

RESEARCH CONNECTION

Economic estimation of costs and benefits for farm-level management of extreme moisture

By William Ashton, Ph.D., Alex Koiter, Ph.D., Michael Asante, & Haider Abbas



Flooded farmland in the Assiniboine River Valley east of Brandon, Manitoba, following heavy rainfall.

Why this research is important

Manitoba has a long history of flooding. Four of the top ten Assiniboine River floods and five of the top ten Red River floods took place during the last 25 years. Manitoba's recent flood of 2011 was of a scope and severity never before experienced in the province—topping the 1:300 year flood levels. Three million acres of cultivated farmland went unseeded in 2011. Thousands of cattle had to be relocated, and many head perished. More than 650 provincial and municipal roads and nearly 600 bridges were damaged, disrupting transportation networks throughout the province. These issues necessitate the management of excess moisture at the farm level to reduce negative downstream effects.

What you need to know

This project aims to improve excess moisture (i.e., flooding) management by assisting producers in understanding on-farm investments to manage excess moisture and catalogue downstream impacts of such events. Within an agricultural setting, excess moisture is sufficient to cause adverse effects on farm operations, including excessive soil erosion, limited equipment movement or reduced trafficability, loss of seed, reduced crop yield/quality, and subsequently loss of farm income. This project is one part of a larger multidisciplinary (e.g., climate, agronomy, plant and soil science), multi-year initiative involving experts from across Manitoba.

How this research was conducted

1. Selection of investment strategies to manage on-farm excess moisture

Four investment options (water reservoirs, tile drainage, landscaping, and cover cropping) were examined to assess farm- and regional-level impacts of farmers' technical choices during periods of excess moisture using a cost-benefit framework. We addressed how the different farm investment options

could mitigate the negative impacts of excess moisture and provide other types of co-benefits on the farm.

2. Adaptation of a farm model to assess the impact of excess moisture on crop yield

A farm model is a representation of the key components of on-farm activities and environmental factors, including climate, crop types, soils, and management practices. The farm model AquaCrop was selected due to its user-friendly interface. The model was calibrated based on climatic factors, crop variables, soil hydraulic properties, and field management practices typically found in Manitoba.

3. Identification of downstream costs and benefits of excess moisture event

Financial costs and benefits of excess moisture at the downstream level were gathered and organized. The unit of analysis is geographically the Assiniboine River basin, and temporally, the 2011 flood. Upwards of 13 variables describe various impacts of this flood, including degradation of land and infrastructure.

What the researchers found

The farm-level management strategies investigated can significantly reduce damages and human suffering in the rural setting. These strategies in league with other actions can reduce the public costs of flood damage. Farm model-based yield forecasts properly evaluate the impact of excess moisture on agriculture and allow better decision-making at the farm, regional, and national levels. We conclude that there is a good prospect for providing useful food security early warning information, incorporating climate-based yield forecasts earlier in the growing season.

There is a need to understand the outcomes of negotiations between upstream and downstream under specific regulatory regimes. A better farm intervention adapted to manage excess moisture at the upstream level could overcome the reactive, disaster-driven character of flood at

the downstream level and contribute towards developing flood risk management that works on a pre-emptive basis.

How this research can be used

This study finds practical solutions to deal with chronic excess moisture to reduce the devastating effects on farm families and the rural economy. Extreme moisture management tools examined support on-farm competitiveness and profitability. They may offer lessons that can be applied in other parts of the province dealing with similar challenges. It may also help reduce the demand on business risk management programs by dealing with the root causes of the issue.

About the researchers

Dr. William Ashton, RDI Director, Principal Investigator
AshtonW@brandonu.ca

Dr. Alex Koiter, Department of Geography and Environment, Principal Investigator
KoiterA@brandonu.ca

Michael Asante, Project Researcher

Haider Abbas, Project Researcher

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Editor: Christiane Ramsey RamseyC@brandonu.ca

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