organic SCIENCE CLUSTER 3

CANADIAN AGRICULTURAL PARTNERSHIP

Getting ready for climate change: exploring cover crops and other techniques to deal with extremes

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Climate change - For the Niagara region

- Temperature: +1.8°F (1.0°C) between 1901-2016
- Warmest years on record: 19 since 2000 (2020 was 1.84°F (1.02°C) warmer than average
- Summer lake surface temperature of Lake Superior: 4.5°F (2.5°C)between 1979-2006
- Since 1951, total annual precipitation has increased by 13.6%
- Frost free season: +16 days between 1951-2017

What to expect?

Theme	General projections	Trend	Category	Data confidence
Climatology				
Air temperature	• 1.5°c - 7°c increase by the 2080s depending on climate scenario and model used. • Greater increases in the winter. • Increased frost-free period and growing season.	↑		high evidence high agreement
Precipitation	• 20% increase in annual precipitation across the Great Lakes Basin by 2080s under the highest emission scenario. • Increases in rainfall, decreases in snowfall. • Increased spring precipitation, decreased summer precipitation. • More frequent extreme rain events.	↑		high evidence medium agreement
Drought	• Projected increases in frequency and extent of drought.	↑		low evidence high agreement
Wind	• Increased wind gust events.	↑		low evidence low agreement
Ice storms	• Greater frequency of freezing rain events.	↑		low evidence low agreement

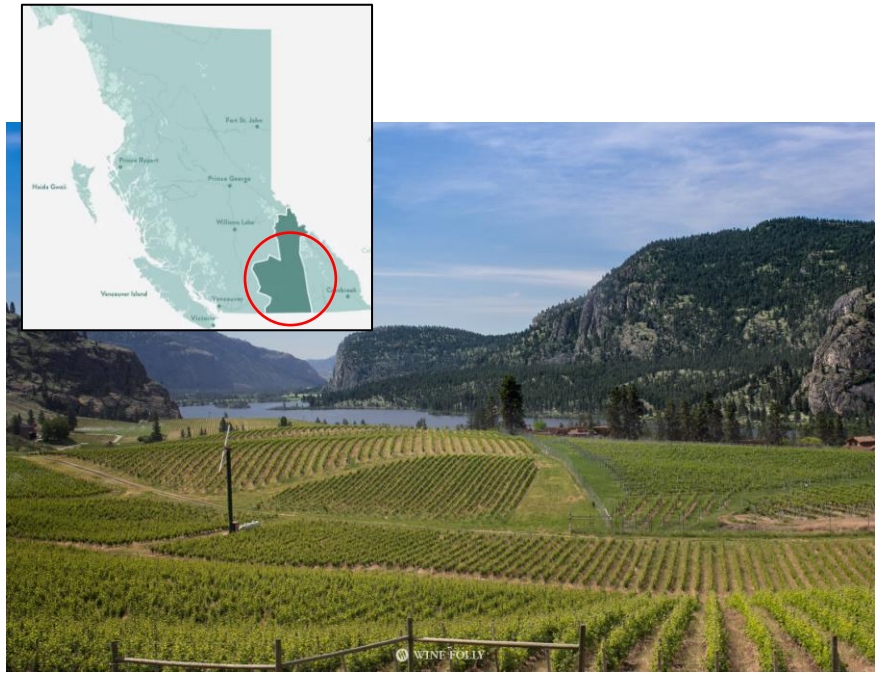
McDermid et al. 2015. State of Climate Change Science in the Great Lakes Basin: A Focus on Climatological, Hydrological and Ecological Effects. Prepared jointly by the Ontario Climate Consortium and Ontario Ministry of Natural Resources and Forestry to advise Annex 9 - Climate Change Impacts under the Great Lakes Water Quality Agreement

Objectives

- Enhance climate change adaptation within vineyards
- Examine the use of cover crops, rootstocks, and novel irrigation strategies
- Improve grape production and quality
- Increase economic and environmental sustainability (resilience)

Developing and testing novel strategies

- Okanagan Valley (BC), Niagara Region (ON)
- Four vineyards (irrigated, non-irrigated)



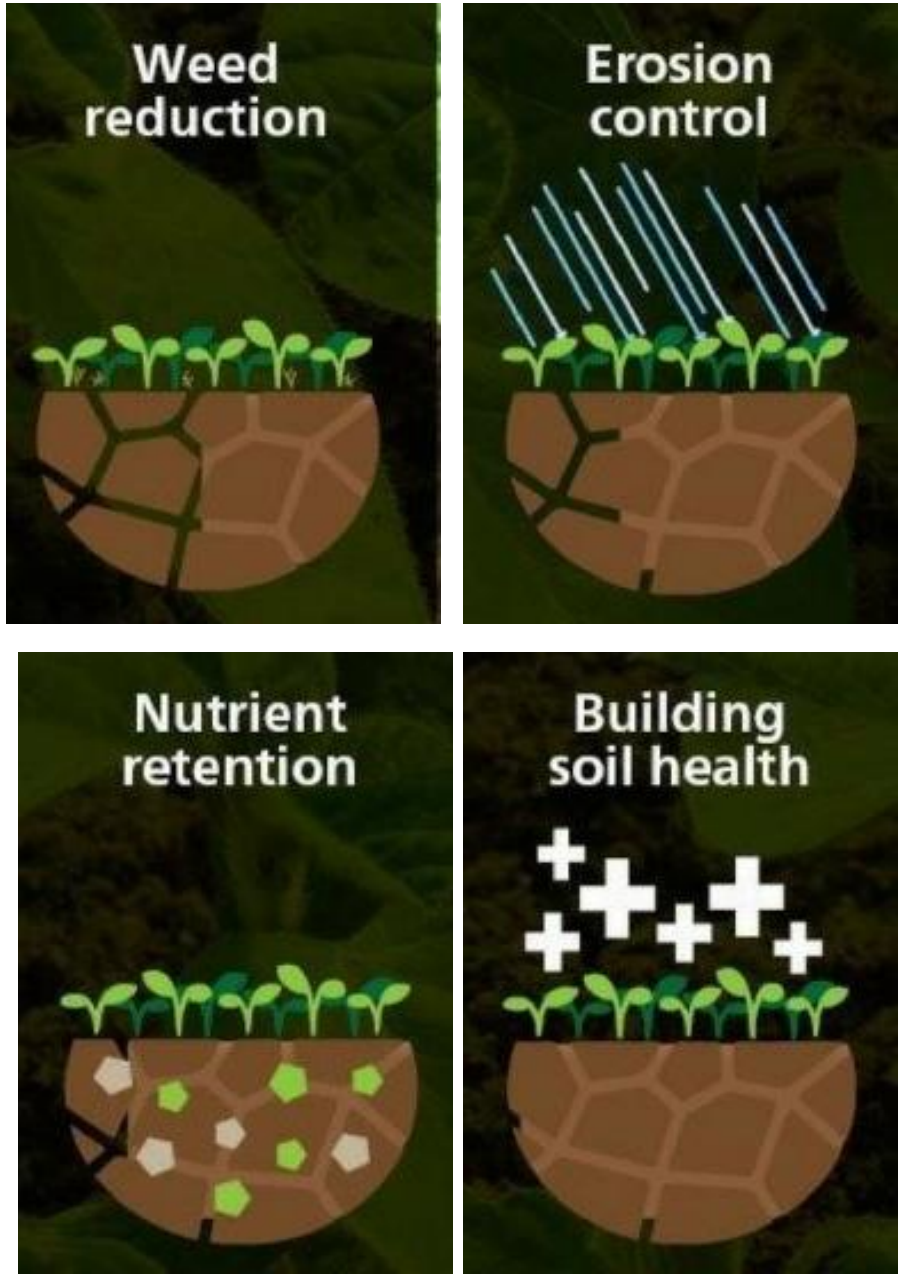
Components

- Selection of cover crop species
  - in- and inter-rows
- Monitoring of different rootstocks
- Monitoring of the ecosystem
  - Soil
  - Invertebrate community
  - Vegetation community
  - Vineyard performance (grape composition, bud damage, etc.)

Nature-based solution

- Why Cover Crops?

- Prevent leaching and volatilization of nutrients
- Radiation protection
- Maintain soil moisture
- Carbon sequestration
- Biological control agents
- Increase microbial activity/diversity
- Enhance grape yield/quality



Greenhouse experiment

- Targeted species:
  - Legumes:
  - Forbs:
  - Grasses:

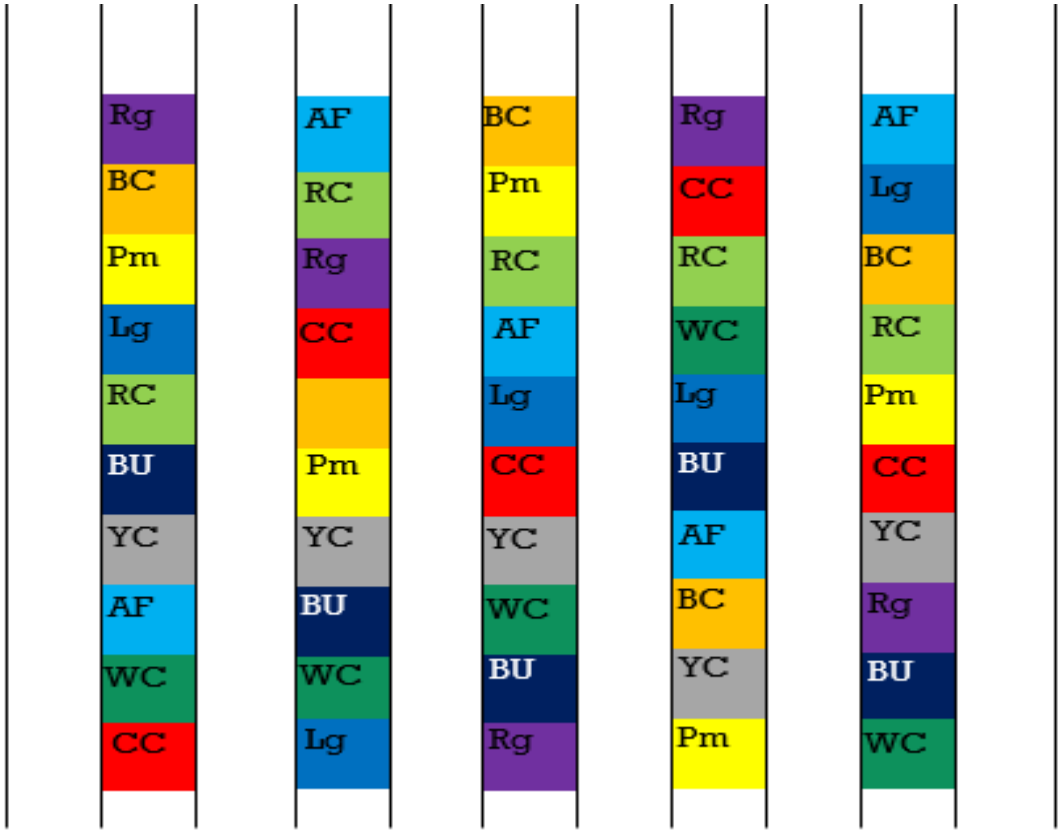
- Three treatments:
  - Flooding condition (100% FC everyday)
  - Control (60% Field Capacity every other day)
  - Drought condition (20% FC once a week)

Complete randomized Block design, 10 replicates, 53 days growth

Results

Results

Field experiments



Schematic of 2019 experiments

- 5 replicates/species
- 3 panels/replicate
- Broadcast and over-sown

Field testing: results

Results

Discussion: most adaptable plants

- Greenhouse: Pearl millet; Hairy vetch; Berseem clover; Yellow clover

- 2019 field test: Crimson clover; Pearl millet; Red clover; Yellow clover
- 2020 Field test: Pearl millet; Hairy vetch; Crimson clover

Weather vs climate

To come: 2021-2023 (min)

Expected outcomes

- Enhance agroecosystem resilience to climate change
- Enhance ecosystem services with the combination of the three approaches;
- Introduce potentially new strategies to organic wine production.

Acknowledgements