

Prairie Droughts: Assessment of Adaptation Costs

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Climate change is having an increasing socio-economic impact on agricultural producers in the Canadian Prairies. In 2002, crop insurance payments and withdrawals from the Net Income Stabilization Account were at record highs. (StatsCan 2003). Investment in adaptation strategies reduces the net impact of climate change and the overall social & economic costs. However, estimating the investments in adaptation strategies and assessing the effectiveness of the strategy (costs and benefits relative to a norm) poses many challenges. Agricultural systems are complex and integrated.

Climate impacts vary in time, space and intensity. Adaptation strategies make use of the variability from year to year and from place to place. To assess costs of the strategies, the variability must be taken into consideration. This study is analyzing data from previous farmer surveys relevant for the study area, including the agricultural census, and will collaborate with researchers in the South Saskatchewan River Basin studies to collect additional data.

Aims and objectives of the survey:

- to assess the adaptation options and costs of recent droughts to prairie stakeholders, including farmers, (governments, and insurance industry).
- to develop an agent-based model (ABM) to simulate the responses of farmers and rural communities to climate change and variability, thereby to enable the IAM to estimate the "transitional" costs of climate change to Prairie economy and rural communities

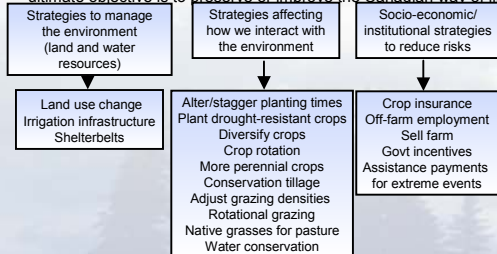
What is the adaptation cost?



Adaptation Strategies

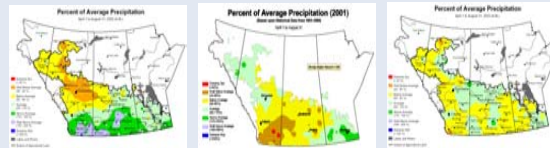
Adaptation Aim: Preservation of natural and man-made capital (UNEP 1998)

- ultimate objective is to preserve or improve the Canadian way of life



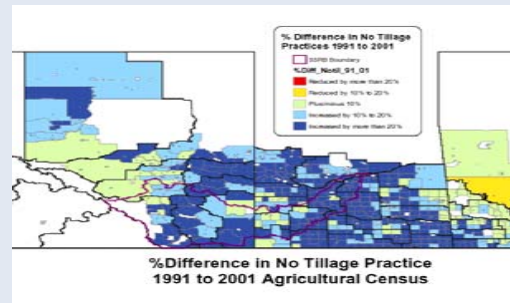
Spatial Variability of Drought 2001, 2002, 2003

Successive years of drought increase the severity of impacts

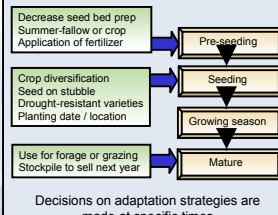


Maps prepared by Prairie Farm Rehabilitation Administration using the National Climate Data Archive

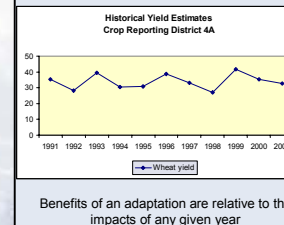
What is the probability of implementation of an adaptation strategy?



Implementation of short-term adaptations in annual farm decision-making



How effective is an adaptation from year to year?



Reducing Canada's vulnerability to climate change

Development of methodology framework for costing adaptations

- Only drought responses are being considered. Responses to shorter term extreme climate events such as hail, dust storms, high temperatures are not modelled.
- Location (cell) is identifiable to the level of a census sub-division or soil polygon.
- An agent represents a producer group, that can be characterized by similar beliefs, desires and intentions e.g., rancher, dryland farmer. These characteristics can be viewed as the «person» of an individual agent. The probability distribution of agents choosing each adaptation strategy varies, and will be based on an analysis of historical statistical data and producer surveys.
- Bottom-up approach: Initially the decision to implement an adaptation strategy will be made by the producer, based on his own investment goals. External influences may be added to the model later.

Adaptation decision-making should:

- Be based on knowledge about the land and water resources (e.g. soil, water supply).
- Be based on an understanding of the effectiveness of the adaptation strategies (costs & benefits).
- Consider the time in the season when a drought is forecast (reactive or planned adaptations), the temporal aspects of the adaptation strategy (short-term, long-term, not time dependent).
- Incorporate feedback mechanisms that allow learning through experience.
- Allow gathering of new information.

Assessment of costs/benefits of each adaptation strategy should consider:

- Initial cost of implementing the adaptation strategy.
- Effectiveness of the strategy (costs/benefits relative to a «norm»).
- Risks and uncertainties. Some strategies are «no regrets», while others have a high risk.

Scenarios developed through recursive application of decision rules for each cell

Dynamic variables are inputs from the following models:

- market information --> forecast of prices and market conditions.
- climate and hydrological information --> crop growth and livestock models --> forecast of production.
- socio-economic information --> forecast of demographics, status of farm operations (YTD).

Partners: Agricultural and Environmental Policy Analysis/ AAFC
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