

Extreme Weather: Envisioning Ontario Agriculture Under Climate Change

Decision Support Tool Development

Scott Mitchell¹, John Bolte², Sampsa Hamalainen³, Patricia Larkin⁴, Dan MacDonald³, Tonia Tanner¹, Amadou Thiam⁵, Ruth Waldick¹, Anna Zaytseva¹



3



Agriculture and
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Agroalimentaire Canada

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uOttawa

5



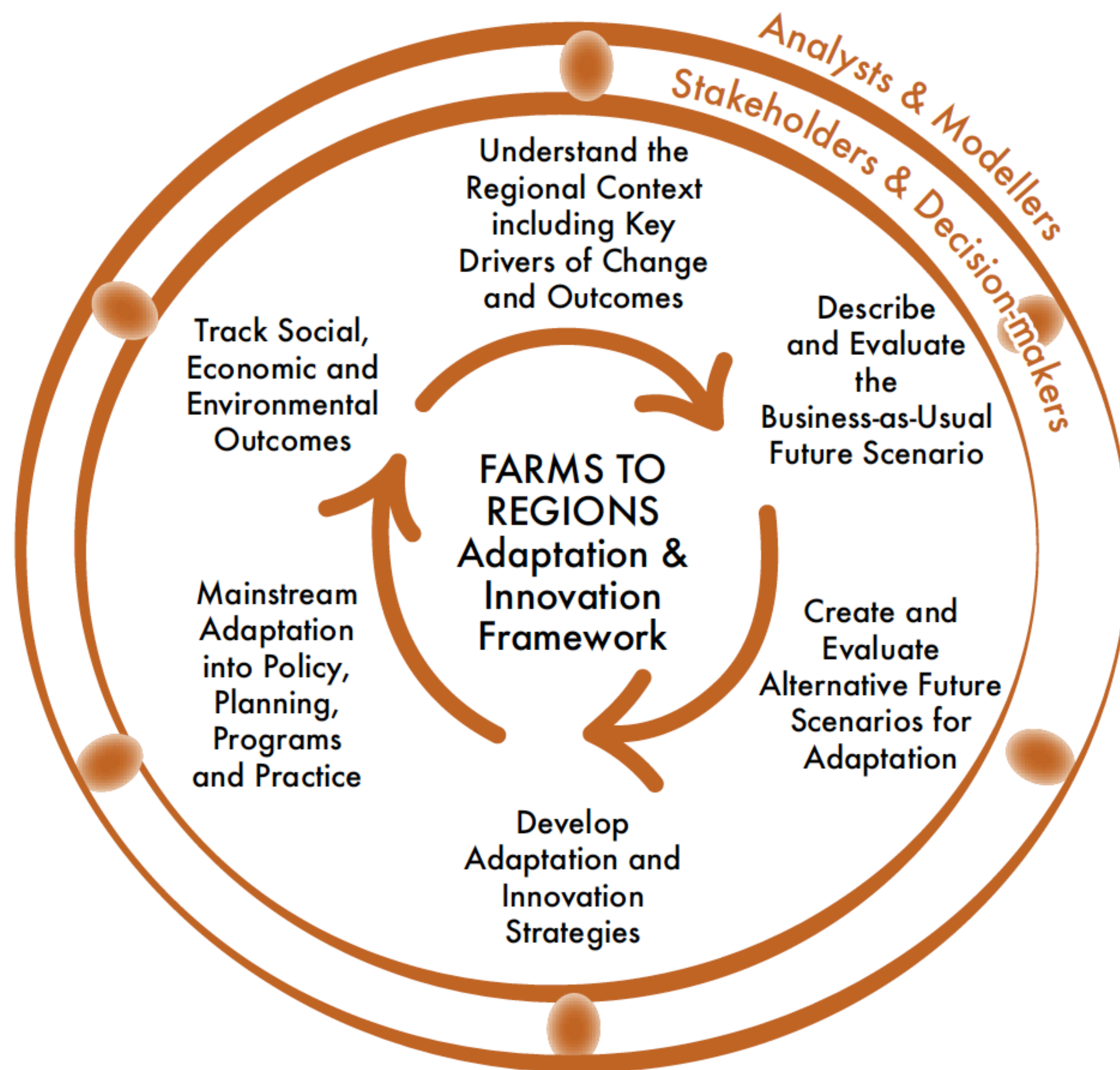
MINISTRY OF AGRICULTURE, FOOD AND RURAL AFFAIRS



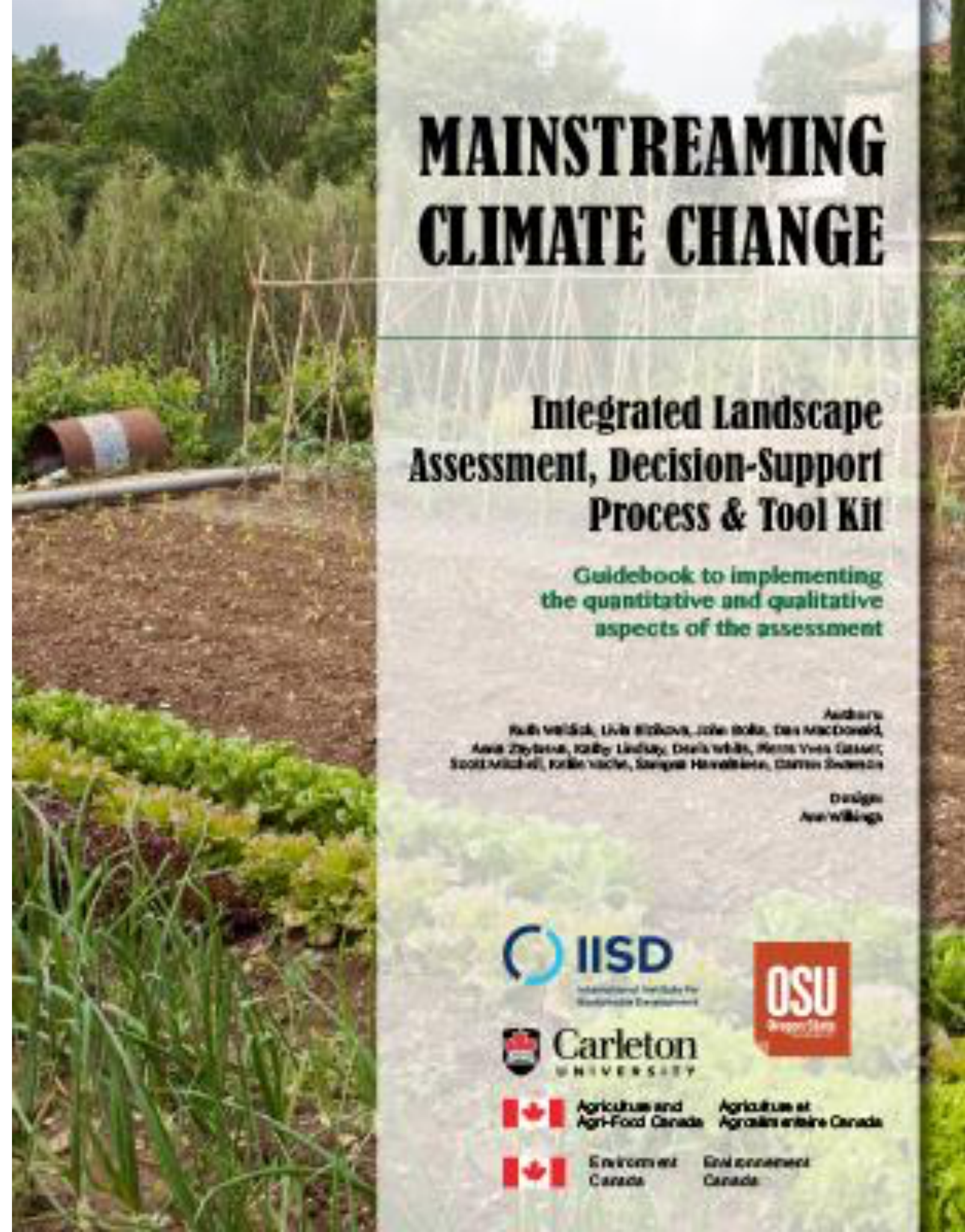
What's this project about?

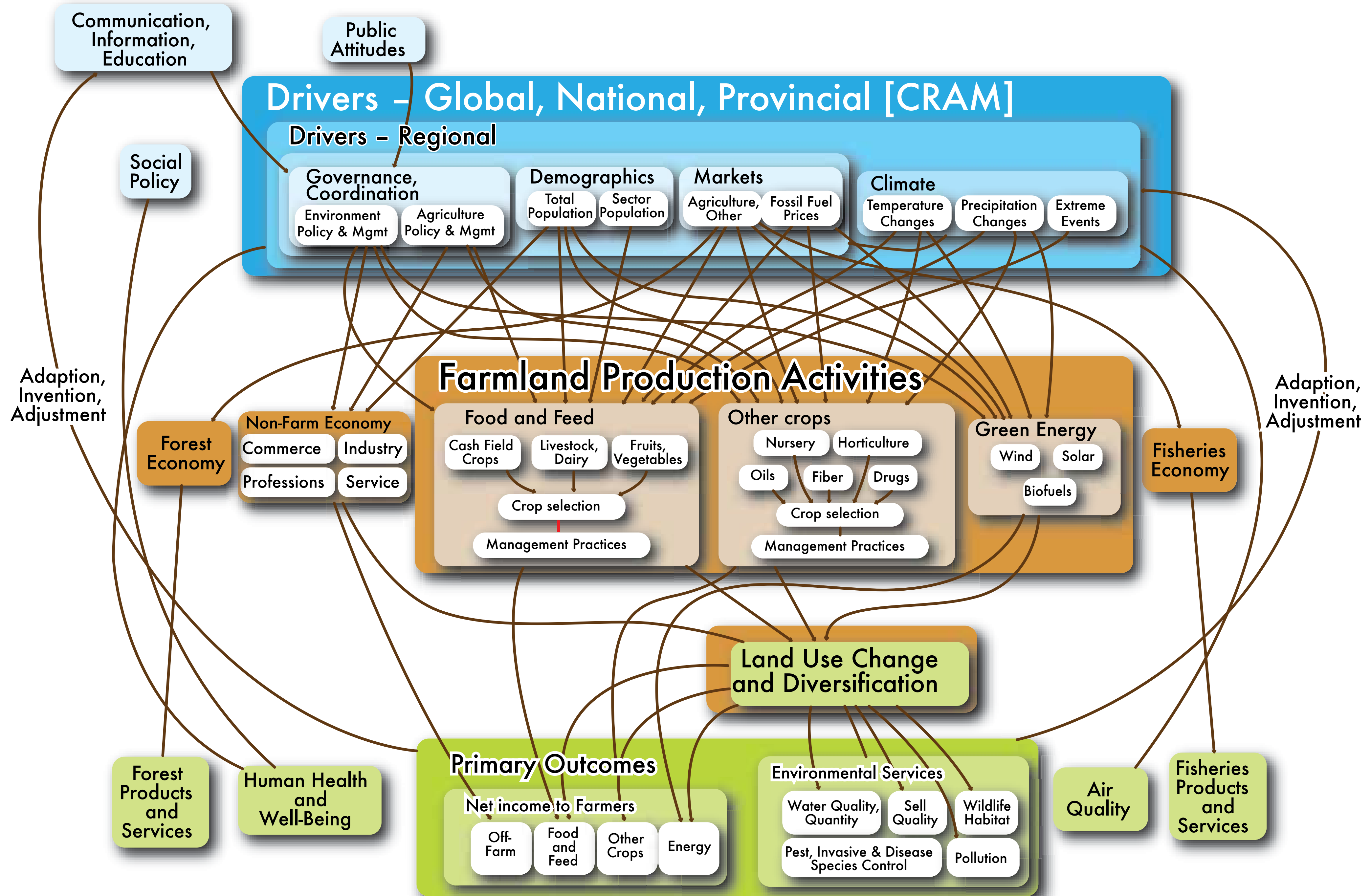
- Farms to Regions (predecessor): concluded 2015
- create and deliver information about current and future climate extremes* that will affect Ontario's agriculture sector and rural communities
 - *what do WE mean by extreme? (weather patterns)
- develop a decision support tool to characterize risk and vulnerabilities associated with climate change and extremes in agriculture, allowing users to plan for and mitigate risks by evaluating different adaptation choices
 - spatial scenario development – impacts on agriculture
 - map-based, field-level mapping; expectations
 - data realities: weather stations (time), GCM resolution
 - how to translate what the weather data and climate models tell us into possible impacts to crops and livestock
- use of seasonal, phenology-linked indices with links to specific crops and operations

Figure 1. Farms to Regions – Adaptation & Innovation Framework

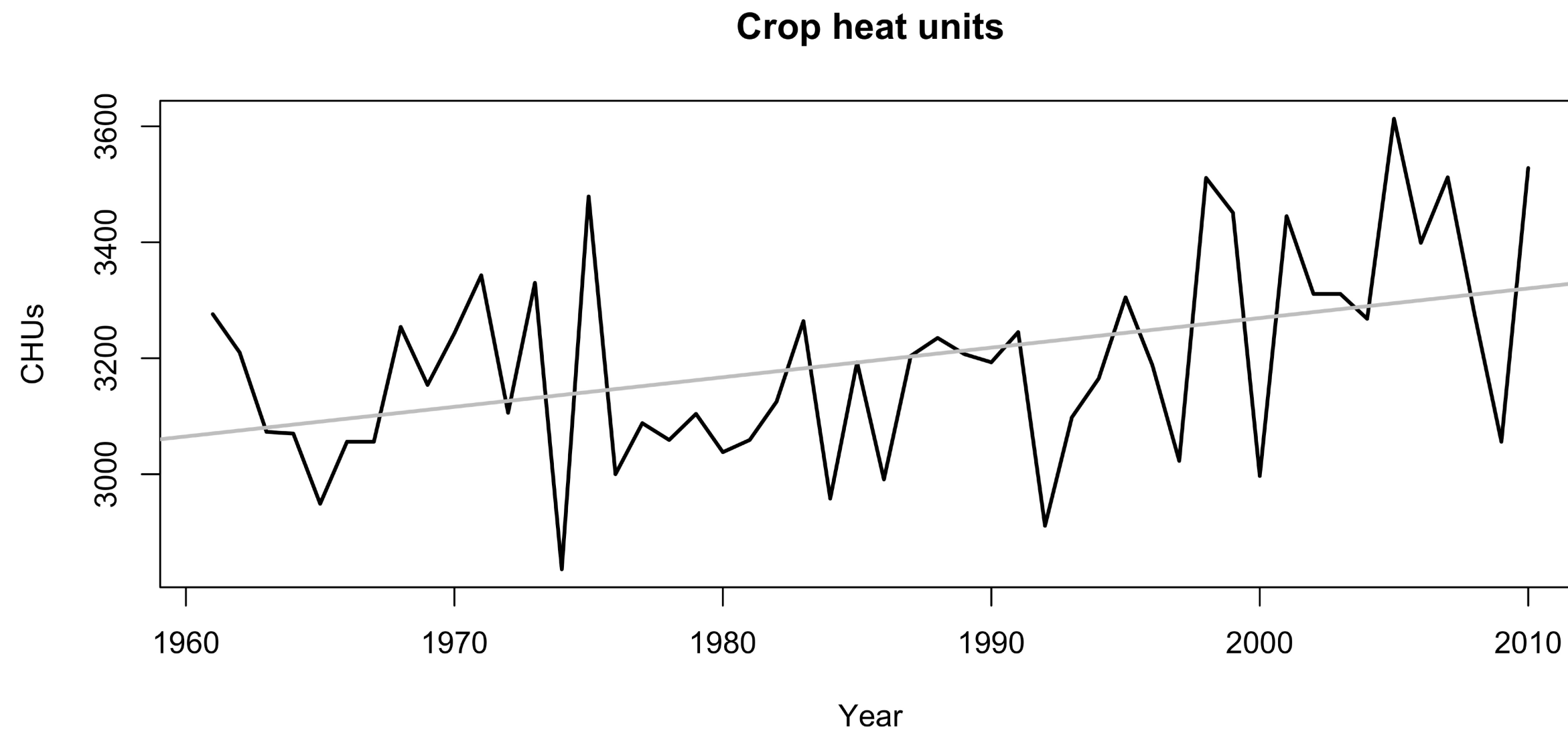
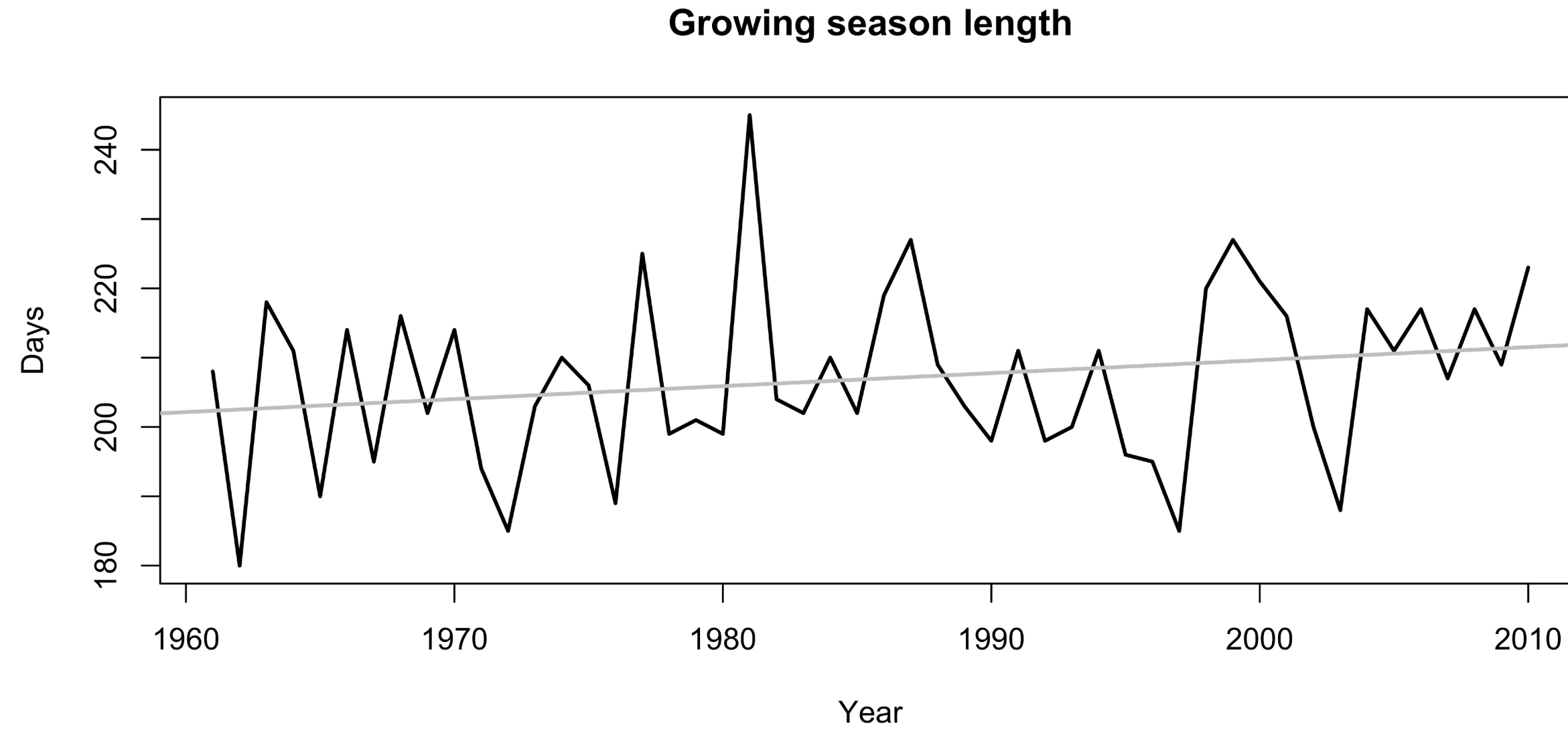


www.carleton.ca/envisionontarioag





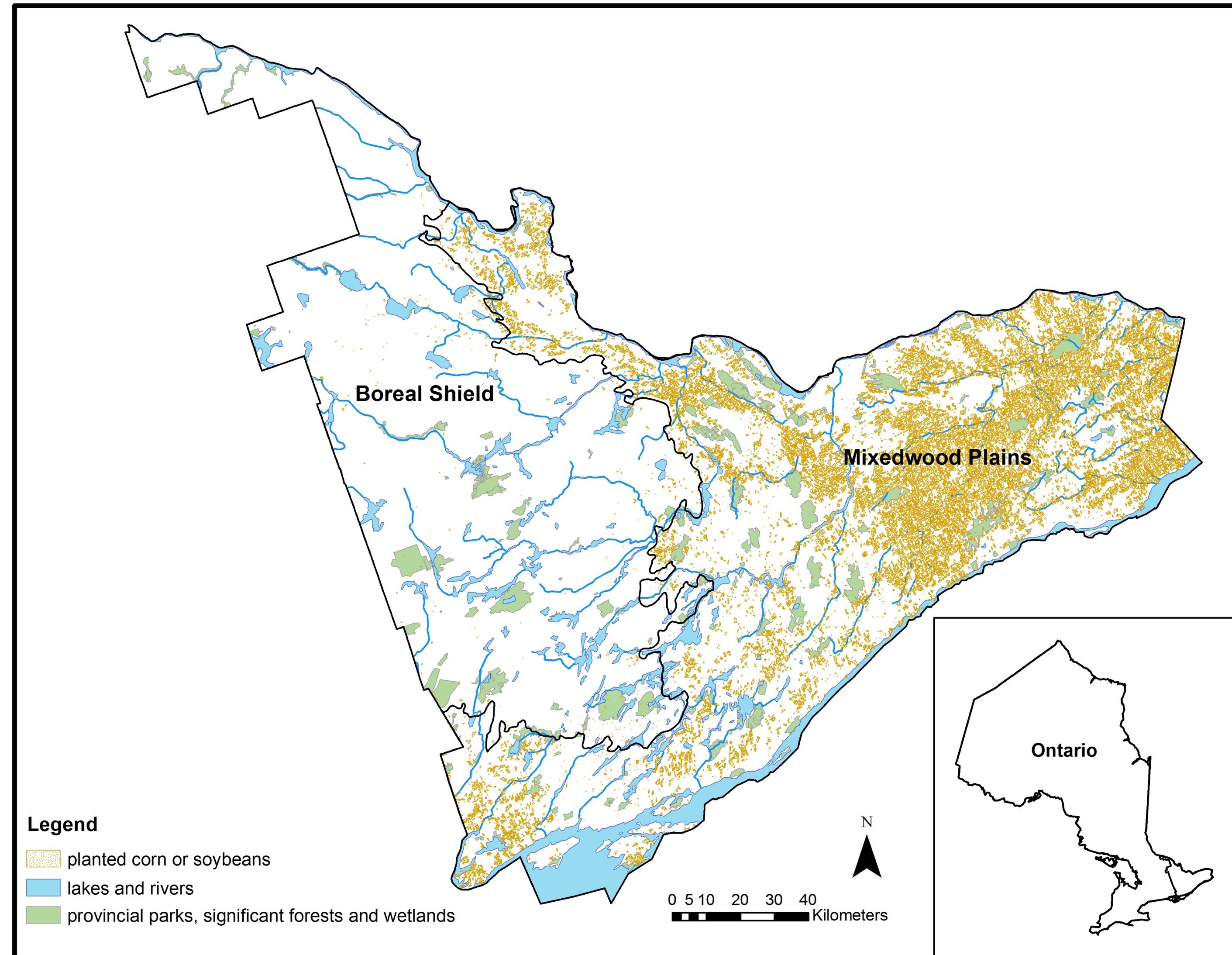
Why extremes? This is NOT the whole story!



Why focus on scenarios & indicators / phenological impacts?

- every climate change model run is a scenario, not a prediction
- those models lack spatial and temporal detail, **but** there is demand for information relevant to locally evaluating levels of risk and potential tradeoffs
- for example, crop modelling typically focuses on yield,
 - usually works best at very local levels; high data needs, assume conditions not changing
 - focusing on **phenological impact** allows us to identify times when crops are particularly vulnerable to climatological events, and assign a typical impact to crop yield; concentrate on relative impacts rather than specific physiological processes

Study area: eastern Ontario



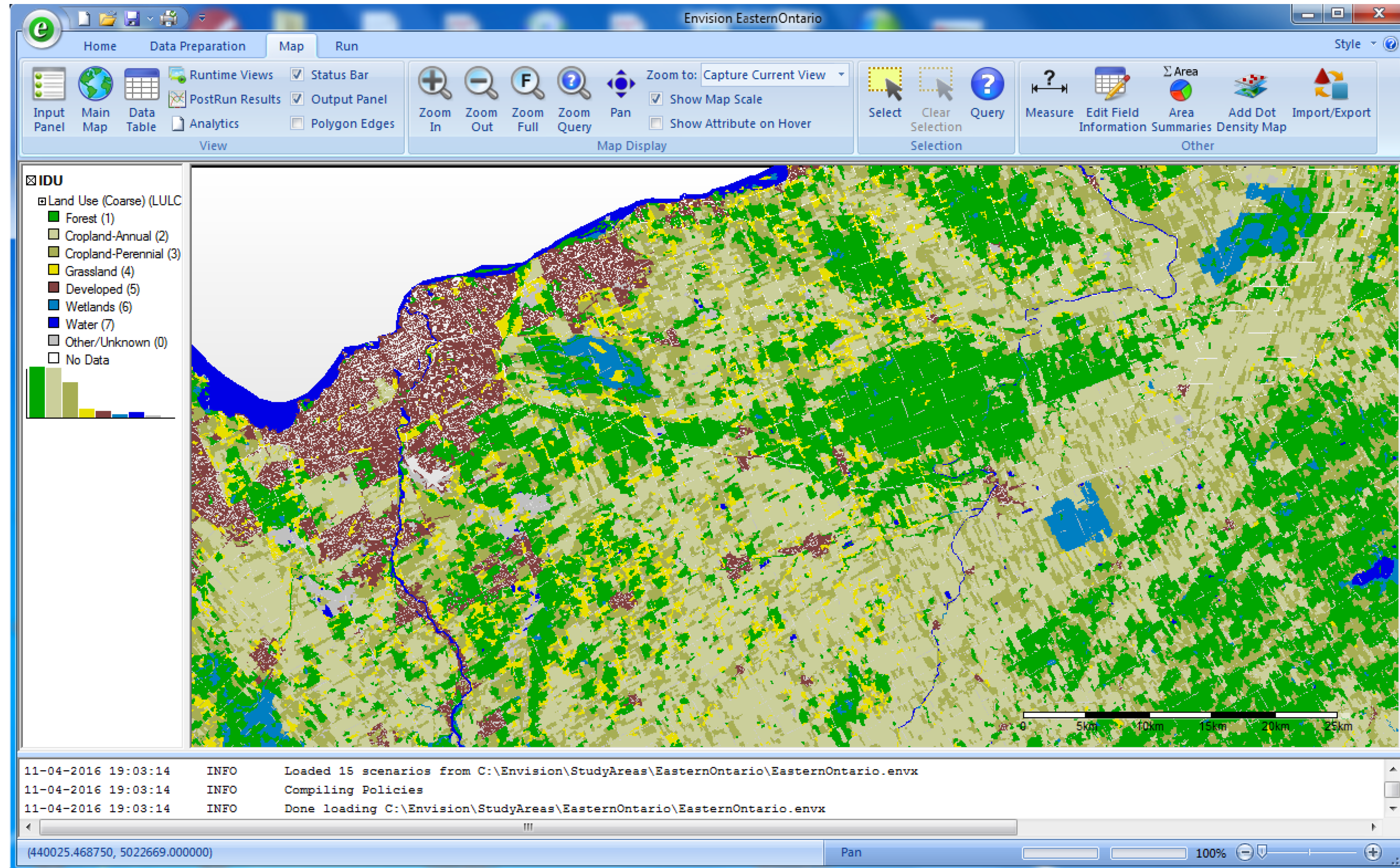
What have we been working on for 3 years?!!

- data needs and shortcomings
 - evaluation, procuring, documenting
- improved farm model (Dan MacDonald)
- creating the database (Sampsa Hamalainen)
- farm types, sizes; trends, evolution (Tonia Tanner)
- crop-specific indicators (Anna Zaytseva)
- (general resilience indicators (Ruth Waldick, Patricia Larkin, Livia Bizikova; see presentation in previous webinar))
- dissemination

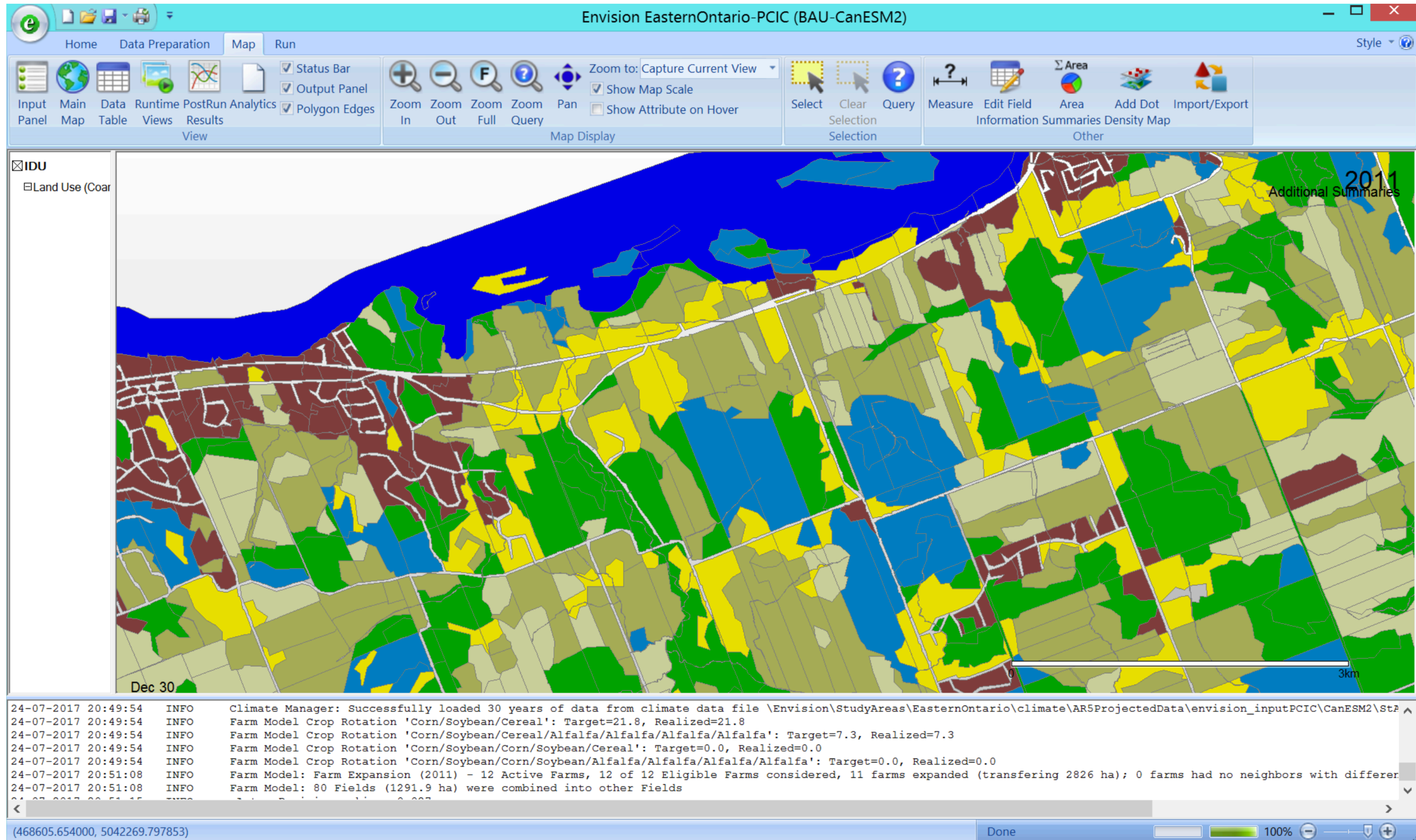
Issues with existing information

- there are problems using limited weather data, or climate model projections, to characterize extreme weather
 - how extremes usually considered? (climate model variability)
 - spatial-temporal resolution of models \neq farm-scale / local level planning
- many “challenges” making sense of existing data, dealing with gaps, figuring out which datasets are relevant to what locations
- after the data (and climate model predictions) are “cleaned up” and assigned to different parts of a study region, how do we make sense of them, and make them relevant to agriculture ?
- DISSEMINATE

Envision (scenario exploration framework)



Integrated Decision Units (IDUs)



DEMO

The screenshot displays the ENVISION software interface. The title bar reads "Untitled - Envision". The ribbon menu includes tabs for Home, Data Preparation, Map, and Run. The Home tab is active, showing various tool icons such as Input Panel, Main Map, Data Table, Runtime Views, PostRun Results, Analytics, Status Bar, Output Panel, Polygon Edges, Paste, Cut, Copy, Copy Map Legend, Edit Project, Edit Policies, Edit Actors, Edit LULC, Edit Scenarios, Set Policy Colors, Edit Field Information, and Analysis Modules. A "Tip of the Day" dialog box is open in the center, titled "Tip of the Day" with a close button (X). The dialog contains a yellow warning icon and the text "Did you know...". Below this, it states: "You can toggle the Output Window by hitting < Ctrl>-0 (The control key and the 'O' key)". At the bottom of the dialog, there is a checked checkbox for "Show tips at startup", navigation arrows, and a "Close" button. The background of the main window shows a landscape image with the text "ENVISION Version 7 Integrated Modeling Platform". Below the image, there are sections for "A framework" and "Analyses". At the bottom of the main window, there is a scale bar from 0 to 60 and a "Mode" dropdown menu.

DEMO

The screenshot displays the ENVISION software interface. The title bar reads "Untitled - Envision". The ribbon menu includes tabs for Home, Data Preparation, Map, and Run. The Home tab is active, showing various tool icons for input, map, data, runtime, post-run, and analytics. A "Tip of the Day" dialog box is open in the center, titled "Tip of the Day" with a close button (X). The dialog contains a yellow warning icon and the text "Did you know...". Below this, it states: "You can toggle the Output Window by hitting < Ctrl>-0 (The control key and the 'O' key)". At the bottom of the dialog, there is a checked checkbox for "Show tips at startup", navigation arrows, and a "Close" button. The background of the main window shows a landscape image with the text "ENVISION Version 7 Integrated Modeling Platform". Below the image, there are sections for "A framework" and "Analyses". At the bottom of the main window, there is a scale bar from 0 to 60 and a "Mode" dropdown menu.

```

EasternOntario.xml  EasternOntario.envx
226 =====
227 -->
228 <farm_model farmID_col="FARMID" lulc_col='LULC_B' rotation_col='ROTATION' farmType_col='FARMTYPE'
229         region_col='REGION_ID' init='1' yrf_threshold='0.5' output_pivot_table='1' track='*'>
230
231 <rotations>
232     <rotation name="Corn/Soybean/Cereal" id="100" sequence="147,158,134"
233     <rotation name="Corn/Soybean/Cereal/Alfalfa/Alfalfa/Alfalfa/Alfalfa" id="101" sequence="147,158,134,12
234     <rotation name="Corn/Soybean/Corn/Soybean/Cereal" id="102" sequence="147,158,147,15
235     <rotation name="Corn/Soybean/Corn/Soybean/Alfalfa/Alfalfa/Alfalfa/Alfalfa" id="103" sequence="147,158,147,15
236 </rotations>
237
238 <!-- note: the following are from FarmTypesLUT.xlsx -->
239 <!-- 'id' is the internal code used for this type (stored in [FARMTYPE] field). See FarmModel.h for values -->
240 <!-- 'code' is a 1-3 character field used to autopopulate the [FarmType] column from the [FT_Extents] field -->
241 <!-- region: 1=ottawa, 2=PR, 3=SDG -->
242 <!-- expand_types: farm types that this farm types can expand into -->
243 <farm_types>
244     <farm_type id='0' code='' name='Unknown' rotations='' />
245     <farm_type id='1' code='CCF' name='Cow calf and fld crop' rotations='101,103' />
246     <farm_type id='2' code='CCO' name='Cow Calf Only' rotations='' expand_regions='3' ex
247     <farm_type id='3' code='DYO' name='Dairy Only' rotations='' />
248     <farm_type id='4' code='DFC' name='Dairy and Fld crop' rotations='101,103' expand_regions='1,2,3' ex
249     <farm_type id='5' code='DYH' name='Dairy and hay' rotations='' expand_regions='1,2' />

```


The “rich” data

- Attribute tables
- Model outputs
- Custom scripting to extract information

Status Bar
 Output Panel
 Polygon Edges

Zoom In Zoom Out Zoom Full Zoom Query Pan
 Zoom to: Capture Current View
 Show Map Scale
 Show Attribute on Hover

Select Clear Selection Query
 Measure Edit Field Information Area Add Dot Import/Export
 Summaries Density Map Other

Data Sources: IDU Start Editing Find Query Refresh Save Save As..

Id	BUFF_DIST	OBJECTID	LAND_PARCE	DESCR	SUT_NUMBER	GEOG_TWP	CONCESSION	LOT_IDENT	CAD_ID	ID_1	GRIDCODE	AGLC_ID	LC_CLASS	ORIG_FID_1	FID_SOLRIS	CCS_ID	SLC_ID	County_ID	POLY_ID	HECTARES	SL	di_d	di_dw	c
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1	0.000000	0.000000			0.000000				0	364304.00000	80.000000	364304.00000	Wetland	0	-1	3506008.0000	544011	Ottawa	OND40107278	1254	40107278	-	100.000000	1.000000
2	0.000000	0.000000			0.000000				0	364304.00000	80.000000	364304.00000	Wetland	0	-1	3506008.0000	544011	Ottawa	OND40107278	1254	40107278	-	100.000000	1.000000
3	0.000000	0.000000			0.000000				0	364304.00000	80.000000	364304.00000	Wetland	0	-1	3506008.0000	544011	Ottawa	OND40107278	1254	40107278	-	100.000000	1.000000
4	0.000000	0.000000			0.000000				0	369771.00000	20.000000	369771.00000	Water	2	-1	3506008.0000	547002		OND40107278	1254	40107278	-	100.000000	1.000000
5	0.000000	0.000000			0.000000				0	370962.00000	80.000000	370962.00000	Wetland	5	-1	3506008.0000	544011	Ottawa	OND40107278	1254	40107278	-	100.000000	1.000000
6	0.000000	0.000000			0.000000				0	371231.00000	80.000000	371231.00000	Wetland	6	-1	3506008.0000	547002	Ottawa	OND40107122	15	40107122	7	100.000000	1.000000
7	0.000000	0.000000			0.000000				0	371231.00000	80.000000	371231.00000	Wetland	6	-1	3506008.0000	547002	Ottawa	OND40107122	15	40107122	7	100.000000	1.000000
8	0.000000	0.000000			0.000000				0	372634.00000	30.000000	372634.00000	Barren	9	-1	3506008.0000	544012		OND40107278	1254	40107278	-	100.000000	1.000000
9	0.000000	0.000000			0.000000				0	373516.00000	230.000000	373516.00000	Mixedwood	10	-1	3506008.0000	547010	Ottawa	OND40107114	9	40107114	6	70.000000	1.000000
10	0.000000	0.000000			0.000000				0	373524.00000	220.000000	373524.00000	Broadleaf	11	-1	3506008.0000	547002	Ottawa	OND40107130	7	40107130	3	70.000000	1.000000
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26	0.000000	0.000000			0.000000				0	385143.00000	230.000000	385143.00000	Mixedwood	25	-1	3506008.0000	547010	Ottawa	OND40107131	78	40107131	3	100.000000	2.000000
27	0.000000	0.000000			0.000000				0	385143.00000	230.000000	385143.00000	Mixedwood	26	-1	3506008.0000	547010	Ottawa	OND40107244	433	40107244	7	100.000000	1.000000
28	0.000000	0.000000			0.000000				0	391691.00000	220.000000	391691.00000	Broadleaf	29	-1	3506008.0000	545006	Ottawa	OND40107133	239	40107133	2	100.000000	1.000000
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34	0.000000	0.000000			0.000000				0	393422.00000	50.000000	393422.00000	Shrubland	33	-1	3501030.0000	544003	SDG	OND40309197	844	40309197	3	100.000000	1.000000
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- Quick access
- Desktop
- Downloads
- Documents
- Pictures
- iCloud
- 2017-2018
- EasternOntario
- src
- working
- OneDrive - Carleton U
- This PC
- Network

The “rich” data

- Attribute tables
- Model outputs
- Custom scripting to extract information



Welcome to

Climate Change Extremes & Ontario Agriculture

[ABOUT](#)

[NEWS](#)

[CONTACT](#)

“Scenario-based risk assessment decision support modelling tools for regional climate change and climate extremes, impacts and adaptation in agricultural watersheds” is a project funded by the Ontario Ministry of Agriculture, Food, and Rural Affairs’ New Directions Research Program. One of our main objectives is to provide a clearing-house for information and resources that are useful for evaluating climate change in Ontario, starting with our pilot program in eastern Ontario.

Agenda

Time	Agenda Item
10:00 – 10:15	Welcome and introductions <ul style="list-style-type: none">▪ Project history, overview and objectives (Scott Mitchell, Carleton University)
10:15 – 12:00	Session 1: Envision modeling platform: overview and technical requirements <ul style="list-style-type: none">▪ Presentation (Scott Mitchell, Carleton University)▪ Presentation (Sampsa Hamalainen, AAFC)▪ Presentation (Dan Macdonald, AAFC)▪ Model run demonstrations
12:00 – 13:00	Lunch break
13:00 – 14:00	Session 2: Development of eastern Ontario farm model: farm dynamics and crop-specific extreme events <ul style="list-style-type: none">▪ Presentation (Tonia Tanner, Carleton University)▪ Presentation (Anna Zaytseva, Carleton University)▪ Model run demonstrations
14:00 – 14:30	Session 3: Future directions <ul style="list-style-type: none">▪ Future and potential partnerships▪ Closing remarks