beata Montgomery to LEARN as Network Administrator has made many of the budgetary and other administrative issues run much smoother!

Network activities started with the funding of 10 research projects at various universities across Canada and two commissioned papers. Many of these projects are expected to be completed by the end of the 2011 fiscal year. LEARN was also involved in the initial development of a proposed pilot conservation auction in Manitoba, and was a partner at a meeting of the proposed Centre for Market Based Instruments in Calgary.

Communication efforts have also started to take shape. We are in the midst of developing a LEARN website, as well as the production of various graphic design tools to enhance presentations and publications. We hope to have these completed by the end of the summer 2010. In addition, one network meeting was held in conjunction with the first LEARN sponsored workshop in Victoria, co-hosted by the Canadian Agricultural Economics Society. The theme for this workshop was the economics of wetlands and wetland policy. This was a highly successful endeavor with over 13 sessions containing participants from academia, government and various non-governmental organizations. One output from this workshop will be a special issue with selected research papers in the *Canadian Journal of Agricultural Economics* in 2011.

In the next year, members, partners and others can look forward to the World Congress of Environmental and Resource Economics in June in Montreal. LEARN will have a significant presence at this event with a sponsored session on Food, Fibre and Fuel, as well as a meeting of network members and partners to be held immediately prior to the Congress kickoff.

We are planning additional workshops for future years and input on topics and locales from members and partners is always welcomed.

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[1] We thank John Cranfield for coming up with this acronym.

Introduction

<u>Network Objectives</u> – LEARN activity is framed around development and analysis of economic policy in the area of agriculture and the provision of environmental goods and services (EGS). Network research will assist in the development of: (1) improved understanding of the adoption of farm level management practices for the supply of EGS, (2) development and analysis of market based instrument programs for the provision of EGS, and (3) the valuation of change in EGS both for policy implementation as well as outcome monitoring. The expectation is that these elements will be integrated in the research program, leading to improved integration of policy analysis, implementation and evaluation from a multidisciplinary perspective.

However, LEARN is more than a research organization and is dedicated to communication and networking through the hosting and co-hosting of workshops, conferences and other fora. Central to this philosophy is the expectation that network research funds will form seed funds to leverage additional funding from other organizations. Many of these organizations and individuals therein are hoped to become partners in the network to increase the potential for networking and learning outcomes. Many already are as you will see in this report.

Membership and Partner List

	Name	Organization	Member	Partner
1	Al Mussell	George Morris Centre		X
2	Al Weersink	University of Guelph	X	
3	Ben Bradshaw	University of Guelph	X	
4	Bob MacGregor	Agriculture and AgriFood Canada	X	
5	Brady Deaton	University of Guelph	X	
6	Brenda Brindle	Government of Alberta		X
7	Chad Lawley	University of Guelph	X	
8	Chokri Dridi	University of Alberta	X	
9	Christin Rawluk	University of Manitoba	X	
10	Cynthia Edwards	Ducks Unlimited		X
11	Darryl Finnigan	Government of Ontario		X
12	Don Flaten	University of Manitoba	X	
13	Elena Bennett	McGill University	X	
14	Emmanuel Yiridoe	Nova Scotia Agricultural College	X	
15	Esther Salvano	Government of Manitoba		X
16	Gary Kachanoski	University of Alberta	X	
17	Gary Johnson	University of Manitoba	X	
18	Henning Bjornlund	UNISA & University of Lethbridge	X	
19	Hugues Morand	Agriculture and AgriFood Canada		X
20	Ian Campbell	Agriculture and AgriFood Canada		X
21	James Vercammen	University of British Columbia	X	
22	Jim Stalwick	Government of Saskatchewan		X
23	Jim Unterschultz	University of Alberta	X	
24	John Kenney	Government of Alberta		X
25	John Parkins	University of Alberta	X	
26	Kees van Kooten	University of Victoria	X	
27	Ken Belcher	University of Saskatchewan	X	
28	Kurt Klein	University of Lethbridge	X	
29	Lota Dabio Tamini	IRDA	X	
30	Marian Weber	University of Alberta & Alberta Innovates Technology	X	
31	Mike Kennedy	Pembina Institute		X
32	Paul Thomassin	McGill University	X	
33	Peter Boxall	University of Alberta	X	
34	Shane Gabor	Ducks Unlimited		X
35	Steve Clark	Nova Scotia Agricultural College	X	
36	Sumeet Gulati	University of British Columbia	X	
37	Tom Goddard	Government of Alberta		X
38	Wanhong Yang	University of Guelph	X	
39	Vic Adamowicz	University of Alberta	X	

LEARN Funded Research Projects 2009-2010

Project #1 - Economic Analysis of Single versus Multiple Species Approaches to Meeting Species at Risk Act Objectives on Agricultural Landscapes

- Location: University of Alberta

- Research Team: Dr. Vic Adamowicz, Dr. Peter Boxall, and Alicia Entem

- Duration: December 2009 – March 2011

Brief Project Description/Overview:

Species at risk in Canada are designated through a process defined by the Species at Risk Act (SARA). The act outlines the management implications of species listing. Species that are listed require recovery or action plans that include socioeconomic analysis. In addition, SARA typically examines species one at a time, rather than in complexes of multiple species on a variety of habitat types.

This project will examine the economic implications of single versus multiple species approaches to the Species at Risk Act in a case study in an agricultural region of southern Saskatchewan. The Milk River Watershed contains as many as 25 listed species. Research undertaken by the Canadian Wildlife Service is providing habitat information on these species as well as general information on the overall landbase. This information, along with land use data for the region, will be used to develop cost effective management plans or plans that maximize conservation objectives subject to the opportunity costs associated with land use (farming, oil and gas, etc.). A comparison of single versus multiple species objectives will provide insights into the potential for integrated habitat based approaches to SARA to generate superior solutions to the species at risk challenge. Capturing interactions between species and habitat types in conservation planning could yield significant advantages.

Data and Methods:

An integrated ecological-economic optimization model will be developed based on the wildlife habitat information available in the region and information on land uses and opportunity costs. The model will be developed using an optimization framework. One candidate software option is Marxan (Marine Spatially Explicit Annealing) although other programming options will be investigated in the literature review component of the project. Marxan is a popular program used to optimize selection of reserve sites based on biodiversity and economic information. However, it is limited in its flexibility for inclusion

of economic dimensions of the problem. Alternatives, including development within GAMS or Risk Solver Platform will also be investigated. The latter has been employed by the investigators in other contexts. Data for the model include information on species abundance and relation to habitat as well as costs associated with agricultural practices in the region and the opportunity costs of energy sector activity. Wildlife data are being collected by Canadian Wildlife Service (one of the graduate students on the project was employed this past summer to help collect these data) while the economic information will be collected within the project.

Outcomes:

The project will provide information on the impact of moving towards multiple-species or system based approaches for SARA relative to single species approaches. These impacts will be measured in terms of cost effectiveness as well as efficacy in meeting biodiversity criteria. The project will also provide information to support decision making regarding implementation of SARA in the region.

- Estimated Budget: $31,600

Project #2 - Explaining Agri-Environmental Stewardship Adoption in Canada: A State of Knowledge Review

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- Location: University of Guelph

- Research Team: Dr. Ben Bradshaw and Dr. Wanhong Yang and Elizabeth Holmes

- Duration: December 2009 – July 2010

Brief Project Description/Overview:

Given the *public good* nature of most agri-environmental stewardship, its adoption in Canada continues to be a pressing policy issue. In support of this need, considerable research has been completed over the years to better understand the financial and other factors that explain the farm-level adoption of practices such as conservation tillage (e.g. Smit and Smithers, 1992). Consistent with Knowler and Bradshaw (2007), before advocating for any new empirical exercise to identify possible correlations between the adoption of certain practices and independent variables such as age, land tenure or education level among a sample of farmers in some Canadian locale, we argue that it is necessary to take stock of existing knowledge in the Canadian context in order to:

- identify common explanations of behavior across existing studies (e.g. Smit and Smithers, 1992);

- identify the role and impact of various conventional policy interventions such as subsidies and extension services (e.g. Stonehouse and Bohl, 1993); and

- contextualize more novel policy approaches to agri-environmental stewardship adoption such as (spatial) targeting (e.g. Yang and Weersink, 2007), environmental farm planning (e.g. Smithers and Furman, 2003), and the development of markets for farm-based ecological goods and services (e.g. Engel *et al.*, 2008)

A 'State of Knowledge Review' is currently underway focused on existing research (1980-2009) that explains, from a social scientific perspective, agri-environmental stewardship adoption in Canada. Initial findings suggest that financial variables alone cannot explain agri-environmental stewardship, which lends support to unconventional mechanisms for stewardship promotion.

- Estimated Budget: $8,000

Project #3 - Do Farmland Ownership Patterns Explain Variation in Farmland Rental Rates?

- Location: University of Guelph

- Research Team: Dr. Brady Deaton, Dr. Alfons Weersink and Dr. Karl Meilke

- Duration: October 2009 – March 2011

Brief Project Description/Overview:

Farmland is a necessary input into agricultural production. Since the 1920's the pattern of farmland use in Ontario has been similar to Canada's overall pattern: i.e., the total acreage in farmland has declined, the number of farms has diminished, and the size of farms, in terms of acreage per farm, has increased. Statistics on these issues are readily available from Statistics Canada and often cited. What is less well understood is: *who—e.g., widows, owner-operators, etc. – owns Ontario's farmland and the economic consequences thereof*.

We address the question of who owns farmland by empirically examining the farmer and non-farmer ownership of farmland in Ontario. With respect to non-farmer ownership we intend to categorize non-farmer owners of farmland into five categories: (1) Retired farmers; (2) Widows of deceased farmers; (3) Non-farmers who use the land as a place of residence; (4) Non-farmer owner investors; (5) A company or corporation who purchases farmland as a form of investment. In addition, information will be gathered on rental patterns so as to assess variation in rental rates across ownership categories.

Categorizing farmland owners in the above manner and gathering information on rental patterns allows us to answer three primary research questions. First, do rental rates vary by non-farmer owner? Second, does the proportion of land rented and the character of non-farmer ownership, vary depending on proximity to urban areas? Third, do rental payments stay within the region? Better understanding of each of these research questions will support our capacity to assess the consequences of various

agricultural policies designed to enhance environmental goods and services. For example, if agricultural zoning reduces farmland property values does it reduce the wealth of non-farmer landowners but have little effect on farmer operators? Do some types of non-farmer land owners charge less rent than others? (Such a finding would obviously challenge conventional theory.) Who are the beneficiaries of agricultural support policies that become capitalized into land values and where are the beneficiaries located? This latter question lends itself to better understanding the relationship between rural development strategies and more general agricultural policies.

In addition to collecting information on landlord characteristics, data on relationship strength and competition for agricultural rental land will be collected. By collecting these two additional variables information regarding rental rates can be tested with regards to social capital theory, while taking into account the intensity of competition for farmland. Information will be collected on three types of rental agreements in South-Western Ontario, cash rental; crop-share and cost-share contracts regarding the 2010 growing season.

A preliminary survey of rental incidence in South-Western Ontario found that 43% of farmers rented land (compared with the 37% found in the 2006 Census of Agriculture for that region). Of the farmers who rented land the average amount of land rented was 250 acres with approximately one-half of the farmers dealing with only one landlord. Interestingly, 24% of tenants indicated that they dealt with five or more landlords, suggesting a divide between those whom rent large amounts of land with those who do not. The maximum number of landlords for an individual farmer was 25. Nearly 90% of the landlords dealt with had only one rental property. In this preliminary survey, no data on landlord characteristics or relationship strength was collected. However, our survey data remains to be processed and analyzed. The results should available by September 2010.

- Estimated Budget: $64, 297

> **Project #4** - Border Tax Adjustments on Food Imports

- Location: University of British Columbia

- Research Team: Dr. Sumeet Gulati and Tegan Adams

- Duration: October 2009 – March 2011

Brief Project Description/Overview:

This research asks two questions:

1. Assuming a hypothetical price for carbon emissions what would be the appropriate border tax adjustments for carbon emissions (or embodied energy) associated with the production and transport of different food categories from different countries to Canada?

2. What would be the impact of such a border tax adjustment on imports of these food categories from different countries to Canada?

We shall calculate border tax adjustments for food categories such as, beef, chicken, pork, eggs, dairy, grain, field grown vegetables, greenhouse grown vegetables and fruit by country of import (for all Canada's current trading partners). We will then estimate how this border tax will affect food category trade patterns.

Based on our results, we will be able to answer questions such as: which foods from which countries will face the largest (or smallest) border taxes and why? Which of our trading partners would see the largest (or smallest) contractions in bilateral food exports? A carbon tax has already been introduced in BC. It is likely that other carbon regulations will come into play shortly. As these regulations evolve, costs of food production in Canada will rise. As producing food domestically becomes more expensive, concerns regarding imports from countries not affected by carbon regulations will become prominent. In all likelihood, with the introduction of a domestic agreement pricing emissions there will be an accompanying border tax adjustment or other similar provision. Most recently for example, the US Congress suggested provisions to address Carbon Emissions and Jobs Leakage. One provision of significant interest proposed for the US is a border tax adjustment scheme that will serve to prevent carbon leakage from trade and outsourced goods (including food). Our research will help us understand the implications of such a provision in Canada. Our research will involve the following steps:

1. Calculate the carbon emissions generated from the production and transportation of the imported food categories to Canada.

2. Assume a hypothetical price for CO2 (for example 30$ per tonne of CO2), and its scope (for example it could be that only fossil fuel use in agriculture is subject to the price for emissions produced).

3. Based on 1 calculate the appropriate border tax adjustment for the hypothetical policy expressed as an ad-valorem tariff by food group and country. And finally,

4. Estimate the impact of this ad-valorem tariff on the patterns of trade for these food categories by country.

To determine the embodied energy relative to foods imported to Canada we will estimate the production and transport emissions of food categories. Production emissions for each food category will be calculated relative to their consumption of agri-inputs domestically (feed, energy supply-demand, agricultural chemicals, land-use emissions). Transport emissions will be relative to the distance each food group travels, the transport vehicle used and the quantities shipped. We shall make a set of assumptions on the method of transportation (air, boat, rail or a combination) based on data available and the perishability of the food considered. We shall combine this with relevant distances depending

on the method of transportation (for example land distances could be from, mapquest.com, marine distances from marinechain.com and air distances travelled from mapcrow.com) and the emissions factors by weight method to get transport emissions. Quantities shipped are available through Industry Canada's Trade data.

We will use this information and details on the hypothetical CO_2 policy to calculate the appropriate border tax adjustment. The border tax adjustment will act similar to a tariff relative to embodied energy of foods imported to Canada.

We shall predict the potential impacts of such a border tax on imported foods based on effects of previously implemented tariffs on foods. Based on historic trading data we shall thus estimate a relationship between tariff (or non-tariff barriers) and trade patterns by food category and country. We shall use Agriculture and Agri-Food Trade and Industry Canada trade data to get import prices and quantities by food category (from 1970 to 2008). We will also obtain additional trade data from FAO Stats on Food Trade to Canada. Trade policy data will derive from the Trade Analysis and Information System.

- Estimated Budget: $23,485

Project #5 - Ecological Goods and Services in BC Agriculture: Studying Nutrient Management in the Lower Fraser Valley

- Location: University of British Columbia

- Research Team: Dr. Sumeet Gulati and Karen Ageson

- Duration: October 2009 – August 2010

Brief Project Description/Overview:

The concept of EGS, as it relates to agriculture, assumes multifunctionality: that agriculture produces more than just food and fibre. Agriculture produces non-commodity ecological goods and services when it uses the environment in a way that is valued by society. Market prices of food and fibre do not reflect these valued ecological goods and services, and are therefore undersupplied. The concept of EGS is finding currency in environmental policy as governments find ways to utilize market-based mechanisms to incent the production of ecological 'goods' from agriculture and minimize ecological 'bads'.

The deliverables from this research include:

1. An academic literature review of EGS in theory and practice as relevant to the province of British Columbia and particularly focused on nutrient management practices.

2. A report on the potential of employing the concept of EGS to minimize agricultural nutrient loading of groundwater in the Lower Fraser Valley (LFV) of BC.

Why is this research important? There is a prominent agricultural industry in the LFV, sharing a bioregion with the urban metropolis of Greater Vancouver. The LFV hosts some of the most fertile land in Canada, and ranks amongst the highest concentrated agricultural activity in the country. There is measurable environmental impact, documented in the literature, that links increased agricultural intensity to ground and surface water pollution. Projected growth in the livestock industry threatens to further exacerbate agricultural nutrient management issues in the LFV. To date, there has been little research into market-based instruments that might address negative environmental externalities in the LFV, and little valuation research that would lay the groundwork for market-based instruments to address nutrient management issues.

The research approach: An extensive literature review to establish a theoretical framework grounded in the principles of EGS, cognizant of limitations in practice, i.e. data requirements, public expenditure implied by policy, lack of additionality. Established literature lends credence to a case study approach, specific in focus and pertinent to particular agri-ecological conditions. Further literature review, review of government publications, interviews with government and professional agrologists and farm visits, to ascertain the LFV agricultural context, the major agri-environmental issues facing the industry, state of knowledge and potential data sources.

Potential data sources include census data, industry provided growth rates, Environment Canada water quality data, and Agriculture Canada ammonia emissions inventory data. This work will also possibly shed light on data limitations, as well as policy inconsistencies that may need to be addressed for successful implementation of market-based policies. A literature and government policy review will reveal insights into alternative policy regimes that may be pertinent to nutrient management in the LFV context, (that is cross-compliance regulation for payments for EGS).

- Estimated Budget: $13,000

Project #6 - Review of the Literature on Control of Nutrients in Several Watersheds

- Location: University of Manitoba

- Research Team: Dr. Gary Johnson, Dr. Donald Flaten and Dr. Derek Brewin

- Duration: January 2010 – March 2010

Brief Project Description/Overview:

The problem of nutrient (phosphorus and nitrogen) related pollution from a mix of agricultural and non-agricultural sources is not a new one, but in the Lake Winnipeg watershed we are seeing it emerge once more. The proposed literature review is an attempt to look at the nature of the problem in several watersheds where nutrient loading has been the problem, look at both in place and proposed policy measures for solving the nutrient-loading problem, and examine the success at reducing the level of relevant nutrient or nutrients.

The potential watersheds that might be included would ideally have three attributes. First, the watershed must have a long enough history of physical and social scientific research that literature exists regarding the assessment of the problem prior to policies and assessment of the results after the implementation of the policies. Second, agricultural contribution to nutrient loading from both crop cultivation and animal husbandry is significant, but not the only source of the nutrient or nutrients thought to cause the problem. Finally, the more similar to Lake Winnipeg with regard to size, the type of nutrient or nutrients and their sources the better. This latter attribute may be more difficult to find, given the unique nature of watersheds. Some potential watersheds that will be looked at are Lake Erie, Lake Champlain, Lake Balaton, the Thames River and Estuary, the Delaware River and Estuary, the Chesapeake Estuary and its main river sources, and the Baltic Ocean.

The method will be to narrow down the watersheds to at least two but no more than four watersheds based on the attributes in the discussion of potential watersheds. Once the choice of watersheds has been made then an annotated bibliography or inventory of relevant literature from the physical and social sciences regarding nutrient loading and policies in place to reduce the nutrient loading from all sources will be done. The focus with regard to agricultural loading will not only be on policies, but also on beneficial management practices (BMPs) put into place with regard to reducing agricultural nutrient loading. The final phase of the project will be a more detailed review of that literature to evaluate its potential relevance to Lake Winnipeg.

- Estimated Budget: $6,000.00

Project #7 - A Performance-Based Approach to Agri-Environmental Policy in Canada: Development and Comparative Assessment

- Location: University of Saskatchewan

- Research Team: Dr. Ken Belcher, Dr. Mike Quinn and Julia Baird

- Duration: December 2009 – March 2011

Brief Project Description/Overview:

Public awareness of the effects of agriculture on the environment is increasing. To date, government and environmental agency programs have focused on providing financial and technical incentives, such as cost-share payments, to farmers to encourage the adoption of conservation management, including beneficial management practices (BMPs). These payments do not discriminate between farmers who have a large impact on the environment and those that have little impact. Consequently, some incentive payments may not result in environmental improvement. The objective of this research is to evaluate the potential to use measures other than practice based incentive payments for environmental programs for agriculture.

Methods: The main data collection method for this research will be interviews and surveys. Agricultural producers in the southern Alberta watersheds of Indianfarm Creek, Battersea Drain and Whelp Creek will be questioned in-person about their experiences with previous environmental programs and how they view their responsibility for environmental sustainability. These watersheds were chosen for their representativeness of the various agricultural activities in Alberta and because biophysical data has been collected by Alberta Agriculture for a current study quantifying the impacts of BMPs. The focus of the consequent policy development, however, will focus on Indianfarm Creek watershed. For this reason, stakeholder organizations in the Indianfarm creek watershed will also be interviewed so that all direct stakeholders are represented. In addition, rural and urban residents living beyond Indianfarm Creek watershed will be included in a mail survey to assess the viewpoint of the wider public regarding agricultural producers' and the public's responsibility for the environment. The responses to these interviews and surveys will be aggregated and evaluated to get an overall sense of the perspective of agricultural producers and the public concerning the responsibility for the environment on agricultural land.

Agri-environmental performance-based policy instruments used in Canada and other jurisdictions will be evaluated for their effectiveness and acceptability in the target watershed based on the respondents' views. In particular, targeting payments to particular practices and locations that have the most potential for improvement will be investigated. The 'new' policy options will then be compared, using multi-criteria analysis, to the current incentive payment schemes for their respective environmental, social and economic benefits to the study area and beyond. The results from this analysis will be used to inform the development of effective agri-environmental policy.

Projected application of research: There has been increasing interest in alternatives to practice-based incentive payments and this research will investigate the social acceptability and potential environmental, social and economic implications of alternatives. In addition, the research will include stakeholders in the decision-making process; another recent area of interest in environmental policy. Governments may use this information to inform their methods for developing environmental policies and environmental non-governmental organizations may use this research to implement local initiatives within watersheds. At a broader level, this research contributes to the literature on the use of performance-based measures for environmental policy and also to the literature on stakeholder involvement in environmental program development for agriculture.

- Estimated Budget:$29,000

Project #8 - Climate Change Impacts on Waterfowl Habitat in Western Canada

- Location: University of Victoria

- Research Team: Dr G. Cornelis van Kooten, Dr. Barrie Bonsal, and Dr. Terry Prowse

- Duration: October 2009 – March 2011

Brief Project Description/Overview:

Climate change is expected to increase drought in Canada's grain belt, with projections suggesting that the 21st Century will be substantially drier than the previous one. A major casualty will be North America's duck factory – the pothole region of the southern Prairie

Provinces. A drier climate will reduce the number of wetlands, which will have an adverse impact on agricultural ecosystems and the region's ability to produce waterfowl, as is clearly demonstrated by the high correlation between wetlands and breeding duck populations.

Wetland ecosystems are important not only for producing waterfowl, but also for the ecosystem services they provide. The latter include filtration of agricultural and other pollutants (thereby improving quality of ground and even some surface waters), water for livestock and wildlife, visual and recreational amenities, greenhouse gas storage, and so on. Wetlands are also impacted by policies that seek to mitigate climate change, particularly policies related to the enhanced production of biofuels.

Objectives: The research objectives are: (1) to investigate the possible effect that projected future drought will have on the distribution of wetlands in the southern prairies, and the potential for the 'duck factory' to shift northwards; (2) to examine the impact that climate mitigation policies (particularly efforts to increase cropland used for biofuels) will have on wetlands; (3) to determine the socially optimal level of wetlands to protect, keeping in mind the amenity values provided by wetlands and their value in storing methane (e.g.); and (4) to suggest possible policies that help achieve optimal retention of wetlands in the face of drought and economic incentives (e.g., biofuels subsidies) to drain wetlands and covert them to agricultural production.

- Estimated Budget: $36,000

Project #9 - Water Cultures and Irrigation Farming in Alberta

- Location: University of Alberta

- Research Team: Dr. John Parkins, Gaylene Halter, Mike Kennedy

- Duration: October 2009 – March 2011

Brief Project Description/Overview:

Canadians hold strongly to the belief that water is an abundant natural resource. At the same time, current systems of water management are under strain from industrial development and a regulatory legacy that is difficult to change. Recognizing the socially embedded context of water regulation, this study will identify and examine the deeply held belief systems of key water users and regulators in Alberta as a way of understanding the conditions and pathways for change in water regulation. Research will focus on the case of irrigation farmers in southern Alberta and guiding questions for this study are as follows. (1) What are the underlying norms and practices that are associated with water use among southern Alberta irrigation farmers? (2) How do these irrigation farmers maintain their place of privilege as water users in the province?

This study draws on a sociological theory of field and habitus, with attention to issues of culture and power. Field research will include in-depth interviews with key actors in the field of water management in Alberta, and members of the irrigation farming community. These interviews will be supplemented with Q-method (a structured approach to analyzing the logic of belief systems that includes ethnographic and factorial techniques) as a way to gain deeper insight into the dominant discourses that help to sustain regulatory arrangements among current water users.

Policy relevance from this project is derived from current efforts within the province to address water management challenges and ways of introducing new policy mechanisms such as market-based instruments. Water management is deeply embedded in social relationship and social institutions, and a deeper understanding of the foundational belief systems (value, norms, and cultures) of key social actors such as producers, regulators, and local residents will provide insights into the possibilities, directions, and acceptabilities of water management transformation.

Deliverables from this project will include the following. (1) A research report on belief systems and possibilities for change in water management. (2) A policy paper on the basic social conditions for water management transformation and the directions and limits of change (with attention to market-based instruments). This policy paper will be based in part on completed analysis of water use and regulation issues in the Battle River Watershed.

- Estimated Budget: $36,500

- Location: McGill University

- Research Team: Dr. Paul J. Thomassin, Dr. Laurie Baker, Réne Roy and Mathieu Gourdes-Vachon

- Duration: October 2009 – July 2011

Brief Project Description/Overview:

The Chaudière watershed is an intensively farmed area that has one of the highest concentrations of animal production in Québec and approximately two thirds of it land area in crop production (AAFC, 2007). The Bras d'Henri sub-watershed is located within the Chaudière watershed and has 32 percent of its land in crop production and has 84.24 animals per square kilometre (MDDEP, 2006). Surface water quality has deteriorated substantially in the Bras d'Henri and agricultural non-point source pollution has been identified as the major cause of this deterioration (MDDEP, 2006). As a result of this intensity in production and the substantial decrease in water quality, this watershed has been identified for study under AAFC's Watershed Evaluation of Best Management Practices (WEBs).

The WEBs project is undertaking a biophysical-hydrological-economic evaluation of Best Management Practices (BMPs) in the watershed. The BMPs being investigated include: riparian zones, precision feeding, alternative manure applications, reduced pesticide applications, and alternative crop mixes. The study will include hydrologic modelling, economic modelling and the integration of both the economic and hydrologic models. The goal is to be able to identify the economic and environmental impact of adopting BMPs in the sub-watershed. This will allow for the estimation of abatement costs curves that will be used in the experimental economics component of the project.

The ERCA request for funding will supplement the WEBs funding. The research to be undertaken is a survey of the agricultural practices of 80 producers in the Bras d'Henri sub-watershed. The information gathered will include: the number of fields on the farm, crops grown, rotations, number of animals, spatial location of farm and fields, location of fields in and out of the watershed, cost information, farm structure, and rented land. The survey will also gather information on BMPs that the producers have already adopted and their preferences for alternative BMPs that could be adopted in the future. This is a follow-up survey to one that was carried out in 2007 to see how farm structure has changed, with respect to the poor hog prices, and the impact of BMP adoption. Special emphasis will be made to interview and gather data on 19 producers who did not complete the initial survey. These operators contain some of the larger operations in the area and are critical for the model development. These larger operators have multiple production sites within the watershed for production, are mainly animal producers, and the structure of these units are substantially different from the family farms currently modelled. The ERCA funding will be used to fund a PhD student to design and implement the survey and to pay for undergraduates to collect data.

Information gathered in the survey will be utilized in the economic model. The model has been designed as an inter-regional mixed integer programming model, where each farm is considered as a region that allows for the trading of inputs, outputs and manure. The spatial information gathered on the farms will allow a refinement of the environmental coefficients that are based on homogeneous hydrologic units. This will allow for a more accurate estimation of the trade-off curves.

- Estimated Budget: $15,300

Related Research: Commissioned Papers, Thought Pieces, and Other Research (2009-2010)

1. Impact Evaluation of Ducks Unlimited Conservation Areas: Scoping the Science

(Robin Naidoo, World Wildlife Fund; Vic Adamowicz and Peter Boxall, University of Alberta)

Despite decades of funding for conservation interventions of various types (protected areas, endangered species legislation, community-based conservation, etc), the environmental community has conducted very few rigorous evaluations of the impacts of their investments [1]. While issues of spatial and temporal scale make evaluation of environmental programs exceedingly difficult in many cases, formal evaluation lags far behind other fields such as development and education, and a challenge has been issued for the community to improve their performance in this regard. At the same time, the rise of Payments for Environmental Service (PES) programs presents us with an opportunity to plan these interventions in such a way that in a few years' time we are able to evaluate conclusively, for at least a sample of programs, their effectiveness in achieving desired environmental and socioeconomic outcomes.

Impact evaluations are best designed at the outset of program, so that treatment and control areas can be assigned a priori according to standard experimental design rules. This ensures a rigorous evaluation of program outcomes relative to the *counterfactual*, i.e., what would have happened in the absence of the program. Nevertheless, post-hoc evaluations of interventions, using statistical methods to construct counterfactuals, are not only possible, but are only alternative when evaluating past programs or programs that were begun without such an experimental design in place. The essential point of this type of exercise is to rigorously define, in the absence of a randomly selected group of control or reference sites, a set of such sites that offers an unbiased representation of the counterfactual that can then be compared against program sites.

We propose here to investigate the feasibility of using this second, post-hoc procedure to conduct an impact evaluation of the wetland conservation programs of Ducks Unlimited and possibly other ENGOs in Canada. Recent approaches to conducting such statistical evaluations of conservation interventions (e.g., protected areas in Costa Rica; [2,3]) provide appropriate and timely reference material for such a project. To conduct a similar analysis for Ducks Unlimited conservation sites would require several types of information:

A measure of the outcome that the site was meant to achieve. In the case of wetland sites, the easiest variable to measure, given the difficulty of measuring biodiversity directly, may be wetland cover. Cover at wetland sites would need a pre-intervention measure and a post-intervention measure (over a time interval long enough for the program to have had an effect).

A measure of variables that, as well as site protection, are expected to have an impact on wetland conversion. Wetland conversion is expected to be a function of geography (e.g, inherent suitability for agriculture, proximity to roads or cities), as well as the socioeconomic characteristics of landowners (e.g., income, farming practices, attitudes towards conservation).

We will ascertain whether these data are already available and if not, what cost it would take to collect. We will produce a working paper that summarizes not only the specifics of the Ducks Unlimited case, but the general issues to consider when contemplating the design of an impact evaluation study for planned or existing conservation programs.

2. The Unintended Impacts of Farm Support and Stabilization Programs on the External Impacts of Agricultural Production

(James Vercammen, University of British Columbia)

The purpose of the paper will be to examine the unintended linkages between farm income support/stabilization programs and the externality (positive and negative) impacts of primary agriculture. The land use decision of farmers (extensive margin) and the input intensity decision of farmers (intensive margin) combine with random weather outcomes to create external impacts on the environment and surrounding communities. Negative environmental impacts include nutrients leaching into water supplies, residual pesticides drifting in the air, wind and water erosion of top soil and the destruction of wildlife habitat and biodiversity. Positive societal benefits of agricultural production include the provision of green space around urban areas, an aesthetically-valuable diverse crop mix, diversity in the supply of local food and expanded commercial options for local food processors. Support and stabilization programs affect farmers' land use and input intensity decisions, which in turn alter the external impacts of agricultural production. Understanding how the design and parameter settings of support and stabilization programs affect farm-level decisions, and understanding how changes in farm-level decisions affect the environment and local communities, is a key component of effective policy design and administration.

This paper should be viewed as the beginning of a larger research program on this topic. The larger research program could utilize a dynamic model of farm-level decision making, overlain with a dynamic farm support and stabilization programs, in order to fully assess how farm support and stabilization programs create unintended consequences for the environment and local communities. A necessary step before constructing a dynamic model is the creation of a simple static model that is capable of clearly illustrating the key linkages between program design and external impacts. The purpose of this paper will be to construct a simple static model and use it to generate a series of testable hypotheses. The initial model will be kept simple because the ultimate goal is to create a dynamic version of the model in order to address a broader set of research questions.

3. Designing Conservation Auctions to Facilitate BMP Adoption: Pilot Auctions and Workshops in Manitoba

(Katherine Packman and Peter Boxall, University of Alberta)

LEARN researchers were invited by MAFRI senior staff to run a series of workshops and experimental economic pilots on conservation auctions in Manitoba. This activity was to serve as preparation for possible "real" pilot auctions in a selected watershed in Manitoba. Over a period of 2 weeks in March 2010, Ms Packman ran a series of 13 experimental auctions with government staff, academics, students, producers and other interested citizens. These sessions were organized by MAFRI. Following each set of experiments, participants were invited to complete a questionnaire, followed by a discussion on the efficacy of using reverse auctions to increase the uptake of BMPs. The selected BMP used in the experiments involved the restoration of wetlands. The design of the experiments followed closely the research led by Peter Boxall involving the South Tobacco Creek Watershed under the Watershed Evaluation of BMPs research program funded by AAFC. Overall, the workshops and the reverse auction process had a positive reception, and they provided an anchor to initiate discussion.

LEARN Conferences and Workshops:

The University of Victoria in conjunction with the University of Alberta, the ERCA-LEARN and Ducks Unlimited Canada hosted a workshop on "Wetlands Management, Economics and Policy" at the Hotel Grand Pacific in Victoria, British Columbia, January 13-15, 2010. As wetland policy discussions and changes are ongoing across Canada, the U.S. and elsewhere, the timing of such a workshop was ripe for advancing the state of knowledge about the benefits of wetlands and fuelling policy discussions.

Wetland ecosystems are among the most important in the world, both from an economic and environmental perspective. Wetlands provide a large number of services, the most important of which relate to protection against flooding, water quality, assimilation of wastes, and wildlife habitat. In Europe, coastal wetlands protect residential areas against flooding from the sea, while all wetlands are important for recreation, improving water quality, and providing habitat for numerous waterfowl and other wildlife. The Prairie Pothole Region of Canada and the United States provides most of the breeding habitat for North American waterfowl. However, this region is also North America's breadbasket and, as is true of many wetland areas, is a highly altered landscape that is primarily utilized for agricultural production. Given the focus in many countries on energy crops for ethanol and biodiesel, it will be increasingly difficult to protect wetlands and associated grasslands in such agricultural regions.

The workshop was attended by 70 delegates from Canada, the United States, Scotland, The Netherlands, France and Tanzania. The delegates and speakers were economists, scientists and policy makers from universities, governments and the private sector. In recognition of the important but often neglected role of wetlands in society, selected papers from the workshop will be published in a special issue of the *Canadian Journal of Agricultural Economics* devoted to wetlands management, economics and policy in June, 2011.

Outputs in the reporting period:

Presentations:

Holmes, E. (2010). Target Setting in Stewardship: Opportunities and Challenges. Stewardship Network of Ontario Forum 2010: International Year of Biodiversity. June 8, Toronto, ON.

Holmes, E. (2010). Ecological Goods and Services…Recognizing Landowner Contributions. Eastern Ontario Certified Forest Owners' Annual General Meeting. February 27, Watson's Corners, ON.

Publications:

Packman, K. and P.C. Boxall. Conservation Auctions in Manitoba: A Summary of a Series of Workshops. 56 pp.