

# A5: Integrated Assessment & Modelling (IAM) on Climate Change Costs to Prairie Communities

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## Program Outcome

ESS S&T contributes to estimates of the costs of climate change and outputs are used as part of larger efforts to inform debate about new Kyoto targets.

## Partners

- Dr. S. Wang, Dr. Y. Zhang, CCP J28
- Dr. B. MacGregor, Chief, Agricultural and Environmental Policy Analysis/ AAFC
- Dr. S. Gameda, Science Branch/AAFC
- CCAF/PARC funded SSRB projects (CCP J31, EC, UOS)

## Key Stakeholders

- Climate Change Impacts and Adaptation Directorate
- Environmental Economics Branch, EC
- Policy Analysis and Research & PFRA, AAFC

## Motivations

While it is anticipated that Prairie agriculture patterns will shift northward as climate warms with limited impacts on overall outputs, questions remain as to what would be the costs during the transitional process and what would be the costs avoidable by adaptation. Answers to these questions are key to understanding the vulnerability of the communities and to developing adaptation strategies to reduce the vulnerability. For the purpose of informing debate about the new emission targets, an understanding of the net costs of climate change to Prairie agriculture is necessary. This is because costs during the adaptation could be more significant, making many rural communities with limited adaptive capacity unable to adapt. This activity, along with A4 of this Project and in partnership with CCP J28, OGDs and academia, is an attempt to address these questions.

## Reducing Canada's vulnerability to climate change

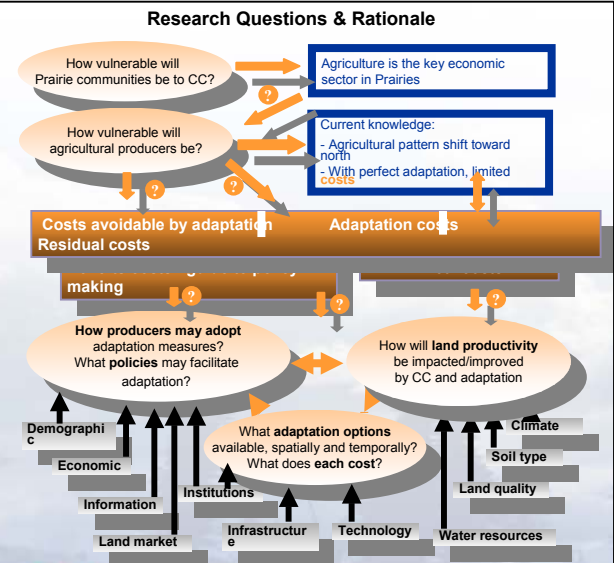
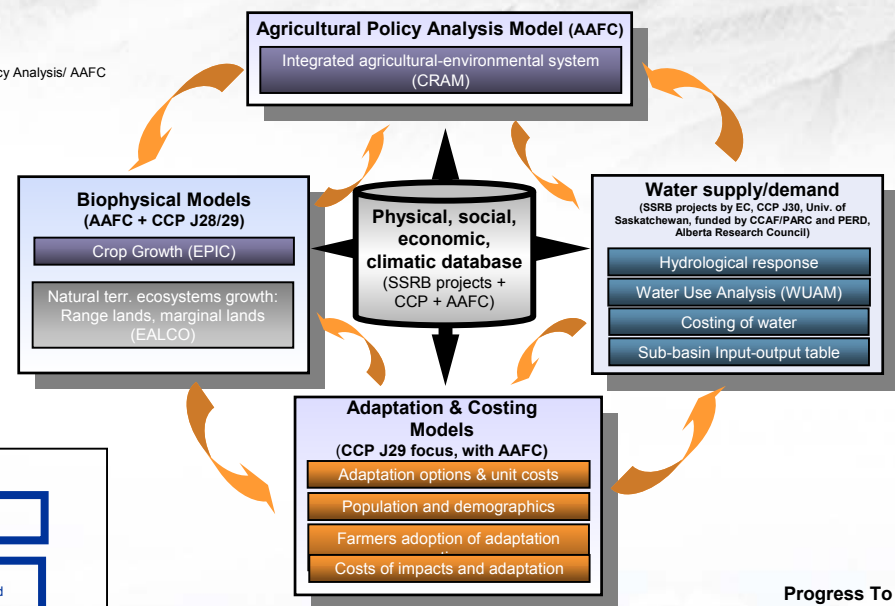
### Target Outputs (with partners)

- Cost estimates of climate change impacts on agriculture:
  - Costs for adaptation
  - Costs avoidable by adaptation
  - Costs remaining after adaptation
  - Differences in costs with different climate change scenarios that are reflective of different global greenhouse gas mitigation efforts
- An integrated assessment of potential agricultural impacts, autonomous adaptive capacity, vulnerability, policy scenarios, and implications for communities
- A map series showing spatial distributions of these outputs
- A preliminary integrated assessment model for assessment of adaptation strategies

### ESS S&T Used

- Glacier monitoring and modelling
- Ecosystem model (EALCO) initialized and validated by land cover and associated products derived from earth observations; water budget simulated by the model
- Transportation networks from NTDB
- Population distribution model developed using census data and ESS framework data (drainage basins, settlement distributions, permafrost zones, etc.)
- Geomatics: Spatial-temporal analysis, spatial statistics, spatially-explicit modelling, remote sensing, GIS
- Systems science and integrated assessment

## Preliminary Concept of Integrated Assessment



The estimation of the costs of adaptation, the costs avoidable by adaptation and the related residual costs requires an understanding of the impacts of climate change on agricultural production, the options and costs to adaptation, the capacity of farmers to adopt adaptation measures, and the effects of adaptation on production. Even more complex, farmers' decisions are manifestations of not only climatic impacts and land quality, but also socio-economic dynamics and policy interventions. This extreme complexity of the problem entails a systems approach that is capable of addressing the connectedness of the system elements, especially the feedback occurring between adaptation and production. Integrated Assessment (IA) as an emerging area of study aims to address such complexity. The figure above illustrates a preliminary concept of integrated cost assessment that this Activity aims to fulfill. The key to the success of this framework is the partnerships with AAFC (Agricultural and Environmental Analysis Directorate, Science Branch), and with the Prairie climate change impacts research community, in particular, CCAF/PARC co-funded projects that are underway to assess water demand and supply balances under climate change for the South Saskatchewan River Basin (SSRB). The focus of this Activity will be on modelling and simulation of human adoption of the measures taking several socio-economic and policy effects into account, and on bringing the pieces together. The Activity 4 of this project focuses on adaptation options and unit costing, see separate poster for detail. AAFC plans to conduct simulations of crop response to climate change (subject to CCAF funding); the simulations of the response of grasslands and marginal lands are planned to be performed by collaborative efforts between CCP Projects J28 and J29 using the ESS ecosystem model EALCO.

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## Progress To Date:

- **Consultation meetings with stakeholders and partners:**
    - With AAFC: joint two CCAF proposals; preliminary workplan
    - Collaborative workplan with CCAF SSRB projects (University of Saskatchewan, EC, CCP)
  - **IAM framework:**
    - Concept designed
    - Model components identified (water, crop, grassland, marginal land, economic, agri. policy)
    - Preliminary use cases created; software for model integration and agent modelling identified
    - Most required physical & socio-economic datasets acquired and integrated for the study area
    - Population distribution model developed (see separate poster)
  - **Project J29 A5 focus of effort (see also A4 poster for adaptation options and costing)**
    - Agent-based modelling; agent model & architecture; programming software identified
- Expectations for 2004/05**
- Links to AAFC policy model (CRAM) defined
  - Grassland/marginal land response scenarios simulated for sampled soil polygons
  - Focus groups and farmer survey (if needed) on adaptation and costs conducted
  - Adaptation measures identified and costed
  - Prototype agent-based model developed
  - Demographic scenarios generated
  - An extended, integrated spatial database developed
  - Reports and early publications on above outputs.