

**Poster Abstracts for the Second Annual Canadian Agriculture Policy  
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**An opportunity cost model for species at risk within Saskatchewan's milk river watershed**

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Species at risk recovery strategies and action plans and their associated cost-benefit analyses have previously been completed on a species by species basis under the Species at Risk Act (SARA). The quality of cost-benefit analyses varies widely from species to species and often either benefits or costs, or both, are poorly accounted for in species' recovery strategies and action plans. The multiple species at risk (Multi-SAR) recovery strategy within Saskatchewan's Milk River Watershed provides a unique opportunity to conduct an in-depth analysis of the costs (both direct and opportunity costs) of protecting multiple species' habitat within the dry mixed grass and mixed grass prairie of south-western Saskatchewan. MARXAN (Marine Spatially Explicit Annealing) and ArcGIS 10 computer software are used to determine a conservation strategy that will secure the future of the area's species at risk at the lowest possible cost given the current information on oil, natural gas, and agricultural land values; beneficial management practices and their costs; current land use; species' threats; and species' habitat distribution. The result is a detailed understanding of the real costs incurred when habitat is protected using different stewardship initiatives. There are huge cost-savings possible if habitat designations for species are planned simultaneously and make use of overlapping habitat areas; the reduced costs of simultaneous planning are especially large if larger habitat patches are required for species at risk. While costs and benefits of species designation and protection are not legally required at the early stages (listing, recovery strategy creation, and critical habitat designation) of species protection under the Species at Risk Act, this study suggests the consideration of costs in the early stages of planning could improve the efficiency of habitat designation and protection.

## **Transitioning to a new approach for sustainable development: the case of Manitoba agriculture**

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Primary agricultural production is the foundation of an industry that provides employment, contributes to federal and provincial economies, and ensures a safe and secure food supply. However, in recent years there has been an increased focus on the environmental impacts related to agricultural production and how farmers manage their operations to minimize these impacts. This research advances an understanding of agricultural development that integrates both economic and environmental sustainability by analyzing Manitoba's implementation of multiple policy tools to address environmental concerns related to primary agriculture. I seek to better understand what catalysts provoked Manitoba's policy changes and, in particular, how incentive based programs have demonstrated a shift in policy approach. I also examine how policy measures directed towards the primary agricultural industry have affected the success of efforts to fulfill related environmental and economic goals. While this research will primarily focus on Manitoba's policy, it also incorporates some comparative work on similar programming taking place across Canada. It is hoped that this research will help to identify measurable steps and policy principles that could be adapted as part of a national sustainable development framework.

## **Potential for Weather-Indexed Insurance in China's Loess Plateau Dryland Cropping Region**

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As a result of global climate change, extreme precipitation and drought events could become more frequent in China. For example, over 30 million of hectares of arable land were impacted either by drought or flooding during the 1990s and the beginning of the 2000s, and 14 million more were affected by rare low-temperatures in 2007. This has been a great challenge to China's crop production and food security. In addition, farmers usually had few options for risk management, and until recently the government offered little protection and/or income support to farmers. Government support of agriculture began in 2004, as it recognized the significance of agriculture to the wellbeing of peasants (including the need to slow migration to the cities), and the important need to keep food price inflation in check. This support consisted of the implementation of policies to enhance crop production and support farm incomes. An existing tax on farm products was removed in 2006, and in 2008 the government introduced a weather-indexed agricultural (WIA) insurance. Yet, crop insurance remains generally unavailable because it is not well understood, and the actuarial reliability of WIA insurance remains to be worked out. In essence, while Chinese farmers are certainly desirous of accessing crop insurance, premiums will need to be reasonable and publicly subsidized. In this study, we examine the relationship between weather variables and crop yields for the Loess Plateau region in China. We use regression analysis to develop a relationship between crop yield and variations in precipitation, temperature, wind, and other weather phenomenon. The regression results are then used in a financial, Monte Carlo simulation model to determine potential crop insurance premiums so that they are actuarially sound.

## **A study of the Attitudes and Awareness to Carbon Offset Protocols in Alberta's Agricultural Community**

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Alberta has the highest Greenhouse Gas (GHG) emissions in Canada and, at the same time, one of the largest and most diverse agricultural economies. The agricultural sectors have significant potential for reducing GHG emissions and for storing carbon in biomass and soil. Since 2007, Alberta farmers have been able to enter into offset contracts in which they can get rewarded for adopting farming practices that reduce GHG emissions as part of the Alberta's Greenhouse Gas Offset System; however, the extent to which farmers adopt activities and alter their practices will depend on beliefs, costs, potential revenues, and other economic incentives created by climate policy. This research looks at the challenges, implications, and opportunities for the promotion and adoption of Alberta's carbon offset protocols based on data collected from farmers regarding their participation and attitudes toward Alberta's Greenhouse Gas Offset System. The research offers a participatory framework for a legitimate assessment of Alberta's carbon offset protocols and suggests reasons for their adoption (or lack of adoption). The research draws on broad trends in agriculture and uses personal interviews and survey research to incorporate a grassroots perspective.

## **Weather-indexed insurance and financial weather derivatives as complements or alternatives to crop insurance in Western Canada**

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In Canada, crop insurance is used to protect farmers from the vagaries in temperature and precipitation. However, crop insurance programs are not actuarially sound, because they are publicly provided and rely on differences between the actual crop yield achieved by a farmer in a given year and average (farm or region level) yields. Crop insurance usually suffers from adverse selection and moral hazard; while the former can be prevented by mandatory participation in crop insurance, moral hazard is difficult to avoid. Both problems can be avoided by relying on a new method to assess and insure against potential weather-related crop loss, namely, weather-indexed insurance.

In this study, we discuss the differences between crop insurance and weather-indexed insurance, and between weather-indexed insurance and financial weather derivatives that can be used in lieu of insurance. For example, weather-indexed insurance relies on historical yield data and current prices to determine actuarially soundness and payouts. Financial weather derivatives rely on speculation concerning future weather outcomes and crop prices. Thus, while the former may be open to gaming, the latter may not and, thus, may be a better alternative to weather-indexed insurance. To examine this further, we use regression analysis to develop a relationship between crop yield and variations in precipitation, temperature, and other variables using data from a GIS model of Saskatchewan's cropping region. Based on the regression analyses, we use Monte Carlo simulation to derive an actuarially-sound, financial weather derivative that can be used to insure farmers against crop loss. This financial instrument does not suffer from problems of adverse selection or moral hazard. We then specify an econometric model to determine whether the weather-indexed insurance can be gamed using data on climate events.

## **Agricultural Nutrient Management Employing the Concept of Ecological Goods and Services in BC Agriculture**

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There is an appetite for market based management mechanisms in agri-environmental policy. The purpose of my study is to explore how the market based concept of ecological goods and services (EGS) can be applied towards the management of an agricultural externality in British Columbia, Canada. Through literature review I establish the importance of valuation in market based management. With an EGS program in mind I identify the City of Abbotsford as a potential ecological service buyer and establish economic value for improvements to water quality in the Abbotsford-Sumas aquifer. I use a replacement cost approach based on the present value costs of the proposed Stave Lake surface water system. My results suggest that if nitrate remediation and/ or nitrate management practices improve water quality and the costs fall below \$168 million there are potential net benefits to the City of Abbotsford. This value could form the basis for a city program or EGS trading scheme to encourage farmers to place a higher priority on water quality in their land management practices. A key finding is that lack of information on the degree to which nitrate contamination constrains well field development limits the ability to conclusively evaluate the net benefits of improved nitrate management and proceed with an EGS program.

## **Estimating a Wealth Account for Agricultural Land in Quebec: Incorporating Natural Capital into a System of Environmental-Economic Accounts**

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A hedonic pricing model was used to create a wealth account for agricultural land in Quebec. Economic and property right information; from individual land transactions, were combined with physical attributes of the land; using geographic information system (GIS) technology, to estimate the implicit prices of agricultural land attributes in Quebec. Implicitly pricing the attributes of agricultural land provides a more flexible means of estimating the value of the wealth account. The wealth account provides an estimate of the natural capital associated with the inventory of agricultural land. The wealth values estimated through this approach increases the compatibility with the current System of National Accounts.

The creation of a wealth account for agricultural land provides an interesting tool to assess the effects of human activity on this natural capital, on its evolution over time and the incorporation of changes in natural capital into public policy decision making. This new approach aims to improve our understanding of the factors that influence agricultural land value and quantify their impact. Moreover, this method, allied with new geospatial technologies, can substantially improve the estimates of our natural capital. This poster will outline the theoretical foundation of the method and the preliminary estimates of the land attributes.