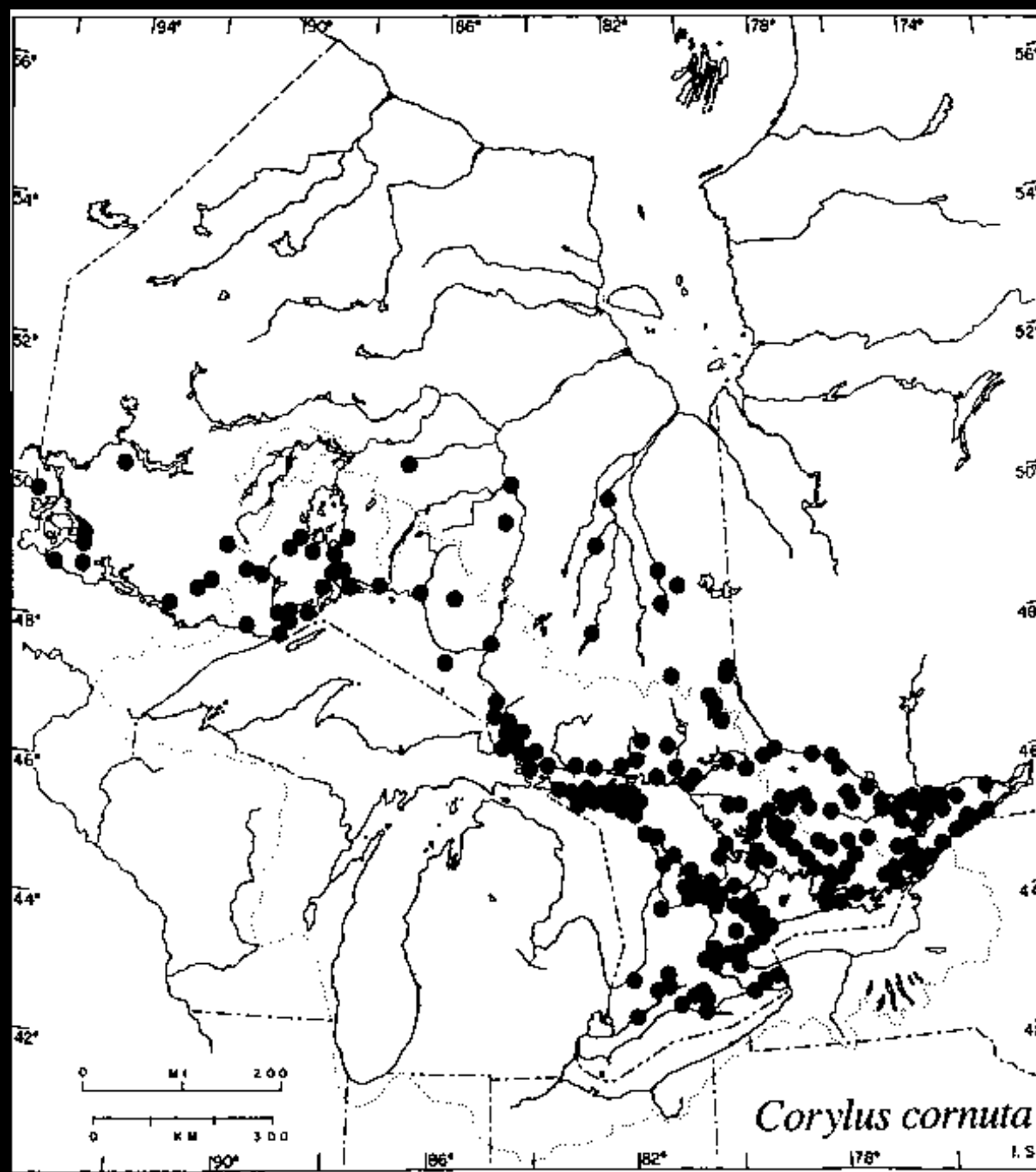# Suitability Mapping

Adam Dale, Wanhong Yang,

University of Guelph,

Richard Worsfold,

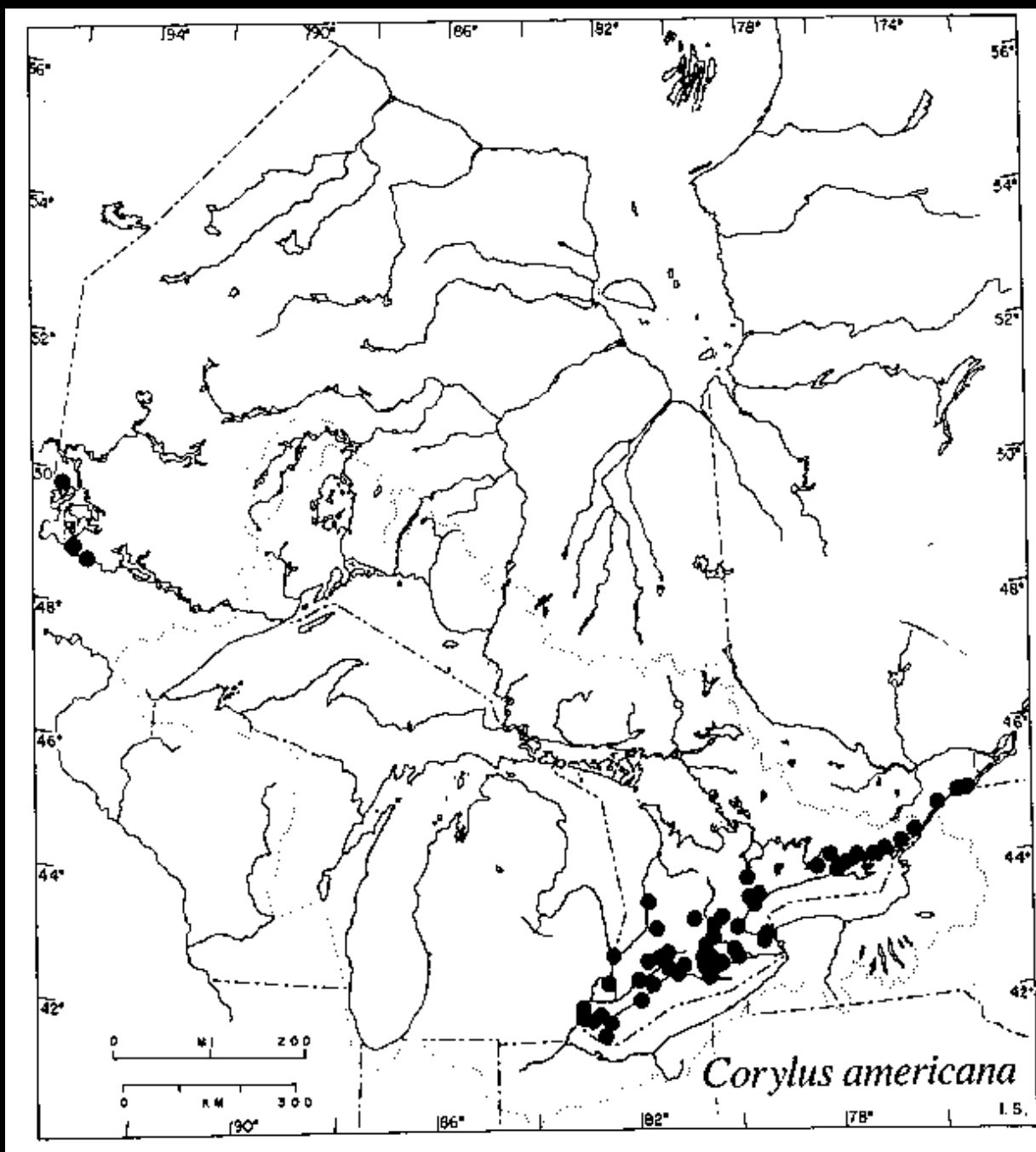Ontario Centres of Excellence

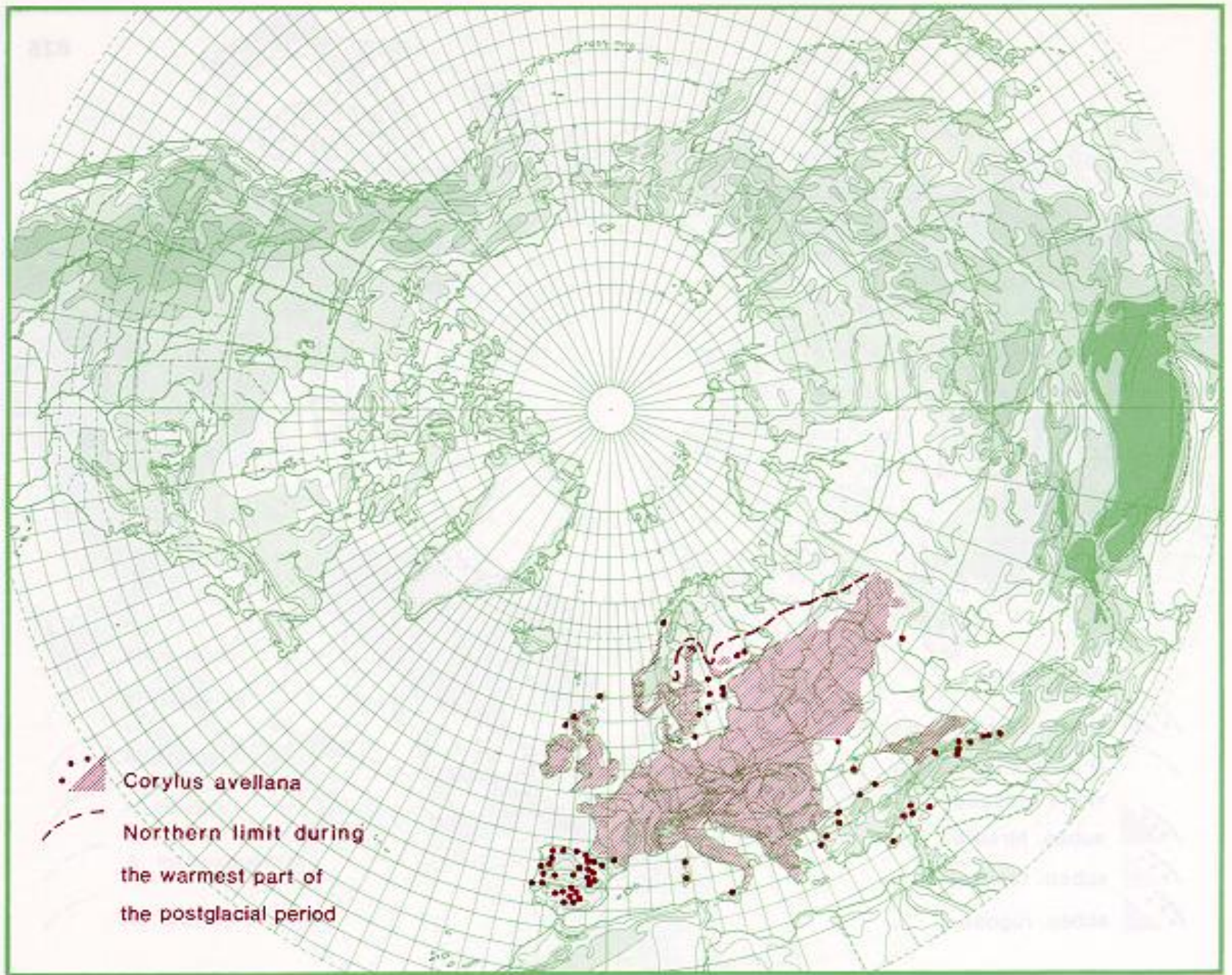# Aim

- To develop maps that show the areas within Ontario where it is suitable to grow hazelnuts
- Three types
  - Climate
  - Soils
  - Topography

- Natural distribution of species
- Initial suitability map
  - Generalized
- Climatic maps
  - -40°C
  - 0.5km resolution

- Natural distribution of species
- Initial suitability map
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Corylus cornuta

Corylus americana

Corylus avellana

Northern limit during
the warmest part of
the postglacial period

Corylus avellana
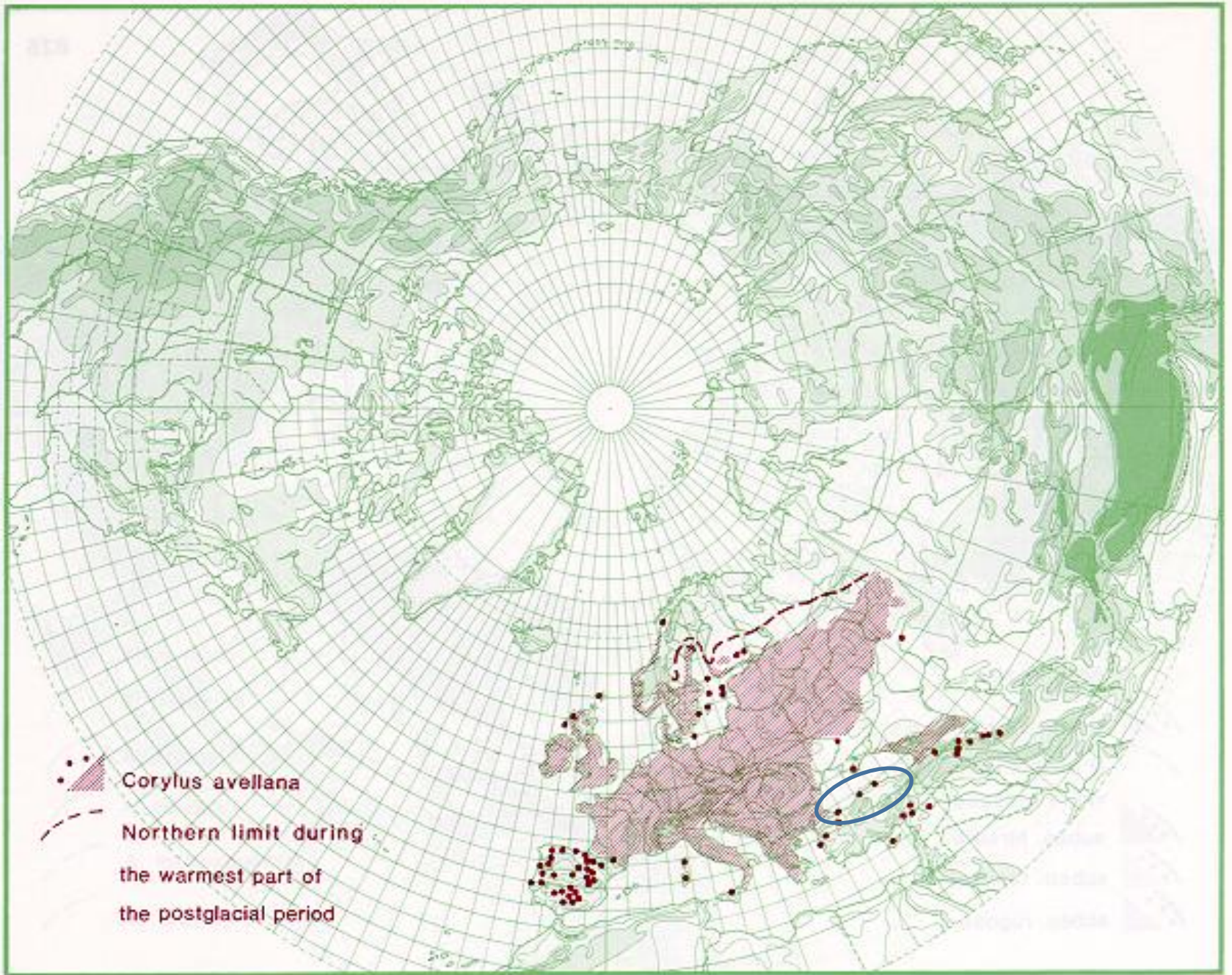
Northern limit during
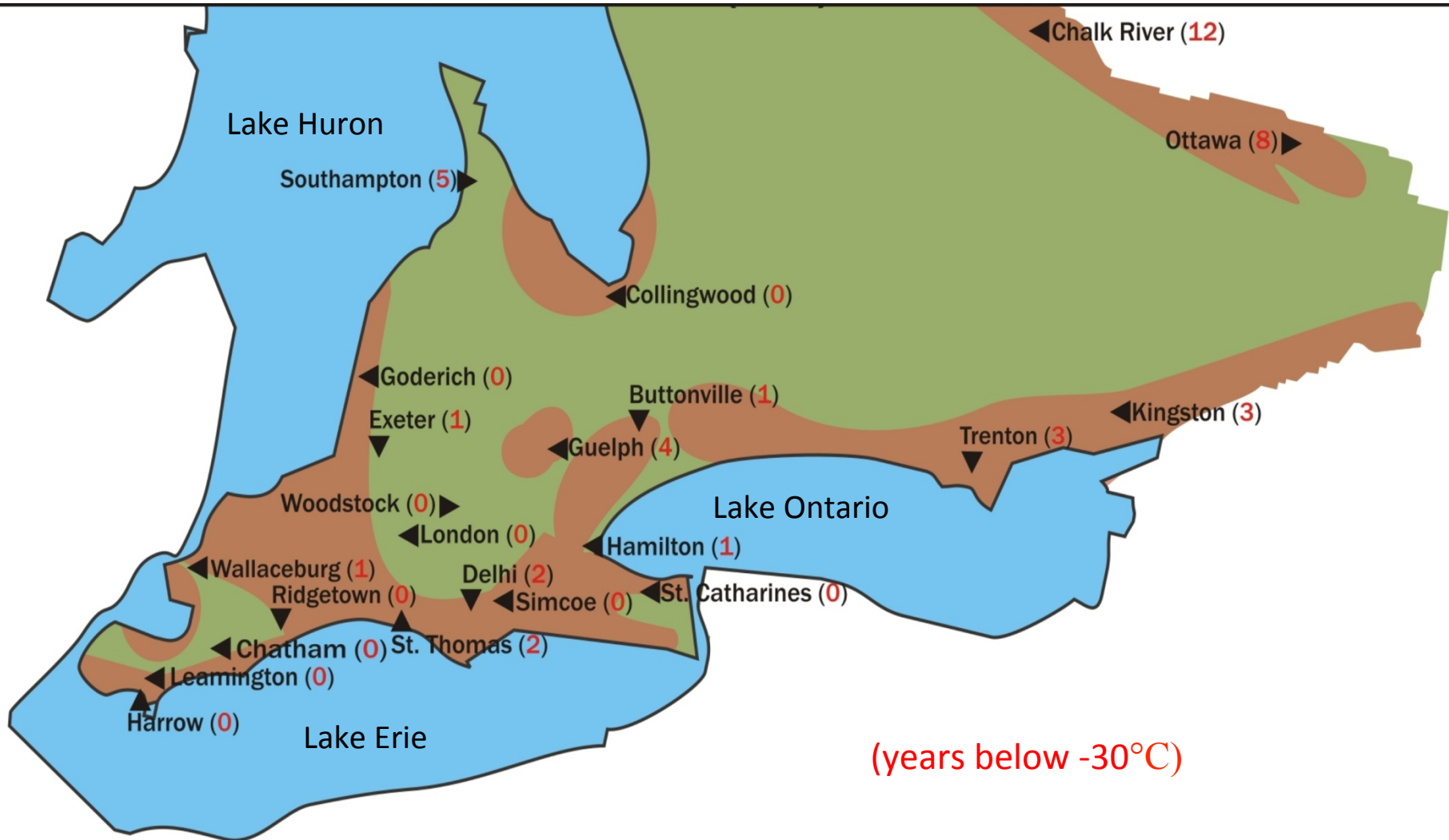the warmest part of
the postglacial period

- Natural distribution of species
- Initial suitability map
  - Generalized
- Climatic maps
  - -40°C
  - 0.5km resolution

Initial Suitability Map

- Temperature
  - Never below -40°C
  - Never Below -30°C
- Soil
  - No heavy clay

South Ontario (1990-2010)

Lake Huron

Chalk River (12)

Ottawa (8)

Southampton (5)

Collingwood (0)

Goderich (0)

Buttonville (1)

Kingston (3)

Exeter (1)

Guelph (4)

Trenton (3)

Woodstock (0)

Lake Ontario

London (0)

Hamilton (1)

Wallaceburg (1)

Delhi (2)

Ridgetown (0)

Simcoe (0)

St. Catharines (0)

Chatham (0) St. Thomas (2)

Leamington (0)

Harrow (0)

Lake Erie

(years below -30°C)

Artwork: Dr J. Deveau, OMAFRA

North Ontario (1990- 2010)

Dryden

◄Fort Frances (**12** , **8**)

Port Arthur
(13)
Lake Superior

Cochrane►
(**4** , **11**)

(years below -40°C)

(years below -30°C)

New Liskeard (**1**,**14**)
◄Sault Ste. Marie
(**10**)
◄Sudbury
(**13**)

Lake Michigan

Lake
Huron

Artwork: Dr J. Deveau, OMAFRA

Legend

⊠⊠⊠	1	Essex-Kent -- apples, peaches, cherries, berries, pears, grapes
∿∿∿	2	Huron-Erie -- apples, pears, strawberries, peaches, cherries
⫽⫽⫽	3	Norfolk-Brant -- apples, pears, cherries, strawberries
⫽⫽⫽	4	Niagara -- peaches, cherries, grapes, apples, pears, strawberries
☰☰☰	5	Peel-Halton & York-Durham -- apples, pears, strawberries, raspberries
▦▦▦	6	Quinte -- apples, strawberries, raspberries
⁝⁝⁝	7	Ottawa Valley & St. Lawrence -- apples, strawberries, raspberries
▲▲▲	8	Georgian Bay -- apples
▨▨▨	9	Northwestern Ontario -- strawberries, raspberries

Québec

Lake Huron

Ontario

Greater Toronto Area

Lake Ontario

Hudson Bay

U.S.A.

Lake Erie

Major Fruit Producing Areas of Ontario

- Natural distribution of species
- Initial suitability map
  - Generalized
- Climatic maps
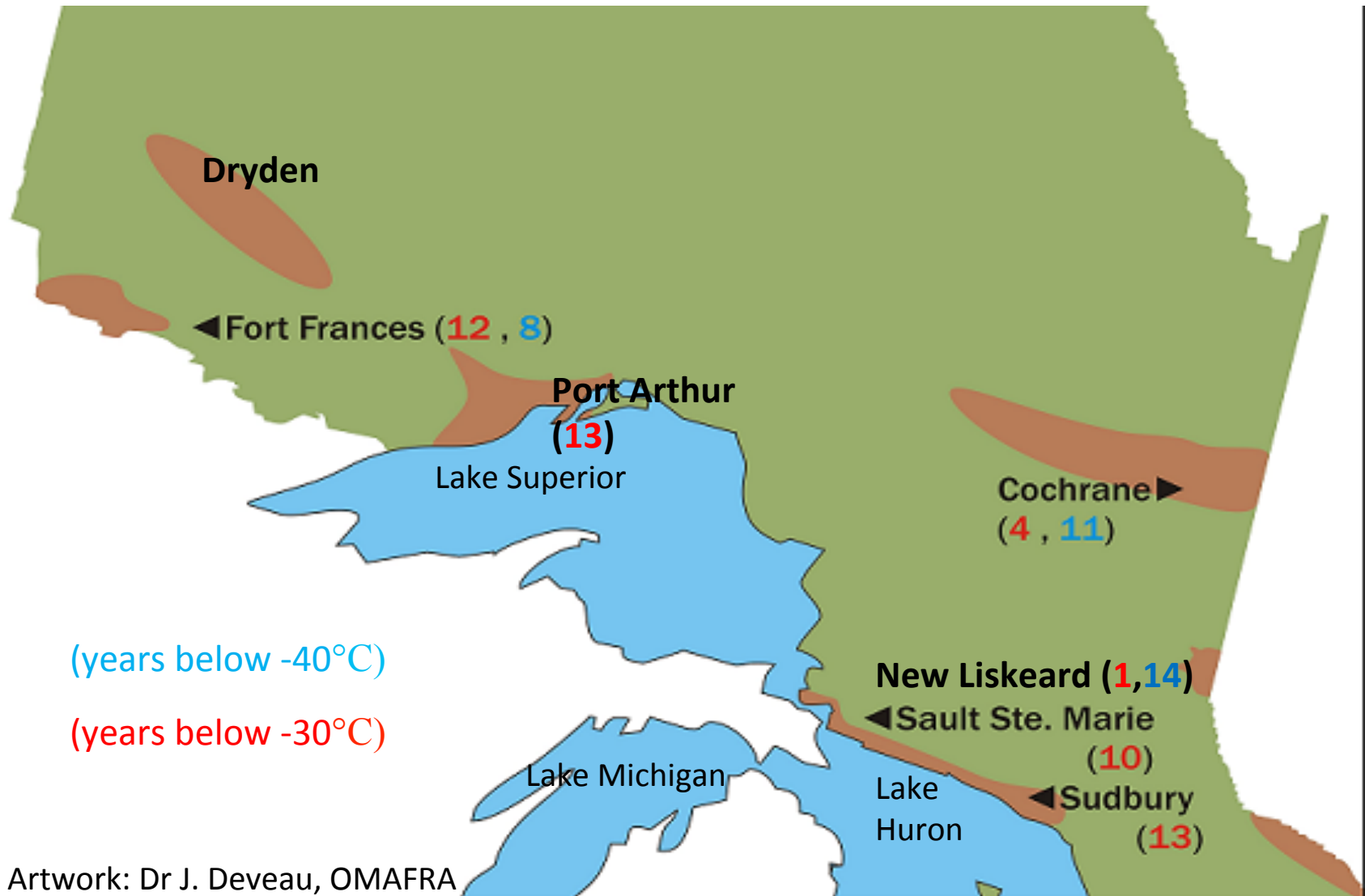 - -40°C
  - 0.5km resolution

# Hazelnut Suitability Criteria

- **Key Criteria**
  - Used Environment Canada data for all Ontario weather stations for 2000-2014
  - No occurrence of temperature at **-28°C** or below
  - No occurrence of spring frost (minimum daily temperature below **-7°C**) weekly from March 1 to May 2
  - No occurrence of spring frost (minimum daily temperature below **-2°C**) weekly from March 1 to May 2
- **Additional criteria**
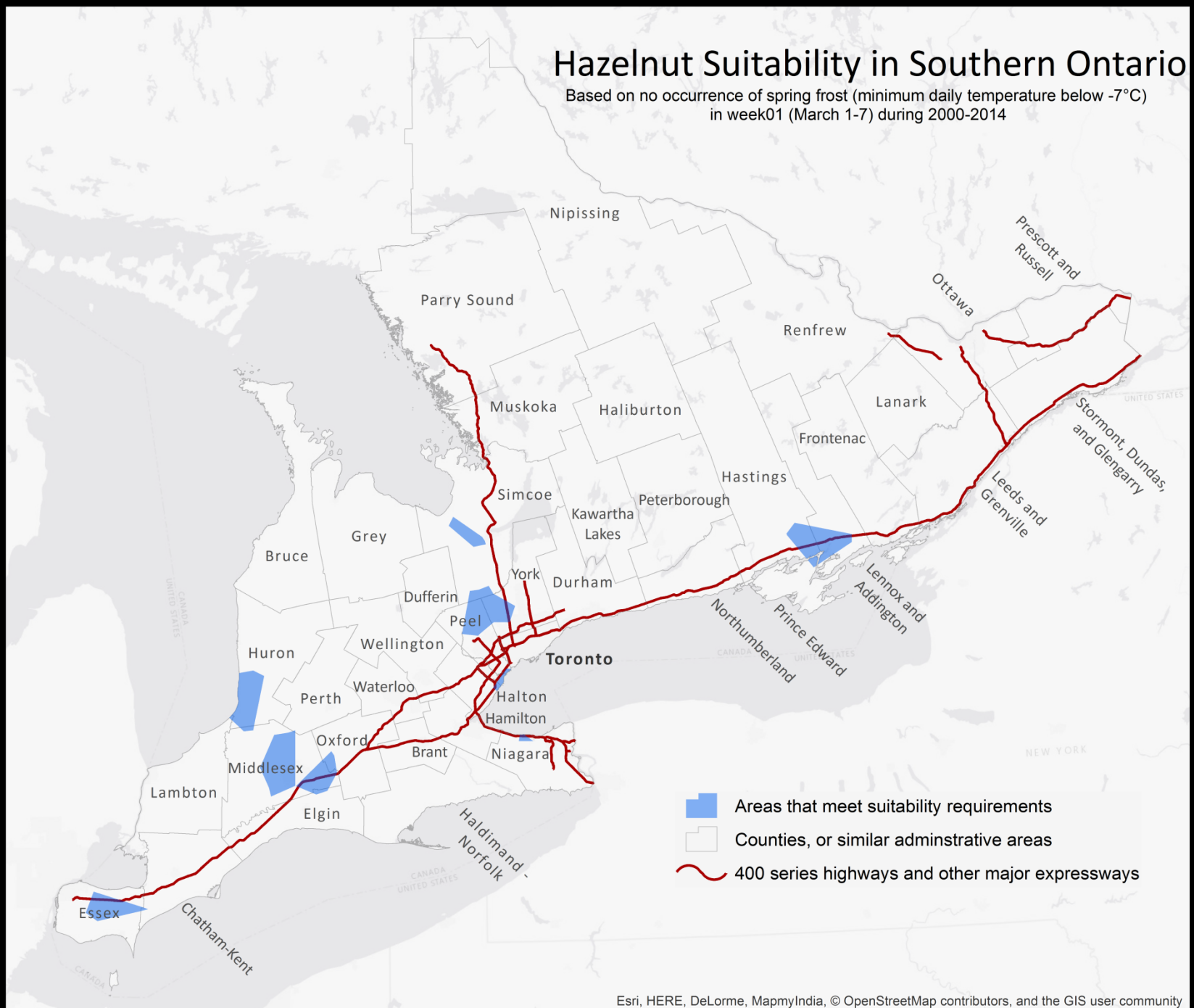 - Average temperature for growing season >16.7°C during 2000-2014
  - Frost-free period >120 days or >150 days during 2000-2014
  - No occurrence of temperature at -40°C or below during 2000-2014
  - soil sand content > 50% or > 60%
  - soil pH 5.5 to 7.5

Hazelnut Suitability in Southern Ontario

Based on no occurrence of temperature at -28°C or below during 2000-2014

Legend:
- Areas that meet suitability requirements
- Counties, or similar adminstrative areas
- 400 series highways and other major expressways

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Hazelnut Suitability in Southern Ontario

Based on no occurrence of spring frost (minimum daily temperature below -7°C)
in week01 (March 1-7) during 2000-2014

Nipissing

Prescott and Russell

Parry Sound

Ottawa

Renfrew

Muskoka   Haliburton

Lanark

Frontenac

Stormont, Dundas, and Glengarry

Simcoe

Hastings

Leeds and Grenville

Grey

Kawartha Lakes   Peterborough

Bruce

York   Durham

Lennox and Addington

Dufferin

Northumberland   Prince Edward

Peel

Wellington

Huron

Toronto

Perth   Waterloo

Halton
Hamilton

Oxford

Middlesex   Brant

Niagara

Lambton

Elgin

Haldimand - Norfolk

Essex   Chatham-Kent

NEW YORK

Areas that meet suitability requirements

Counties, or similar adminstrative areas

400 series highways and other major expressways

Esri, HERE, DeLorme, MapmyIndia, © OpenStreetMap contributors, and the GIS user community
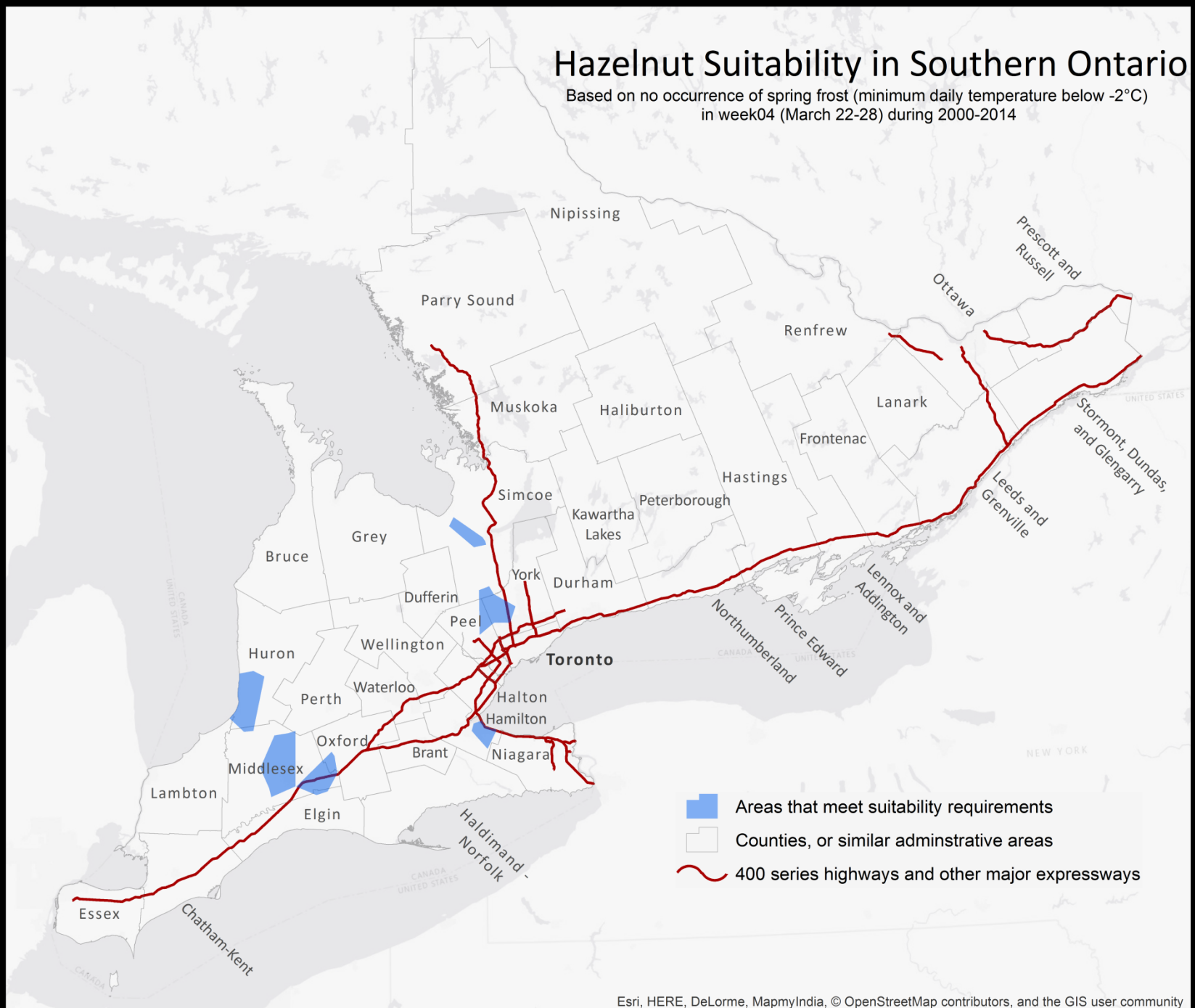
Hazelnut Suitability in Southern Ontario

Based on no occurrence of spring frost (minimum daily temperature below -2°C)
in week04 (March 22-28) during 2000-2014

Legend:
- Areas that meet suitability requirements
- Counties, or similar adminstrative areas
- 400 series highways and other major expressways

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Future progress

- Determine the dates female flowers, male flowers open and vegetative buds open

- No occurrence of daily temperature below -7°C from last week of March to first week of May during 2000-2014.

- No occurrence of daily temperature below -2°C) from second week of May to first week of June during 2000-2014.

- Probability of occurrence around -28, -7 and -7°C

- Web based