



ONTARIO CLIMATE AND AGRICULTURE ASSESSMENT FRAMEWORK (OCAAF)

The success of Ontario's agri-food sector depends on knowledge of future weather and climate implications for the fundamental biological, chemical and physical components that underlie resilient and productive agri-food systems. Ontario's climate is warming and becoming increasingly variable, increasing the need to assess and manage agricultural climate risks. The focus of this research is to develop and pilot a regional framework to assess baseline and future agroclimatic vulnerabilities, risks and opportunities. The goal is to inform policy, program and management choices of key stakeholders in Ontario's agri-food sector so as to maintain or enhance agricultural productivity under a changing climate. It will help prepare us for the impacts of climate change and develop adaptation options. Ultimately, this will contribute to rural development and food security in Ontario.

Initial application of the OCAAF will be used to assess forage-based beef production systems in the Clay Belt for the years 2020-2050 using projected, downscaled climate data from the most recent generation of global climate models and a realistic higher greenhouse gas emissions scenario. An advisory committee and the use of current, local studies will ensure that the project data is "ground-truthed."

OBJECTIVES

- Develop and pilot a regional framework to assess baseline and future agroclimatic vulnerabilities, risks, and opportunities.
- Build an adaptable, transferable and expandable risk-opportunity assessment framework.
- Analyze decadal regional climate change risks and opportunities out to 2050.
- Apply the framework to:
 - Forage-based beef production systems in Ontario's Clay Belt; and
 - Corn production in southwestern Ontario.

OUTCOMES

- A Framework and analyses that are transportable (across regions), translatable (for use with different commodity types and production systems), and functionally expandable (especially for climate change analytical and data management requirements) to inform Ontario agri-food policy.
- Recommendations about adaptation in policy and programs for Ontario.
- Findings on risks, opportunities and adaptive options.
- A monitoring tool for farmers.

	Agriculture in 2015	Agriculture in 2050 with a changing climate
Risk		
Opportunities		

TABLE 1: A FRAMEWORK TO ASSESS CLIMATE CHANGE IMPACTS ON AGRICULTURE IN ONTARIO WILL COMPARE BASELINE AND FUTURE AGROCLIMATIC CHARACTERISTICS.

THE FRAMEWORK

The Ontario Climate and Agriculture Assessment Framework (OCAAF) intends to provide a consistent and robust means to support regional-level assessments of baseline and future agroclimatic risks and opportunities in the context of other major production influences in Ontario. Designed to inform climate-adaptive agri-food strategies, policies and programs in Ontario, the framework will support the policy goal of maintaining (or enhancing) agricultural productivity under a changing climate. As such, the OCAAF must generate estimates of agricultural productivity and agricultural loss as key outcome variables.

In developing OCAAF, single-element indices are being considered, as well as indices that integrate a range of productivity factors and hazard types. In order for OCAAF to meet these criteria, it will be necessary to make simplifying assumptions about the modelled systems, including the interactions among their components. One approach is to use a suite of criteria and indicators that depict the main drivers of crop productivity and loss. Thus, development of the OCAAF began with the identification of features and interactions among the four main biophysical components that drive agricultural productivity at a broad scale: (i) climate and climate change; (ii) landscape conditions; (iii) plant (crop) physiology; and (iv) management/adaptation actions. Through desktop research, and consultation with OMAFRA staff and academic and industry experts, the project team will develop candidate lists of criteria and indicators linking each of these four components to agricultural productivity.

Aside from the Framework itself, OCAAF outputs may include maps, charts, graphs and tables that demonstrate the eventual impacts of climate change on production, in combination with other management, biological and landscape factors. Some output measures from OCAAF may be expressed as index values (e.g. good, moderate, poor), while others may be more continuous values. In either case, OCAAF will be calibrated using historical productivity metrics at sample locations, and use separate independent locations for validation. As currently envisioned, OCAAF will provide index results for a range of different climate change scenarios at the following time horizons: baseline; 2030s; 2050s; and, 2070s.

The beta version of OCAAF will be developed with a focus on forage systems in the Northern Clay Belt of Ontario. Team members will collect historic measures of the landscape, climate, plant and animal biology, and management indicators, calling upon OMAFRA, AAFC, Census, research, and agri-food organizations. These data will be compiled into spreadsheets initially, pending design decisions for best technology solutions. In developing and applying the framework, the project team will build on existing scholarship, datasets and tools (e.g. AAFC Agroclimate Impact Reporter) and employ participatory approaches to integrate scientific, practitioner, and policy expert knowledge. An advisory committee will help with this integration.

In keeping with the overarching research goal of informing policy and program development to capitalize on agricultural opportunities and manage agricultural risks stemming from climate change, recommendations will also be provided for policy and program enhancement. These recommendations will go to OMAFRA and other provincial departments in two forms: 1) a suite of adaptation options for each region and production system studied; and 2) thematic policy briefs that stem from results of the OCAAF's two applications.

THE PROJECT TEAM

The Ontario Centre for Climate Impacts and Adaptation Resources (OCCIAR) has partnered with ESSA Technologies, Risk Sciences International (RSI), and the Université du Québec en Abitibi-Témiscamingue (UQAT) with funding from the Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA) under the New Directions Research Program to conduct this study of climate change-related risks and opportunities for agriculture in Ontario.

PROJECT ADMINISTRATION



Al Douglas (Director, OCCIAR)

Al has been working in the field of climate change impacts and adaptation for 13 years specializes in facilitating adaptation planning at the local and watershed level. Al has expertise in climate science; climate change impact, vulnerability and risk assessment; policy development and adaptation planning in natural resource sectors. *Role in OCAAF: Project lead, climate risk decision support, assessment framework development, regional adaptation and policy mapping.*



Annette Morand (Adaptation Coordinator, OCCIAR)

Annette has been working in the field of climate change adaptation for over 4 years. Her role at OCCIAR involves supporting the development and delivery of climate related resources for communities and sectors within Ontario, including adaptation research, community engagement and adaptation support. *Role in OCAAF: Bioclimate data collection, research, stakeholder engagement, workshop planning and outreach expertise.*

COLLABORATING SPECIALISTS



Donald Robinson (Senior Systems Ecologist, ESSA Technologies)

Don is a Registered Professional Biologist and Systems Ecologist with 30 years' experience in ecological simulation modelling and analysis. At ESSA his skills are applied to terrestrial and aquatic ecosystem management problems requiring a combination of mathematical ecology, statistics and probability, and numerical methods. *Role in OCAAF: Framework design and development, landscape and ecological modeling.*



Jimena Eyzaguirre (Senior Climate Change Specialist, ESSA Technologies)

Jimena is a climate change specialist with 10 years of experience in providing research, analysis and advice to inform climate change policy and programming decisions by the federal government. *Role in OCAAF: Climate change criteria and indicators specialist, vulnerability, risk-opportunity framework development, regional adaptation and policy mapping.*



Tim Webb (Business Area Leader, Disaster Risk Reduction and Terrestrial Ecosystems, ESSA Technologies)

In addition to his extensive work in Disaster Risk Reduction, Tim has worked extensively in the field of natural resource management including the application of ecological simulation modelling, analytical tools, and the techniques of Adaptive Management to a wide array of different real world management problems including watershed management, fisheries assessment and management, and forestry. *Role in OCAAF: System integration, tool development, landscape and bioclimate modelling.*



Erik Sparling (Director, Climate Risk Decision Support, RSI)

Erik has led a range of projects focused on the management, communication, and use of scientific information by a range of end-users, especially with respect to the assessment of climate change-related risks. He has been the author or co-author of various papers, reports and peer-reviewed publications in this area, and has played a main role in advancing the consideration of climate change-related factors in relevant areas of Canada's national codes and standards system. *Role in OCAAF: Climate risk decision support, assessment framework development.*



Dr. Neil Comer (Senior Climatologist, RSI)

Neil has worked in the private sector as an applications engineer/instructor (Weather Services International), in the public sector with the Meteorological Service of Canada and the Adaptation and Impacts Research Section of Environment Canada, and, most recently, in academia (University of Prince Edward Island, Climate Unit). *Role in OCAAF: Climate model outputs, tailoring of climate data, development of climate statistics.*



Heather Auld (Principal Climate Scientist, RSI)

Heather has extensive experience with weather forecasting and operations, climate science, climate change adaptation, training, and stakeholder consultations. She has recognized national and international expertise in climate change impacts and adaptation, engineering climatology for national codes and standards, energy-climate research, extreme event and forensic analyses, disaster risk reduction planning and science-policy linkages. *Role in OCAAF: bioclimate and landscape data tailoring and interpretation, risk-opportunity assessment framework development.*



Dr. Vincent Cheng (MITACS postdoc, RSI)

Vincent received his PhD from the Department of Geography, University of Toronto. Previously he worked in the public sector with the Adaptation and Impacts Research Section of Environment Canada. He specializes in GIS, spatial analysis, extreme event and forensic analysis, and Bayesian statistics. *Role in OCAAF: Spatial analysis, data management and data visualization.*

UNIVERSITY RESEARCHERS



Dr. Carole Lafrenière (Professor, UQAT)

Carole has worked in the public sector with Agriculture and Agri-Food Canada at the Beef Research Farm in Kapuskasing as a forage production and conservation research scientist. She is now working at the Université du Québec en Abitibi-Témiscamingue (UQAT) developing a small research group on Nordic pasture strategies. *Role in OCAAF: Agronomist, forage management and productivity specialist.*

OMAFRA ADVISORS

Tom Hamilton (Beef Cattle Production Systems Program Lead)

Alex Rosenberg (Senior Policy Advisor, Environmental and Land Use Policy Unit)

Amadou Thiam (Engineer, Air Quality, Innovation Engineering and Program Delivery)

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