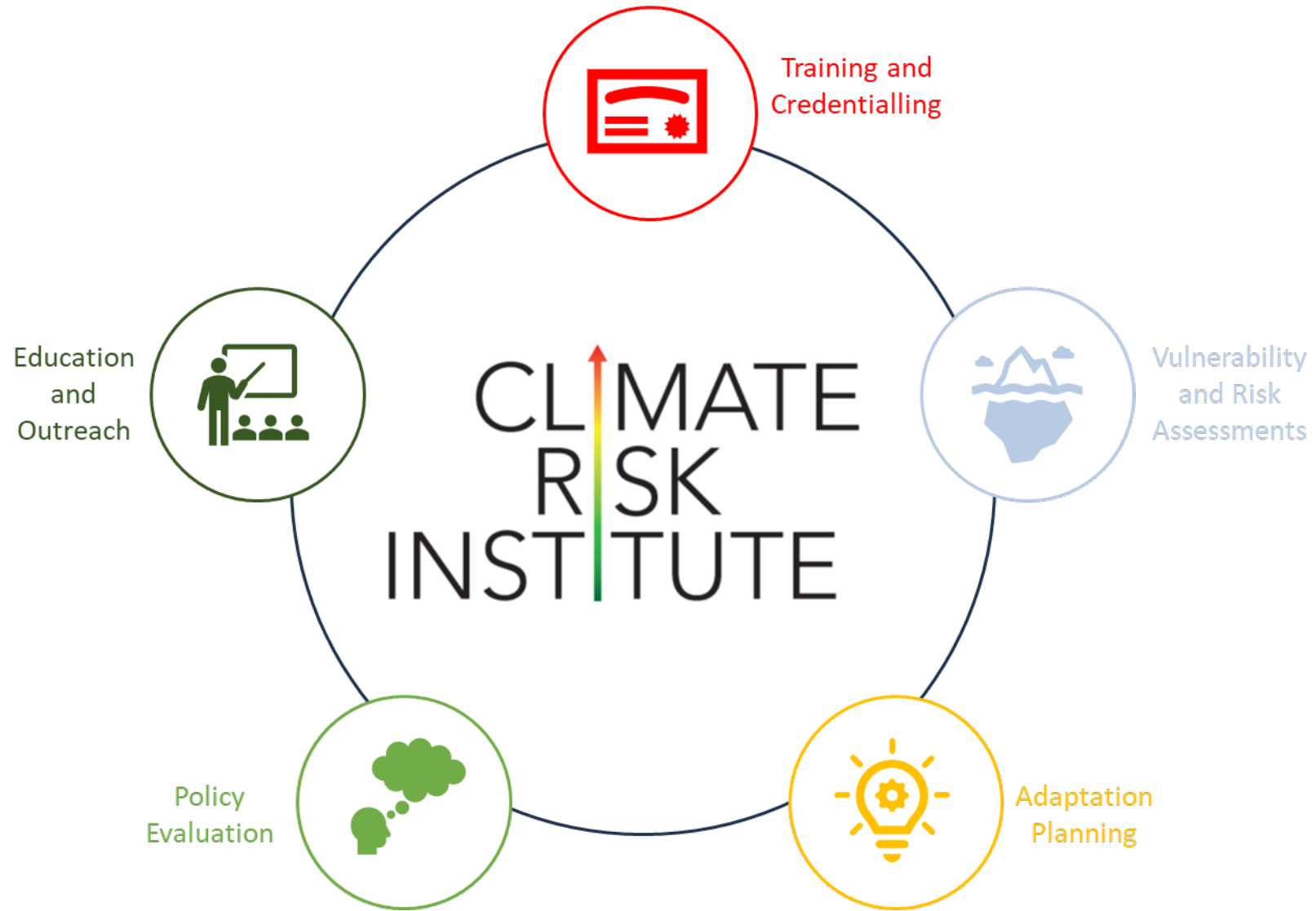




CLIMATE CHANGE AND SUSTAINABILITY

A DISCUSSION

2023



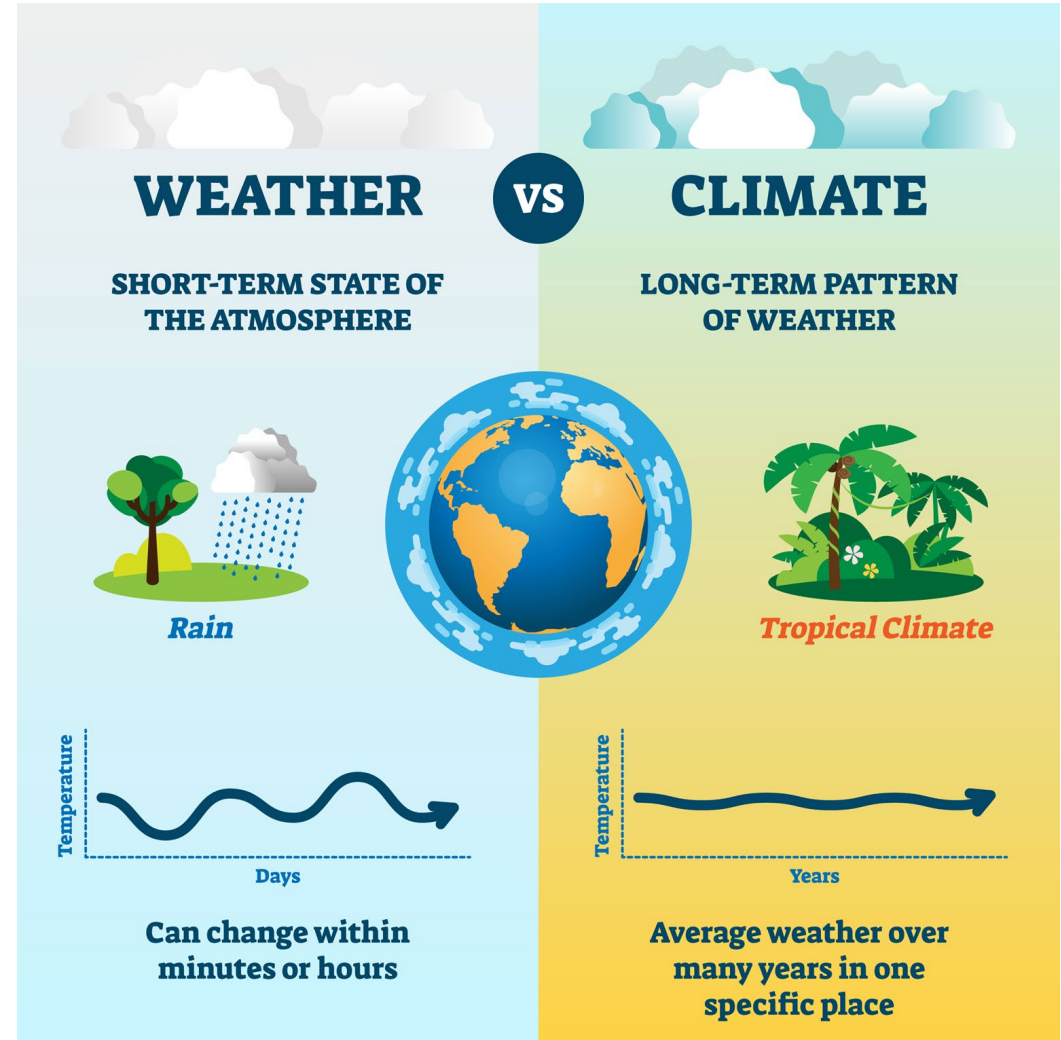
WHAT IS CLIMATE?

Climate

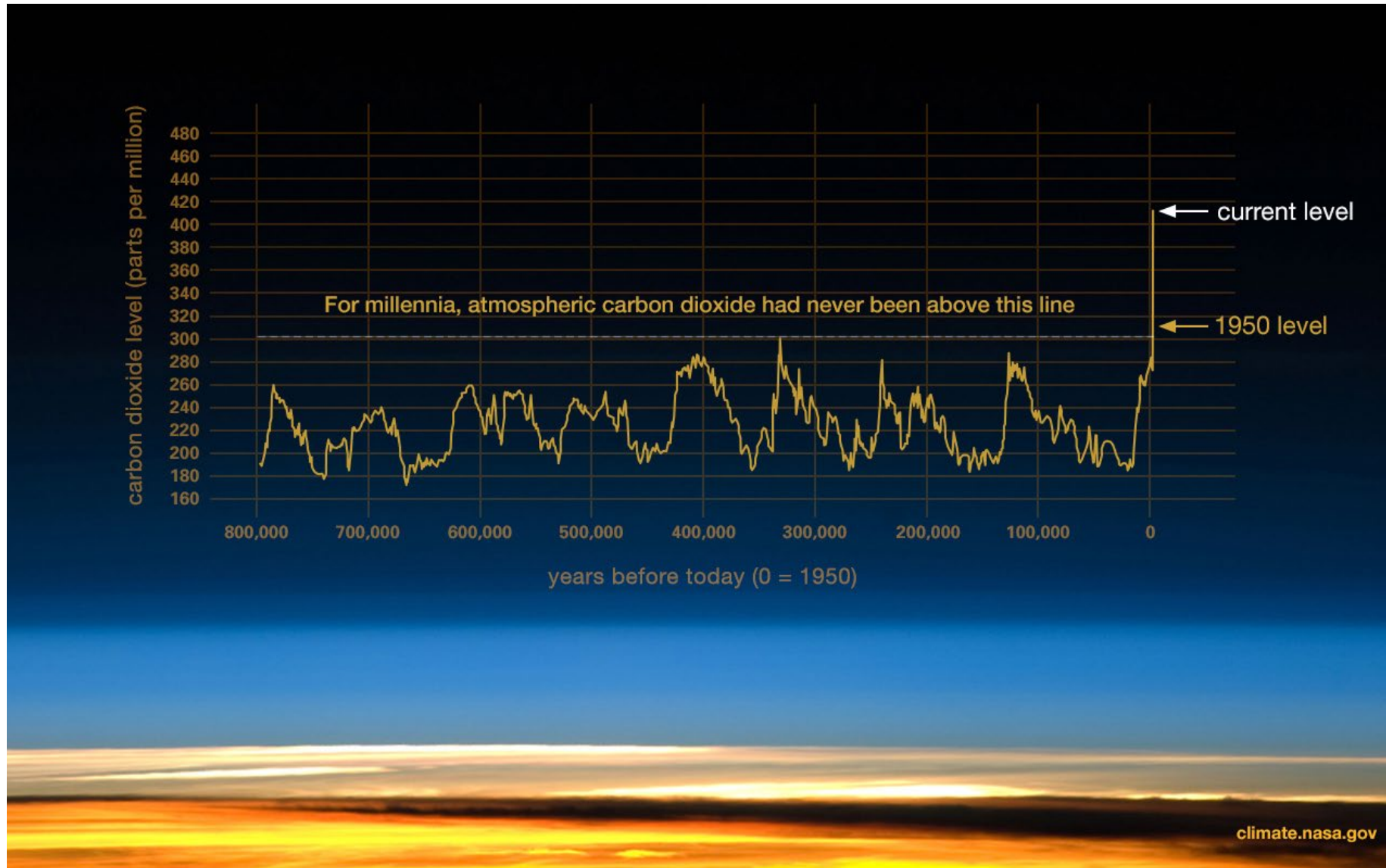
- Statistical description of weather over a period of time, typically 30 years. Includes averages and variability.

Climate Change

- A change in the state of the climate that can be identified by changes in the mean and/or the variability, which persists for an extended period.
- Climate change may be due to natural internal processes, external forcings (such as solar cycles and volcanic eruptions), and persistent anthropogenic changes.



ATMOSPHERIC CO2 & GLOBAL TEMPERATURES



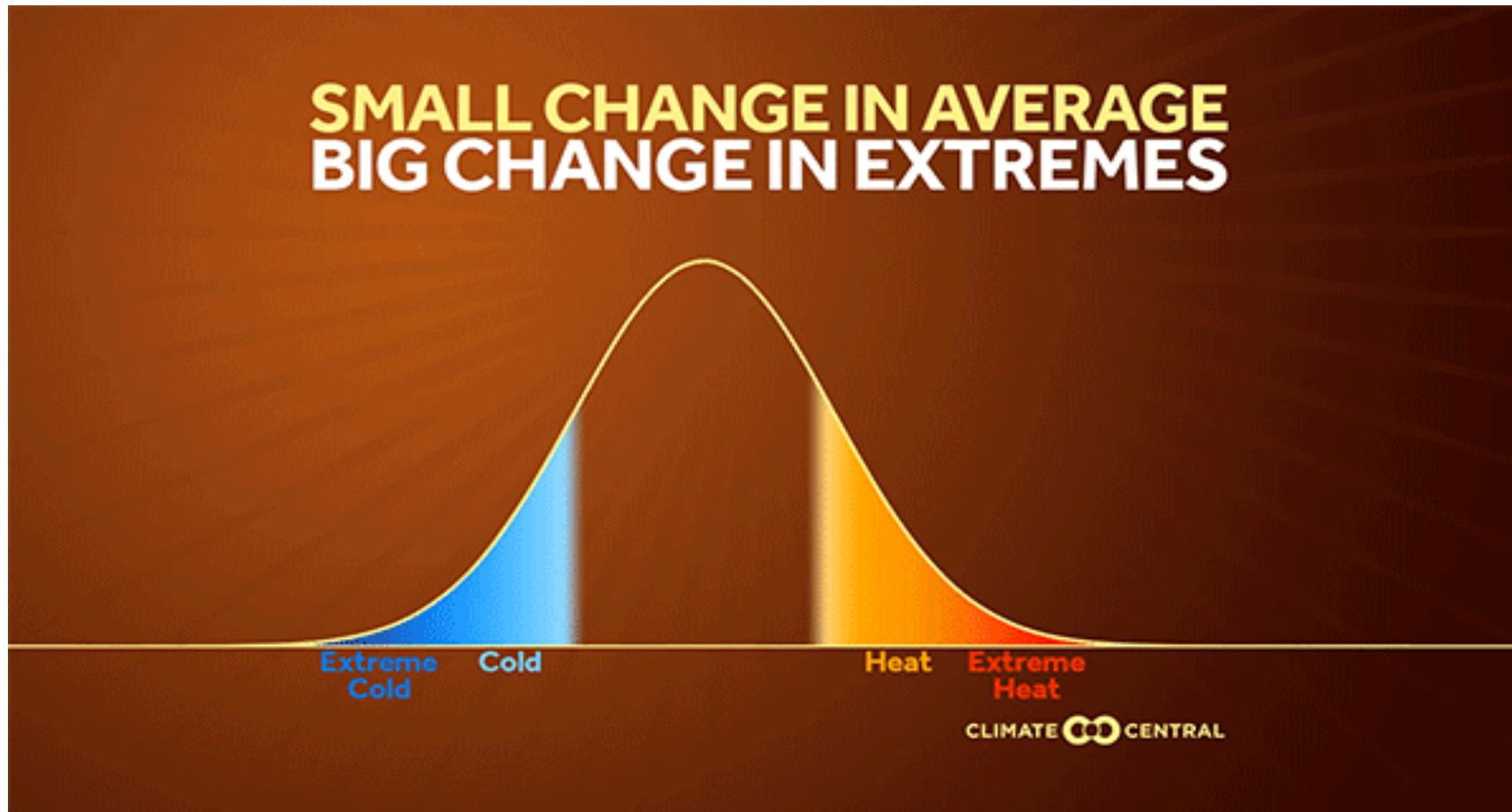


Canada's Changing Climate Report 2019: Main Findings

- Canada has already warmed and will continue to warm.
- Warming in Canada is about double the global rate
- The oceans are warming, becoming more acidic, and are deoxygenating.
- The effects of widespread warming are evident, are projected to intensify.
- Total precipitation is projected to increase on average, with decrease in snowfall and increase in rain. Summer rainfalls may decrease in some areas.
- The seasonal availability of freshwater is changing, with an increased risk of water supply shortages in summer.
- Weather extremes are expected to intensify in the future.
- The rate and magnitude of climate change under high versus low emission scenarios project two very different futures for Canada.

SMALL CHANGES IN AVERAGES = BIG CHANGES IN EXTREMES

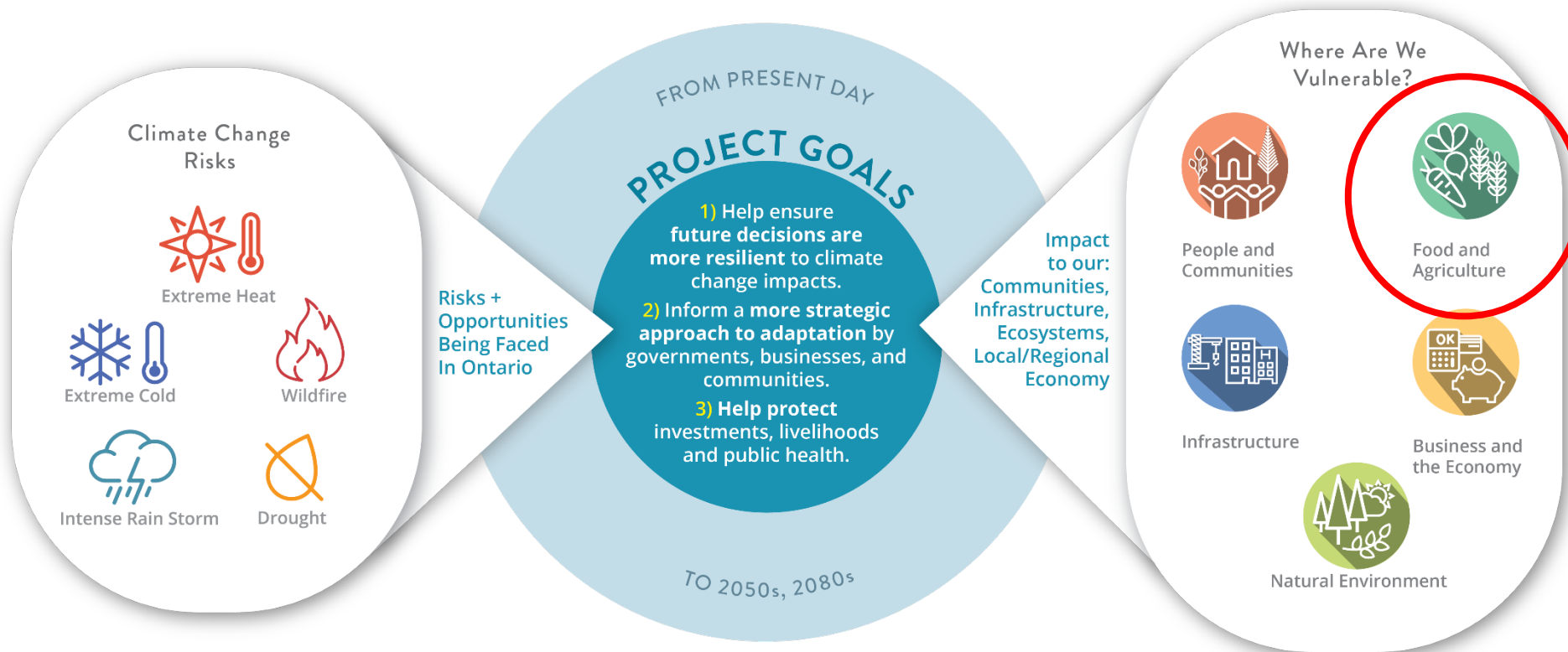
Increases in the frequency and intensity of extreme events



Under a warming climate:

- Fewer cold extremes
- More heat extremes
- More record-breaking heat extremes

Provincial Climate Change Impact and Risk Assessment



- Multi-sectoral climate change impact assessment
- 5 Areas of Focus
- 6 Regions

PCCIA Key Messages

- **The climate has changed.** Between 1948 and 2016, average temperatures have risen 1.3°C and total precipitation has increased by 9.7% in Ontario.
- **Ontario has already experienced significant climate impacts** from flooding, wildfires, heat waves, ice storms and many other events.
- **The climate will continue to change.** In fact, we are locked into climate impacts over the next half century, with impacts expected to become more frequent and more extreme.
- **There is an urgent need to act, to prepare and to invest.** The impacts associated with a changing climate have become more apparent in daily life, increasing risks to social, economic, cultural and ecological systems.



Food and Agriculture

Changing climate conditions could present opportunities for agriculture in Ontario, but **such benefits may be offset or overwhelmed by negative impacts**, resulting in declining productivity, crop failure, and livestock fatalities. **Several commodities are expected to face ‘very high’ climate risks by the end of the century.**

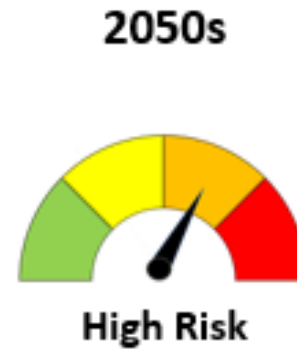
In addition to direct impacts to crop and livestock productivity, Ontario’s agricultural sector is **vulnerable to indirect impacts** caused by climate interactions with pests and diseases, soil and water conditions, and infrastructure that is critical for agricultural production. With **proactive adaptation** by the agri-food industry, Ontario producers may experience more stability, lower economic losses from climate-related impacts and stronger competitive advantage.

Food and Agriculture



Level 1 Category


Field Crops




Fruits and Vegetables




Livestock



Food Security

With elements of productivity, processing, transportation, distribution and large retail, the agri-food system in Ontario is complex and has many points of interaction with weather and climate. **System-wide resilience with a focus on areas that are known to be vulnerable to climate change and regions that are more food insecure, will improve system resilience.**

Climate-related impacts on food security vary across Ontario and stand to contribute to existing vulnerability and inequities. A variety of social, cultural, and economic determinants can be used to identify pre-existing vulnerability to food insecurity in Ontario. Low-income households and neighbourhoods, remote regions, and Indigenous Communities have been identified as being at a disproportionate risk of food insecurity in Ontario.

Grey, Bruce and Huron County Assessment Agriculture Impacts

Positive?

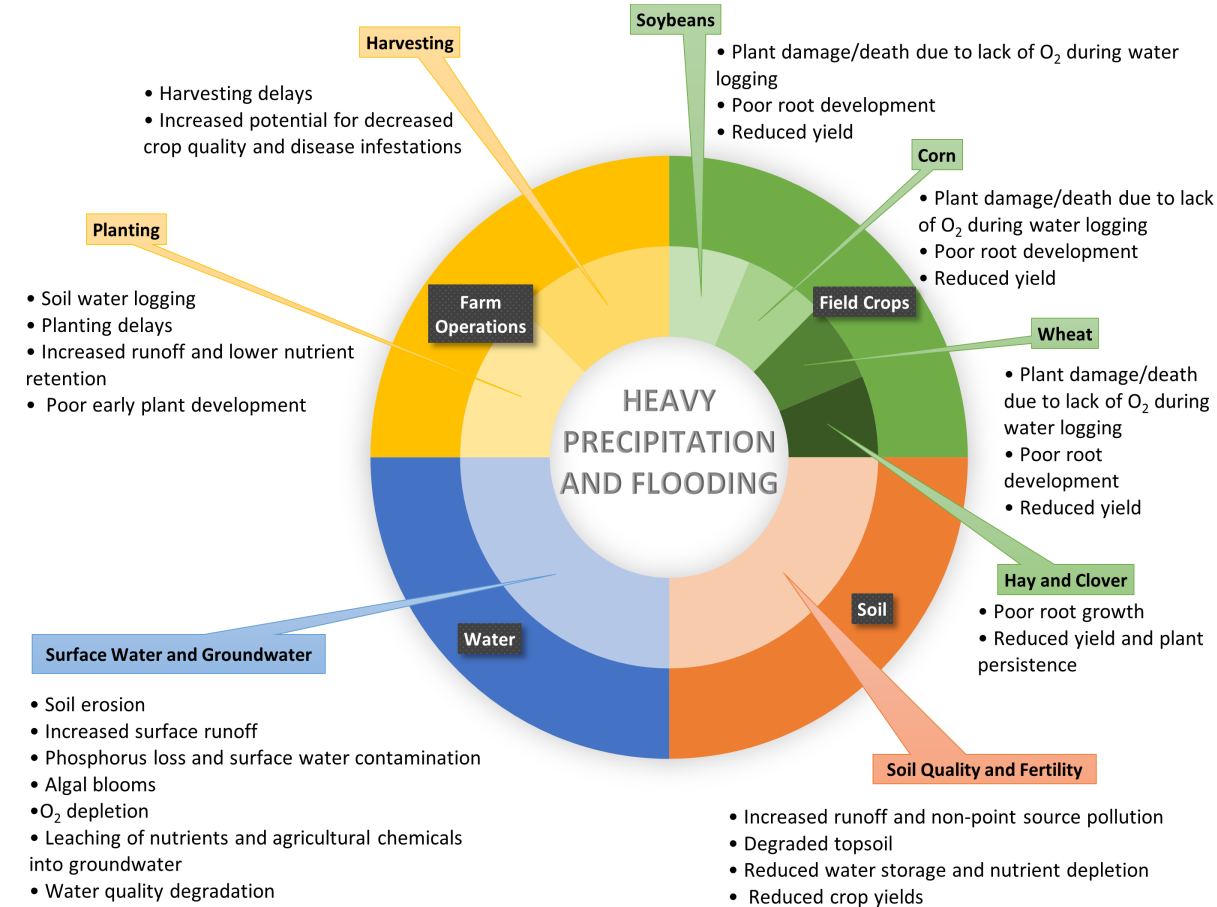
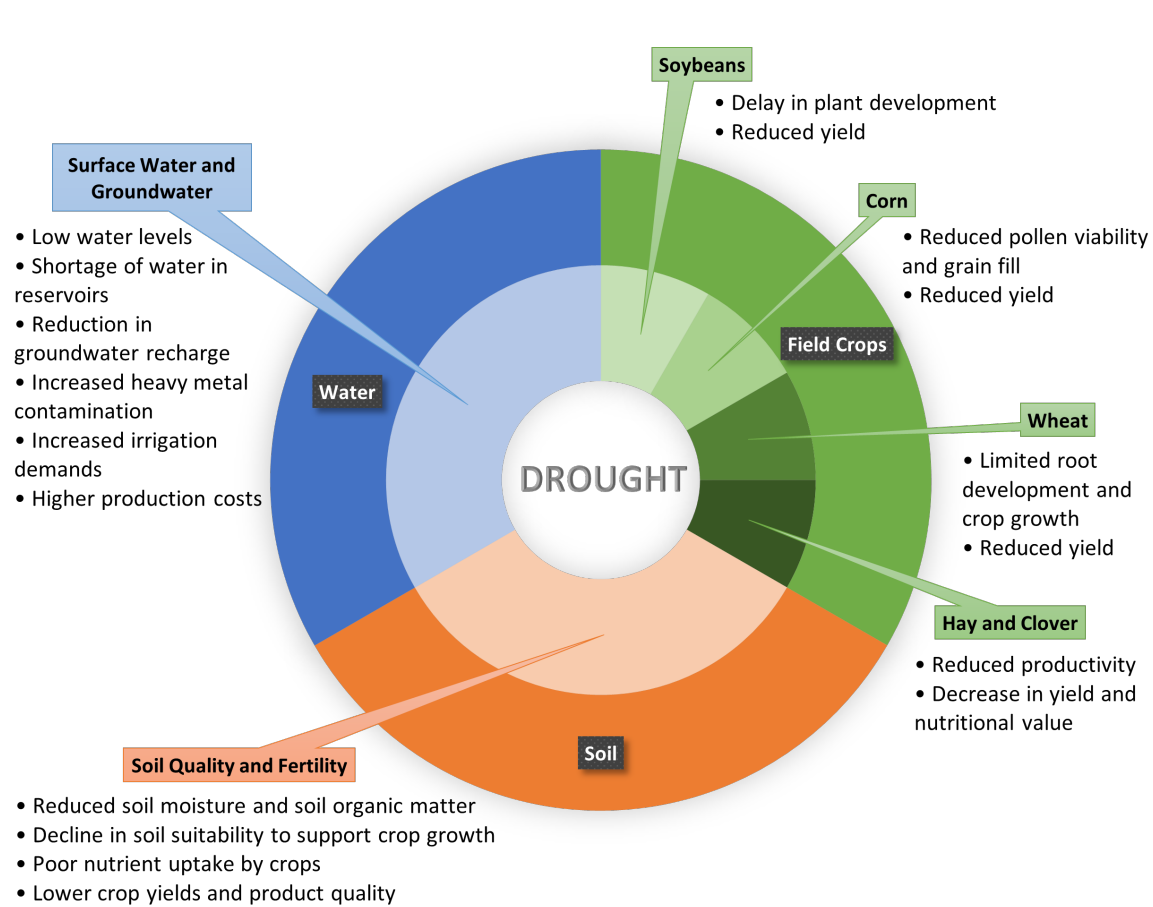
- Longer growing and working season
- Reduced heating demands in winter
- More species diversity

Negative!

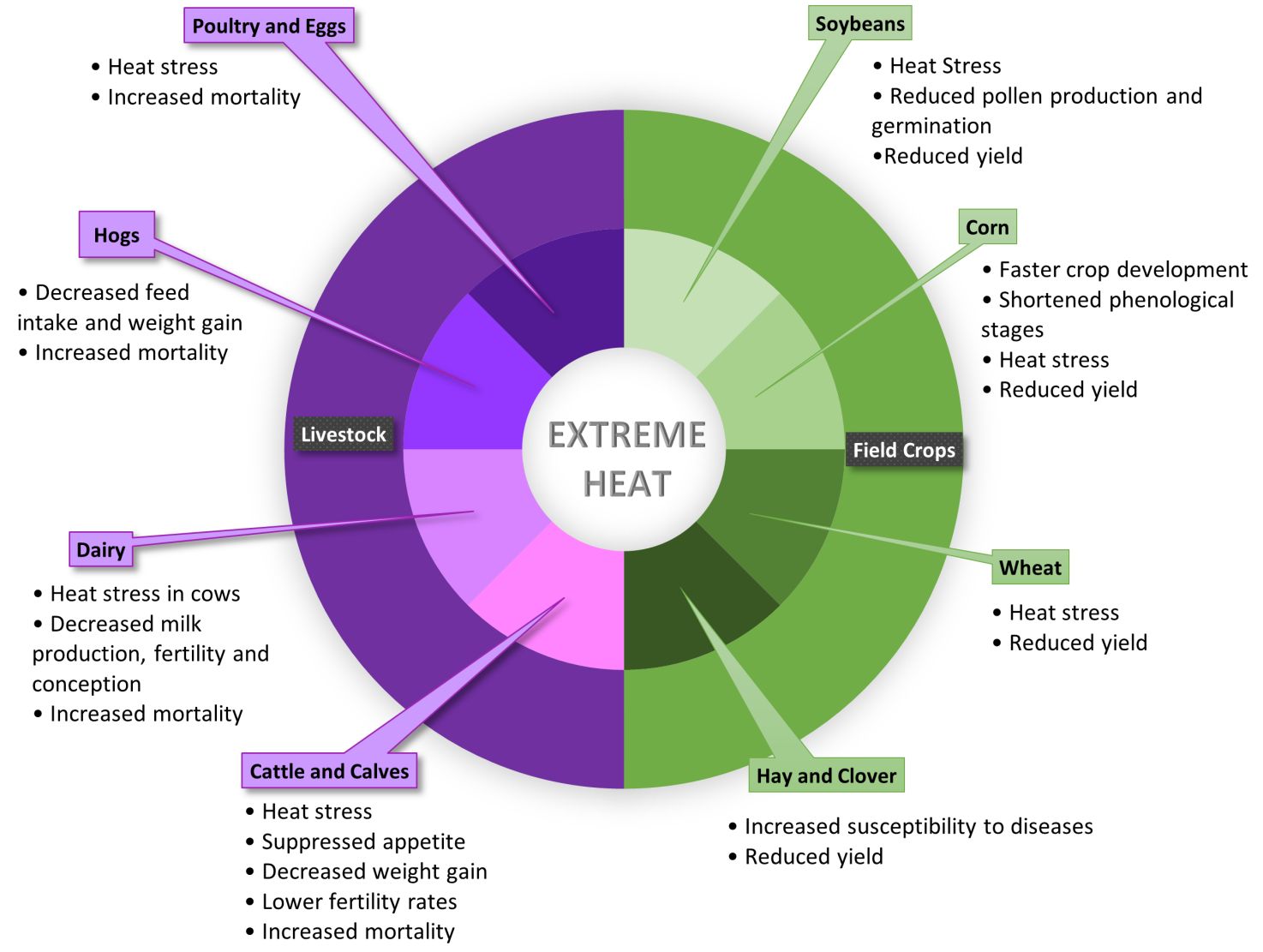
- Plant damage
- Disease susceptibility
- Increased mortality livestock
- Winter tree injury
- Delay planting (flooding)
- Erosion
- Water contamination
- Nutrient depletion
- Heat stress
- Increased irrigation demands



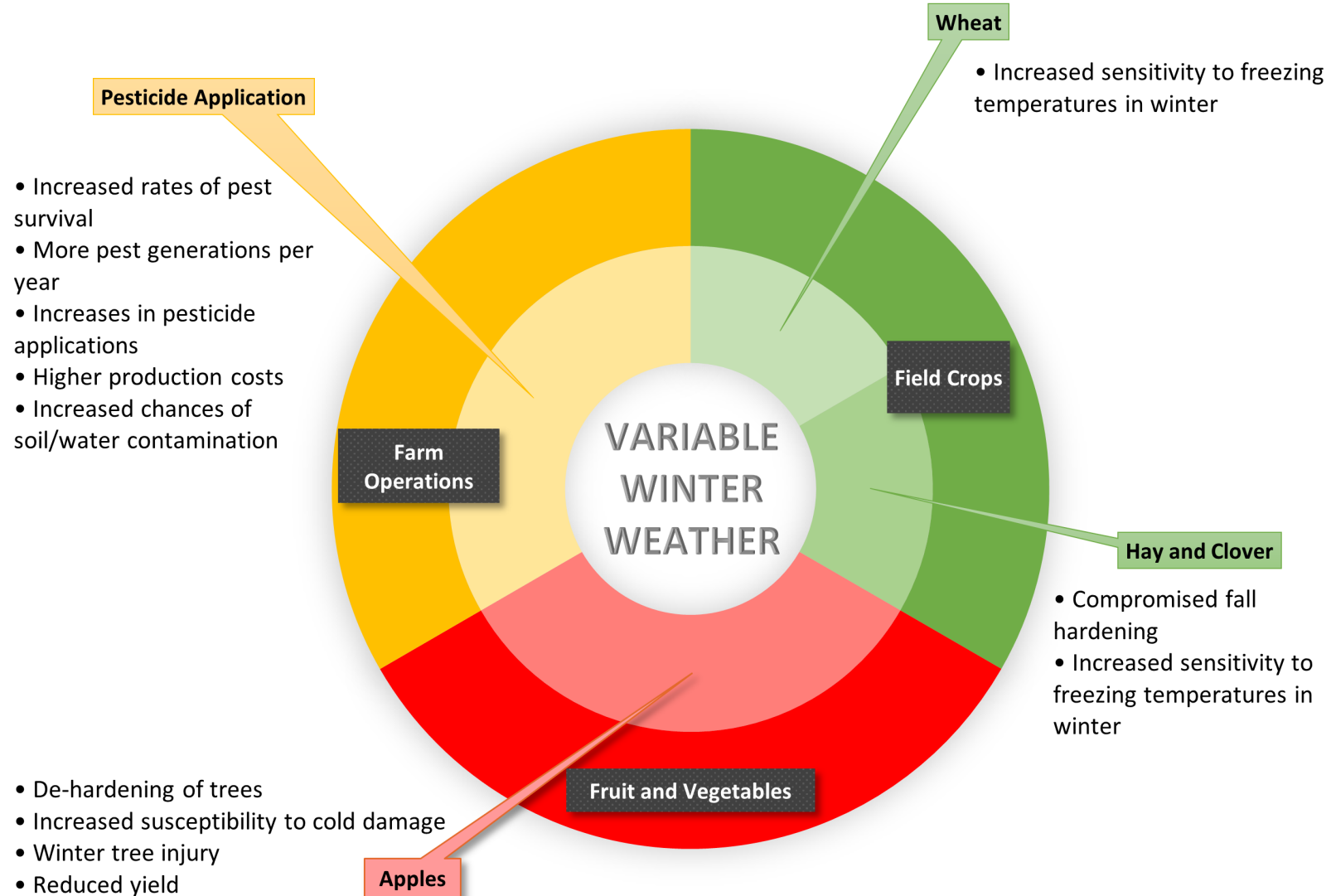
MAJOR IMPACTS



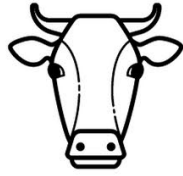
MAJOR IMPACTS



MAJOR IMPACTS

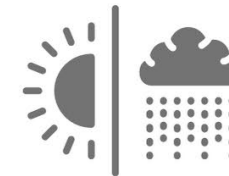


ADAPTATION STRATEGIES & RISK SOLUTIONS



- **Planting new crop cultivars**
- **Using irrigation technologies**
- **Installing cooling and ventilation systems in barns**
- **Livestock diet alterations**
- **Crop rotation**
- **Conservation tillage**

- **Planting cover crops**
- **Rotational grazing**
- **Restoring riparian vegetation**
- **Innovative drain designs**
- **Tile drainage**
- **Adjusting timing of farm operations**



The Ontario Climate and Agriculture Assessment Framework (OCAAF)

A regional framework to assess baseline and future agroclimatic risks and opportunities

Goals

- To inform policy, program and management choices
- To help prepare for the impacts of climate change through adaptation

Objectives

- Build an adaptable, transportable, translatable, and functionally expandable risk-opportunity assessment framework and apply to:
 - Forage production systems in Ontario's Clay Belt (timothy) (Region 1).
 - Corn production in southwestern Ontario, Eco-district 7-E1 (Region 2).
- Analyze decadal regional climate change risks and opportunities out to 2050
- Based on the results, **adaptation options and policy briefs**

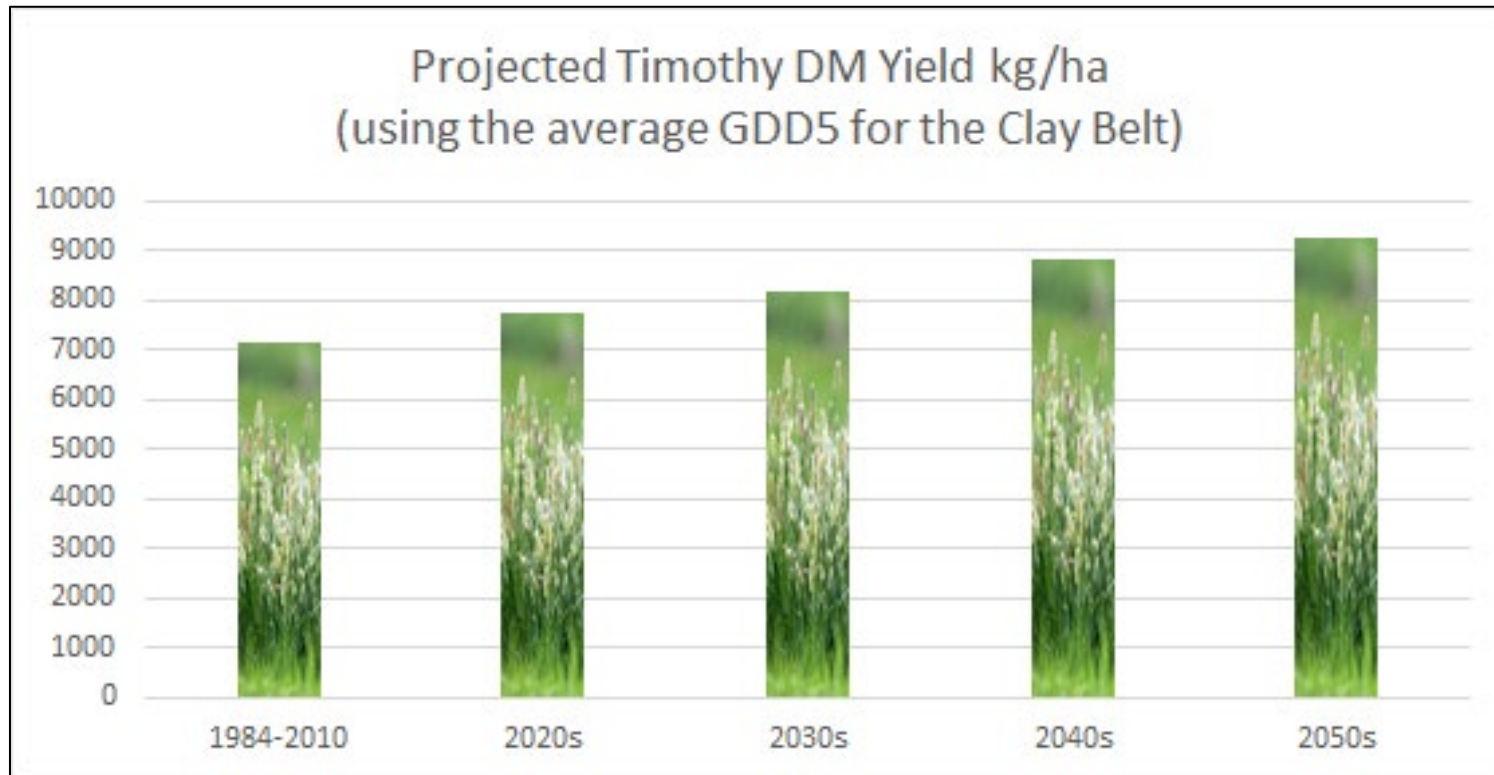


Application to Forage in the Great Clay Belt

- Study of timothy (*Phleum pretense*).
- Research combined:
 - Historical spatial climate data
 - Historical crop production data from experimental stations
 - Information on climate modifiers
 - Future climate projections
- Results include:
 - Projected temperature and precipitation changes at a monthly scale
 - Changes to the LSRS scores and suitability for timothy
 - Projections of future timothy yield out to 2050



Implications for Yield



- With no climate modifiers the DM yield per hectare increases by 30% in the 2050s
- Including the reduction in Fall Hardening and increase in Winter Thaws going forward, it is envisioned this increase will be reduced minimally to perhaps 25% in the 2050s
- This difference can be eliminated if triple cutting becomes viable as projected

Adaptation Options

- 1) Encourage water management practices that mitigate the impacts of climate change - 5 specific measures
- 2) Improve soil management practices and build soil health – 2 specific measures
- 3) Support agriculture research, innovation and knowledge exchange - 2 specific measures
- 4) Encourage the implementation of adaptive measures – 3 specific measures

12 Adaptation Options in Total



Conclusions

- Climate change is happening.
- Presents opportunities and risks to agriculture sector – and the food system as a whole.
- **Climate hazards and risks are diverse and increasing.**
- Adaptation is possible and with planning we can ensure sustainability, yields, food security.



Thank you!

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