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Northern Ontario Farm Innovation Alliance

Northern Ontario Roadmap for Technology in Horticulture

Dan Bath, PhD
Research Scientist, Horticulture Automation

September 21, 2022

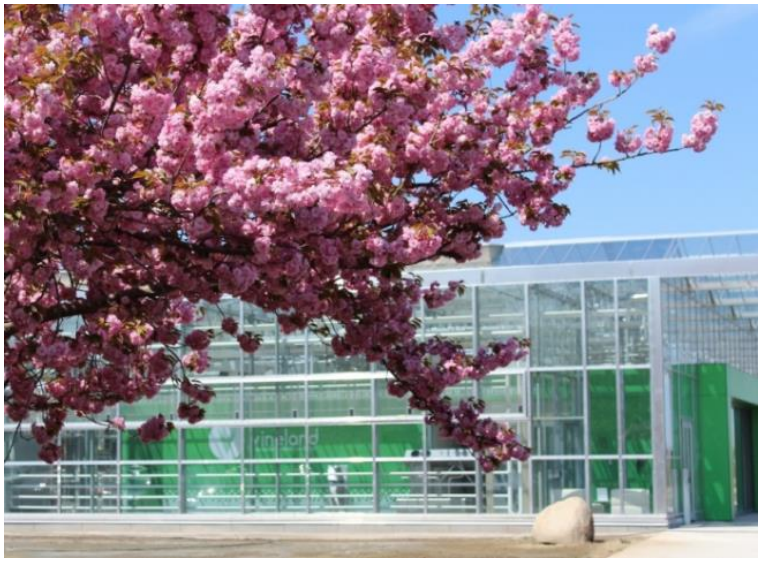
Land Acknowledgement

Aims for today

- Share our research project
- Welcome your feedback
  - How does this research impact Indigenous communities?
  - How could it be better?

What is Vineland?

- Results-oriented organization dedicated to horticulture science and innovation in Canada since 1904
- Deliver products, solutions and services through an integrated and collaborative cross-country network
- Independent, not-for-profit re-launched in 2007



Research Team

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Consumer and Market Researcher
Consumer Insights

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Research Scientist
Plant Production

Sarah Hall
Research Technician
Plant Production

Amy Jenkins
Senior Research Technician
Consumer Insights

Daniel Bath
Research Scientist
Automation

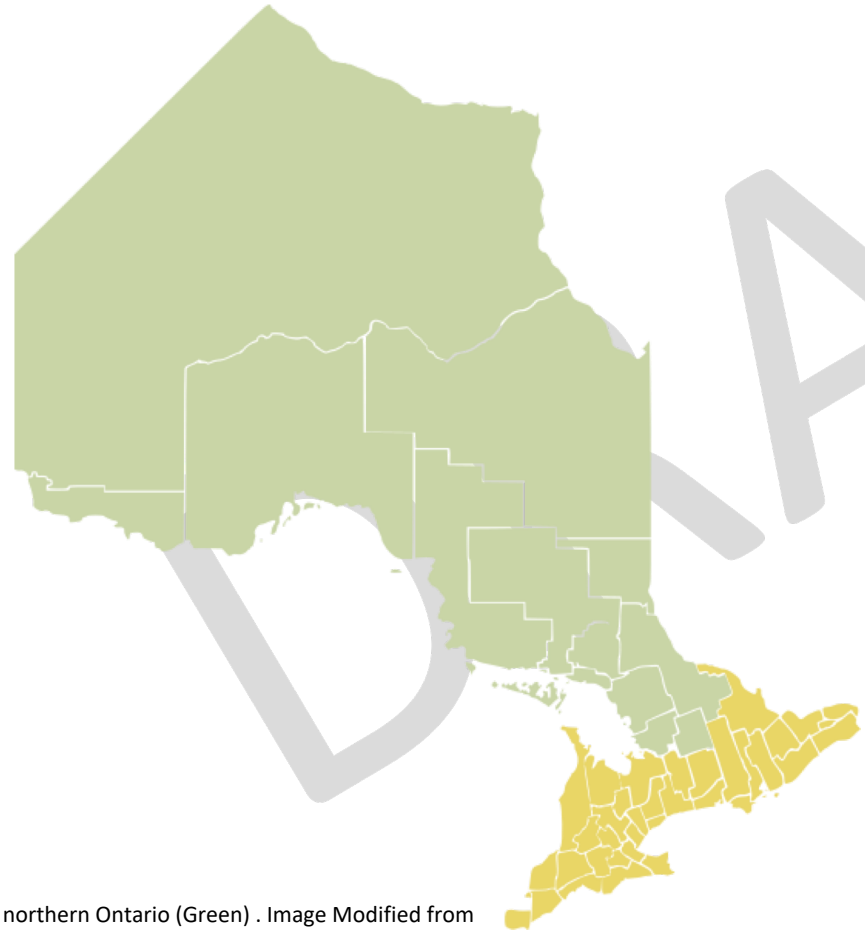
How we build a roadmap

Our process

- One-on-one interviews:
  - In-depth discussions with select growers & industry people
  - Identify key barriers to automation and agriculture
- On-line survey:
  - Quantitative analysis of the industry needs
- Industry research:
  - Based on discovery phase insights, automation experts provide an outlook for the short-, mid- and long-term of the industry
- Knowledge transfer:
  - Online webinar and printed report

Horticulture in Northern Ontario

Topics of interest



- Farming across scales
- Farming in cold climate zones
- Changing climate outlook

The districts of northern Ontario (Green) . Image Modified from https://www.ontario.ca/page/ontario-population-projections

Survey Results

Vineland Research & Innovation Centre

Growers' survey

Barriers & Opportunities to growing produce in N. Ont

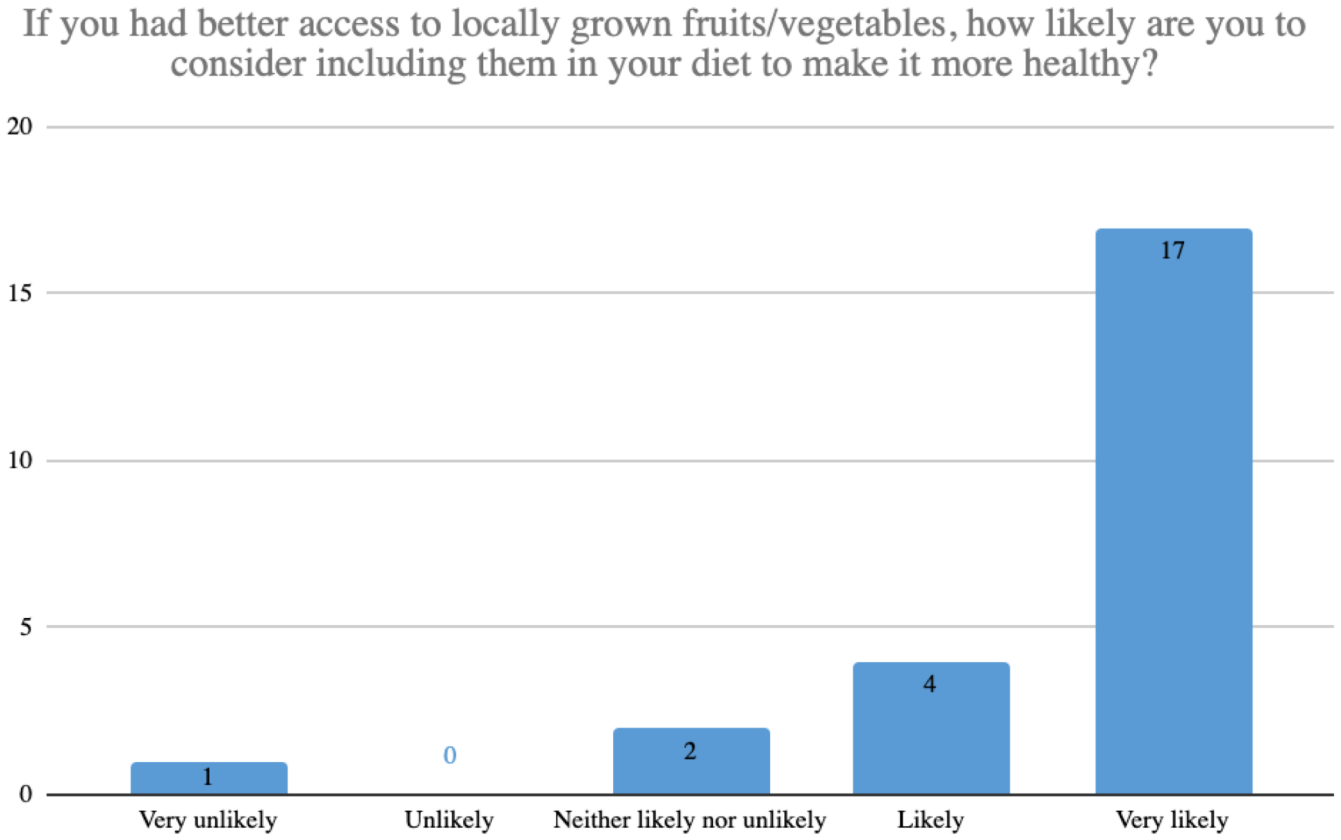
BARRIERS	OPPORTUNITIES
Short growing season, **incompatible weather**	**Increasing awareness** about the benefits of consuming fresh local produce
High **costs of transportation**	**High demand** for locally grown produce with no competition in quality
Price competition from non-local food products	direct-to-consumer **e-commerce models**
High **infrastructure costs**	**Reducing cost** of local food production and transportation
High **costs of production**	Increasing acceptance and adoption of **technological research and innovation** in horticulture
Shortage of skilled labour for production, repairs and maintenance	

Growers' Survey

HIGH PRIORITY training needs for horticulture and/or related businesses in Northern Ontario
Sustainable farming
On-farm training for technology adoption
Information on new innovations and technology developments

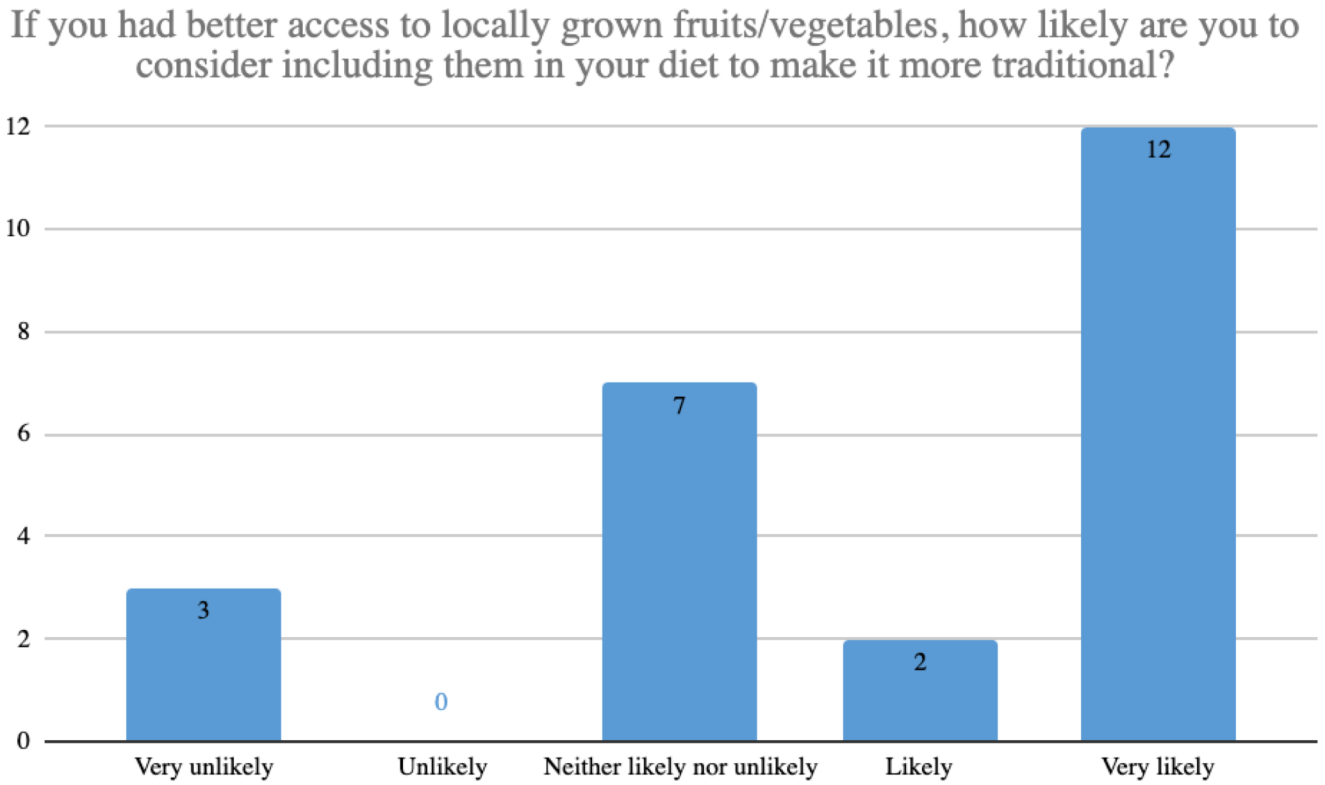
Consumers' survey

Healthy diets



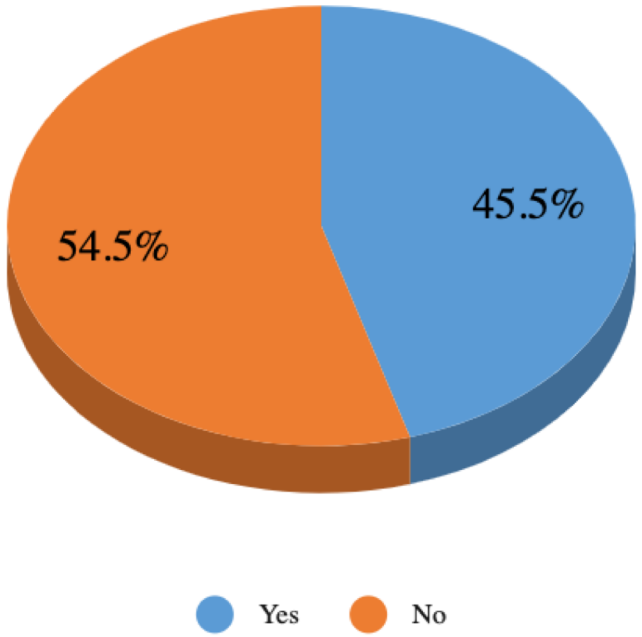
Consumers' survey

Traditional diets



Growers' Survey

Have you considered trading/sharing/offering your locally grown fruits/vegetables to support a traditional Indigenous diet in Northern Ontario?



Research Outcomes

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Automation across scales

Emerging technologies for large-scale operation – strawberry harvesters

- Robotic strawberry pickers have long been a dream.
  Two companies are close to producing commercial solutions.

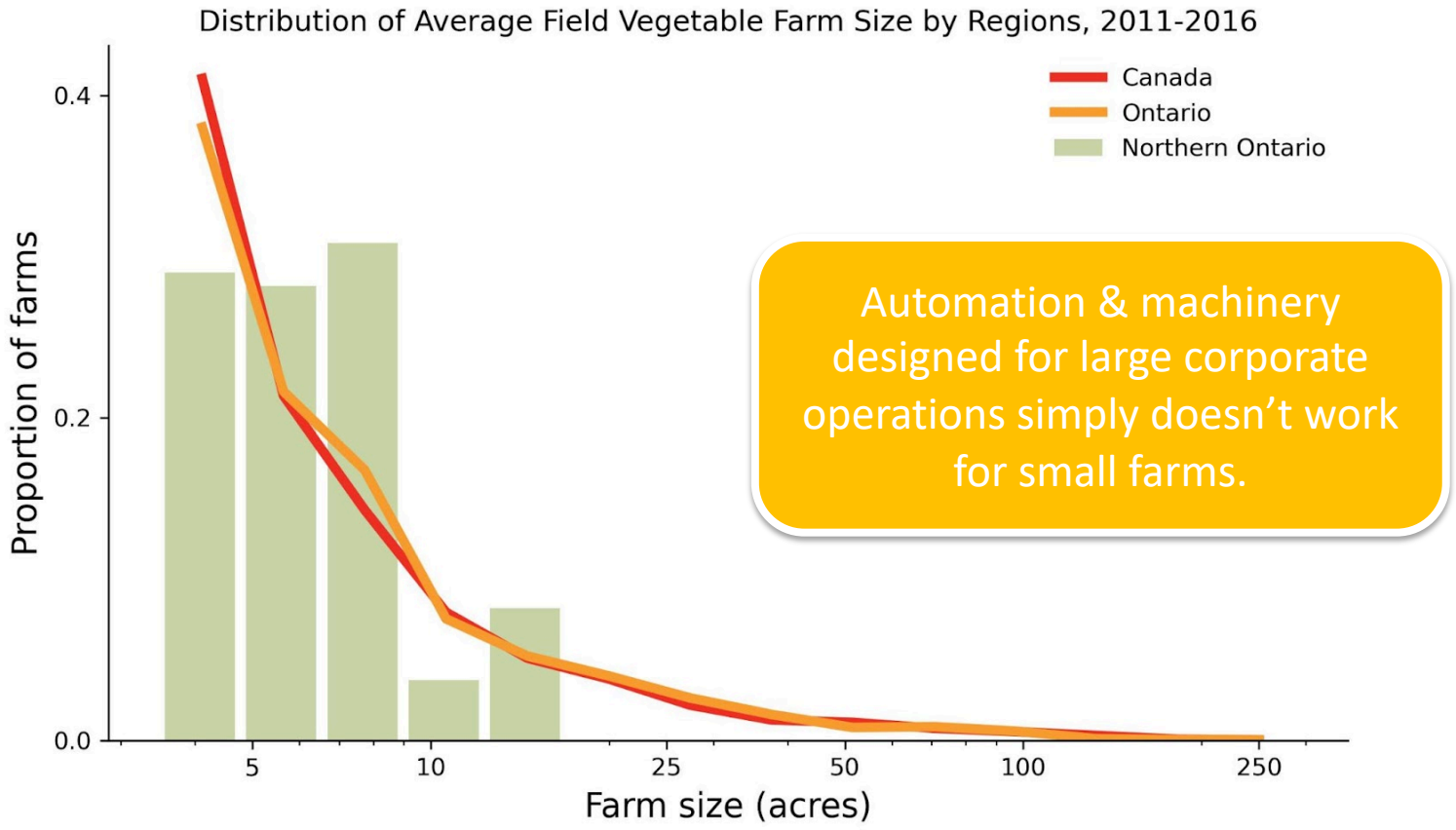
Agrobot E-series

Harvest CROO 6

Image sources:
https://www.agrobot.com/e-series
https://www.ft.com/content/eaaf12e8-907a-11ea-bc44-dbf6756c871a

How do farm operations compare in Northern Ontario with the rest of Ontario & Canada, in terms of size?

Farms are smaller in North Ontario



Automation & machinery designed for large corporate operations simply doesn't work for small farms.

Normalized distribution of field vegetable farms by size in Canada, Ontario, and Northern Ontario. Lines represent kernel density estimation derived from the average farm size (total area and number of farms reporting). Data Source: Statistics Canada. Table 32-10-0418-01 Field vegetables, Census of Agriculture, 2011 and 2016, inactive

Solutions for small farms

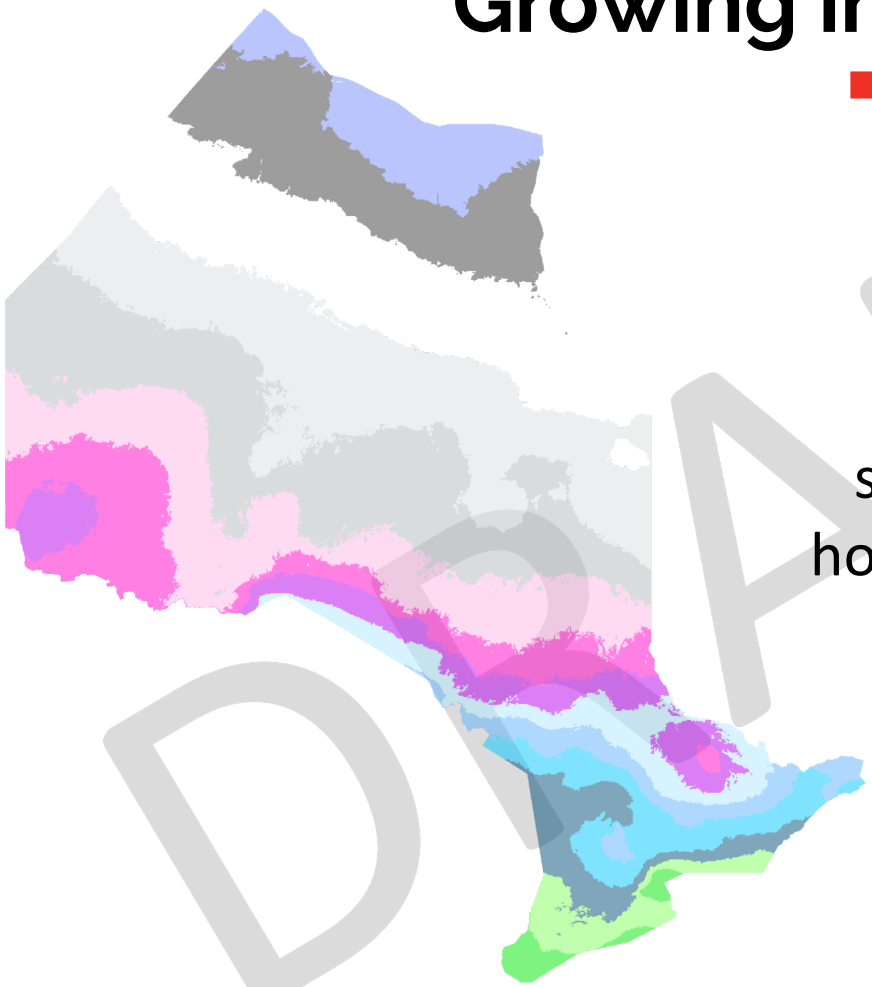
Tools from the organic revolution

Terrateck

Farmers FRIEND

PAPERPOT CO
TOOLS FOR THE MODERN GROWER

Growing in Ontario Climates



What technologies & strategies can improve horticulture production in cold climate zones?

Zone 0b -53.9°C to -51.1°C	Zone 1a -51.1°C to -48.3°C	Zone 1b -48.3°C to -45.6°C	Zone 2a -45.6°C to -42.8°C	Zone 2b -42.8°C to -40°C
Zone 3a -40°C to -37.2°C	Zone 3b -37.2°C to -34.4°C	Zone 4a -34.4°C to -31.7°C	Zone 4b -31.7°C to -28.9°C	Zone 5a -28.9°C to -26.1°C
Zone 5b -26.1°C to -23.3°C	Zone 6a -23.3°C to -20.6°C	Zone 6b -20.6°C to -17.8°C	Zone 7a -17.8°C to -15°C	

Strategies for cold climate horticulture

Plant variety preservation & distribution

Indigenous Seed Keepers Network

www.nativefoodalliance.org

Seed Savers EXCHANGE

https://www.seedsavers.org/

Preserving, rematriating, and adapting heritage or ancestral varieties to suit growing conditions can have profound impacts on food production

Strategies for cold climate horticulture

Plant variety development

- Crop breeding programs for new varieties that are adapted to cold and short growing season
- Advanced genetic screening techniques
- Development can be faster than traditional methods, although with less holistic focus

Strategies for cold climate horticulture

Modified environments

Strategic landscape
- Microclimate
- Windbreaks

Modified
- Row cover
- Hoop house

Controlled
- Greenhouse
- Indoor Agriculture

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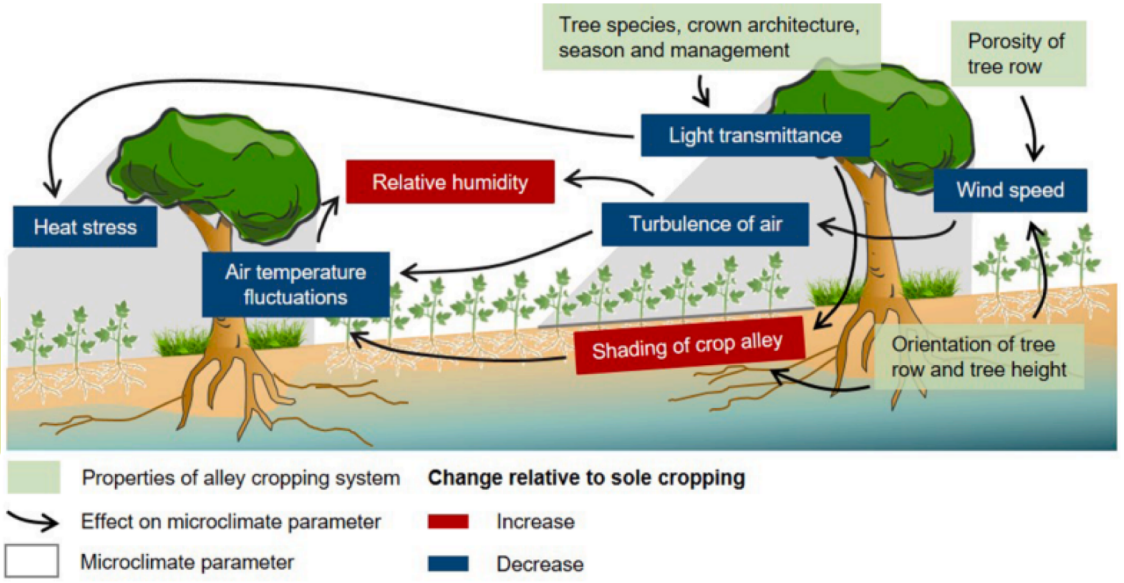

Jacobs, S. R., Webber, H., Niether, W., Grahmann, K., Lüttschwager, D., Schwartz, C., ... & Bellingrath-Kimura, S. D. (2022). Modification of the microclimate and water balance through the integration of trees into temperate cropping systems. *Agricultural and Forest Meteorology*, *323*, 109065.

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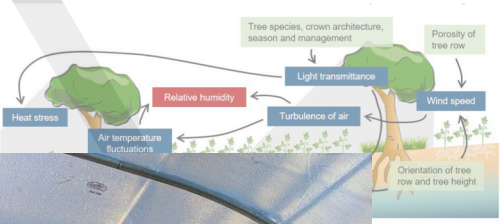

https://www.smallfarmcanada.ca/

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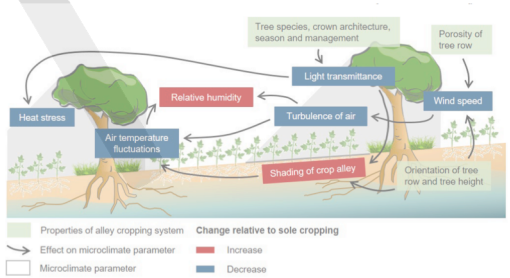

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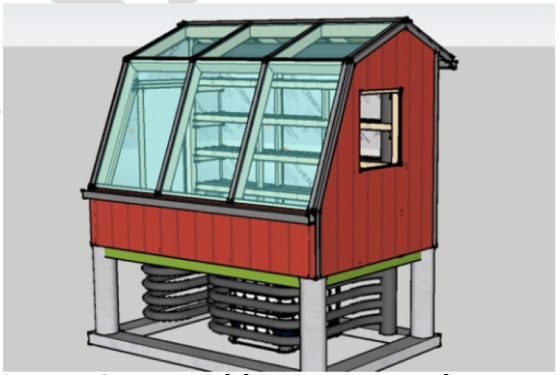
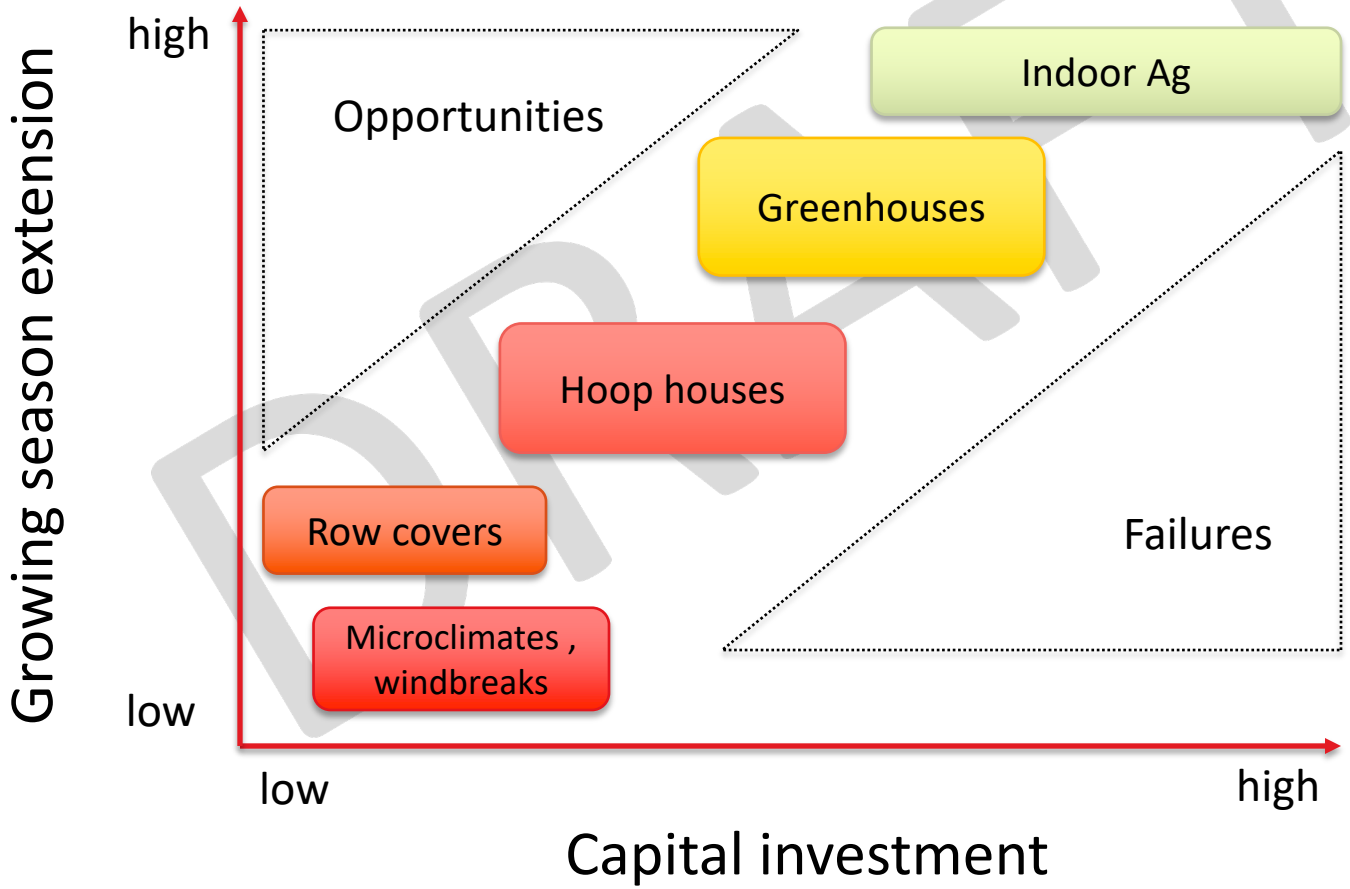


https://nopri.org/projects/all-season-greenhouses/

Season extension technologies

Impact vs Investment



Examples of Indoor Agriculture

AgricUltra Advancements Inc

Growcer

Food Security Structures
Canada

Growcer

Ottawa, ON

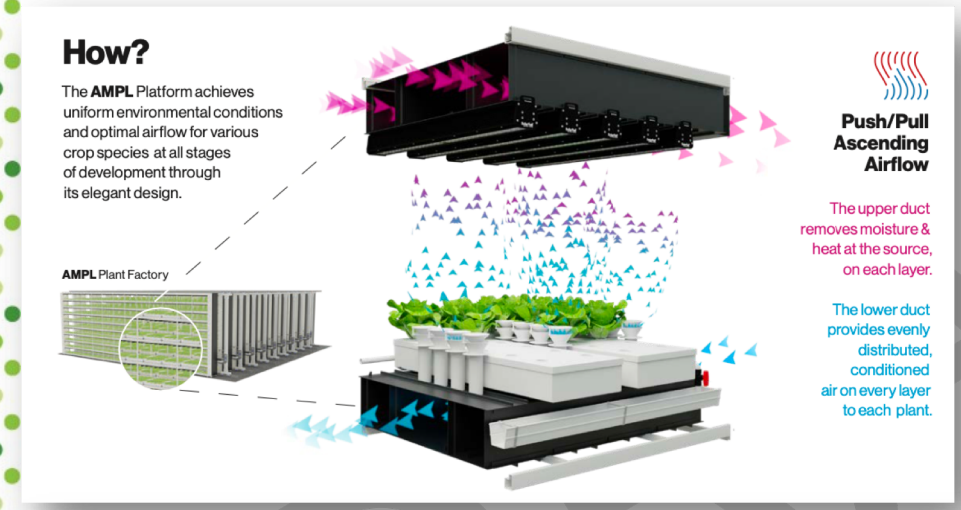
- Ready to grow
- Low skill level req'd for development
- Works with many different business models,
  including community projects

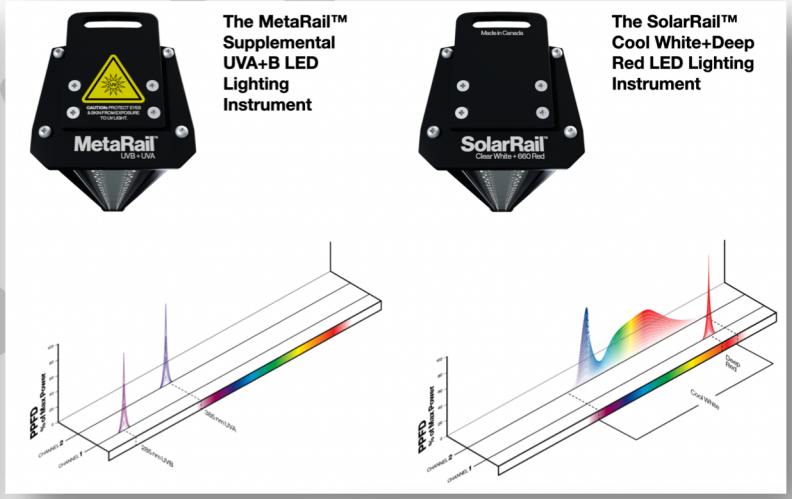
Food Security Structures Canada

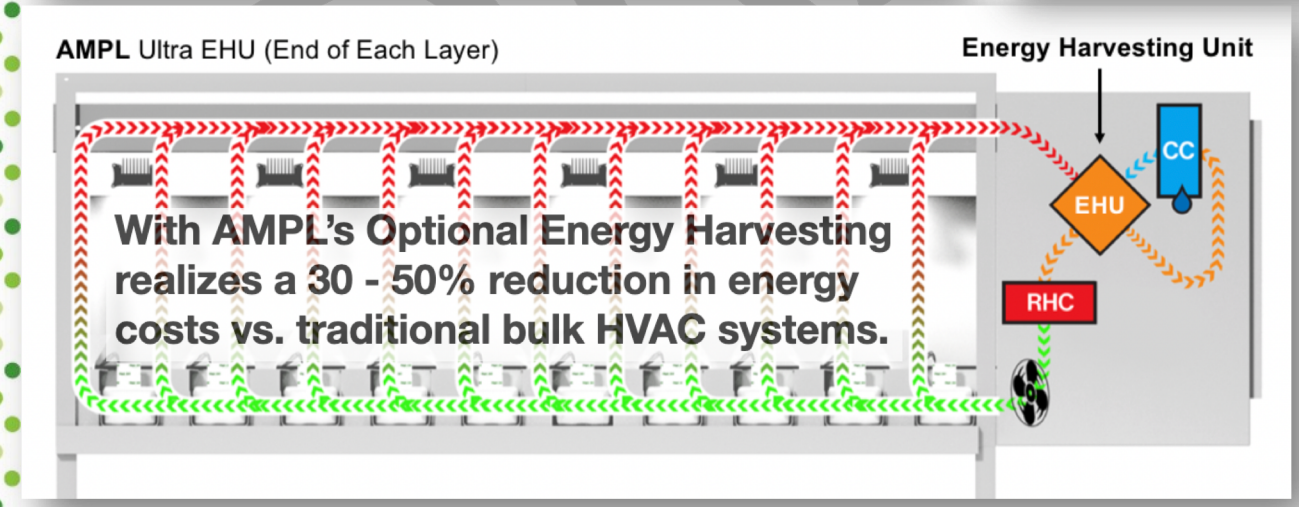
London, ON

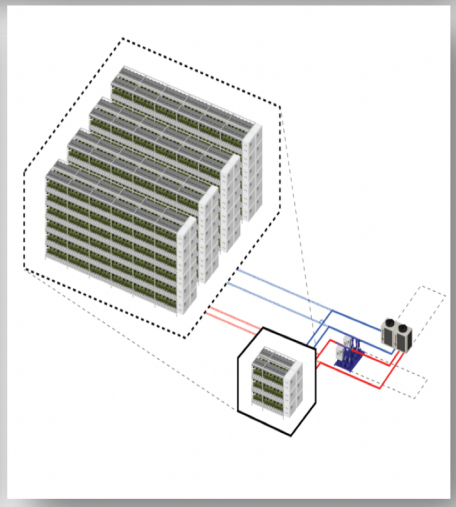
Agricultra Advancements Inc

Beamsville, ON





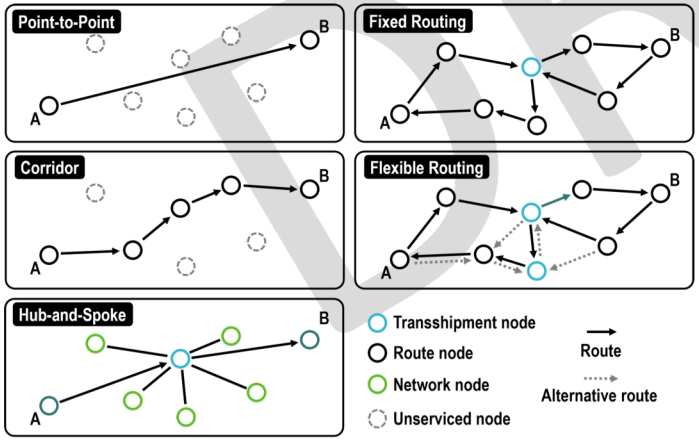


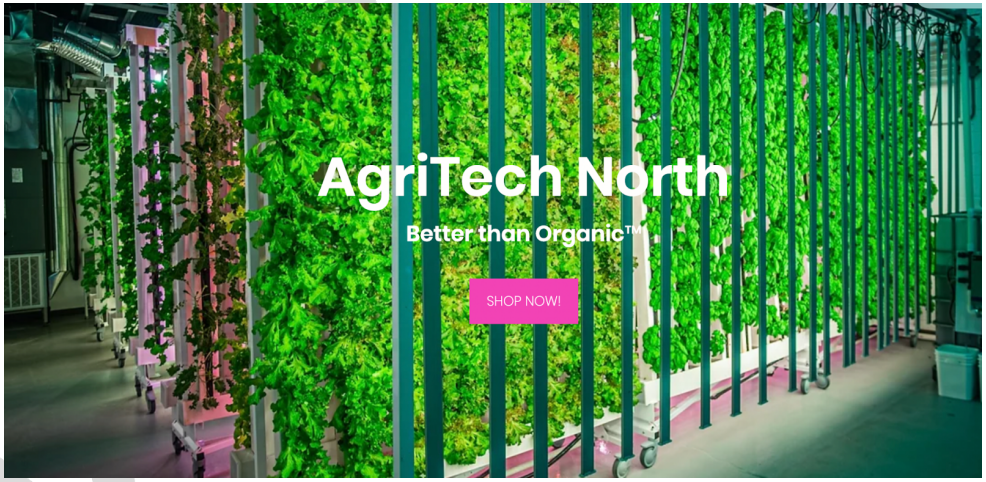


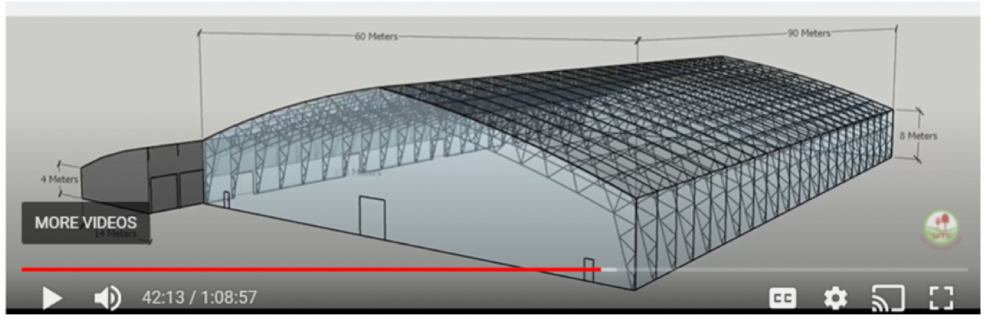
Agritech North

Dryden, ON

- Successful Vertical Farm reducing costs of local produce
- Expanding to a new greenhouse facility
- 3D printed replacement parts
- Developing a distribution network



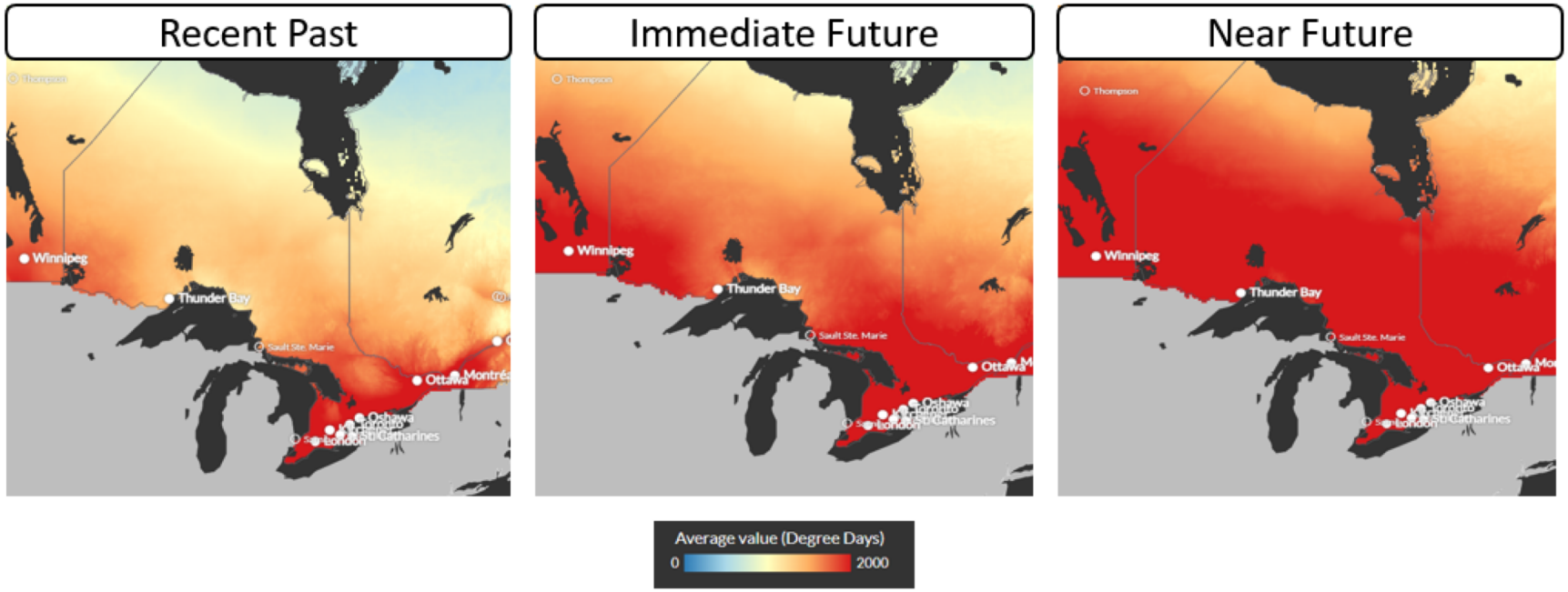




How will growers in Northern Ontario be impacted by climate change?

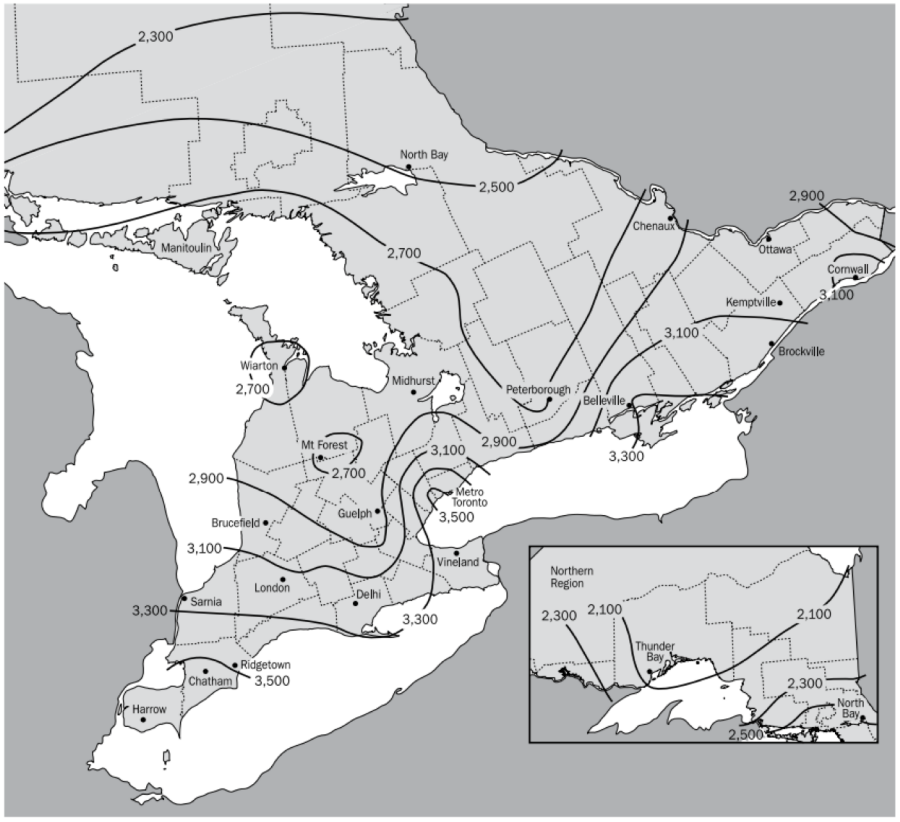
Changing Climate Outlook

Annual Growing Degree Days (GDD)

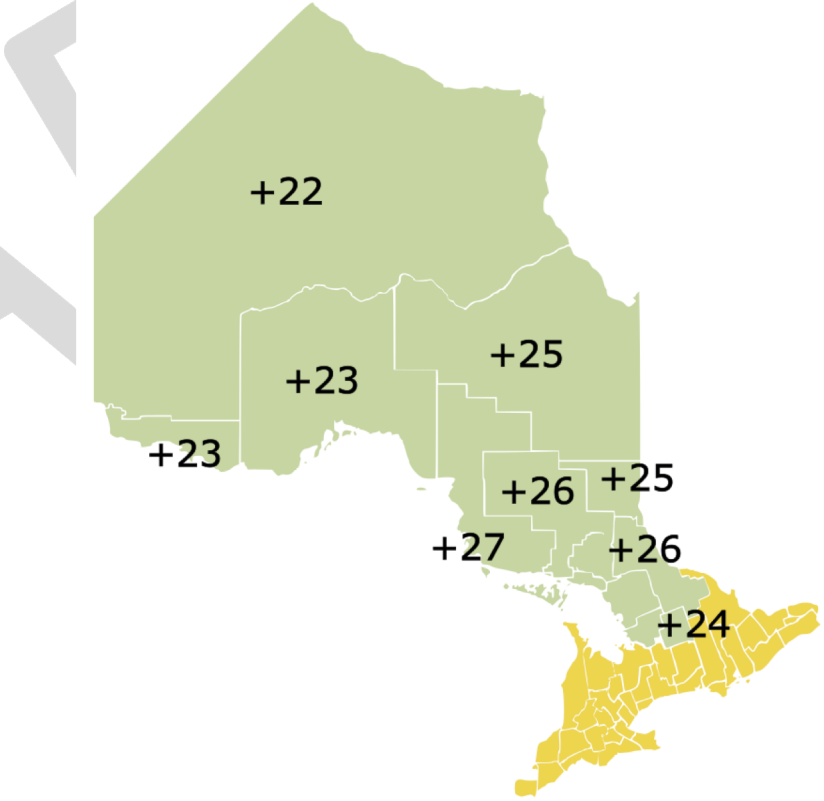


Average number of GDD in the recent past (1976-2005), immediate future (2021-2050) and near future (2051-2080) under the RCP 8.5 scenario in which emissions continue to increase at current rates. Figures from Canada Climate Atlas

Climate change and growing season



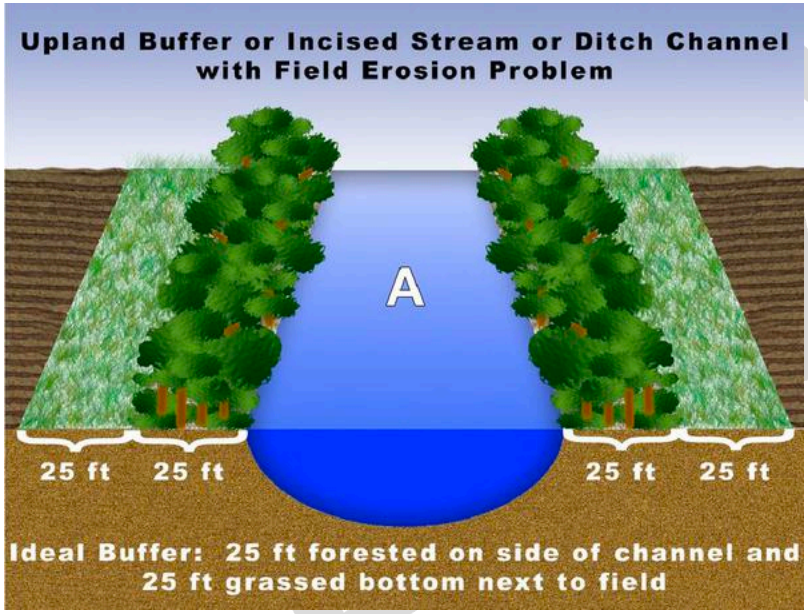
Isopleth map of **Crop Heat Units** for corn based on the daily maximum and minimum temperature from 1971 to 2000 (OMAFRA, 2017).



Predicted **additional frost-free days** per year.

Data from Canada Climate Atlas uses the high scenario in which emissions continue to increase at current rates.

Mitigating risks from extreme weather



https://content.ces.ncsu.edu/agricultural-riparian-buffers

- Controlled Environment Agriculture
- Flood hazard assessment and mapping
- Drought assessment and mapping
- Weirs, catchments, riparian buffers

Closing

Summary of topics:

- Automation at the right scale
- Season extension strategies
- Getting ready for new climate patterns

Things to Explore:

- New Innovations for smart greenhouses
- Distribution networks & transportation strategies
- Community investment & infrastructure


Northern Ontario
Agriculture Conference
SAVE THE DATE
February 15 & 16
2023
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Thank you

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