Agriculture and Agri-Food Canada | Agriculture et Agroalimentaire Canada

Canada

Extreme Weather Effects on Agriculture

The Effect of Changing Weather Patterns on Farming Operations

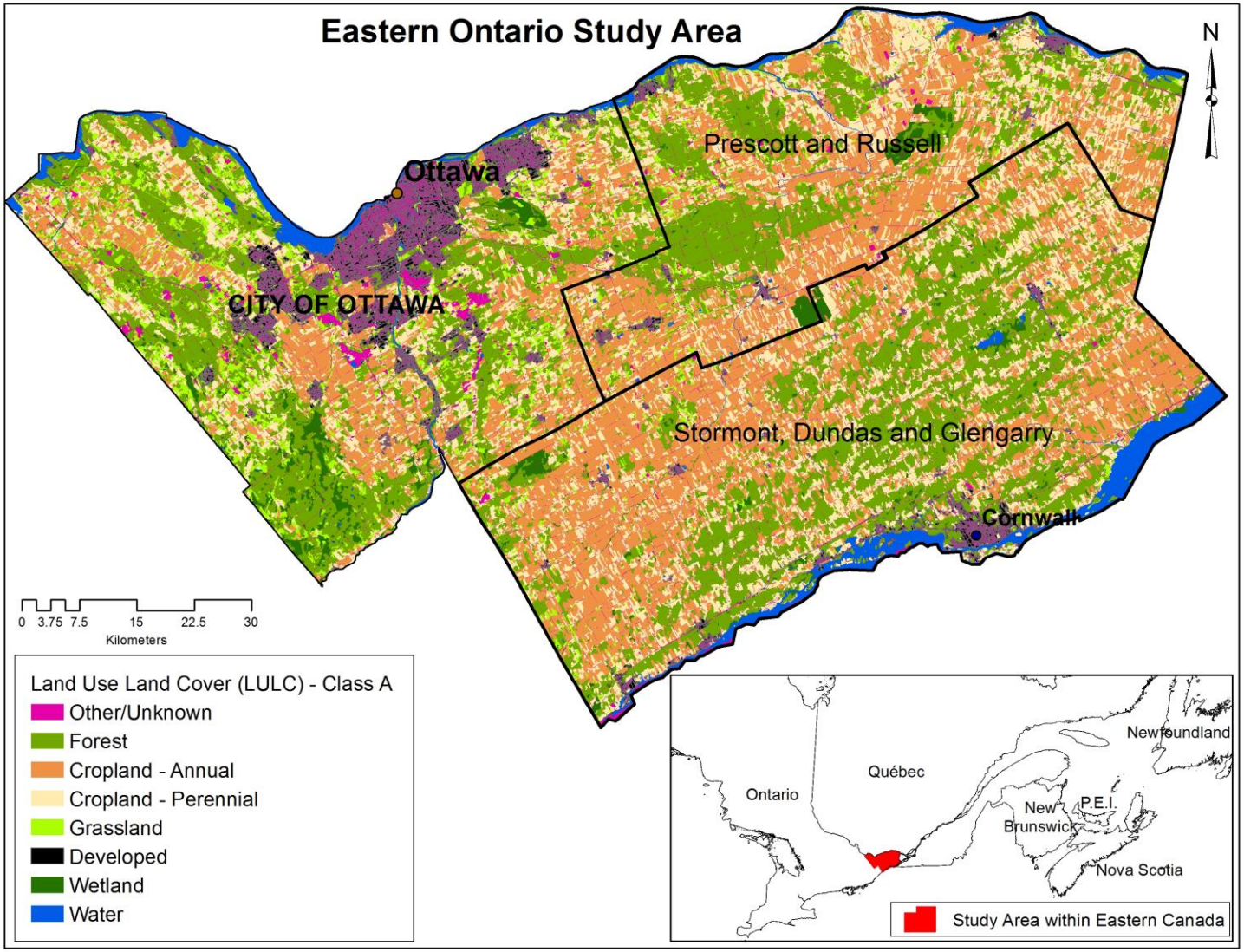
Dan MacDonald, Ruth Waldick, Sampsa Hamalainen – AAFC, Ottawa, Scott Mitchell, Anna Zaytseva – Carleton University
Chesterville, Ontario
February 27, 2017

The Question

- How will day to day farm operations be affected by changing weather patterns?

- Focus on seeding operations for cash crop farms.
- Corn/soy/cereal based rotations.

Study Area

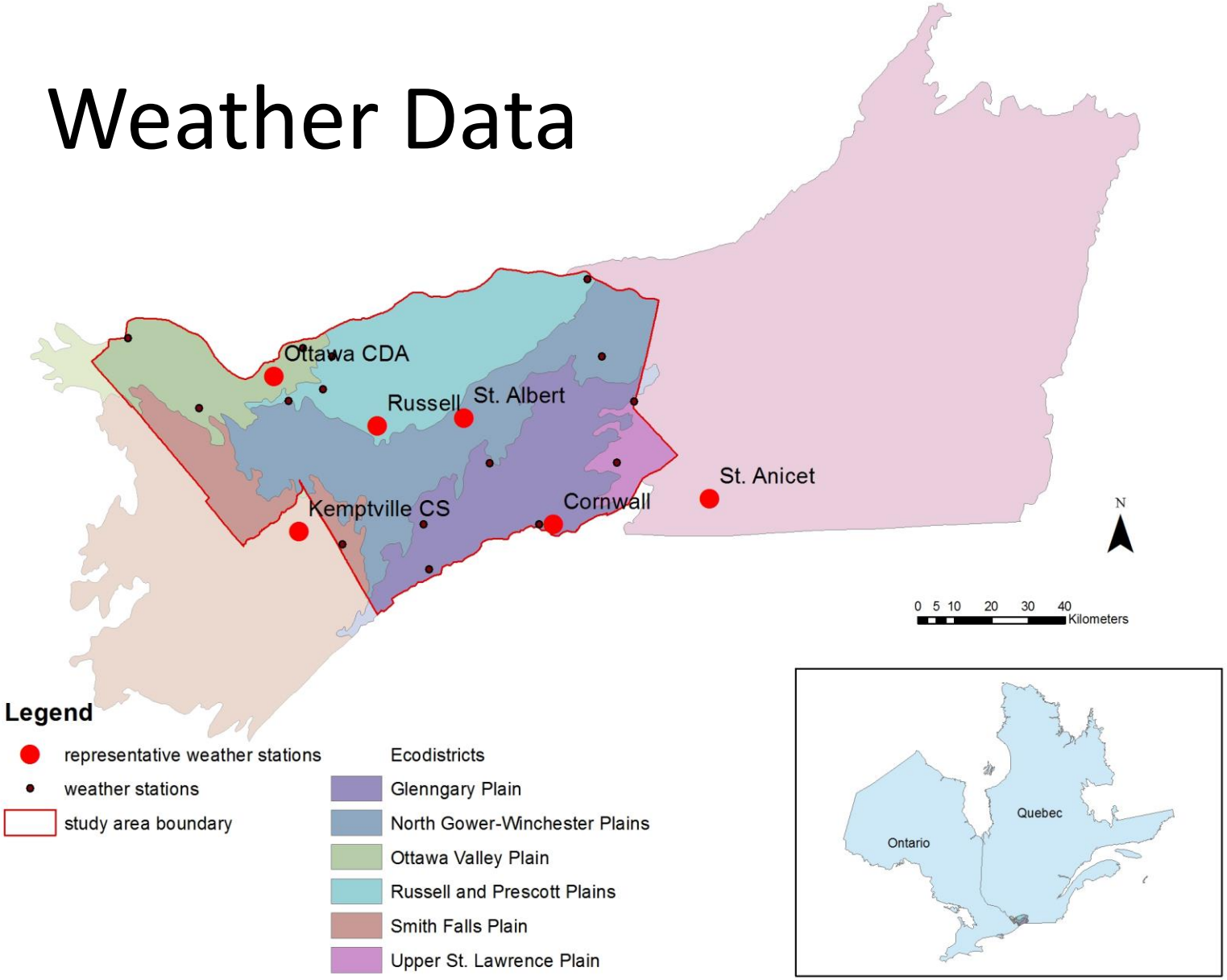

Eastern Ontario Study Area
N
Ottawa
Prescott and Russell
CITY OF OTTAWA
Stormont, Dundas and Glengarry
Cornwall
0 3.75 7.5 15 22.5 30
Kilometers
Land Use Land Cover (LULC) - Class A
Other/Unknown
Forest
Cropland - Annual
Cropland - Perennial
Grassland
Developed
Wetland
Water
Ontario
Québec
Newfoundland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

Simulation model for Eastern Ontario

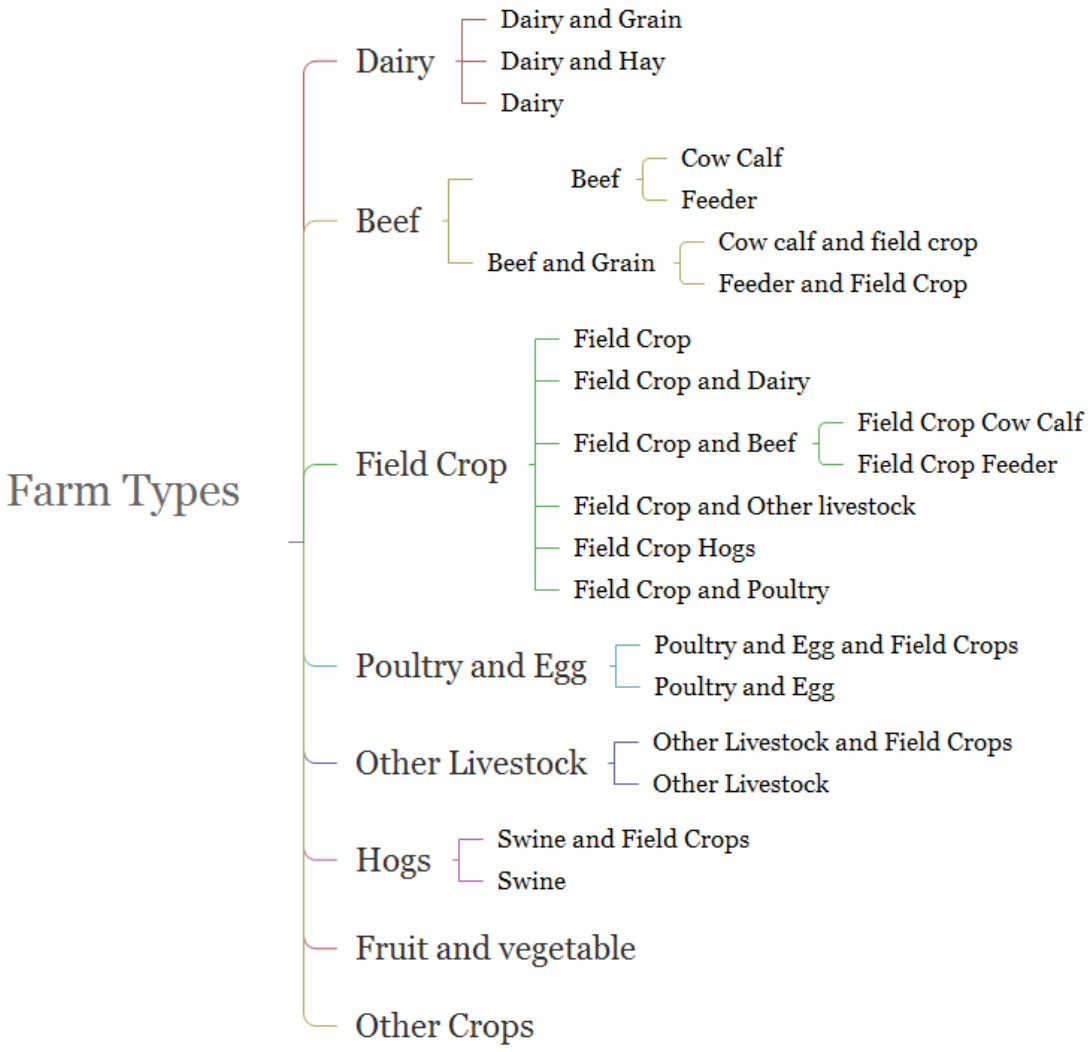
Envision Eastern Ontario Model

- 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.
  - Maximum and minimum temperature and precipitation.
- Crops development - heat unit based growth curves.

Weather Data



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

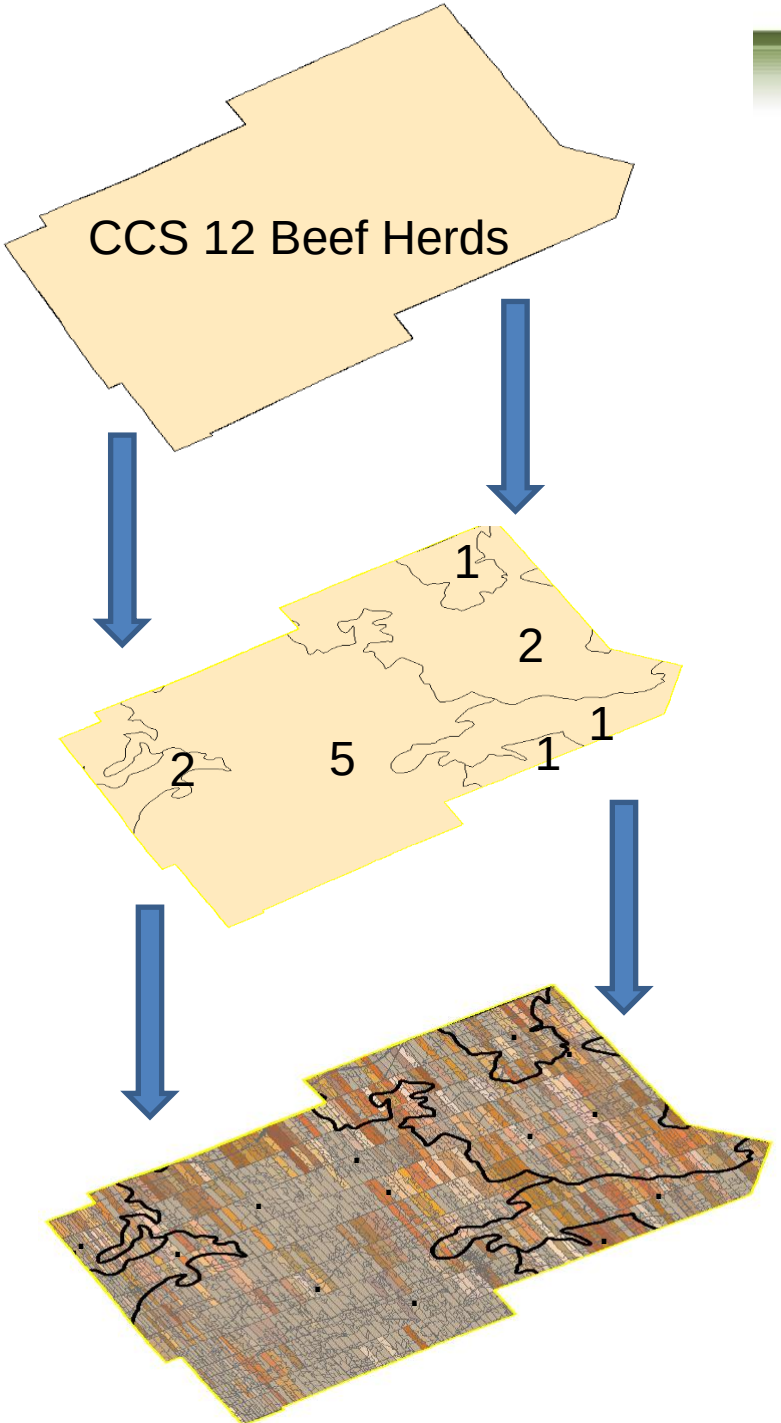
CCS - Farm Types

Consolidated Census Subdivision

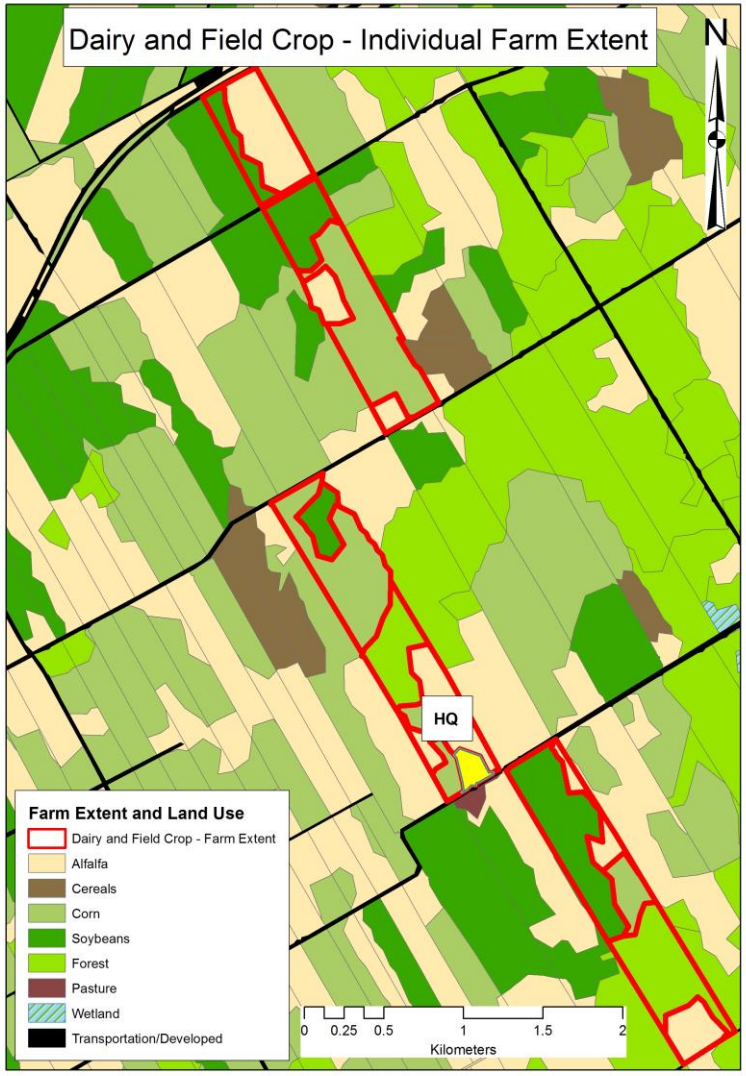
Ag Census SLC Regions

Derived from Soil Landscapes of Canada

IDU - Integrated Decision Unit

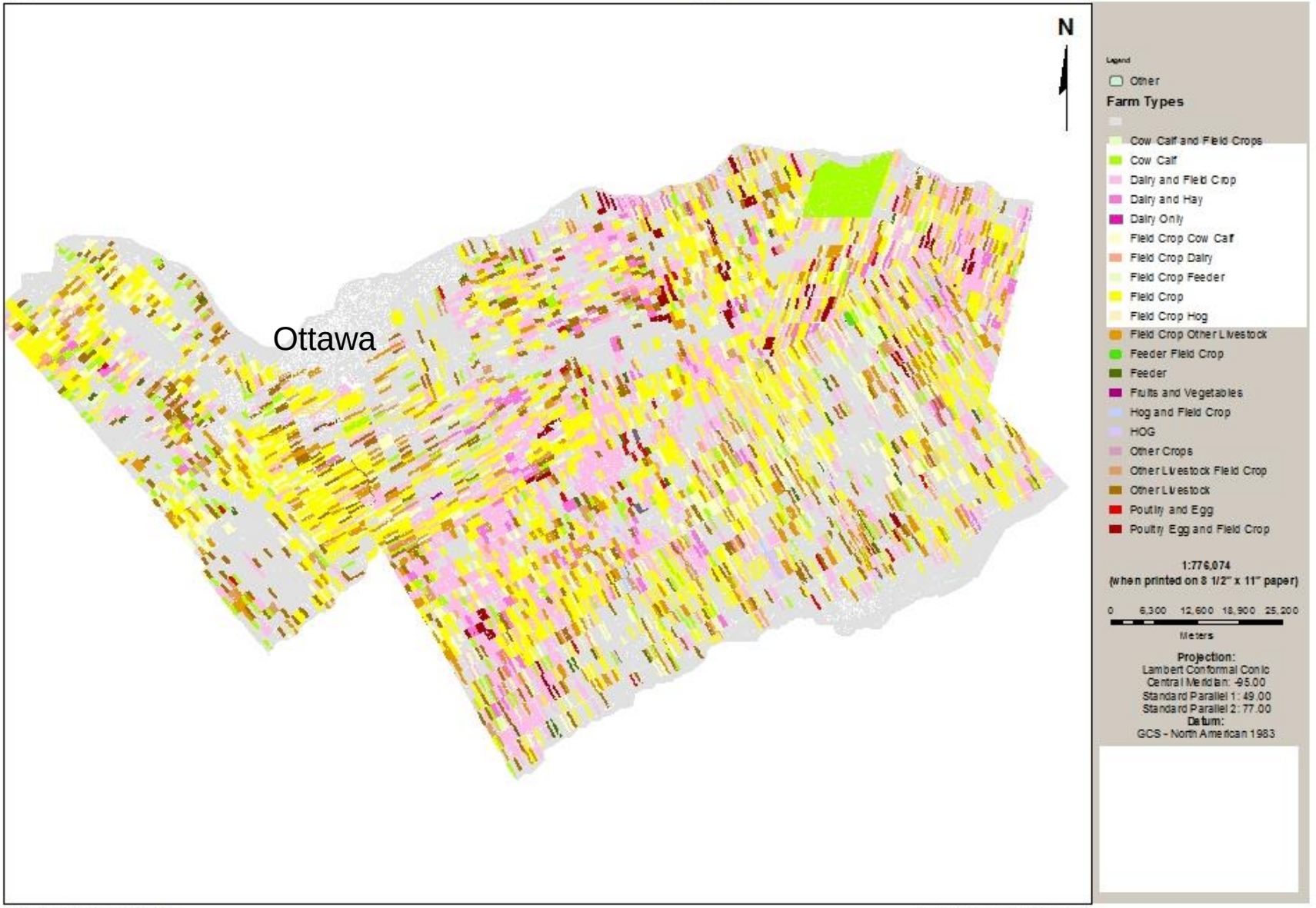


Individual Farm



Eastern Ontario Farm Types

Census of Ag 2011



Produced by Agriculture and Agri-Food Canada
Agri-Environment Services Branch, Agri-Geomatics

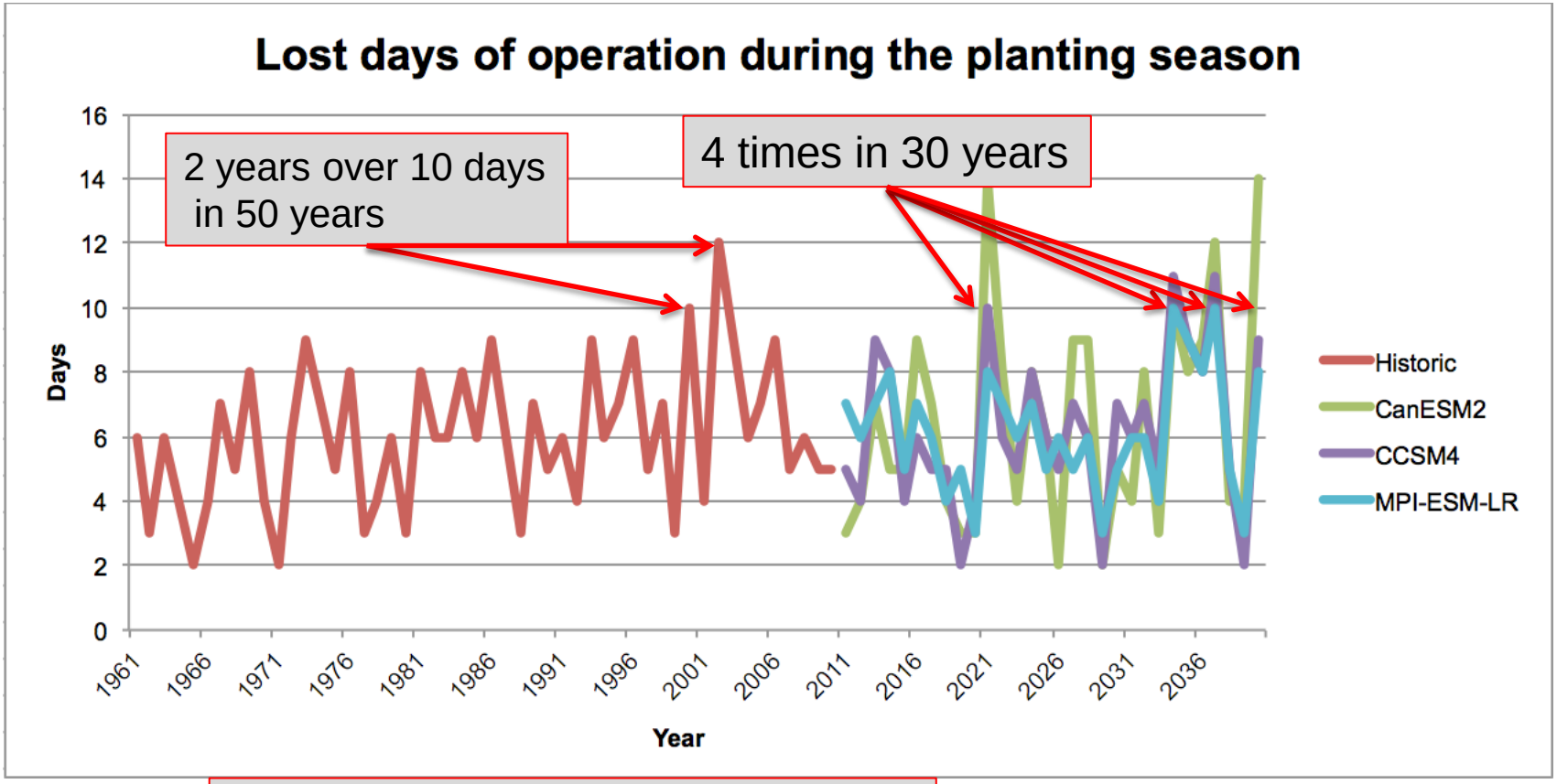
Eastern Ontario seeding patterns

- Target Planting dates for crops
  - Cereal – April 15
  - Corn – May 1
  - Soy – May 10
- 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

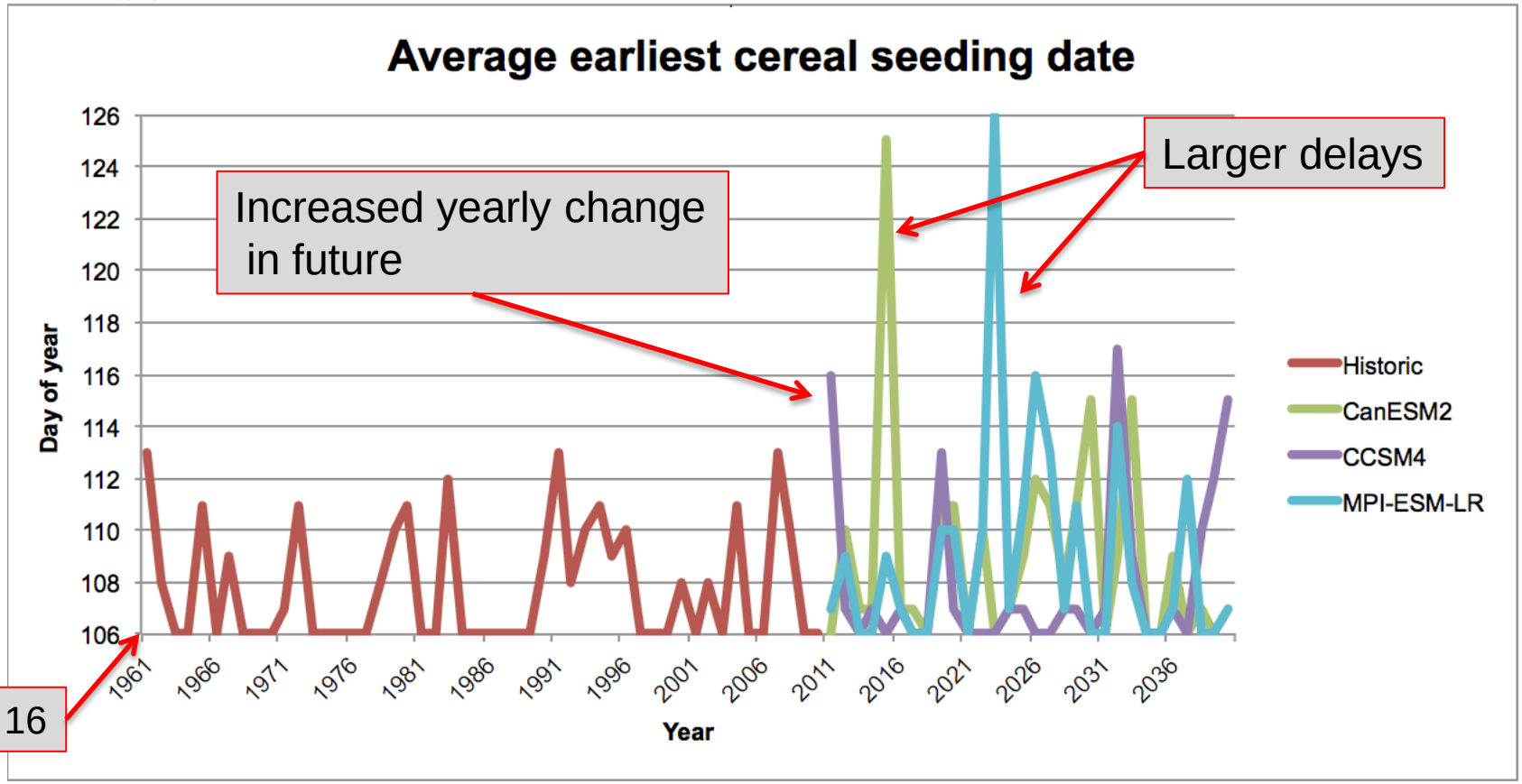
- Green-up, start of operations
- Seeding delays
  - Lost days of operations
    - During seeding, Change in intended crop as a result of delays
- Reseeding
  - Late frost, flood, etc.

Weather Impacts – Lost Days



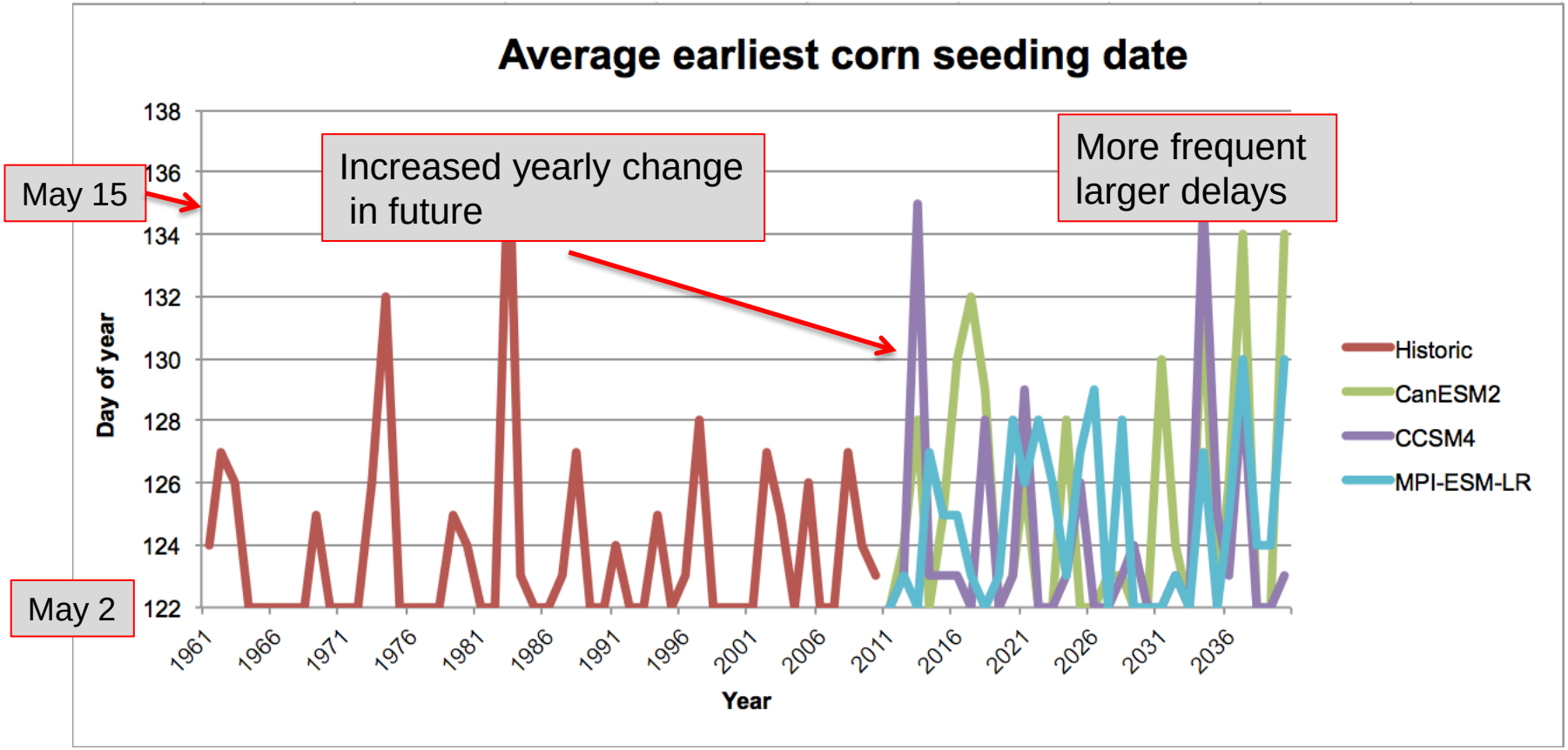
10 mm rain delay rain day + 1 day
25 mm rain delay rain day + 2 days

Weather Impacts – Seeding date



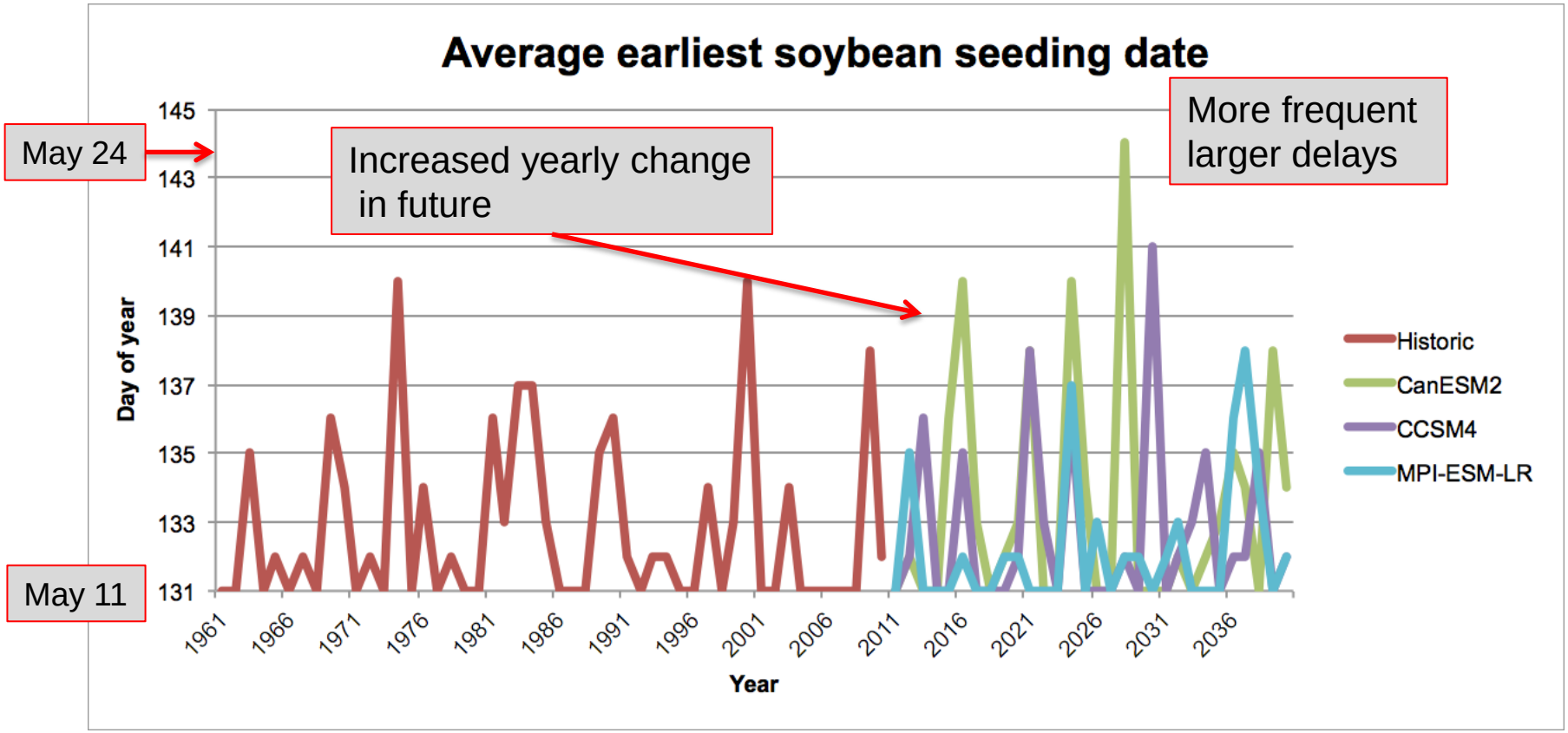
30% increase in 7 day ppt over 30 year average = delay 1 day

Weather Impacts – Seeding Date



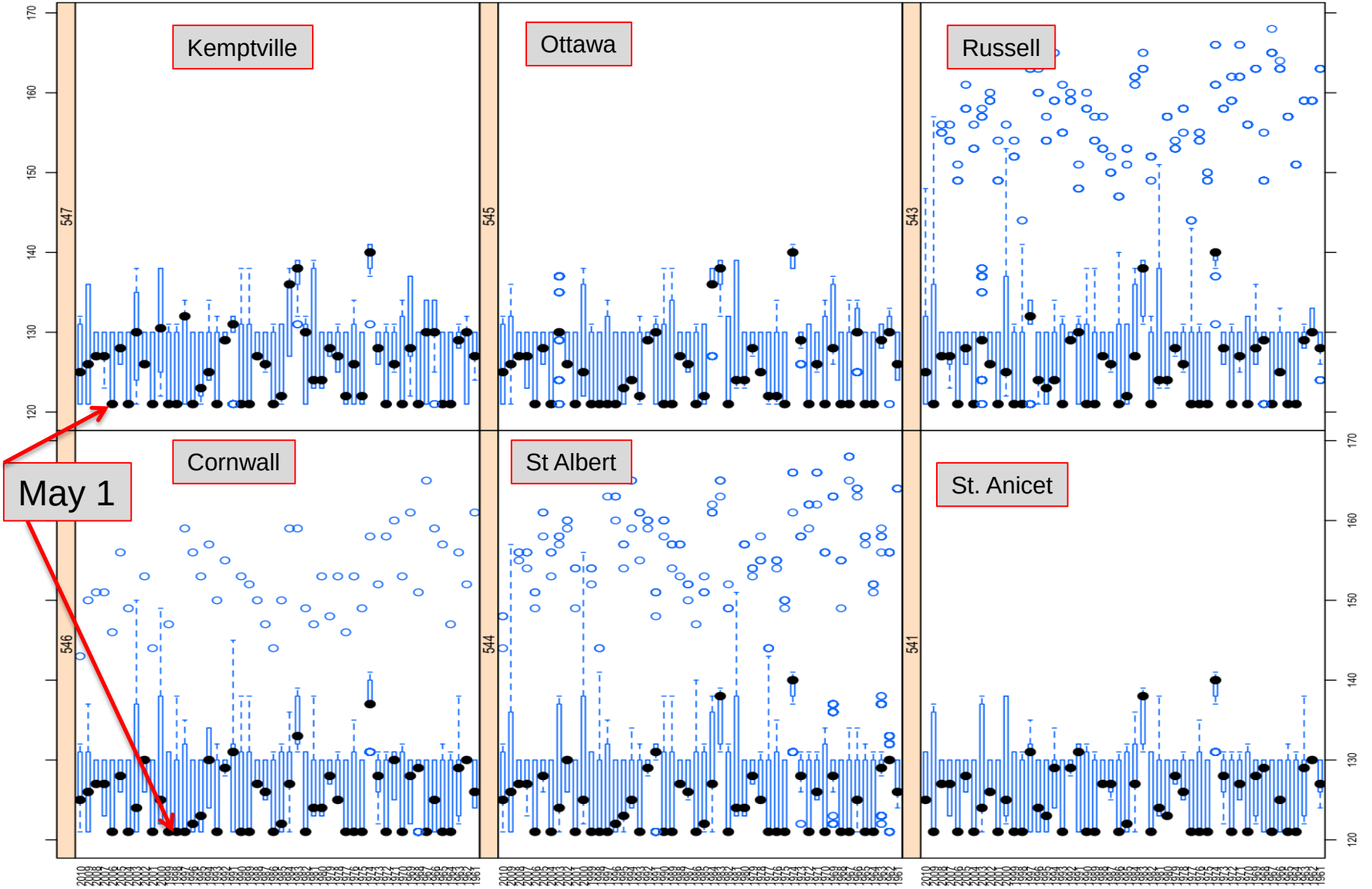
30% increase in 7 day ppt over 30 year average = delay 1 day

Weather Impacts – Seeding Date

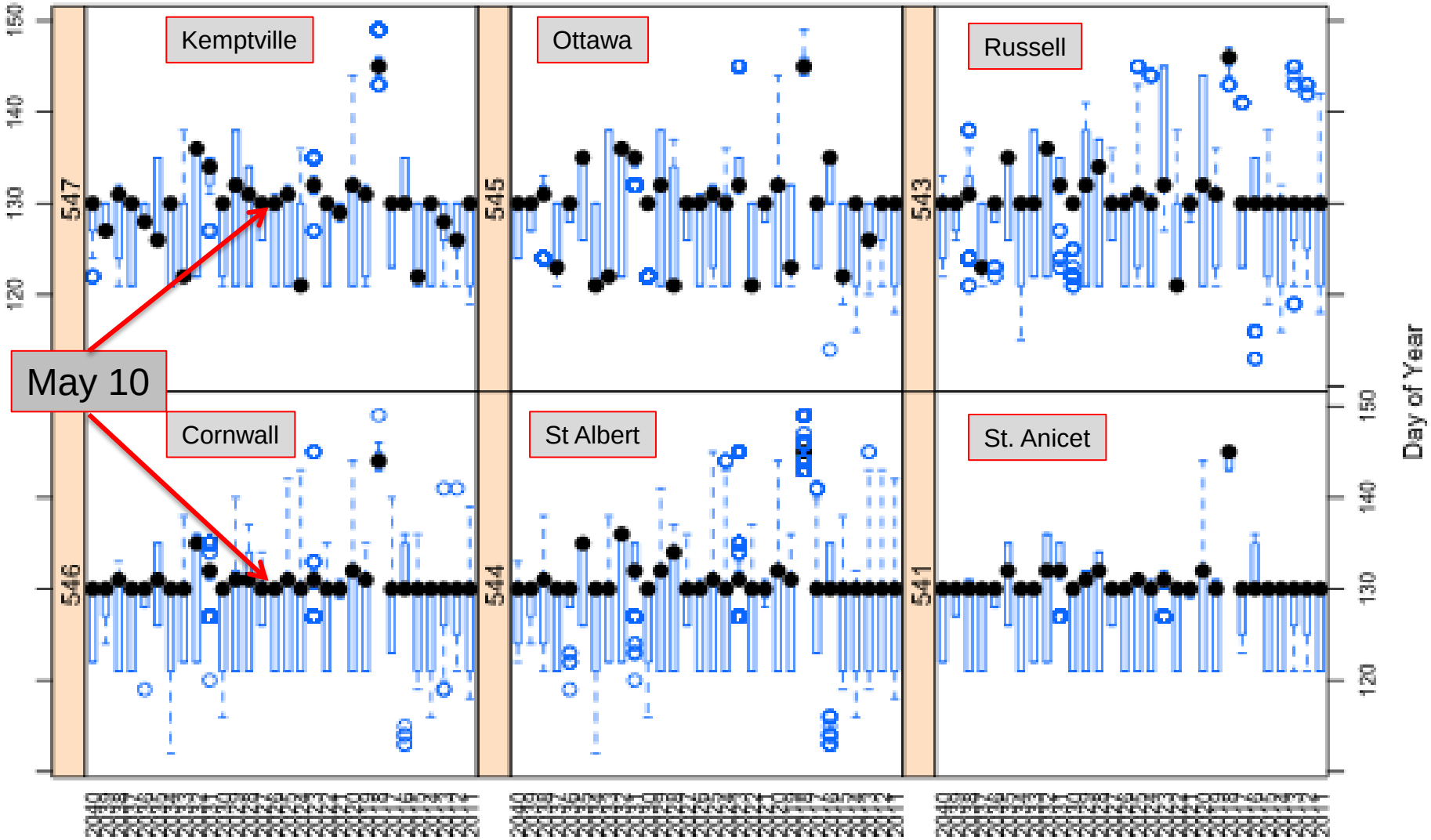


30% increase in 7 day rain over 30 year average = delay 1 day

Average Planting date - historic



Average Planting date - CCSM



Economic impact

- Yield reduction as a result of seeding delay,
  - Corn,
    - 1% yield reduction for every day of delay past May 10.
  - Soy,
    - 8% yield reduction for every day of delay past May 24
    - 15% delay of not planted by June 10

Discussion

- Agriculture is somewhat unique among industries
  - Resilience comes from numbers of small enterprises.
    - 1900 farmers seeding 100 acres/day = 190 000 acres seeded every favorable day.

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 and perhaps opportunity may require rethinking of long standing norms or patterns of field operations

Future direction

- Look at livestock impacts - Grazing, hay production, heat stress…
- Improve how we deal with wet soil.
- Improving weather data.
- Improve how we seed. Include cultivation operations.
- Calculate soil erosion.
- Better yield information.

Questions, comments?

Dan MacDonald

AAFC, Ottawa

Dan.macdonald@agr.gc.ca

Questions

- Have you seen changes in weather patterns?
  - Are they better or worse, or both?
- What do you see as the biggest weather challenges on farm?
  - How have they impacted your operations?
  - What changes have you made to deal with these challenges?
    - example – crop types, change in timing, change in equipment, change in inputs (fertilizer, chemical)
- Does our model look like agriculture in Eastern Ontario?
  - How can we make more realistic? What changes need to be made?