Agriculture and Agri-Food Canada | Agriculture et Agroalimentaire Canada

Canada

Extreme Weather Effects on Agriculture

The effect of Changing Weather Patterns on farming operations

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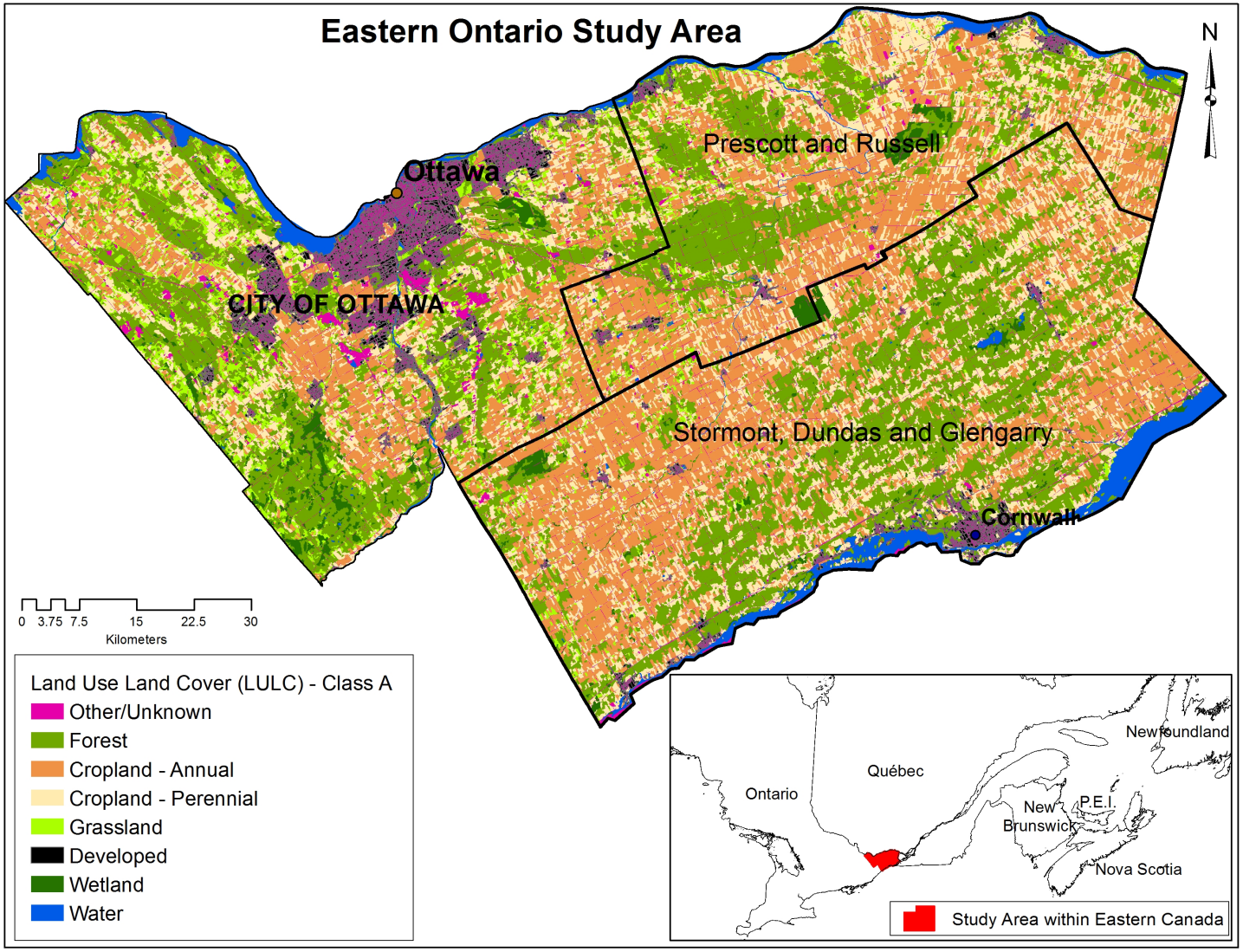
CMOS Congress 2016
Fredericton, New Brunswick
June 1, 2016

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.

Study Area


Eastern Ontario Study Area
N
Ottawa
CITY OF OTTAWA
Prescott and Russell
Stormont, Dundas and Glengarry
Cornwall
0 3.75 7.5 15 22.5 30
Kilometers
Land Use Land Cover (LULC) - Class A
Other/Unknown
Forest
Cropland - Annual
Cropland - Perennial
Grassland
Developed
Wetland
Water
Ontario
Québec
Newfoundland
New Brunswick
P.E.I.
Nova Scotia
Study Area within Eastern Canada

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.

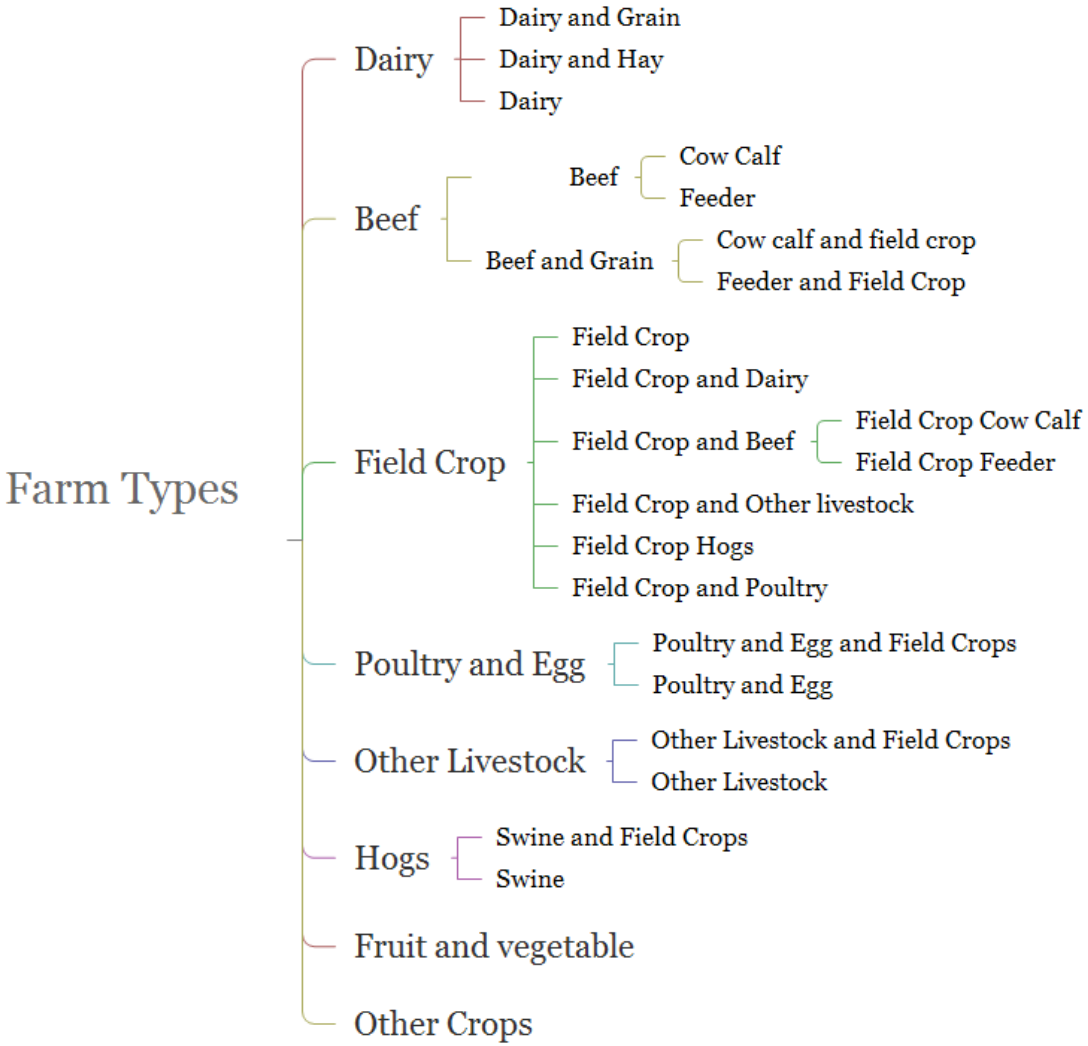
Envision Eastern Ontario Model

- 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.

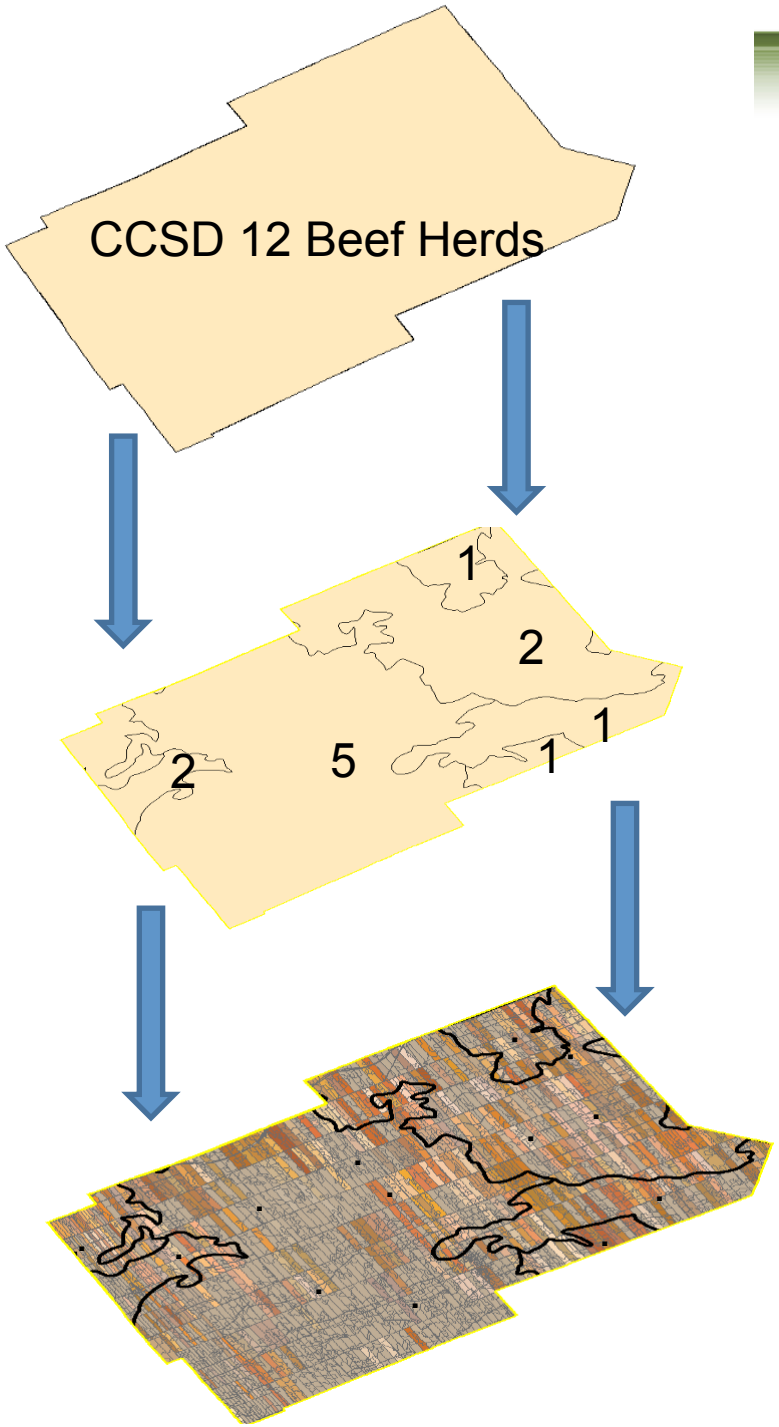
Farm Types


Farm Types
Dairy
Dairy and Grain
Dairy and Hay
Dairy
Beef
Beef
Cow Calf
Feeder
Beef and Grain
Cow calf and field crop
Feeder and Field Crop
Field Crop
Field Crop
Field Crop and Dairy
Field Crop and Beef
Field Crop Cow Calf
Field Crop Feeder
Field Crop and Other livestock
Field Crop Hogs
Field Crop and Poultry
Poultry and Egg
Poultry and Egg and Field Crops
Poultry and Egg
Other Livestock
Other Livestock and Field Crops
Other Livestock
Hogs
Swine and Field Crops
Swine
Fruit and vegetable
Other Crops

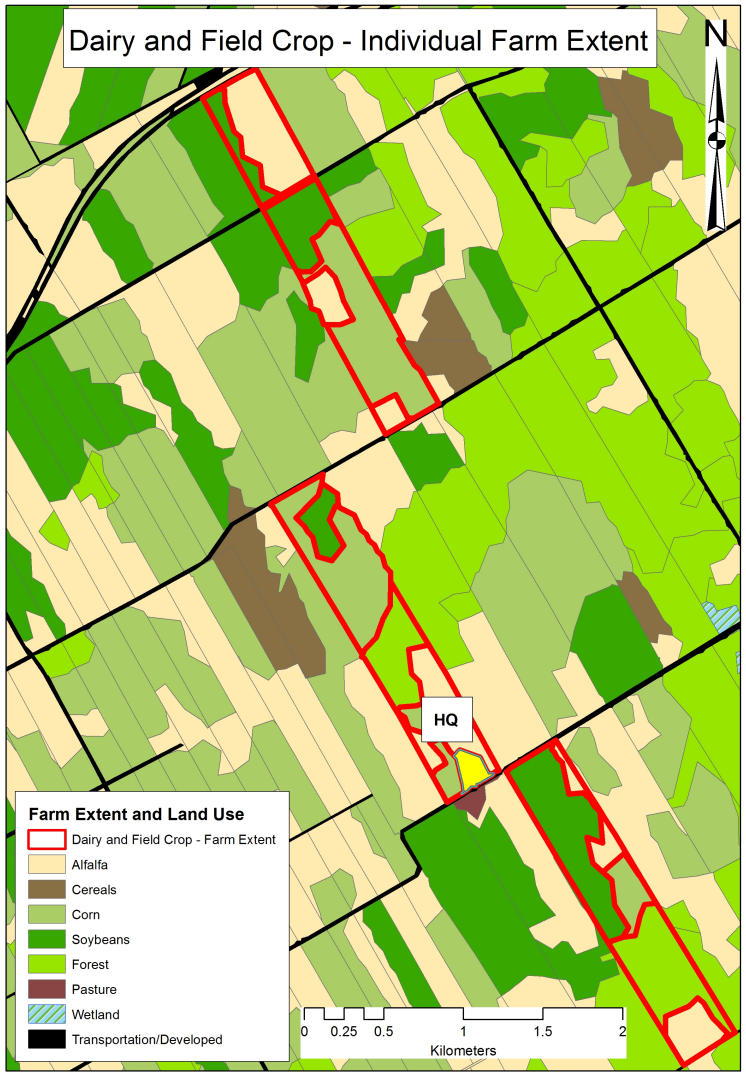
CCSD - Consolidated Census Subdivision
Farm Types

Ag Census SLC Regions
Derived from Soil Landscapes of Canada

IDU -Integrated Decision Unit



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
  - Looking at Versatile Soil Moisture Budget to predict soil trafficability on differing soil types. (Baier, W., Dyer, J.A. and Sharp, W.R., 1979. The Versatile Soil Moisture Budget. Tech. Bull. No. 87, LRRC, Research Branch, Agriculture Canada, Ottawa, ON, 52 pp.)
- Improved crop yield forecasting
- Improving weather data
  - Weather generators, regional climate models, decadal forecasts.