Extreme Weather Effects on Agriculture

The effect of Changing Weather Patterns on farming operations

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Study Objectives

• Investigate the effects of changes to weather patterns as a result of changing climates on production agriculture in eastern Ontario.
  – Focus on seeding operations for cash crop farms.
  – Corn/soy/cereal based rotations.
Agricultural Systems in Eastern Ontario

• Agricultural operations are primarily dairy, field or cash crop, beef with some pig and poultry production.

• The principle crops are corn, soy, cereals and perennial hay.
Envision Eastern Ontario Model

• 2844 farms of 22 farm types
  – Based on census of agriculture statistics
  – Spatially distributed on the landscape
    • Average farm size, not their real locations
• Weather and farming operations follow a daily time step.
  – Tmin, Tmax, Ppt
• Crops development - heat unit based growth curves.
Weather data

• Map of weather stations and ecoregions.
CCSD - Farm Types

Ag Census SLC Regions

IDU - Integrated Decision Unit

Consolidated Census Subdivision

Derived from Soil Landscapes of Canada

CCSD 12 Beef Herds
Individual Farm
Eastern Ontario seeding patterns

• Target Planting dates for crops
  – Cereal – April 15
  – Corn – May 1
  – Soy – May 20

• Planting is delayed by weather events (wet weather, late green up)

• Start date for the next crop is the last date for seeding of the previous crop.

• Farmers can seed 100 acres per day.
Critical Periods during seeding season

• Green-up, start of operations

• Seeding delays
  – Lost days of operations
    • During seeding, Change in intended crop as a result of delays

• Reseeding
  – Late frost, flood, etc.
Results

• Graphs showing Cool Spring
• Seeding delays
• Late killing frost (reseeding)
Discussion

- Agriculture is somewhat unique among industries
  - Resilience comes from numbers of small enterprises.
    - Thousands of farmers seeding 100 acres/day, 1 good day = Hundreds of thousands of acres planted.
Discussion

• Economic impact
  – Yield reduction as a result of seeding delay,
  – Loss of marketing opportunity
    • When commodity price is high
  – Cost of reseeding
Conclusion

• Farmers have learned how to farm these lands over generations adjusting old world patterns to new world realities
  – Weather patterns have been a big part of that adjustment.

• The vulnerability may require rethinking of long standing norms or patterns of field operations
Future direction

• Improve the seeding delay algorithm

• Improved crop yield forecasting

• Improving weather data
  – Weather generators, regional climate models, decadal forecasts.