Appendices

Current and Future Opportunities for Agricultural Development in Northeast Ontario: A Regional Development Perspective

Table of Contents

Appendix 1: Community Profile

The NeCN Agriculture Study was undertaken within the Northeast Community Network (NeCN) catchment area. This area contains 12 municipalities along the Highway 11 corridor as well as 2 First Nations Groups and 3 Community Futures Development Corporations. The following list presents these member groups:

1. Constance Lake First Nation
2. Municipality of Mattice-Val Côté
3. Town of Hearst
4. Township of Opasatika
5. Municipality of Val Rita-Harty
6. Town of Kapuskasing
7. Municipality of Moonbeam
8. Township of Fauquier-Strickland
9. Town of Smooth Rock Falls
10. Town of Cochrane
11. Town of Iroquois Falls
12. Township of Black River-Matheson
13. City of Timmins
14. Nord-Aski R.E.D.C. CFDC
15. North Claybelt CFDC
16. Venture Centre CFDC
17. Wahgoshig First Nation

The following community profile will attempt to amalgamate the socio-economic information for the 12 municipalities and Constance Lake First Nation[1] using Census of Canada data from 2006.

General Characteristics

As of 2006, the NeCN catchment area contained a population of 75,993, representing a decline of 4 per cent from 79,212 in 2001. The area covers 8046 square kilometres and thereby holds a population density of 9.4 persons per km. Within the area it is found that considerable variation exists in population size, area covered, and population density as presented in the following table sorted by population.

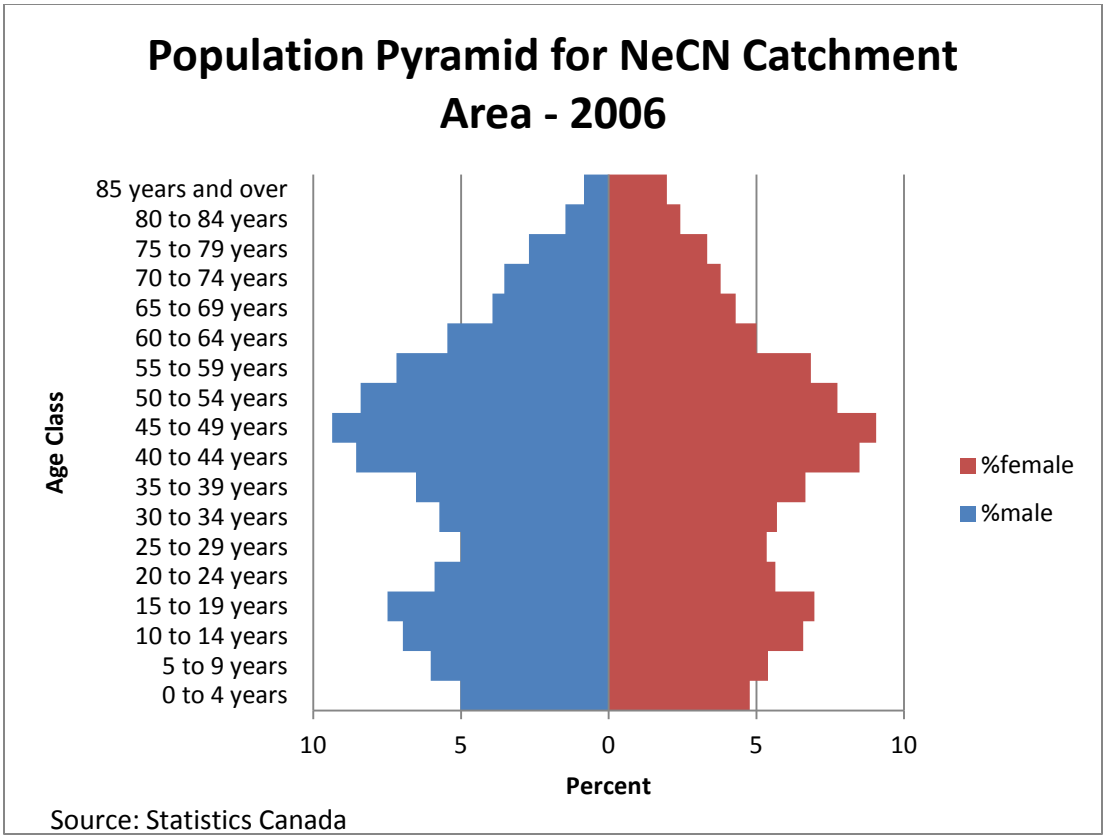
[1] Census Data was not available for Wahgoshig First Nation at the time of compilation

	Population in 2006	Proportion of total NeCN Population	Land area (square km)
NeCN Catchment Area	75993	100.0%	8046.0528
City of Timmins	42997	56.6%	2961.5782
Town of Kapuskasing	8509	11.2%	83.9842
Town of Hearst	5620	7.4%	98.666
Town of Cochrane	5487	7.2%	538.7636
Town of Iroquois Falls	4729	6.2%	599.4293
Township of Black River-Matheson	2619	3.4%	1161.6661
Town of Smooth Rock Falls	1473	1.9%	199.7903
Municipality of Moonbeam	1298	1.7%	235.1724
Municipality of Val Rita-Harty	939	1.2%	382.6434
Municipality of Mattice-Val Côté	772	1.0%	414.6369
Constance Lake First Nation	702	0.9%	26.2014
Township of Fauquier-Strickland	568	0.7%	1013.5379
Township of Opasatika	280	0.4%	329.9831
Source: Statcan. (2011)			

These characteristics can also be compared to the Cochrane District Census Division in which it is found. In comparison, it is found that the NeCN catchment area contains most of Cochrane District's 82,503 residents however very little of its vast area of 141,247.30 square kilometres.

Age Characteristics

Much like other parts of rural and Northern Ontario, the NeCN catchment area has a high proportion of older adults. We can observe this in the following population pyramid where there is limited youth, and then a particular decline in the prime working age population of 20-40 year olds. We also find that the largest proportion of residents fall within the 'Baby 'Boomer' 40 to 60 year age cohort.

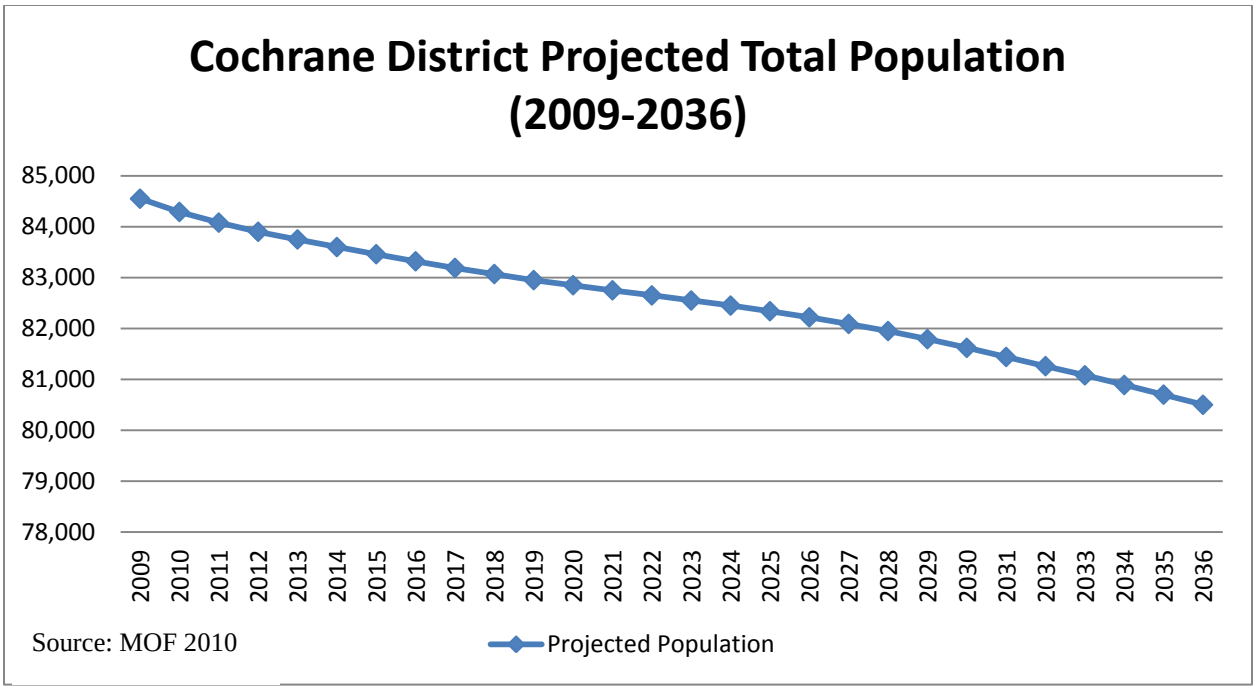


Source: Statistics Canada

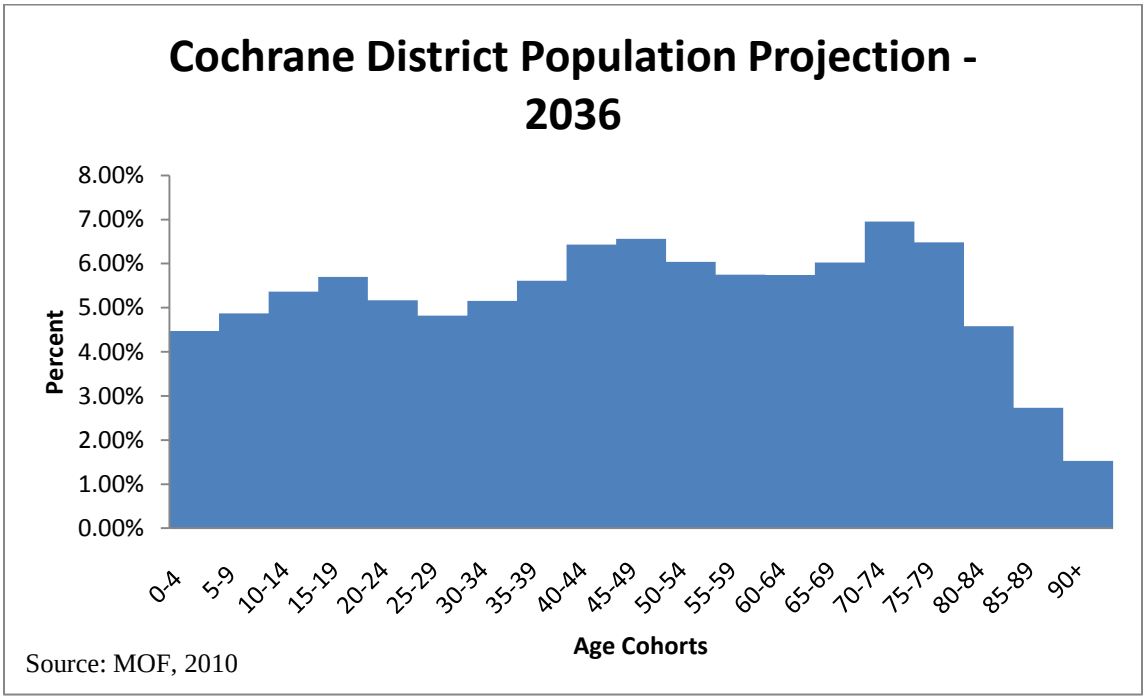
Population/Age Projections

The Ontario Ministry of Finance prepares population projections for Ontario with current data projected out to 2036. This data is provided only at the Census Division level and therefore we cannot amalgamate the projections for the NeCN catchment area. Nevertheless, given the large proportion of the population of Cochrane District located in this area we can presume that the population of the NeCN catchment area will follow a similar trend.

In terms of total population, it is projected that the population of Cochrane District will decline into the future. Ministry of Finance projections indicate an expectation that the population will have increased to 84,550 in 2009 but will steadily decline to below 2006 levels by 2036.

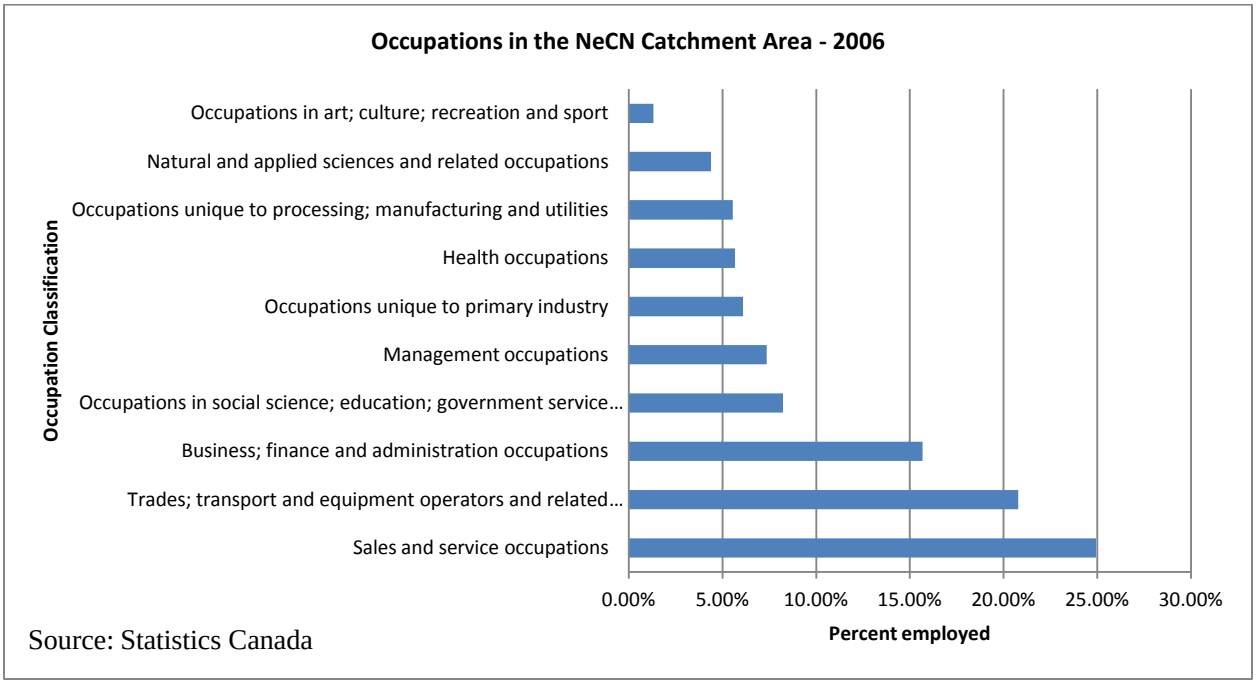


In terms of age distribution, it is projected that the population pyramid will 'fill out' by 2036 with a less clear indent in the younger cohorts. However, this will be parallel with a considerable increase in the eldest cohorts.



Occupations

As of 2006 the NeCN catchment area contained a total experienced labour force 15 years and over of 38,100. Of these it was found that sales and service sector occupations made up the largest proportion in the NeCN catchment area with 25 per cent. This was followed by trades, transport, and equipment operators and related occupations (21%) and business, finance, and administration occupations (16%).

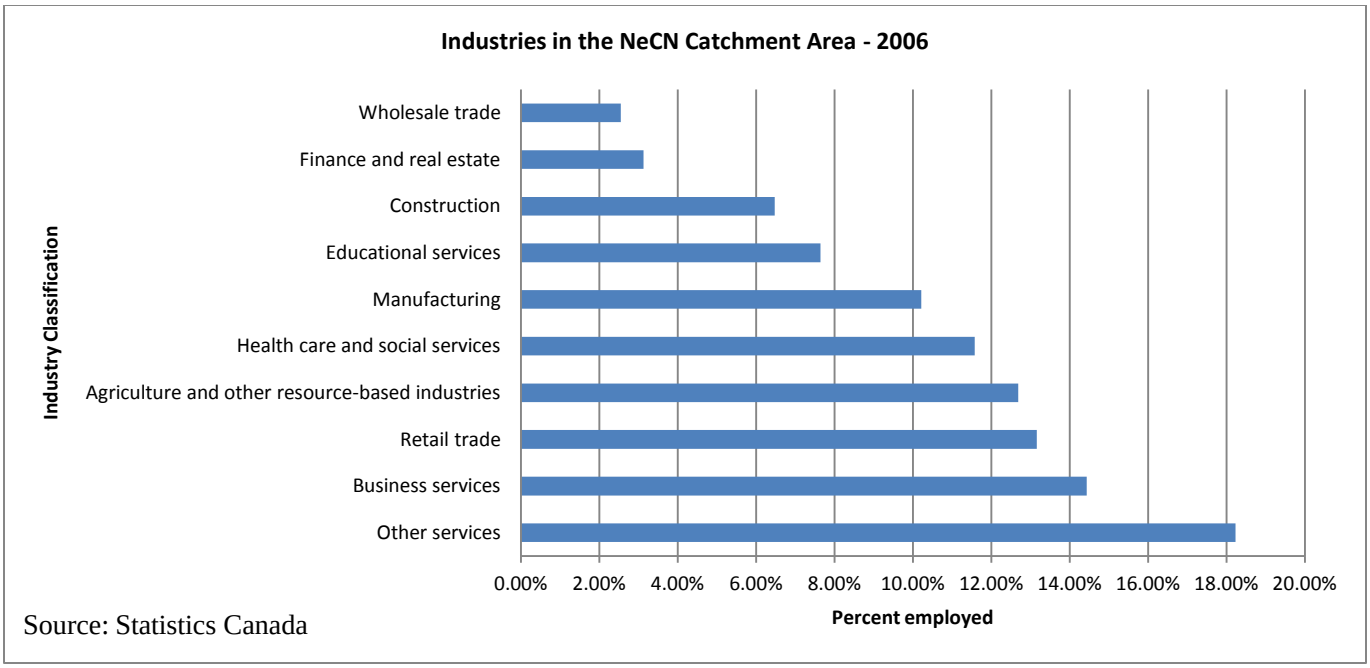


Source: Statistics Canada

Industries

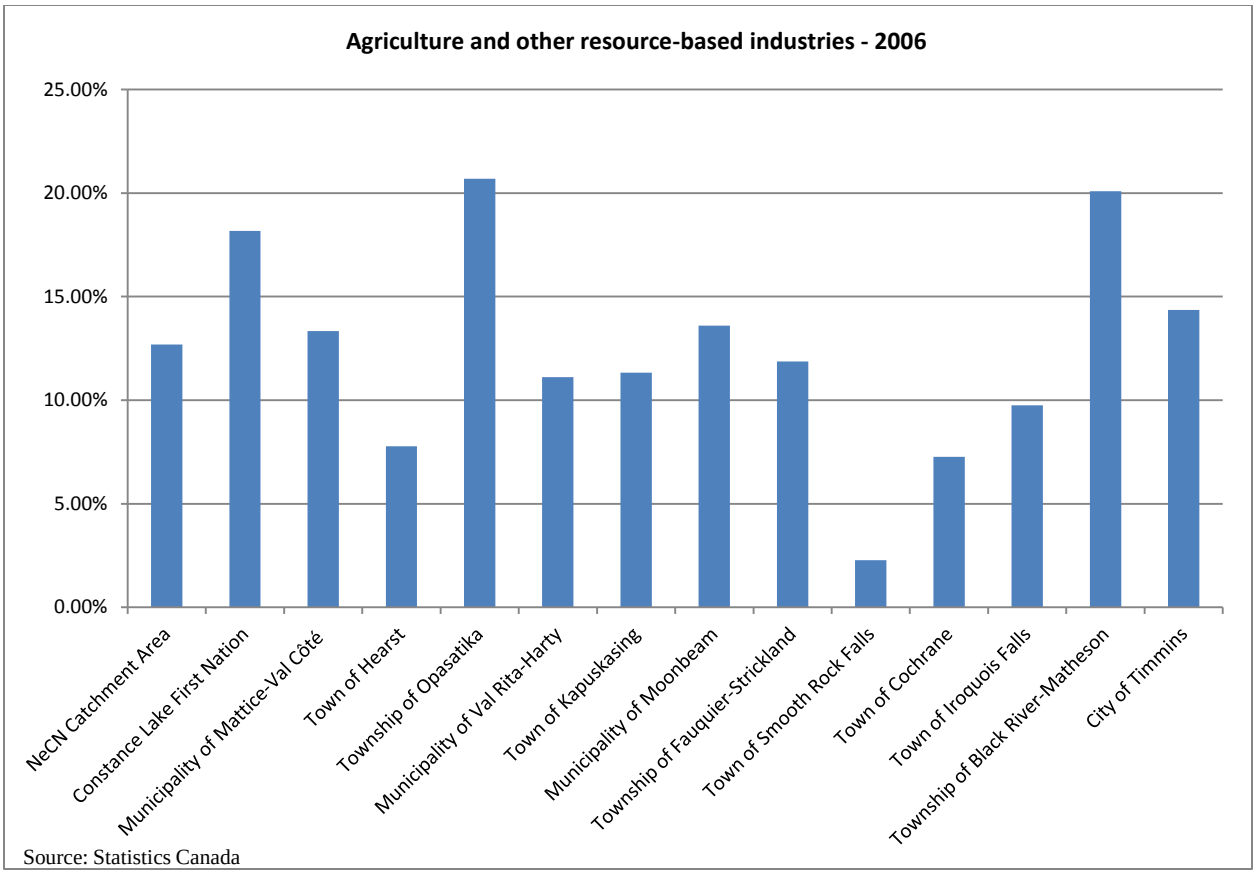
As of 2006 Other Services was the industry in the NeCN catchment area that employed the largest proportion of residents. Statistics Canada states that Other Services contains such industries as repair and maintenance; personal and laundry services; religious, grant-making, civic, and professional and similar organizations; and those employed in private households (Statcan, 2004).

The proceeding industries with the highest employment were found to be business services (14%); retail trade (13%); and agriculture and other resource-based industries (13%). The breakdown is presented in for following graph.



Source: Statistics Canada

However, much like any other variables, it should be noted that there are significant differences between the municipalities located within the NeCN catchment area. For instance, when comparing agriculture and other resource-based industries it is found that some municipalities have significant proportions such as Opasatika (21%), Black River-Matheson (20%), Constance Lake First Nation (18%), and Timmins (14%). In contrast, other municipalities have very small proportions of their population employed in this industry classification, such as Hearst (8%), Cochrane (7%), and Smooth Rock Falls (2%).



BIBLIOGRAPHY

Statcan. (2004). "Variant of NAICS 2002: Labour Force Survey (LFS) Industries." Statistics Canada. Accessed on April 28, 2011 from <http://stds.statcan.gc.ca/spaggr-agrsp/labour-travail-2002/labnaics02ts-travscian02tr-eng.asp?critstart=81&critend=82>.

MOF. (2010). "Ontario Population Projections Update: 2009 – 2036." Ontario Ministry of Finance. Accessed on April 28, 2011 from <http://www.fin.gov.on.ca/en/economy/demographics/projections/>.

Statcan. (2011). "Census of Population 2006: Community Profiles." Statistics Canada. Accessed on April 19, 2011 from < http://www12.statcan.ca/census-recensement/2006/dp-pd/prof/92-591/index.cfm?Lang=E>.

Appendix 2: Climate

In comparison with the rest of Canada, the NeCN catchment area is not particularly far North. Indeed, the Town of Hearst is the community representing the furthest North point of the study area and has a latitude almost identical to Lethbridge in Southern Alberta. While there is limited agriculture activity occurring North of Hearst, there is substantial agricultural production North of Lethbridge.

Nevertheless, there is much more to climate than merely latitude as can be seen in the large climactic variances between the NeCN catchment area and Southern Alberta. Instead, a multitude of other factors impact the climate of a given area including elevation, prevailing winds, distance to large water bodies, soil types, and even the direction faced by slopes (Brown, 1997). Therefore, for the purposes of agriculture, the most effective means of evaluating climactic conditions is the Crop Heat Unit (CHU) system.

Crop Heat Units (CHU)

The Crop Heat Unit (CHU) measurement is an indexing system designed to help farmers select the most appropriate crop hybrids and varieties for the conditions of their area. The CHU rating of an area is determined by the total accumulated crop heat units for the frost-free growing season in the various areas of the province (Brown, 1997). While originally designed for selecting corn varieties the CHU system can also be used in the selection of other warm season crop varieties. The measurements provided by the CHU system also provide a means of comparing the climactic conditions of different areas of the province.

Not surprisingly, the CHU value of an area is based upon temperature. Specifically, Crop Heat Units are determined using daily minimum and maximum air temperatures accumulated over the growing season (Brown, 1997).

CHU and CHU-M1

The Crop Heat Unit measurement system has recently been revised in accordance with changing farming practices and crop varieties. The new Crop Heat Unit measurement took effect in 2009 and has been named CHU-M1. This has created a situation in which different numbers are used to explain the conditions of a single geographic area causing some confusion. This section will briefly explain the difference between the two measurement systems.

The first main difference between the measurement systems is that the CHU measurement system utilizes daily minimum and maximum air temperatures for the period of 1961 to 1990 while CHU-M1 has been updated with data from 1971 to 2000 (OMAFRA, 2011).

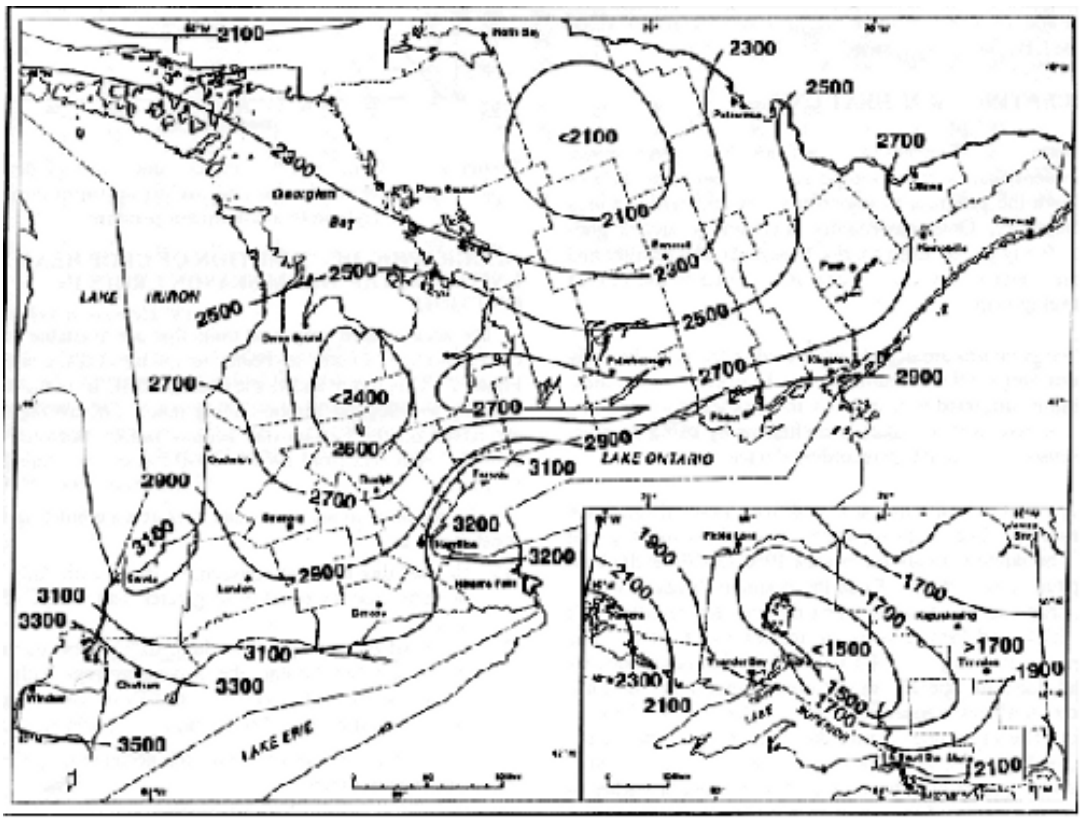
The second important difference between the two methods is the way that the growing season is determined. Under the original CHU measure the growing season is triggered by "the last day of three consecutive days, with daily mean air temperatures equal to or greater than 12.8 °C (55 °F)" (Brown, 1997). However, under the new CHU-M1 measure the start of the growing season is always assumed to be May 1st anywhere across the province (OMAFRA, 2011). The result of which has been a marked increase in crop heat units across the province under the CHU-M1 measurement.

Crop Heat Units in the NeCN Catchment Area

The proportion of crop heat units in the NeCN catchment area will vary depending on the measurement method utilized (CHU or CHU-M1). Presumably the new CHU-M1 results will be the most appropriate for use going forward however given that the older CHU results are still frequently used both will be provided in this section.

Under the older CHU measurement system the NeCN catchment area falls within the 1700-1900 range (see Figure 1). Specifically, findings from the Kapuskasing test site indicated a CHU score of 1720 (Brown, 1997).

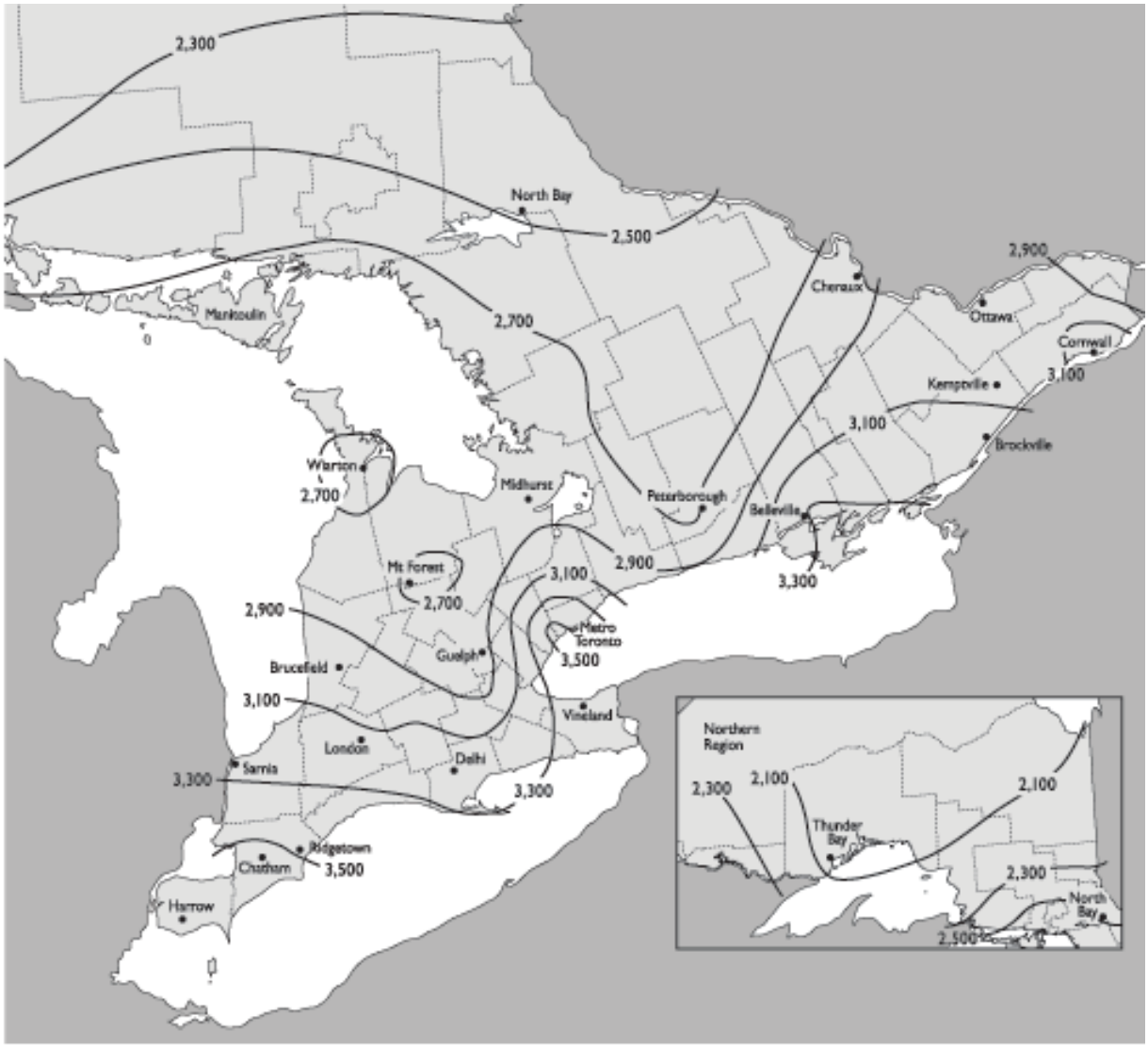
Figure 1: Crop Heat Units for Ontario based upon CHU measurement system



Source: (Brown & Bootsma, 1997)

Under the new CHU-M1 measurement the proportion of crop heat units in the NeCN catchment area are found to be within the range of 2100-2300 (see Figure 2). Unfortunately, more specific measurements are not available for this method.

Figure 2: Crop Heat Units for Ontario using the CHU-M1 measurement system

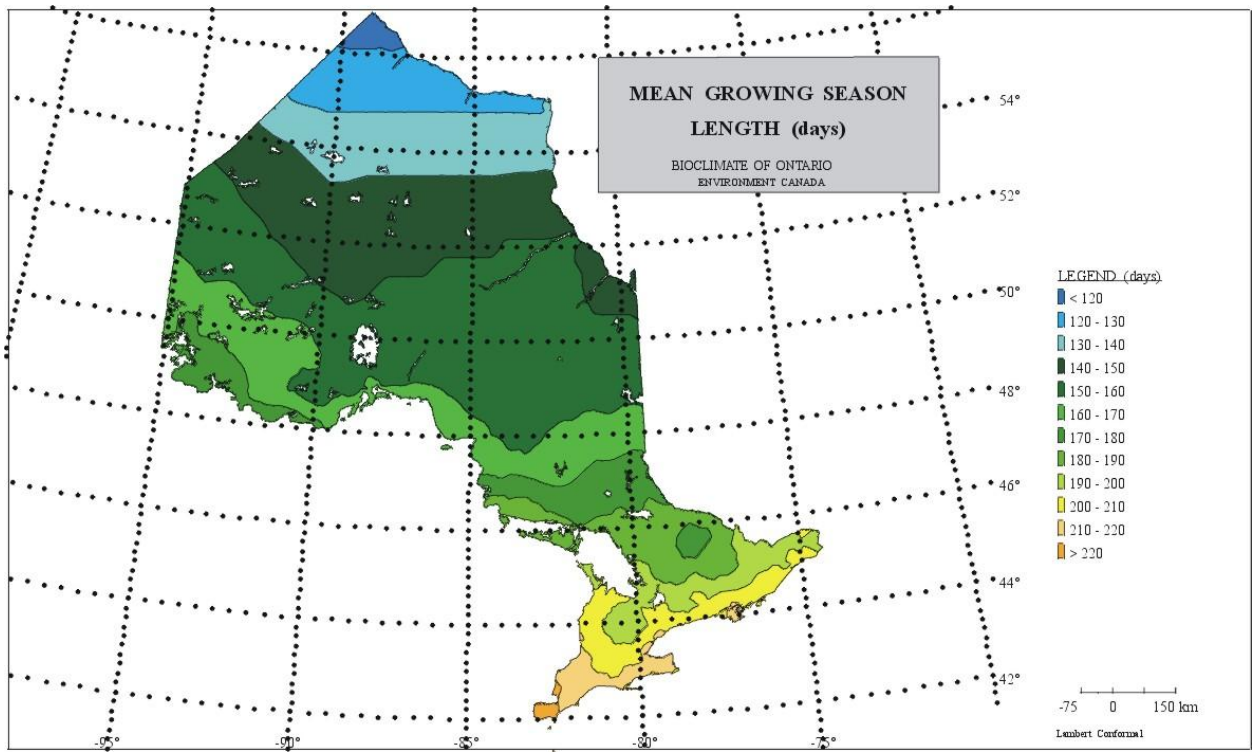


Source: (OMAFRA, 2011b)

Growing Season in the NeCN Catchment Area

In addition to Crop Heat Units the measure of Growing Season Length can be used to compare climate conditions within Ontario. For the NeCN catchment area the mean growing season length has been found to be 150-160 days (Figure 3).

Figure 3: Mean Growing Season Length (days)



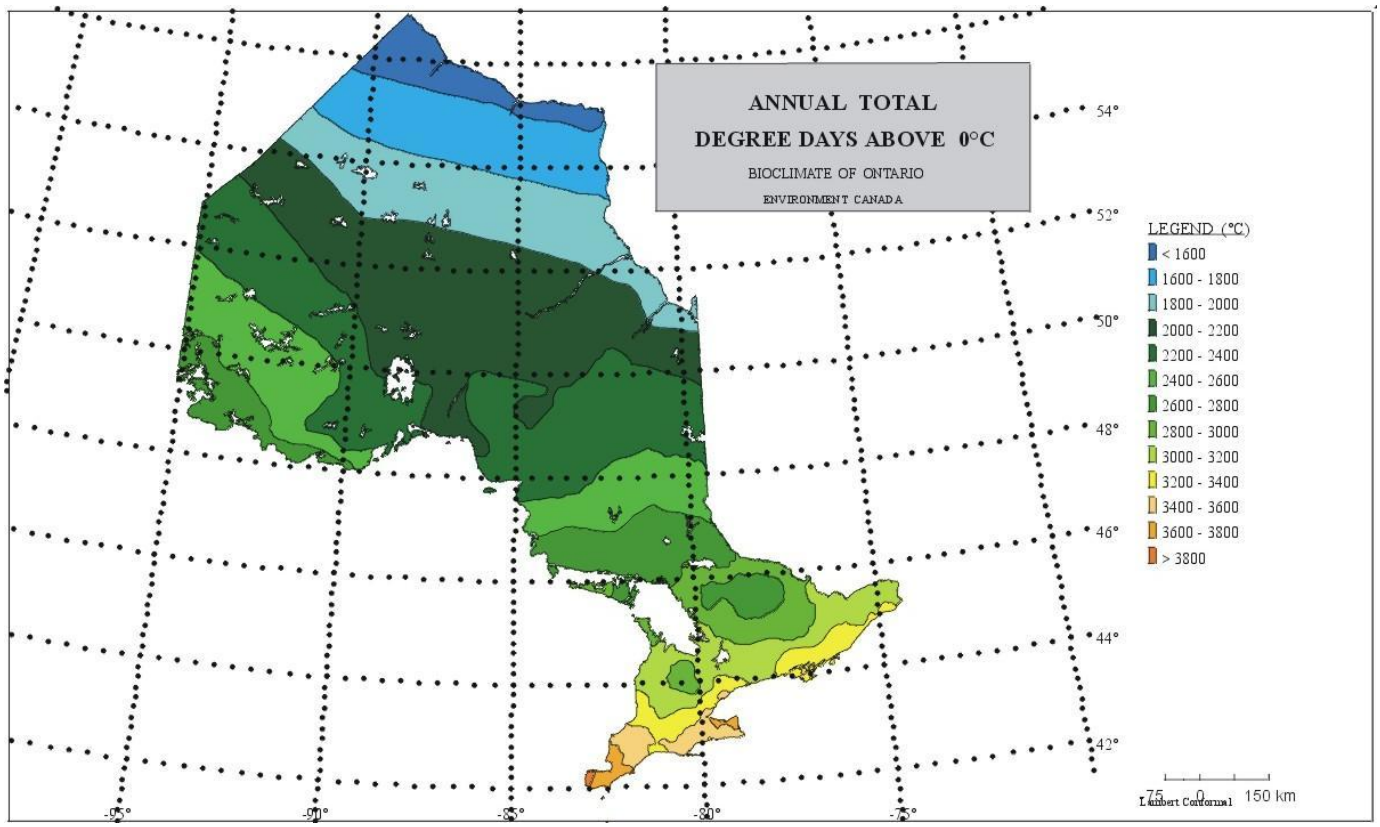
Source: (Environmental Information Office, 2000)

Growing Degree Days

A more specific measure for evaluating the climate of a given area is the Growing Degree Days measurement. Growing degree days are calculated based on the assumption that development of plants and insects during the growing season will only occur once air temperature exceeds some minimum developmental threshold or base temperature (OMAFRA, 2011c). The Ontario Ministry of Agriculture, Food, and Rural Affairs (OMAFRA) uses a season start date of April 1 and uses three base temperatures: 3, 5 and 10 degrees Celsius (OMAFRA, 2011c). Other sources use 0 degrees, instead of 3, as the lowest base measure.

Under the 0 degree Celsius base temperature, the NeCN catchment area is found to have between 2200 and 2400 annual total growing degree days (Figure 4).

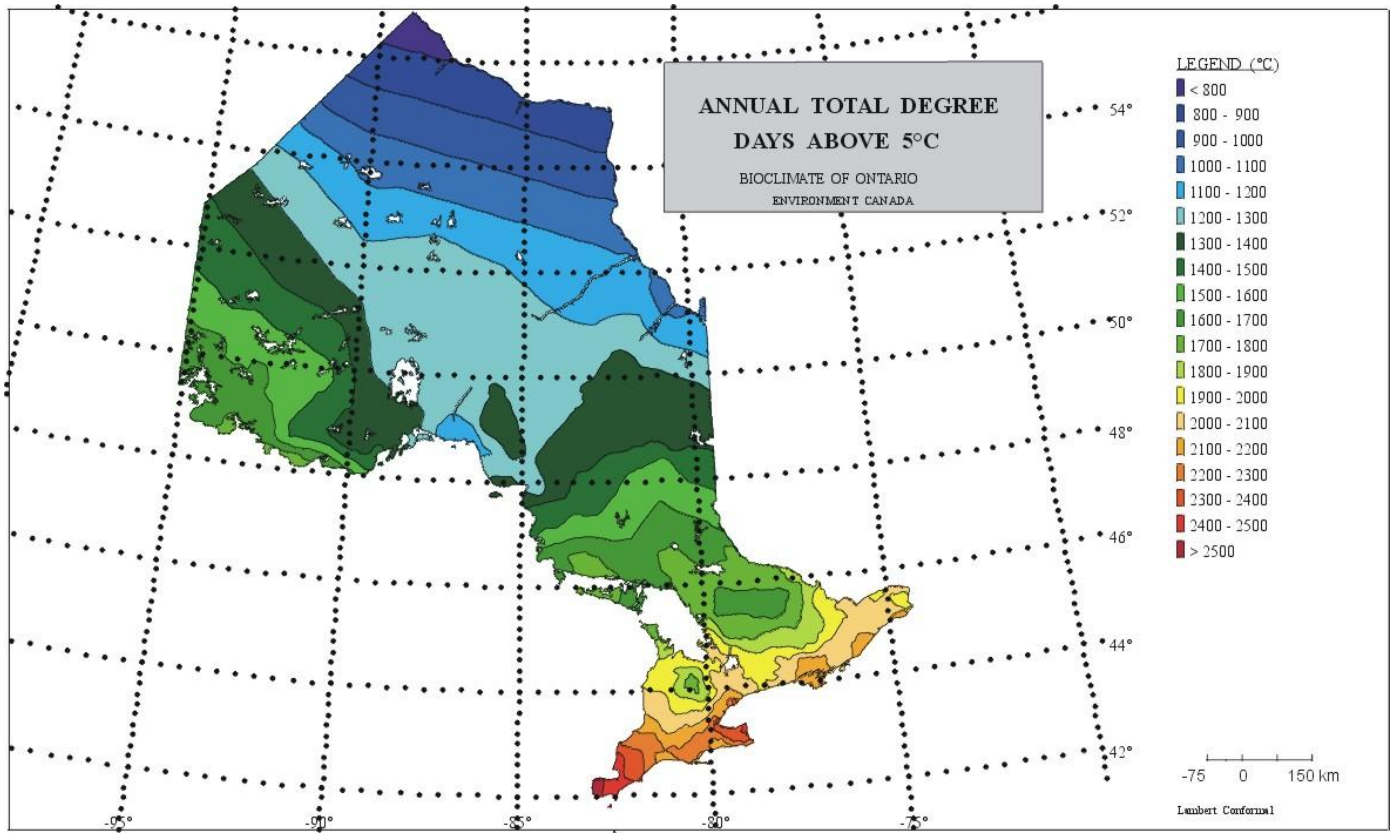
Figure 4: Annual Total Degree Days Above 0^{o}C



Source: (Environmental Information Office, 2000)

When using 5 degrees Celsius as the base temperature it is found that the NeCN catchment area has between approximately 1300 and 1400 annual total growing degree days (Figure 5).

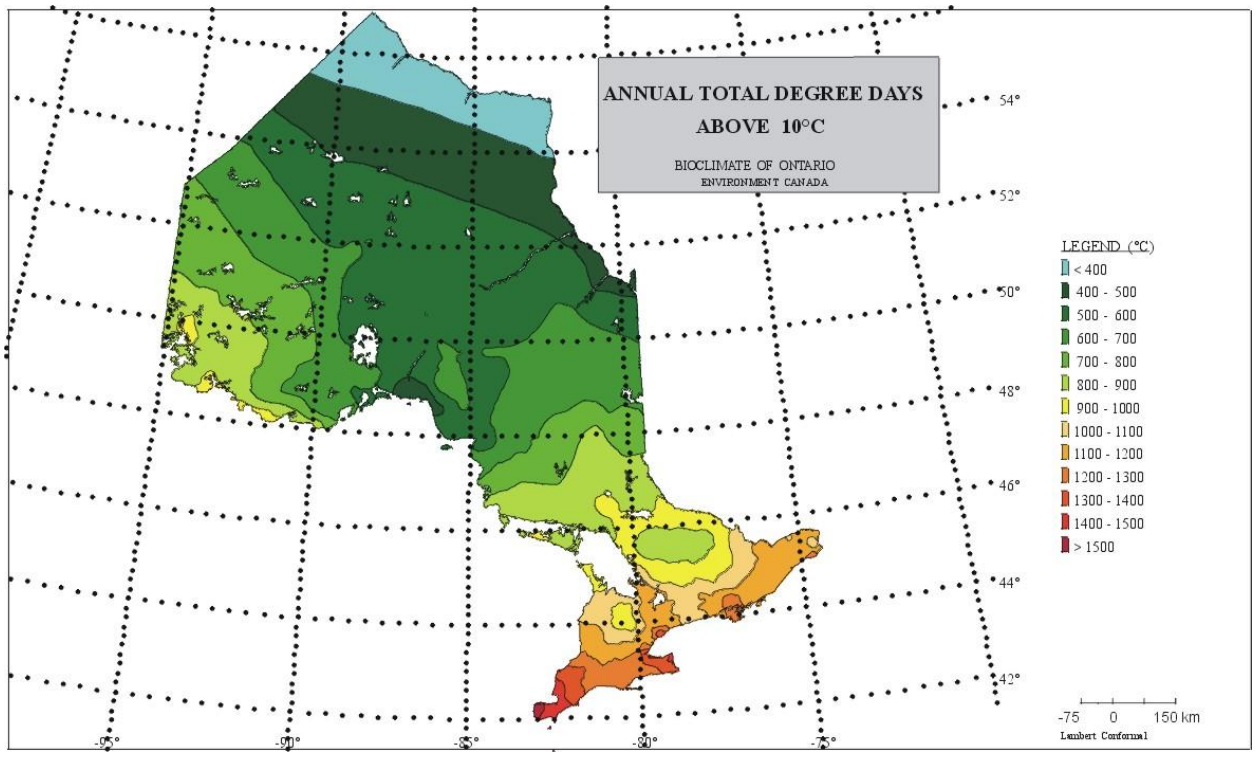
Figure 5: Annual Total Degree Days Above 5°C



Source: (Environmental Information Office, 2000)

Utilizing 10 degrees Celsius as the base temperature it is found that the NeCN catchment area has between 600 and 700 annual total growing degree days (Figure 6).

Figure 6: Annual Total Degree Days Above 10^{o}C

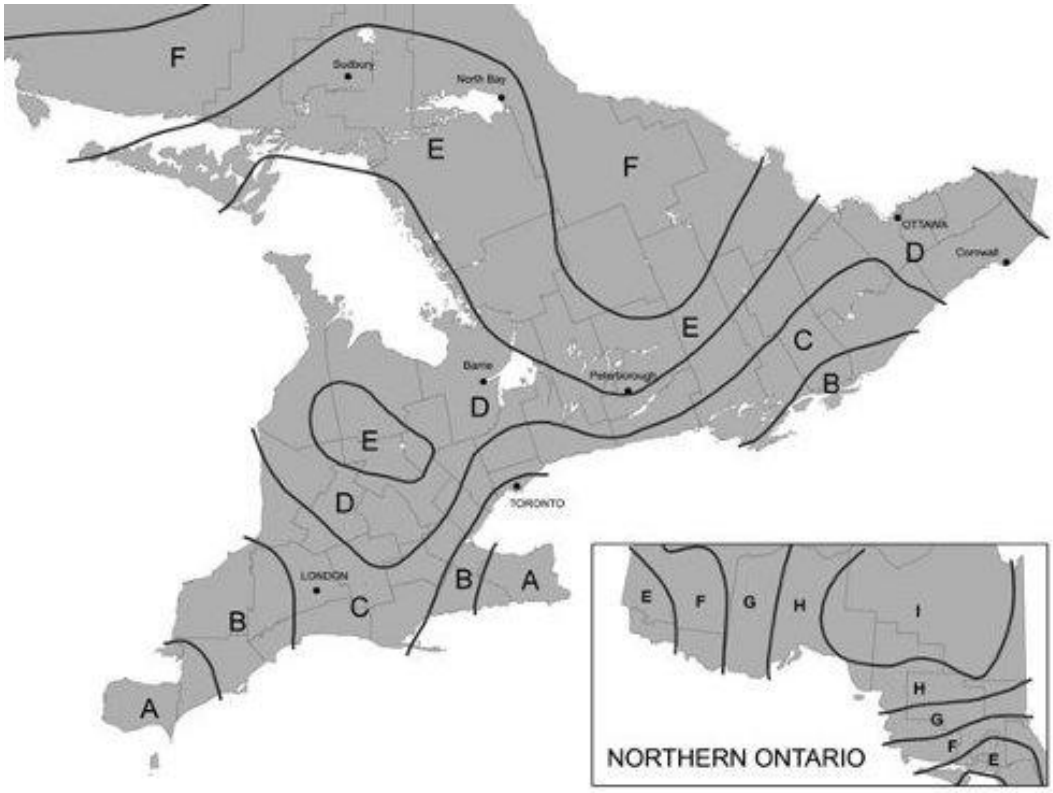


Source: (Environmental Information Office, 2000)

Climate Zones

The Ontario Ministry of Agriculture, Food, and Rural Affairs (OMAFRA) has produced a range of *Climate Zones* based on the average frost-free period over the period of 1976-2005 (OMAFRA, 2011a). The NeCN catchment area falls within *Zone I* representing an average frost free period of 90-100 days, an average date of last spring frost of June 7th and an average date of first fall frost on September 9th (OMAFRA, 2011a).

Figure 7: Climate Zone Map of Ontario (1976-2005)



Source: (OMAFRA, 2011a)

Climate Normals

The Following table presents various climate related data for select communities within the NeCN catchment area.

Climate Normals for Select Areas in Cochrane District (1971-2000).

		Temperature				Precipitation		
Weather Station	Month or Year	Daily Average (^{o} C)	Standard Deviation	Daily Maximum (^{o} C)	Daily Minimum (^{o} C)	Rainfall (mm)	Snowfall (cm)	Total Precipitation (mm)
Cochrane (a)	January	-18.4	2.6	-12.1	-24.7	0.7	71.6	72.3
	July	16.8	1.1	24	9.5	90.1	0	90.1
	Year	0.6	3.5	6.9	-5.7	583.2	296.8	880
Iroquois Falls (b)	January	-17.9	2.9	-11	-24.7	2.7	46.7	49.4
	July	17.2	1.1	24.1	10.2	93.3	0	93.3
	Year	NA	NA	NA	NA	561.2	214.8	776
Timmins (c)	January	-17.5	3	-11	-23.9	2.9	61.7	53.9
	July	17.4	1.1	24.2	10.5	91.5	0	91.5
	Year	1.3	1	7.5	-4.9	558.1	313.4	831.3
Kapuskasing (d)	January	-18.7	2.9	-12.4	-24.9	0.7	60.8	54.6
	July	17.2	1.1	23.9	10.5	100.5	0	100.5
	Year	0.7	1	6.9	-5.4	544.6	313	831.8

(a) Cochrane: Latitude = 49o 4’ N; Longitude = 81o 2’ W; Elevation = 275 m.
(b) Iroquois Falls: Latitude = 48° 45' N; Longitude = 80° 40' W; Elevation = 259 m.
(c) Timmins: Latitude = 48° 34' N; Longitude = 81° 22' W; Elevation = 295 m.
(d) Kapuskasing A: Latitude = 49° 24' N; Longitude = 82° 28' W; Elevation = 226 m.
NA: not available
Source: (Cummings, 2009) citing data from Environment Canada (2008)

BIBLIOGRAPHY

Brown, D., & Bootsma, A. (1997, January). Crop Heat Units for Corn and Other Warm Season Crops in Ontario. Retrieved July, 2011, from http://www.omafra.gov.on.ca/english/crops/facts/93-119.htm

Cummings, H. (2009). Cochrane District Agricultural Economic Impact Study. Guelph, Ontario: Harry Cummings and Associates Inc. (HCA).

Environmental Information Office. (2000, May 01). Ontario Bioclimate - Degree Days. Retrieved July, 2011, from http://www.utoronto.ca/imap/collections/climate_and_biota/ontario_bioclimate2.htm#Growing

OMAFRA. (2011a, April 07). Climate Zones and Planting Dates for Vegetables in Ontario. Retrieved July, 2011, from http://www.omafra.gov.on.ca/english/crops/facts/climzoneveg.htm

OMAFRA. (2011b, April 07). Corn: Hybrid Selection. Retrieved July, 2011, from http://www.omafra.gov.on.ca/english/crops/pub811/1hybrid.htm#chu

OMAFRA. (2011c, April 11). Growing Degree Days in Ontario - A Description. Retrieved July, 2011, from http://www.omafra.gov.on.ca/english/crops/facts/GDDOntario.htm

Appendix 3: Soils and Available Land

Soils in the NeCN Catchment Area

This section will provide information on the soil quality and classifications present within the NeCN catchment area. It should be noted at the forefront that this data is not exact, particularly within this area where sources often provided cautions regarding the scale and age of the information. Nevertheless, the soil data can be considered approximations for use in comparisons with other areas or formulating a general idea of the conditions of the area.

Much of the information from this section comes from the previously completed *NCBAN Land Inventory & Soil Classification Update & Analysis* which utilized the same study area as this study. This previous study produced an excellent source for exploring the conditions of the NeCN Catchment area at the following webpage: http://www.cgis.com/cpal/Default.aspx?Map=NCBAN. This source is particularly useful as it provides for place specific information as opposed to the generalities of area wide figures. This is particularly true given the pocketed nature of quality soils in the region which is not captured in the compilation numbers. Instead, this source allows for navigation to specific areas of interest in a user-friendly format.

Nevertheless, there is still a place for compilations to supplement mapping which the following sub-sections will provide.

Canada Land Inventory (CLI) Soil Classifications

The Canada Land Inventory (CLI) may be used for determining the soil capabilities of an area in regards to agricultural production. Soils in a given area are grouped into 7 classes and 13 subclasses according to the potential of each soil for the production of field crops (AAFC, 2008). Generally, soils classed as 1,2,3, or 4 are considered capable of sustained use for cultivated field crops, those in classes 5 and 6 only for perennial forage crops and those in class 7 for neither (AAFC, 2008). The CLI classification also attributes a range of sub-classifications for soil capabilities providing additional details of an area's soil quality.

CLI Classifications in Cochrane District

The following table demonstrates the CLI classification for Cochrane District based on acreage and excluding classifications not considered agriculturally viable (5 and higher). It can be observed that most of the District's viable land is classified as either 3 or 4.

Canada Land Inventory Class Acreages			
CLI Class	**2**	**3**	**4**
Total Acreage	3,130	1,422,380	1,785,610
Source: (Rowsell, 2011)			

In terms of sub-classifications, the following table provides further insights into the quality of soils in the District. It should be noted that this refers to all CLI classifications in the District and not just the agriculturally viable lands.

CLI Limitations (all classes of mapped soils)			
CLI Sub-Class	**C**	**W**	**R**
Total Acreage	2,048,200	2,016,880	622,090
Source: (Rowsell, 2011)			

The definitions according to AAFC (2008) for the CLI sub-classifications are as follows:

'c' - Adverse Climate - this subclass denotes a significant adverse climate for crop production as 'median' climate which is defined as one with sufficiently high growing-season temperatures to bring crops to maturity.

'w' - Excess Water - this subclass includes soils where excess water other than brought about by inundation is a limitation to agricultural use. Excess water may result from inadequate soil drainage, a high water table, seepage or from runoff from surrounding areas.

'r' - Consolidated Bedrock - this subclass includes soils where the presence of bedrock near the surface restricts their agricultural use. Consolidated bedrock at depths greater than 3 feet from the surface is not considered as a limitation except on irrigated lands where a greater depth of soil is desirable.

CLI Classifications in the NeCN Catchment Area

As the scale of the area decreases as does the accuracy of the CLI information. Nevertheless, the NCBAN (2008) report has provided values pertaining specifically to the study area.[2] The following table summarizes these findings:

[2] The report provides the following explanation for the differing values at each scale: In general but not always, the areas delineated at 1:50,000 are smaller than the corresponding areas mapped at 1:250,000. The differences are likely due to generalizations in the polygon boundaries and also in the inclusions which contribute to the areas. This comparison reinforces the need for a follow-up site inspection to confirm any results obtained from the database analysis.

	CLI Class 3 soil area (ha)		CLI Class 4 area (ha)		Total (Class 3 + 4) ha	
Map sheet	**1:50000 scale**	**1:250000 scale**	**1:50000 scale**	**1:250000 scale**	**1:50000 scale**	**1:250000 scale**
42a	198,344	231,734	360,113	426,445	558,457	658,180
42g	377,518	464,523	362,806	324,209	740,324	788,732
42h	315,441	377,391	353,793	416,013	669,234	793,404
Source: (Manseau, 2008)						

Available Agricultural Land in the NeCN Catchment Area

There are a variety of ways that can be used to estimate the availability of agricultural land in the NeCN catchment area. For instance, according to data from the 2006 Census of Agriculture only 3 per cent of Cochrane District's acreage classed by the CLI as 2, 3, or 4 was being farmed (Rowsell, 2011). However, simplistic figures such as this provide only an idea of the vast amount of land available, but not practicalities such as accessibility or Crown Land coverage which are particularly relevant for this area.

Therefore, the previously completed NCBAN report provides the most appropriate information for estimating available agricultural land within the NeCN Catchment area. This report provides several different methods and varying estimates which will be summarized in this section.

Estimates for the NeCN Catchment Area Overall

The NCBAN study presents the following estimates[3] of available agricultural land within the same boundaries as the NeCN Catchment area:

1) Quantifying the study area's agricultural lands employing the MPAC data sets reveals a total farm base of 50,755 hectares. Assuming the introduction of vacant land and single residences holding an acreage value in excess of 30 acres, the total farm potential within the study area can be estimated at 384,880 hectares for a total potential private lands farm base of 435,635 hectares or 1,076,018 acres (Manseau, 2008).

[3] The NCBAN study provides the following words of caution when using the estimates: Of the available information, no single soil classification methodology can accurately interpret the soils data in the study area with any measure of reliability. MPAC, by its own admission, states that its soil classification data is suspect and is dated circa 1970. Furthermore, MPAC states that any decisions made employing its data set must be confirmed by field testing for accuracy. Additionally, the CLI based approached, at the 1:250,000 scales provides for a broad interpretation of the regional land base yet is too coarse a tool for examining soils classification at the parcel level (Manseau, 2008).

2) Qualifying the soil class of study area's farm base, employing the MPAC soil classification data fields, reveal that 48.88% of the land base falls under Class 3 and 19.13% falls under class 4 (Manseau, 2008).

3) Qualifying the soil class of study area's farm base, employing the CLI soil classification polygons, reveal that 53.26% of the land base falls under Class 3 and 17.51% falls under class 4. Assuming the introduction of vacant lands and single residences holding an acreage value in excess of 30 acres, an estimated 308,658 hectares of class 3 soil and an estimated 204,785 hectares of class 4 soils could be added to the current farm lands (Manseau, 2008).

4) Quantifying the study area's agricultural lands employing the Census data sets reveal a total lands in crop and improved pasture volume of 14,421 hectares. Assuming the reintroduction of historical improved farmlands from its peak in 1951 (50,400 hectares), the study area's current level farmland can be increased by 35,979 hectares (Manseau, 2008).

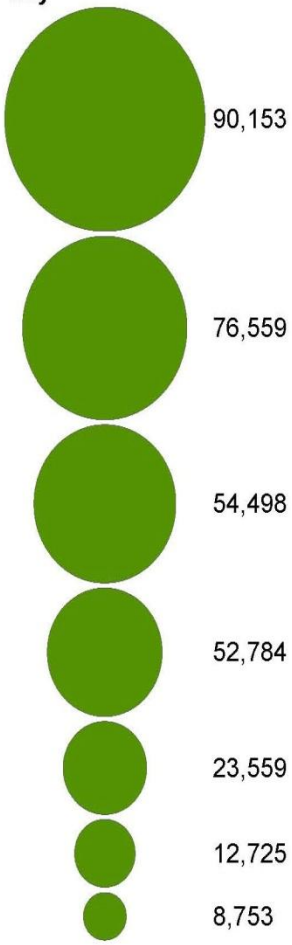
These estimates are summarized in the following table:

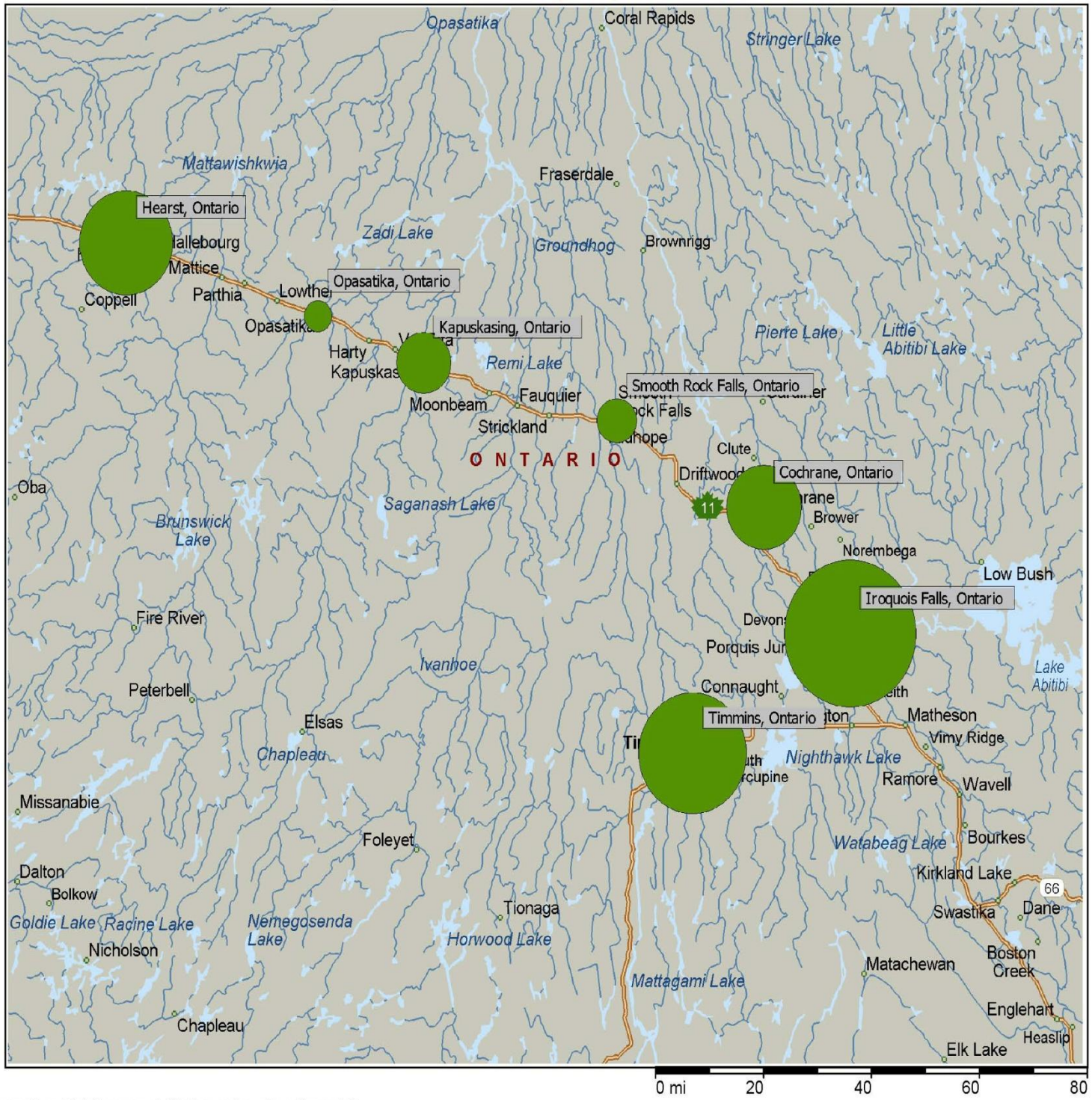
Estimates of Available Agricultural Land from NCBAN Study (2008)					
Data Source	**Current Farm Base (hectares)**	**Available Farm Base (hectares)**	**Total Farm Base (hectares)**	**Class 3 Land**	**Class 4 Land**
MPAC	50,755	384,880	435,635	48.88%	19.13%
CLI	NA	513,443	NA	53.26%	17.51%
Census	14,421	35,979	50,400	NA	NA
Source:					

Available Agricultural Land Estimates in NeCN Catchment Area Municipalities

The following map presents estimates of available agricultural land for seven municipalities and their surrounding areas from the NCBAN report (2009).

Total Potential Agricultural Lands by City





Source: (Manseau, 2009)

BIBLIOGRAPHY

AAFC. (2008, November 27). Overview Of Classification Methodology For Determining Land Capability For Agriculture Retrieved July, 2011, from http://sis.agr.gc.ca/cansis/nsdb/cli/classdesc.html

Manseau, R. (2008). Northern Claybelt Agri-Network Phase I Report: Land Inventory & Soil Classification Update & Analysis. Timmins, Ontario: Commerce Management Group (CMG).

Manseau, R. (2009). Northern Claybelt Agri-Network (NCBAN) Phase II – Technical Report "A". Timmins, Ontario: Commerce Management Group (CMG).

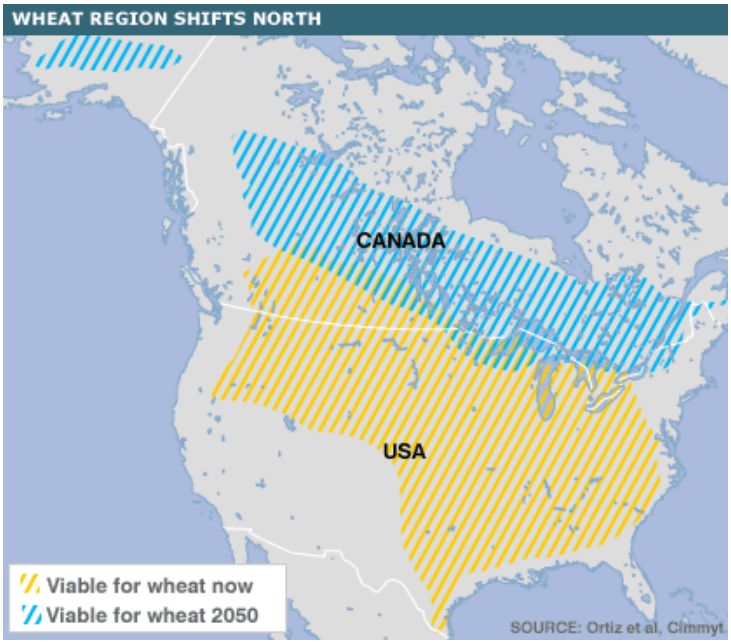
Rowsell, J. (2011). Agricultural Biomass Opportunities in Northern Ontario. New Liskeard, Ontario: New Liskeard Agricultural Research Station, University of Guelph.

Appendix 4: Climate Change

When considering the implications for the environment, society, and security it is difficult to discuss the opportunities relating to climate change. Indeed, within the realm of agriculture, projections tend to indicate that large swaths of the world's best agricultural land will lose considerable productivity in the years to come. This has serious implications for global food security.

Nevertheless, at the same time that these currently productive lands are lost others are expected to emerge. Within the North American context, productivity is expected to shift northwards thereby bringing significant changes to the conditions of Northeast Ontario. For instance, one projection from Ortiz, et al (2008) indicates that the prime climate for wheat production will shift north. This has clear implications for currently productive areas in Asia and the United States where major wheat producing areas will lose significant productivity (Ortiz et al., 2008). It also has implications for the NeCN catchment area, as this projection expects that by 2050 the limit at which wheat can be grown will shift from its current position at 55^{o}N to 65^{o}N with the prime growing areas shifting with it (see Figure 1). This means that unless alternative cultivars are created to meet these changing conditions, areas such as the NeCN Catchment area will not only be able to grow wheat with high productivity, it will be expected to do so in order to mitigate global scarcities.

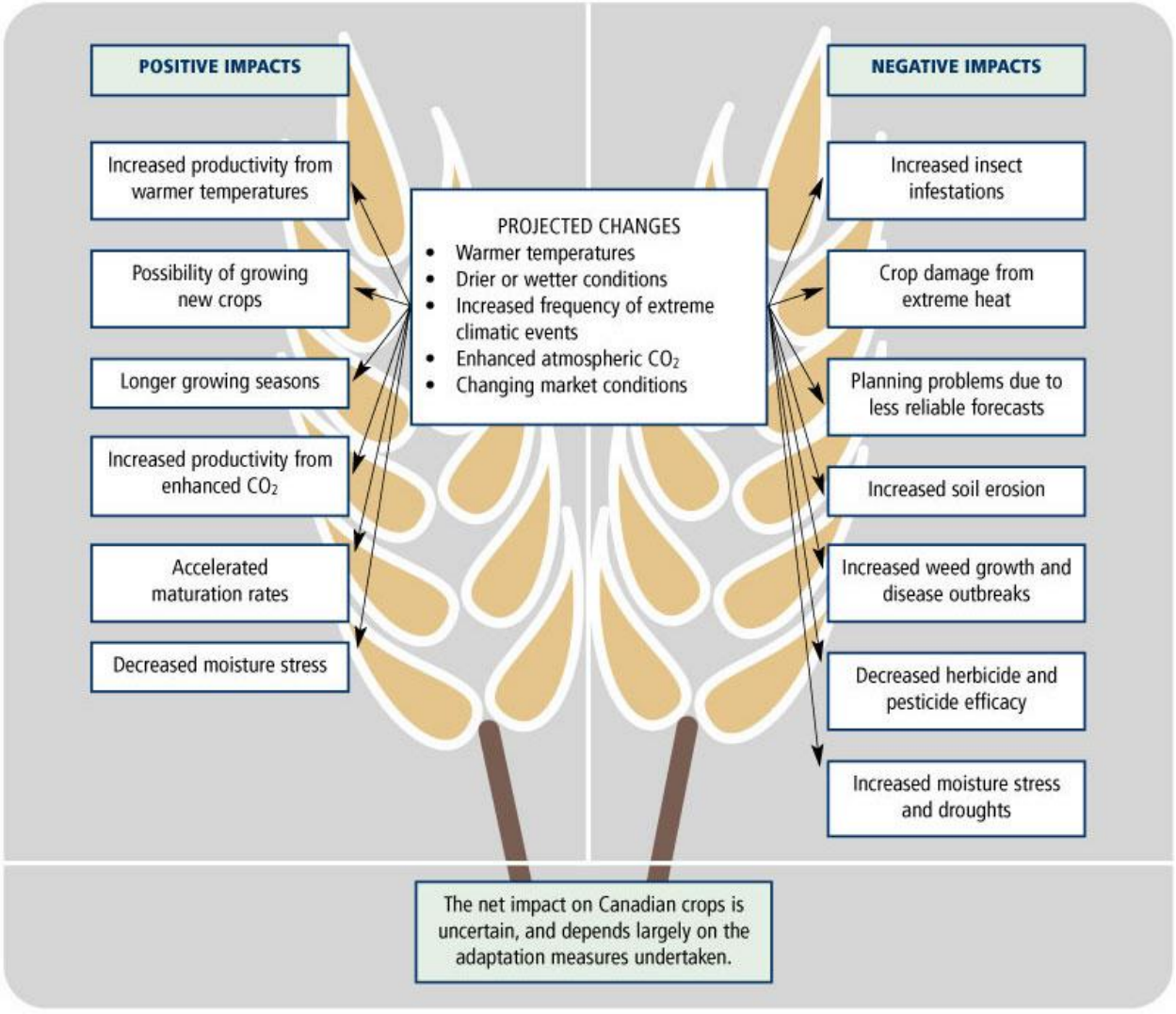
Figure 1: Current and future wheat growing areas in North America



Source: (BBC, 2006)

It is important to keep in mind that many projections are based largely, or exclusively, on the assumption of increasing temperatures resulting in higher yields and increases in viable crop varieties. However, this is not necessarily the entire story. Indeed, there are numerous other variables that must be considered in the relation between climate change and agricultural production. These are often difficult, if not impossible, to predict at this stage nevertheless they are important to note. Some of these impacts are summarized in Figure 2.

Figure 2: Potential impacts of climate change on agricultural crops in Canada



Source: (NRCAN, 2007)

A more thorough look at the climate change implications for Northeast Ontario is presented by Cummings (2009), which is presented in the following excerpt:

Excerpt taken from: (Cummings, 2009)

3.3 Climate Change

Climate change including global warming is now widely recognized as a major environmental issue with economic, health and safety, security, and other dimensions (United Nations Environment Programme, 2009). Agri-food is an economic sector which could be especially sensitive to long-term climatic change.

In a climate change model used by Colombo et al. (2007) the average summer temperature in most of northeastern Ontario is expected to increase by 1 to 2^{o}C by 2011. The same scenario predicts that average summer temperatures in the southern part of northeastern Ontario will increase by 3 to 4^{o}C starting around 2071. With respect to precipitation, between 2011 and 2040, warm season precipitation will decrease by up to 10% in the area north of Hearst and Kapuskasing. However, beginning by 2041, most of northeastern Ontario will receive the same or slightly more precipitation as it did from 1971-2000 (p.15).

With respect to the cold season, the same climate change scenario noted above predicts that the average winter temperature in the southern part of northeastern Ontario will be 4 to 5^{o}C warmer by 2071. With respect to precipitation, snowfall in northeastern Ontario has historically been greatest in the snowbelt to the lee of Lake Superior, between Wawa and Sault Ste. Marie. Cold season precipitation in this area is projected to increase by up to 20% by 2071. While snowfall in Montreal River and areas near White River, Hearst, and James Bay will increase, large parts of the northeast will receive significantly less snow than has been the historical norm. For example, the corridor running north from Espanola and Mattawa to Moosonee will get up to 20% less cold season precipitation by 2011 (p.15).

Climate change is expected to have major implications for the length of the growing season, the variety of crops grown, as well as grain yields in northern Ontario. In examining climate change scenarios for Canada, Qian et al. (2005) predict that the number of frost-free days is expected to increase by 30-45 days in northern Ontario by the middle of the century. The predicted changes for the frost dates indicate an earlier ending of frosts in spring and a later starting of frosts and killing frosts in the fall.

CHU ratings in some parts of northern Ontario will be altered as a result of the expected climate change. For example, in the area around Fort Frances and Thunder Bay the CHU rating will increase by almost 400 units between 2010 and 2039 and almost 800 units between 2040 and 2069 (Bootsma, 2002). According to Bootsma et al (2001), grain corn yields could potentially increase by 0.64 tonnes per hectare with each increase of 100 CHU.

In conducting a regional assessment of the implications of climatic change on land resource potential for crop production in Ontario, Smit et al. (1989) reported the following long-term effects for northern Ontario:

- Grain corn yields would increase to such an extent that it would be feasible to obtain a high return to investment on well-drained loamy soils, and on lands that have a low drought tolerance. On lands where artificial land drainage has lessened the limitations imposed by excessive moisture conditions yields would be sufficient to obtain a modest return (p.166). In northern Ontario, grain corn would become an economically viable crop on about 70% of the land base that is cleared and available for agriculture (p.168).

- The longer growing season and warmer temperatures in northern Ontario would create new opportunities for soybeans. Land which is well-drained would be especially well-suited for soybeans, and a modest return to investment could be expected on those lands where moisture imposes moderate limitations on crop production (p. 168). In northern Ontario soybeans would be a profitable crop on approximately 58% of the regional resource base (p.170).
- Considerable increases in barley yields could be expected throughout the region although lands suffering from excessive moisture would continue to be economically unsuitable for the small grains (p.167).
- Opportunities for hay production are expected to be smaller than the effects on other field crops in northern Ontario (p.168).

However, with the introduction of new crop varieties over the last 20 years and improved soil management practices there has already been a substantial increase in production for certain crops in northern Ontario. For example, in the last 10 years alone (1996 to 2006) the area in corn production in northern Ontario increased from 2,261 acres to 5,932 acres while the area in soybean production increased from 94 acres to 4,385 acres; the area in wheat production increased from 5,416 acres to 21,264 acres; and the area in alfalfa production increased from 66,908 acres to 103,232 acres (Statistics Canada, 1996 and 2006).

References

Bootsma, Andy. Potential Impacts of Climate Change on Agriculture in Eastern Canada: A Summary of Some Results of Recent Research. Presented at Workshop on "Climate Change and Agriculture in the Great Lakes Region: The Potential Impacts and What We Can Do". Kellogg Center, Michigan State University, East Lansing, MI. March 22, 2002.

Bootsma, A., Gameda, S., McKenney, D.W., 2001: Adaptation of agricultural production to climate change in Atlantic Canada. Final Report for Climate Change Action Fund Project A214. Eastern Cereal and Oilseed Research Centre, Agriculture and Agri-Food Canada, Ottawa.

Colombo, S.J., McKenney, D.W., Lawrence, K.M. and Gray, P.A. 2007. Climate Change Projections for Ontario: Practical Information for Policymakers and Planners. Ontario Ministry of Natural Resources.

Qian, B., Hayhoe, H. and Gameda, S. Developing Daily Climate Scenarios for Agricultural Impact Studies. Presented at the 16th Conference on Climate Variability and Change, January 9, 2005. San Diego, CA.

Smit, B., Brklacich, M., Stewart, R., McBride, R., Brown, M., Bond, D. 1989. *Sensitivity of crop yields and land resource potential to climatic change in Ontario, Canada.* Climate Change. Vol. 14 (2), 153-174.

United Nations Environment Program. 2009. UNEP Climate Change Strategy. http://www.unep.org/climatechange/Publications/Publication/tabid/429/language/en-US/Default.aspx?BookID=4006

Statistics Canada. 1996. Census of Agriculture. Ottawa, Ontario.

Statistics Canada. 2006. Census of Agriculture. Ottawa, Ontario.

BIBLIOGRAPHY

BBC. (2006, December 03). New crops needed to avoid famines Retrieved July, 2011, from http://news.bbc.co.uk/2/hi/science/nature/6200114.stm#map

Cummings, H. (2009). Cochrane District Agricultural Economic Impact Study. Guelph, Ontario: Harry Cummings and Associates Inc. (HCA).

NRCAN. (2007, October 10). Climate Change Impacts and Adaptation: A Canadian Perspective - Impacts on Agriculture Retrieved July, 2011, from http://www.adaptation.rncan.gc.ca/perspective/agri_3_e.php

Ortiz, R., Sayre, K. D., Govaerts, B., Gupta, R., Subbarao, G. V., Ban, T., et al. (2008). Climate change: Can wheat beat the heat? *Agriculture, Ecosystems and Environment, 126*, 46–58.

Appendix 5: Agriculture in the NeCN Catchment Area

Number of Cattle by County (estimates) - Cochrane District

	Bulls (>1 yr.)	Dairy cows	Dairy heifers (>1 yr.)	Beef cows	Beef heifers for breeding (>1 yr.)	Beef heifers for slaughter (>1 yr.)	Steers (>1 yr.)	Calves (<1 yr.)
2010	150	300	200	2,300	350	200	200	1,600
Source: (OMAFRA, 2011c)								

Dairy Production in Cochrane District

	Milk Shipments to Milk Processing Plants in Ontario (kilolitres)	Number of Milk Producers (as of July)
2006	3,026	7
2007	3,099	7
2008	2,618	6
2009	2,801	6
2010	2,598	5

Source: (OMAFRA, 2011b, 2011d)

Area and Production Estimates for Cochrane District (2010)					
	Acres seeded	Acres harvested	Yield (bushels/acre)	Production('000 bushels)	Production ('000 tonnes)
Winter Wheat	-	-	-	-	-
Oats	800	700	72	50	0.8
Barley	800	800	43	34	0.7
Mixed Grain	1,000	900	75	68	1.2
Grain Corn	-	-	-	-	-
Soybeans	-	-	-	-	-
White Beans	-	-	-	-	-
Fodder Corn	-	-	-	-	-
Hay	19,000	18,500	1.3[1]	24.1	21.9
Tobacco	-	-	-	-	-
Spring Wheat	-	-	-	-	-
Canola	-	-	-	-	-
Coloured Beans	-	-	-	-	-
[1] Tons/acre					

Source: (OMAFRA, 2011a)

Census of Agriculture (2006) Summary for Cochrane District

Farm and farm operator statistics	
Total population in 2006	82,503
Total number of operators	270
Average age of operators	55.1
Total male operators	190
Total female operators	85
Farms (number)	
Total number of farms	184
Reporting under 53 hectares	41
Reporting 53 to 161 hectares	76
Reporting 162 hectares and over	67
Land statistics	
Land area (km^2)	141,247
Total area of farms (hectares)	30,447
Average area of farms (hectares)	165
Greenhouse Area (square metres)	
Total area under glass or plastic	70,314
Farm finance statistics	
Total gross farm receipts (excluding forest products sold) (dollars)	11,195,641
Total farm capital (market value in dollars)	86,321,292
Total Gross Farm Receipts (farms reporting)	
Under $10,000	75
$10,000 to $24,999	41
$25,000 to $49,999	33
$50,000 to $99,999	15
$100,000 to $249,999	9
$250,000 to $499,999	8
$500,000 to $999,999	1
$1,000,000 to $1,999,999	2
$2,000,000 and over	0
Hired Farm Labour (weeks)	
Year round	1,735
Seasonal	1,407
Total	3,142

Farm Capital Value (farms reporting)	
Under $200,000	50
$200,000 to $499,999	83
$500,000 to $999,999	41
$1,000,000 and over	10

Farms by Industry Group (number of farms)	
Dairy cattle and milk production	7
Beef cattle ranching and farming	42
Hog and pig farming	1
Sheep and goat farming	1
Poultry and egg production	1
Other animal production	21
Oilseed and grain farming	1
Vegetable and melon farming	6
Fruit and tree nut farming	2
Greenhouse, nursery and floriculture	9
Other crop farming	93

Farm Cash Receipts for Main Commodities, 2009 (millions)	
Total	5.70
Dairy	2.00
Cattle and Calves	0.94
Floriculture, Nursery and Sod	0.60
Hay and Clover	0.33
Potatoes	0.12
Forest Products	0.12

Crop and horticulture statistics (hectares)	
Land in crops	11,508
Summerfallow land	40
Tame or seeded pasture	2,907
Natural land for pasture	5,653
Christmas trees, woodland & wetland	8,287
All other land	2,052
Total area of farms	30,447

Major Field Crops (hectares)	
Winter wheat	0
Oats for grain	395
Barley for grain	551
Mixed grains	158

Corn for grain	0
Corn for silage	0
Hay	10,167
Soybeans	0
Dry white beans	0
Other dry beans	0
Potatoes	18

Livestock statistics (number)	
Total cattle and calves	6,069
Dairy cows	x
Beef cows	x
Steers	140
Total pigs	x
Total sheep and lambs	234

Poultry Inventories (number)	
Total hens and chickens	1,515
Total turkeys	129

x Supressed Data

Sources: 2006 Census of Agriculture and Strategic Policy Branch, OMAFRA
http://www.omafra.gov.on.ca/english/stats/county/northern_ontario.pdf
Updated: December 2010

BIBLIOGRAPHY

OMAFRA. (2011a, May 04). Area and Production Estimates by County Retrieved July, 2011, from http://www.omafra.gov.on.ca/english/stats/crops/ctyoats10.htm

OMAFRA. (2011b, January 31). Milk Shipments by County of Origin to Milk Processing Plants in Ontario, 2006 - 2010 (kilolitres) Retrieved July, 2011, from http://www.omafra.gov.on.ca/english/stats/dairy/shipment.htm

OMAFRA. (2011c, May 11). Number of Cattle by County, July 2010 Retrieved July, 2011, from http://www.omafra.gov.on.ca/english/stats/livestock/ctycattle10.htm

OMAFRA. (2011d, January 31). Number of Milk Producers by County in Ontario, as of July, 2006 - 2010 Retrieved July, 2011, from http://www.omafra.gov.on.ca/english/stats/dairy/producers.htm

Appendix 6: Terms of Reference

UNIVERSITY of GUELPH

ONTARIO AGRICULTURAL COLLEGE
School of Environmental Design and Rural Development
Capacity Development and Extension • Landscape Architecture • Rural Planning and Development

Terms of Reference

Prospering with a Stable or Declining Population: Best Community Economic Development and Planning Practices for Rural Communities

Northeast Ontario Case Study

The Issue

The communities situated within Cochrane District in Northeast Ontario are economically reliant on mining and forestry. These industries face a number of challenges associated with what is often referred to as "boom and bust cycles".

As a result, the communities within Cochrane District would greatly benefit from diversification of the local economy, with one option being agricultural expansion. While agriculture is not a significant economic contributor at present, the existence of favourable soil classifications and crop heat units suggest that expansion of this sector would be feasible. Increasing agricultural land prices in Southern Ontario and forecasts associated with climate change point to the potential for enhanced agricultural opportunities in the fertile lands of Northeastern Ontario.

Objectives and Deliverables

There are six objectives for this project each with distinct deliverables building upon previous work:

1. To evaluate the opportunities for agricultural development in Northeast Ontario from a Regional Development perspective.
    a. Analysis of Canada Land Inventory (CLI)
    b. Preparation of climactic maps and crop heat unit availability
    c. Identification of suitable crops with consideration of environmental conditions (Identifying potential profitability and rates of return)
    d. Report of opportunities

2. To work with the existing agricultural community to identify opportunities and challenges regarding the role of agriculture in regional economic development.
    a. Interviews with existing farmers and government representatives
    b. Evaluation of challenges and opportunities inherent to the area
    c. Identify opportunities and challenges related to suitable crops (e.g. infrastructure, government legislation/regulations, etc.)
    d. Report of findings

3. To work with local municipalities and regional development organizations to profile and promote agricultural development as a regional development tool.
    a. Meetings and interviews with local municipalities and regional development organizations to present economic benefits of agricultural development and hear obstacles faced by these groups
    b. Profile of present status of agricultural operations as well as the cost, availability, and condition of land in the region
    c. Report of findings

4. To develop a case study approach of the Northeast Community Network as a means to identify broader regional opportunities.
    a. Examination of the Northeast Community Network in its history and current operations to identify lessons learned for regional development organizations elsewhere
    (this will probably be limited to gathering this information solely for the purpose of enhancing other deliverables related to this project)

5. To evaluate the potential for an expanded agricultural sector resulting from predicted climate change scenarios.
    a. Adapt existing climate change scenarios to the Northeast Ontario context
    b. Evaluate changes, and in turn, opportunities and challenges for agriculture in the region according to these scenarios (this will include the identification of crops that are currently productive in the north and new and future opportunities)
    c. Report of findings

6. Identification of strategic directions that achieve the goal of agricultural development.
    a. Report of strategic directions that may put the project findings into action
    b. Two single day workshops with councillors (afternoon) and general public (evening) regarding best practices for economic development and implementing study findings. (there may be a user-fee attached to this).

Methodology

The research will proceed over 1 year as follows:

1. A local steering committee will be established. This committee will provide advice and recommendations to the research team. A media event will be planned in consultation with the local steering committee.

2. Analysis will proceed using a case study approach. A Strengths, Weaknesses, Opportunities, and Threats analysis approach will be used through interviews with:
    a. Local leaders such as politicians, community economic development officials, and community futures experts
    b. Farmers with active agricultural enterprises in the area
    c. Key staff at a provincial and federal level

3. Research will be conducted to identify the key aspects of an agricultural development strategy. These practices will be applied to immigration strategies, market strategies, and strategies for the stimulation of regional economic development. This will provide a key local deliverable to the community.

4. The community will work in cooperation with the researchers to implement the strategy at a local level.

Assumptions

- The field work will be undertaken within the Northeast Community Network (NeCN) catchment area
- The University of Guelph graduate student will spend a minimum of 6-8 weeks in the community

Timeline

Project commences: April 1, 2011

Graduate student (Eric Marr) available full-time: May 1, 2011 – August 31, 2011

Expected completion of all deliverables: April 1, 2012

Percent of Effort

	Objectives and Deliverables	***% of Effort***
1.	To evaluate the opportunities for agricultural development in Northeast Ontario from a Regional Development perspective.	***15***
2.	To work with the existing agricultural community to identify opportunities and challenges regarding the role of agriculture in regional economic development.	***15***

3. To work with local municipalities and regional development organizations to profile and promote agricultural development as a regional development tool.	***15***
4. To develop a case study approach of the Northeast Community Network as a means to identify broader regional opportunities.	***5***
5. To evaluate the potential for an expanded agricultural sector resulting from predicted climate change scenarios.	***10***
6. Identification of strategic directions that achieve the goal of agricultural development.	***40***

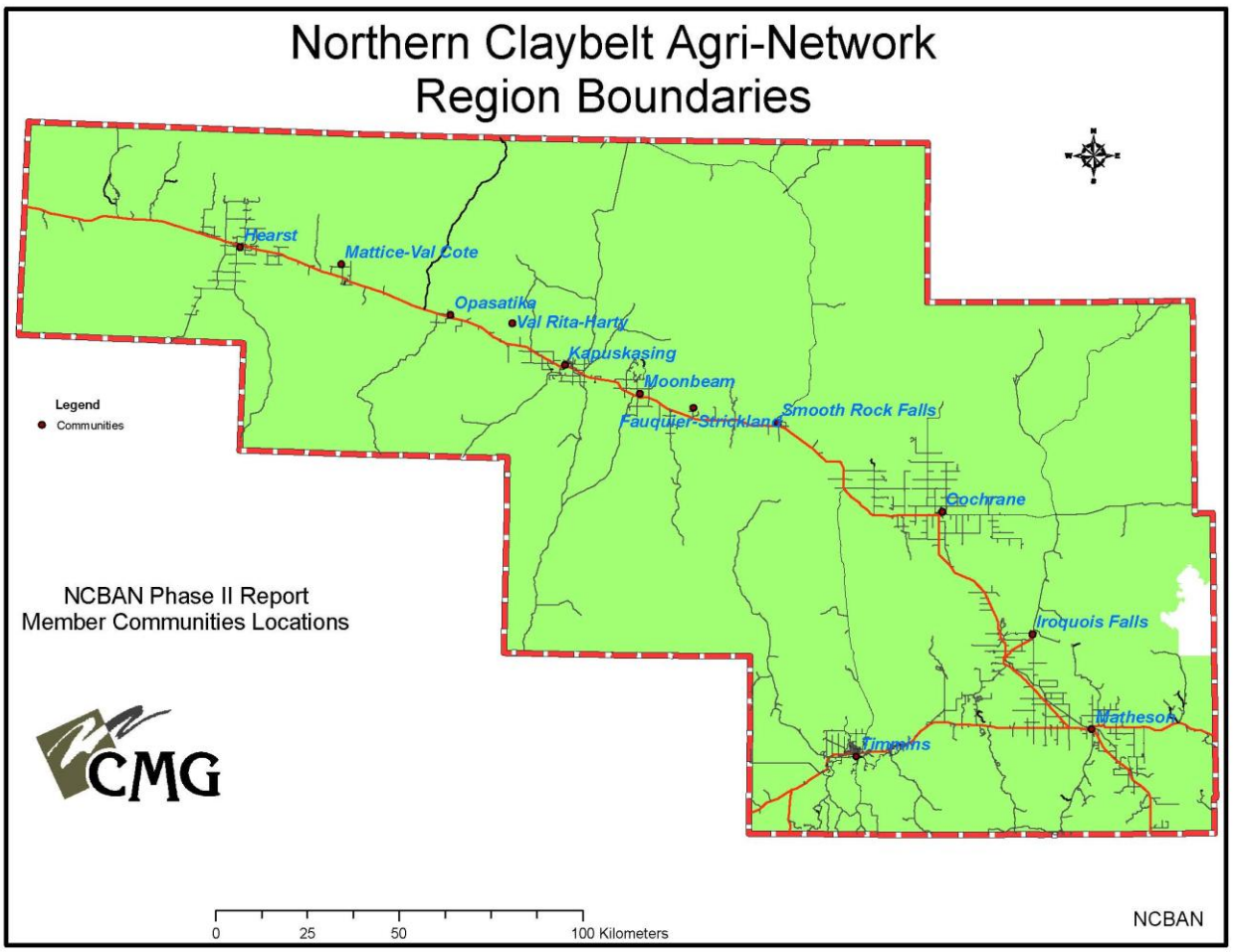
To address these objectives two main reports will be produced:

Report 1: Current and Future Opportunities for Agricultural Development in Northeastern Ontario: A Regional Development Perspective (Objectives 1, 2, 3 and 5)

Report 2: Strategic Directions for Agricultural Development in Northeastern Ontario (Objective 6 and 3)

Appendix 7: Study Area

The following map was excerpt from the NCBAN study (2009) and presents the boundaries of the NeCN catchment area:



Appendix 8: Viable Crops

This Appendix will present information on viable crops within the NeCN catchment area. The intention is to look at crops that are suitable for the climate and soil conditions of the area as well as attempting to present information on the economic viability of various products. This has been undertaken using available data as well as observations from existing farmers in the area.

It should be noted that information relevant for this topic tends to be sparse in the area. Therefore, we have included data from other jurisdictions or areas of the province. It is important to keep in mind that this information may not translate directly into the context of the NeCN catchment area. It is also imperative that readers remember that agriculture is widely variable in terms of level of production, cost of production, and the value of the final commodities. Therefore, it is very difficult to predict what crops may be viable going forward as seasonal variations and market fluctuations can, and do, change dramatically from year-to-year.

Yields, Prices, and Costs of Production for Select Crops						
Crop	Average Yield for Cochrane District (2003 - 2010)	Current Crop Prices (14 October 2011)		Average Crop Price (1981 - 2009)		Sample Cost of Production (2011)
	(bushels/acre)	$/tonne	$/bu	$/tonne	$/bu	$/acre
Oats	67	240.15 (8)	3.41 (9)	138.97	2.14	
Oats only						243.95 (1)
Oats and straw						271.9 (1)
Winter Wheat	-			143.52	3.91	
Soft Winter Wheat		237.1 (10)	6.32 (10)			
Conventional						
Wheat only						280.65 (2)
Wheat and straw						308.6 (2)
No-Till						
Wheat only						243 (2)
Wheat and straw						270.95 (2)
Hard Red Winter Wheat		304.5 (11)				
Conventional						
Wheat only						294.35 (3)
Wheat and straw						322.3 (3)
No-Till						
Wheat only						256.65 (3)
Wheat and straw						284.6 (3)
Barley	50	210 (12)		126.31	2.75	
Barley only						246.3 (4)
Barley and straw						274.25 (4)
Mixed Grain	58			121.76	2.21	-
Canola	-	508.68 (13)		300.00	6.80	
Spring Canola						285.4 (5)
Winter Canola						310.4 (6)
Rye	-			119.03	3.02	-
Hay	1.6 (tons/acre)			82.15	74.51 ($/ton)	260.7 (7)

Notes

(1) Values are samples provided by OMAFRA's Field Crop Budgets for 2011. These values are estimated specifically for Northern Ontario however do not include storage or land rental costs.
(2) Values are samples provided by OMAFRA's Field Crop Budgets for 2011. These values are estimated based on Southern Ontario conditions. The totals do not include costs relating to land rent or fungicide.
(3) Values are samples provided by OMAFRA's Field Crop Budgets for 2011. These values are estimated based on Southern Ontario conditions. The totals do not include costs relating to land rent, herbicide, or fungicide.
(4) Values are samples provided by OMAFRA's Field Crop Budgets for 2011. These values are estimated based on areas with a CHU value of less than 2800. They do not include costs for land rent, storage, or fungicide.
(5) Values are samples provided by OMAFRA's Field Crop Budgets for 2011. These values are estimated based on Southern Ontario conditions. The total also does not include costs for storage, land rent, insecticide, herbicide, fungicide, or technology use agreement costs.
(6) Values are samples provided by OMAFRA's Field Crop Budgets for 2011. These values are estimated based on Southern Ontario conditions. The total also does not include costs for storage, land rent, or fungicide.
(7) Values are samples provided by OMAFRA's Field Crop Budgets for 2011. These values are estimated based on an assumption of 2 cuts per season. This value does not include nitrogen credits or costs for land rent or twine.
(8) Oats, Chicago Board of Trade Nearby Futures, Canadian dollars
(9) Oats, Chicago Board of Trade Nearby Futures, United States dollars
(10) Wheat, Soft Red Winter (SRW) Chicago Board of Trade Nearby Futures, United States
(11) Wheat, United States No. 1 Hard Winter Ordinary (HWO) Gulf free on board (FOB), Canadian dollars
(12) Barley, No. 1 Canada Western (CW) Lethbridge/Alberta Cash, Canadian dollars
(13) Canola, No. 1 Canada, PAR Region Saskatoon Cash, Canadian dollars

Sources

Field Crop Prices, by Crop Year, Ontario, 1981-2009: http://www.omafra.gov.on.ca/english/stats/crops/index.html
Area and Production Estimates by County (2003-2010): http://www.omafra.gov.on.ca/english/stats/crops/index.html
2011 Field Crop Budgets: http://www.omafra.gov.on.ca/english/busdev/facts/pub60a3.htm
Agriculture and Agri-Food Canada - Weekly Price Summary: http://www.agr.gc.ca/mad-dam/index_e.php?s1=pubs&s2=pri

Market Gardens

Experience in Timmins

It is very difficult to quantify the value and cost of production of small scale operations geared towards local markets. However, a discussion with John Caron, a small scale producer in Timmins selling predominantly off farm or at the local markets provided some insights. Based largely on the 2011 season, he found that several crops grew well and included the following listing:

- beans (green and yellow)
- green onions
- lettuce (just about any type except for iceberg variety)
- swiss chard
- root crops (potatoes, turnips, rutabaga, carrots)
- summer squash (zucchini, spaghetti)

However, he noted that in this particular season, brassicas (cabbage, broccoli, cauliflower, radish) did poorly due to insect damage. Similarly, he found that garlic and corn did not do well due to unfavourable weather.

In terms of economic viability, John believes that garlic, onions, beans, potatoes and carrots are his most marketable vegetable products. Although, in his experience poultry is actually the most popular and profitable of his products but due to the supply management of that particular industry he is limited to 300 birds.

Overall, John believes that he could make a living off of market gardening; however he would need to cover a much larger acreage that he does not have the time or energy to undertake.

Information from Alberta

The following table presents findings from the Alberta Ministry of Agriculture and Rural Development with estimated values for market garden crops within the province. It is important to remember that these are specific to Alberta and will vary considerably even within that province. Therefore, for the context of the NeCN catchment area it should be used as a sample only and not presumed to be transferrable.

Crop	Yield (tonnes/acre)	Production Costs (dollars/acre)	Revenues (dollars/acre)
Asparagus	1-2	1,971	3,704
Beans	3.5 - 4.5	896	2,041
Beets	9.5 - 10.5	2,225	5,022
Broccoli	1.75 - 2.5	2,506	3,483
Cabbage	700 - 800 cases	3,078	4,698
Carrots	9 - 15	3,640	8,424
Cauliflower	5.5 - 7.5	2,209	2,840
Celery	750 - 850 cases	6,199	8,689
Corn	1,000 doz.	1,253	3,429
Cucumbers			
– slicers	13.5 - 14.5	6,923	10,184
– picklers	6.5 - 7.5	2,268	4,039
Lettuce	750 - 850 cases	4,239	6,086
Onions – dry	13 - 15	4,293	6,475
Parsnip	5.5 - 7.5	3,521	5,368
Potatoes	9.5 - 11.5	1,372	2,516
Pumpkin	13.5 - 15.5	3,397	4,703
Rutabaga	11- 13	1,161	2,743
Zucchini	16.5 - 17.5	7,576	10,519
Source: http://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/agdex1152			

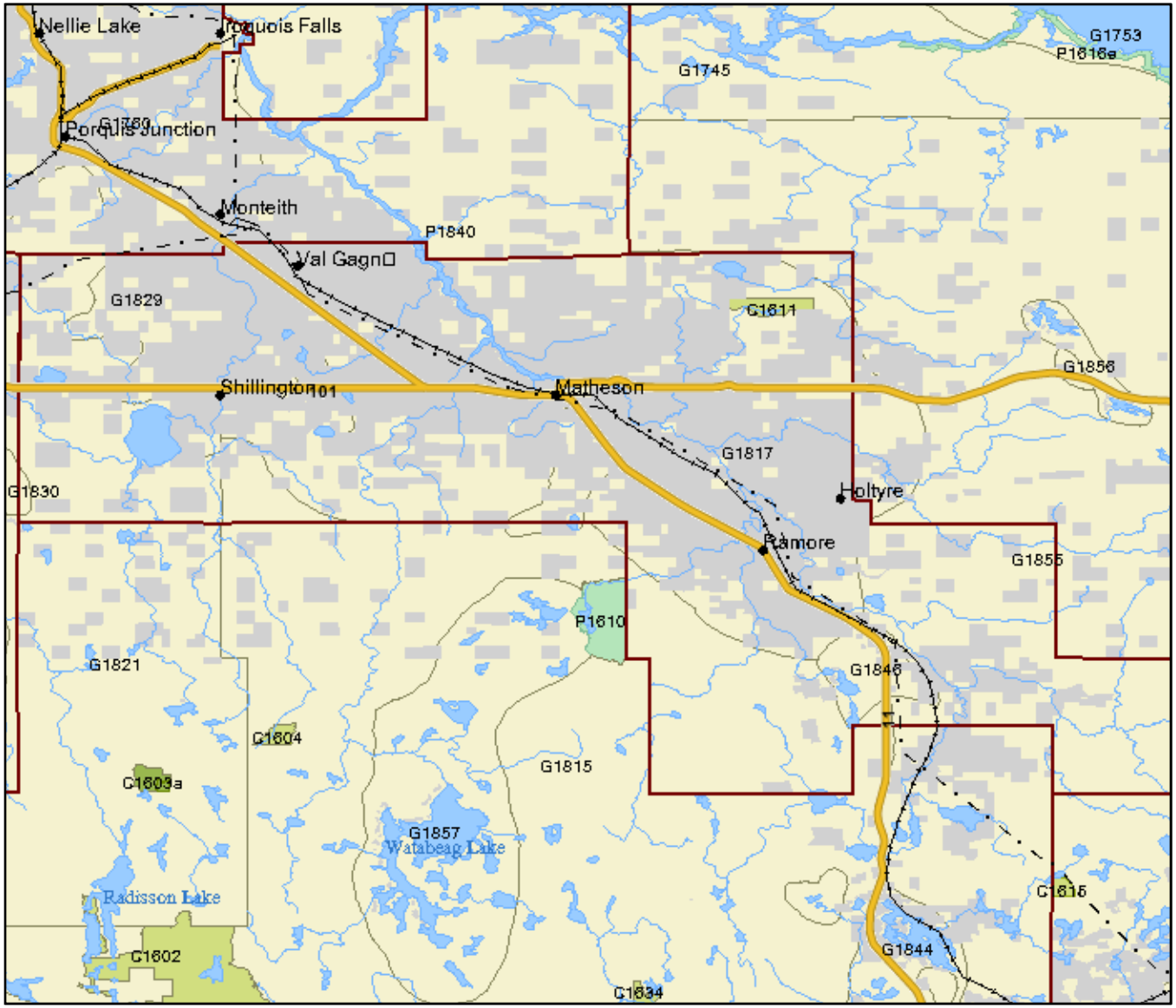
The preceding yield, cost and revenue figures are averages for all regions in Alberta. Yields will vary according to local growing conditions, revenues will vary according to markets and the marketing channel used. Production costs don't include operating and ownership costs of equipment. The numbers presented are estimates and should be used as guidelines only.

Appendix 9: Crown Land Maps

The following maps were created using the Ministry of Natural Resources' *Ontario Crown Land Use Policy Atlas*. Each map represents a different community within the NeCN catchment area. The maps present a variety of land uses however the most useful is crown land which carries important considerations for the options for using the land as well as the potential land available for agricultural use. While in most practical exercises the scale of these maps will be too high to be useful, they do present a useful look at which communities have the most available private land and where it tends to be located. As well, it should be noted that the *Ontario Crown Land Use Policy Atlas* is navigable and can be accessed by the general public for more specific evaluations of available land.

One will find when observing the maps that the two most common classifications are Private Land shown in purple and General Use Area – Crown Land shown in yellow

Black River-Matheson



Legend

Primary Land Use
- Provincial Park
- Recommended Provincial Park
- Conservation Reserve
- Recommended Conservation Reserve
- Forest Reserve
- Wilderness Area
- Enhanced Management Area
- General Use Area
- Provincial Wildlife Area

- Private Land
- Indian Reserve
- Other Federal Land
- National Park
- Overlay Area
- Lake / River
- Lower or Single Tier Municipality
- Highways
- Railway
- Power Line
- Ontario Boundary
- Small Crown Parcel

Map centre: 48° 27' 46.3" N, 80° 26' 43.8" W

Map created: May 31, 2011

0 8 16 24 32 km

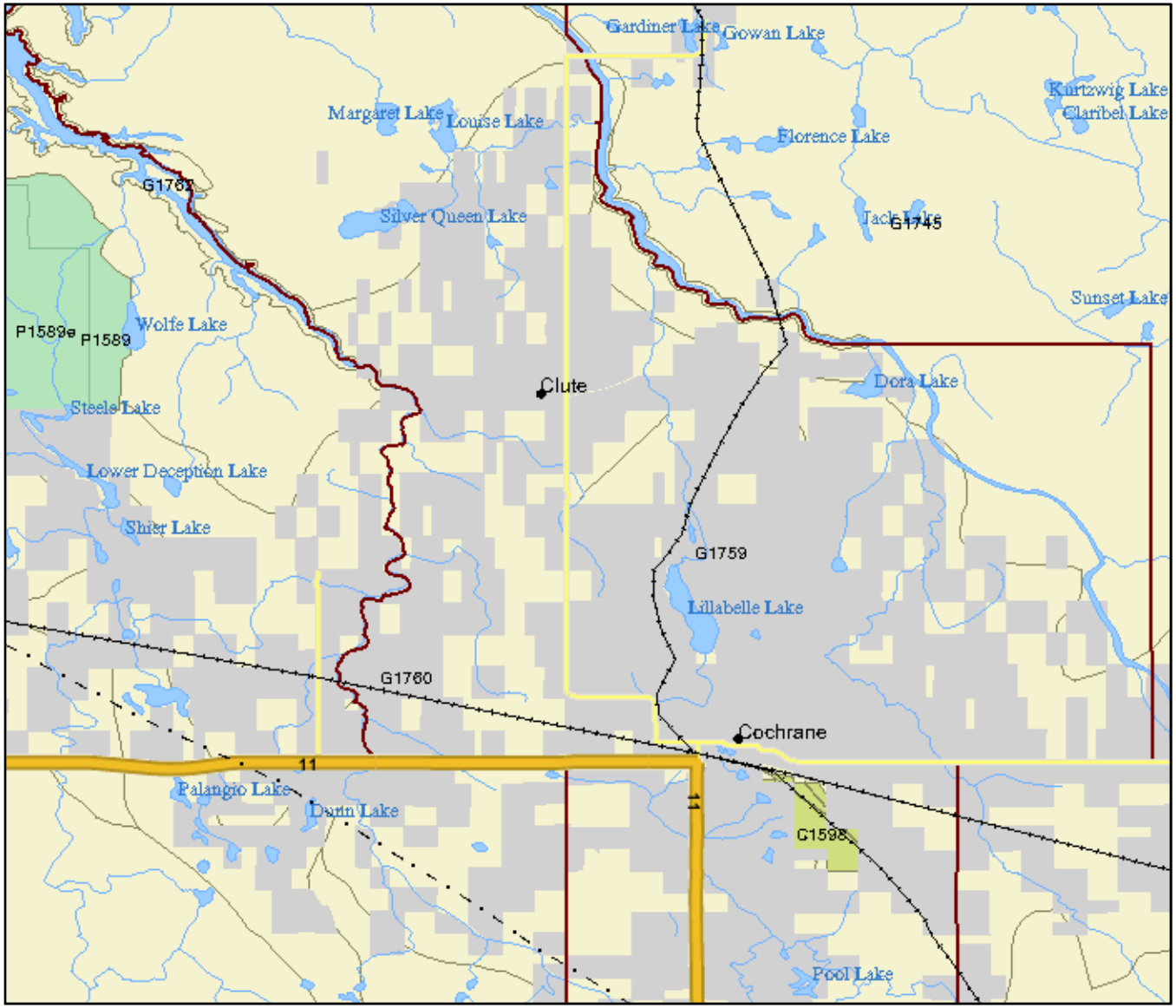
Scale: 1:470,000

Ontario

This map should not be relied on as a precise indicator of routes or locations, nor as a guide to navigation. The Ontario Ministry of Natural Resources (OMNR) shall not be liable in any way for the use of, or reliance upon, this map or any information on this map.

This map was produced automatically by the Crown Land Use Policy Atlas, a Ministry of Natural Resources website.

Cochrane



Legend

Primary Land Use

- Provincial Park
- Recommended Provincial Park
- Conservation Reserve
- Recommended Conservation Reserve
- Forest Reserve
- Wilderness Area
- Enhanced Management Area
- General Use Area
- Provincial Wildlife Area

- Private Land
- Indian Reserve
- Other Federal Land
- National Park
- Overlay Area
- Lower or Single Tier Municipality
- Arterial Roads
- Highways
- Railway
- Power Line
- Ontario Boundary
- Small Crown Parcel

Map centre: 49° 08' 45.4" N, 81° 04' 01.3" W

Map created: May 31, 2011

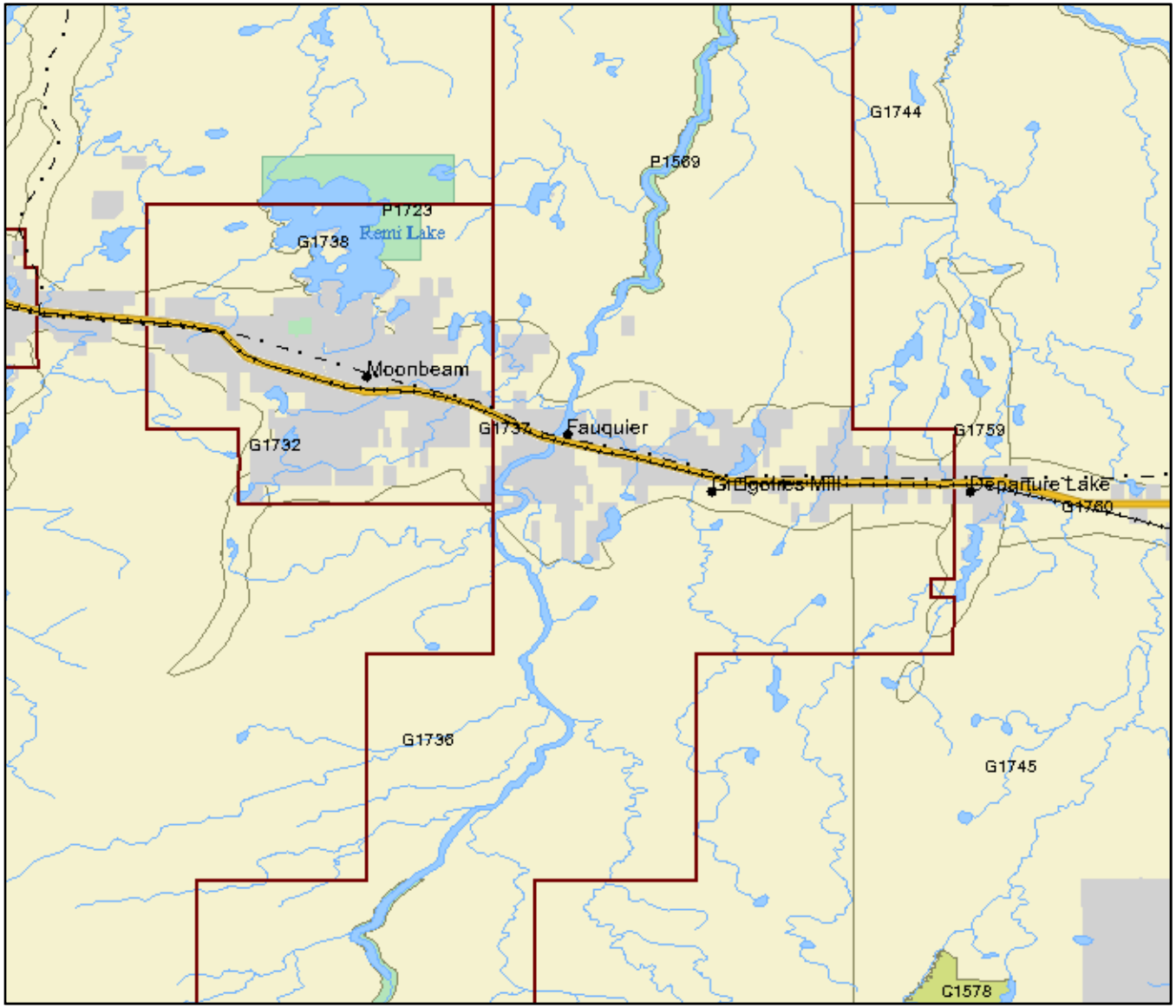
0 4 8 12 16 km

Scale: 1:246,608

Ontario

This map was produced automatically by the Crown Land Use Policy Atlas, a Ministry of Natural Resources website.

Fauquier-Strickland



Legend

Primary Land Use
- Provincial Park
- Recommended Provincial Park
- Conservation Reserve
- Recommended Conservation Reserve
- Forest Reserve
- Wilderness Area
- Enhanced Management Area
- General Use Area
- Provincial Wildlife Area

- Private Land
- Indian Reserve
- Other Federal Land
- National Park
- Overlay Area
- Lake / River
- Lower or Single Tier Municipality
- Highways
- Railway
- Power Line
- Ontario Boundary
- Small Crown Parcel

Map centre: 49° 16' 33.2" N, 82° 01' 15.8" W

Map created: May 31, 2011

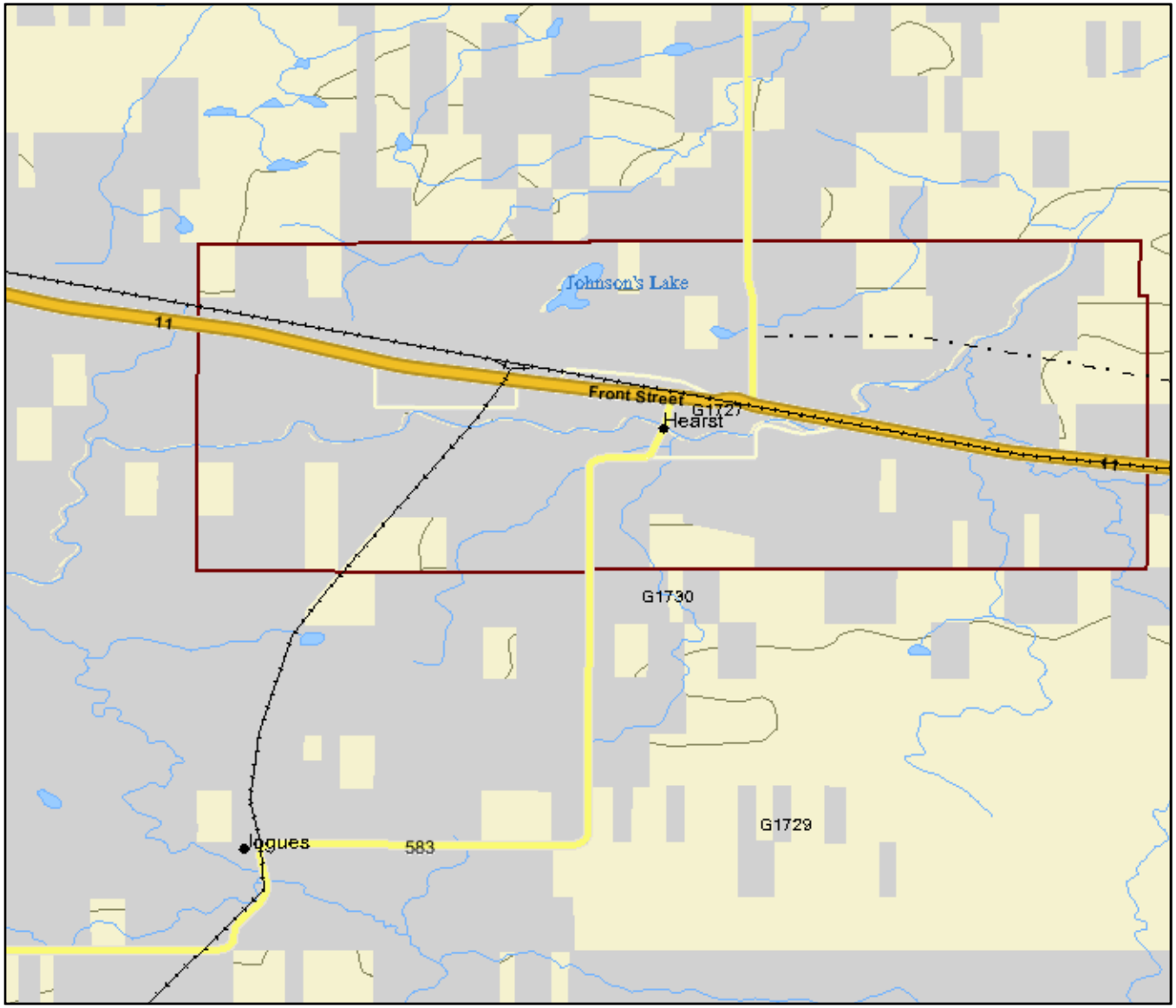
0 8 16 24 32 km

Scale: 1:422,500

Ontario

This map was produced automatically by the Crown Land Use Policy Atlas, a Ministry of Natural Resources website.

Hearst



Legend

Primary Land Use

- Provincial Park
- Recommended Provincial Park
- Conservation Reserve
- Recommended Conservation Reserve
- Forest Reserve
- Wilderness Area
- Enhanced Management Area
- General Use Area
- Provincial Wildlife Area

- Private Land
- Indian Reserve
- Other Federal Land
- National Park
- Overlay Area
- Lower or Single Tier Municipality
- Collector Roads
- Arterial Roads
- Highways
- Railway
- Power Line
- Ontario Boundary

Map centre: 49° 40' 05.9" N, 83° 40' 53.3" W

Map created: May 31, 2011

N

S

0 2 4 6 8 km

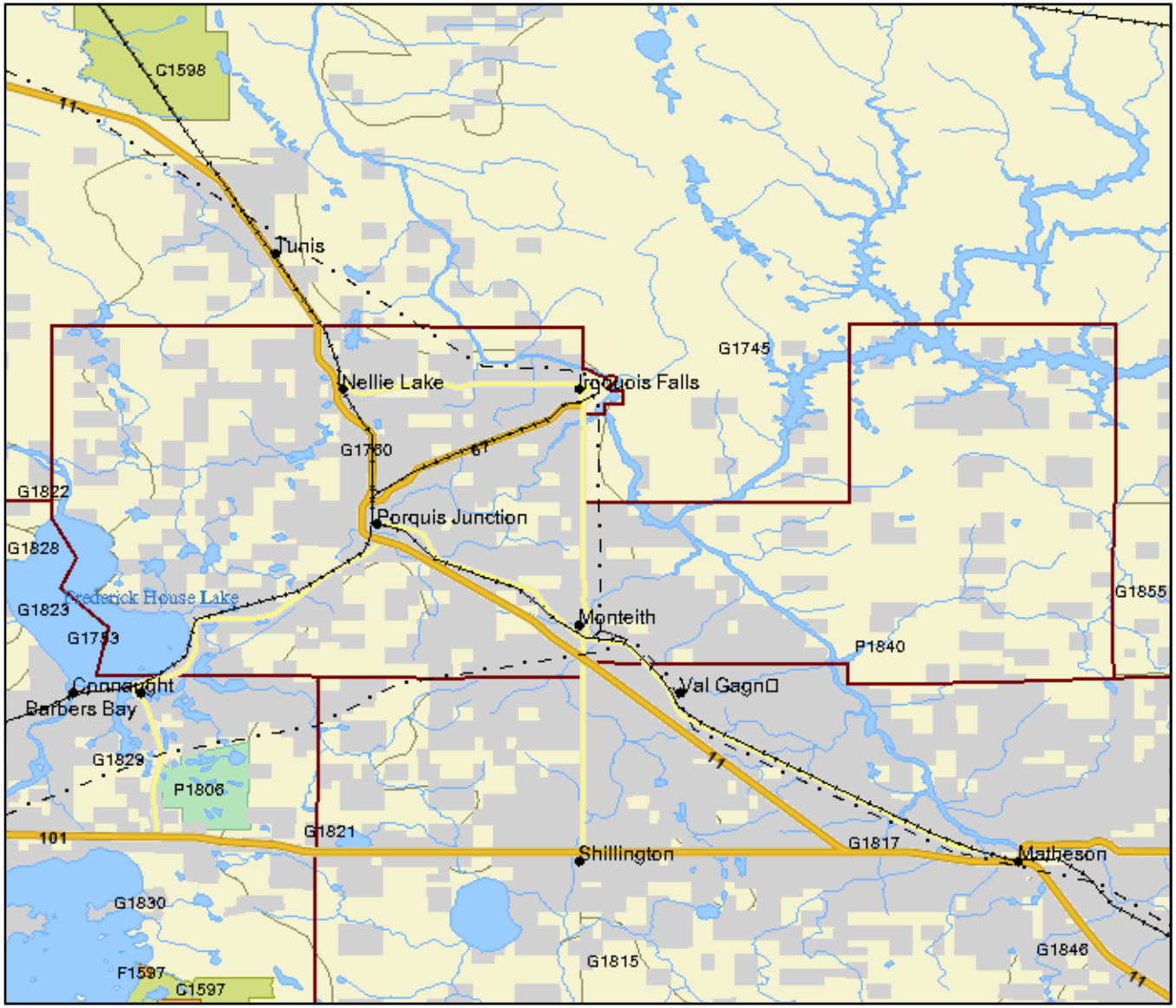
Scale: 1:144,642

Ontario

This map should not be relied on as a precise indicator of routes or locations, nor as a guide to navigation. The Ontario Ministry of Natural Resources (OMNR) shall not be liable in any way for the use of, or reliance upon, this map or any information on this map.

This map was produced automatically by the Crown Land Use Policy Atlas, a Ministry of Natural Resources website.

Iroquois Falls



Legend

Primary Land Use

- Provincial Park
- Recommended Provincial Park
- Conservation Reserve
- Recommended Conservation Reserve
- Forest Reserve
- Wilderness Area
- Enhanced Management Area
- General Use Area
- Provincial Wildlife Area
- Private Land
- Indian Reserve
- Other Federal Land
- National Park
- Overlay Area
- Lower or Single Tier Municipality
- Arterial Roads
- Highways
- Railway
- Power Line
- Ontario Boundary
- Small Crown Parcel

Map centre: 48° 42' 34.6" N, 80° 40' 42.4" W

Map created: May 31, 2011

0 6 12 18 24 km

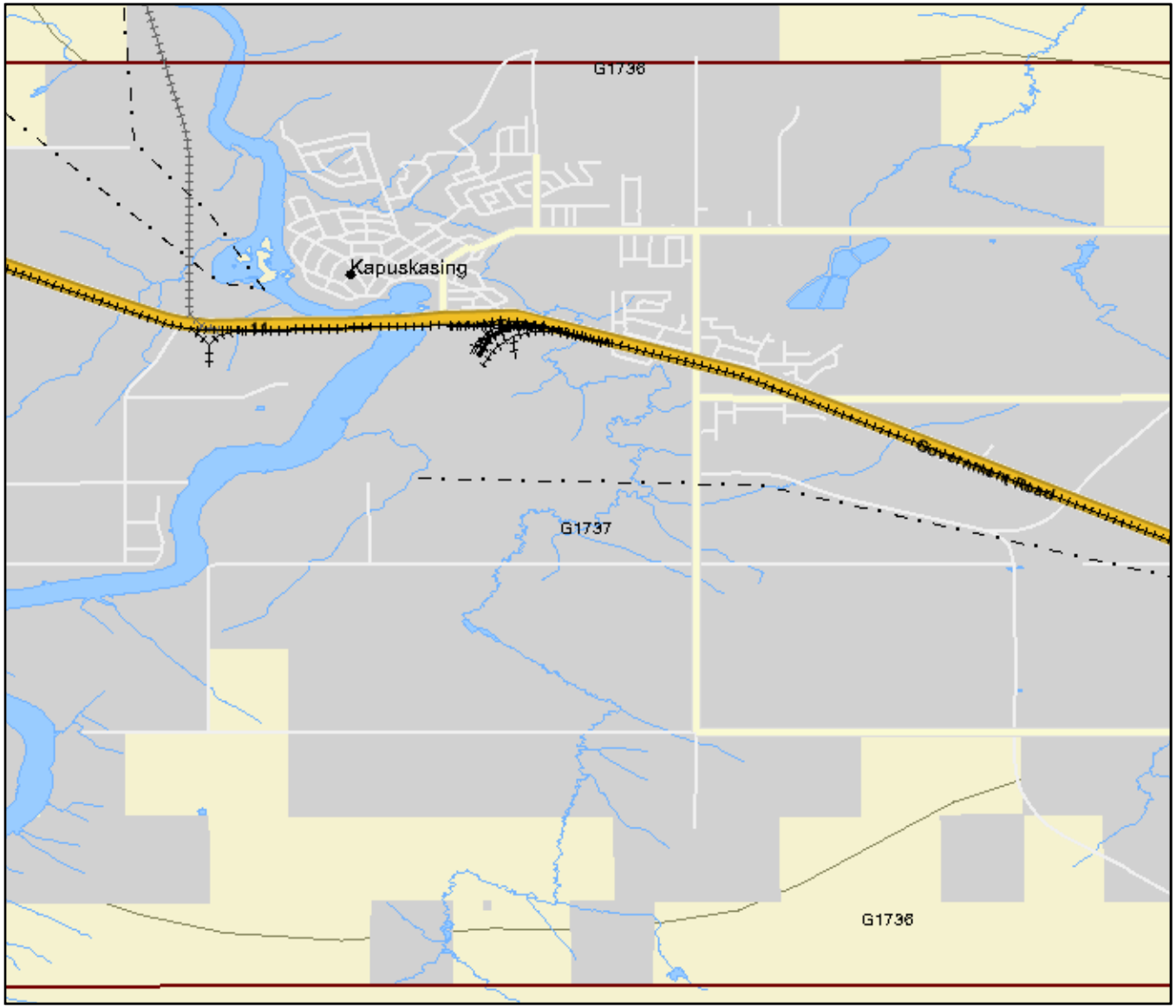
Scale: 1:360,000

Ontario

This map should not be relied on as a precise indicator of routes or locations, nor as a guide to navigation. The Ontario Ministry of Natural Resources (OMNR) shall not be liable in any way for the use of, or reliance upon, this map or any information on this map.

This map was produced automatically by the Crown Land Use Policy Atlas, a Ministry of Natural Resources website.

Kapuskasing



Legend

Primary Land Use
- Provincial Park
- Recommended Provincial Park
- Conservation Reserve
- Recommended Conservation Reserve
- Forest Reserve
- Wilderness Area
- Enhanced Management Area
- General Use Area
- Provincial Wildlife Area

- Private Land
- Indian Reserve
- Other Federal Land
- National Park
- Overlay Area
- Lake / River
- Lower or Single Tier Municipality
- Local Roads
- Collector Roads
- Arterial Roads
- Highways
- Railway
- Power Line
- Ontario Boundary

Map centre: 49° 23' 48.7" N, 82° 24' 45.7" W

Map created: May 31, 2011

N

S

0 1 2 3 4 km

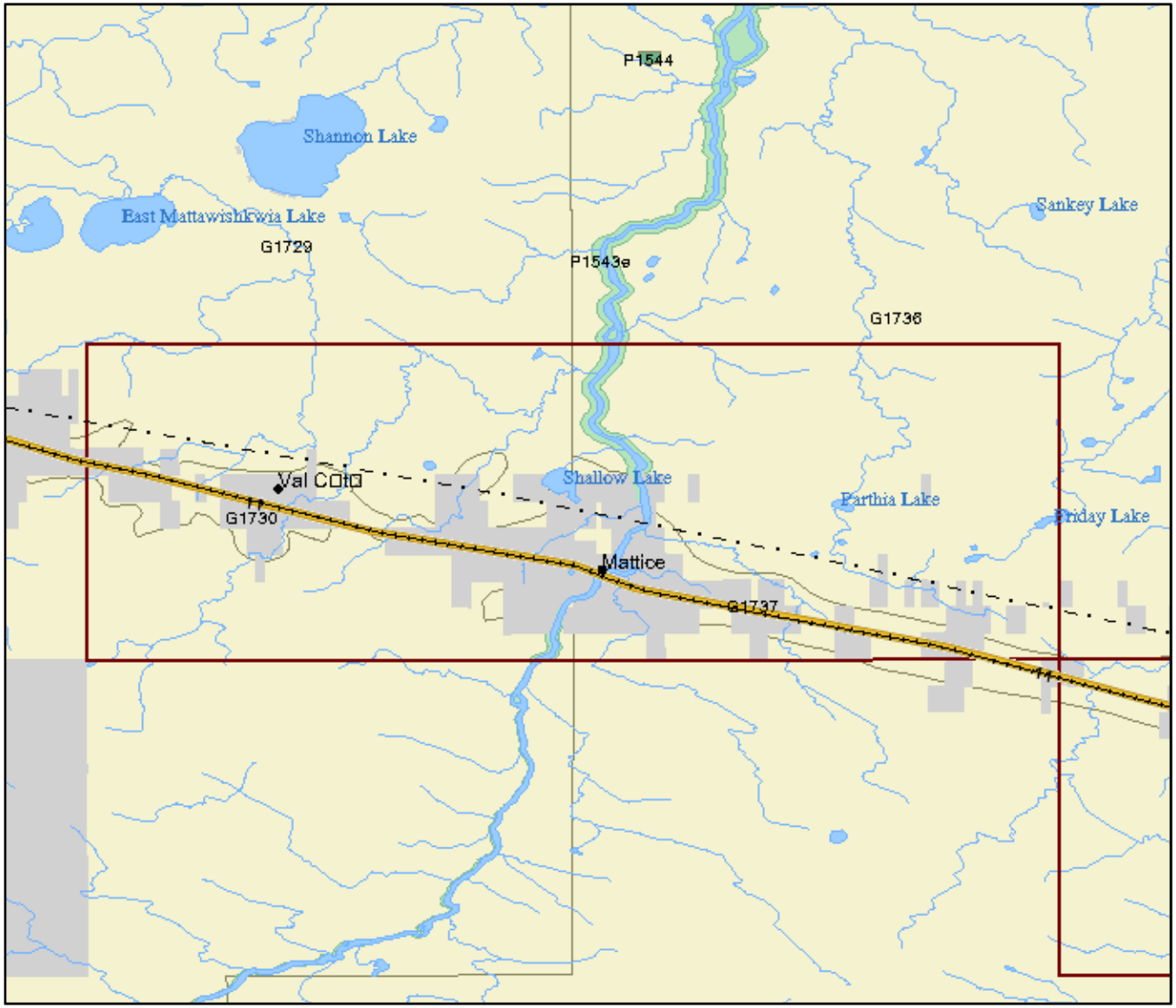
Scale: 1:62,843

Ontario

This map should not be relied on as a precise indicator of routes or locations, nor as a guide to navigation. The Ontario Ministry of Natural Resources (OMNR) shall not be liable in any way for the use of, or reliance upon, this map or any information on this map.

This map was produced automatically by the Crown Land Use Policy Atlas, a Ministry of Natural Resources website.

Mattice-Val Côté



Legend

Primary Land Use
- Provincial Park
- Recommended Provincial Park
- Conservation Reserve
- Recommended Conservation Reserve
- Forest Reserve
- Wilderness Area
- Enhanced Management Area
- General Use Area
- Provincial Wildlife Area

- Private Land
- Indian Reserve
- Other Federal Land
- National Park
- Overlay Area
- Lower or Single Tier Municipality
- Arterial Roads
- Highways
- Railway
- Power Line
- Ontario Boundary
- Small Crown Parcel

Map centre: 49° 38' 36.7" N, 83° 16' 19.7" W

Map created: May 31, 2011

0 5 10 15 20 km

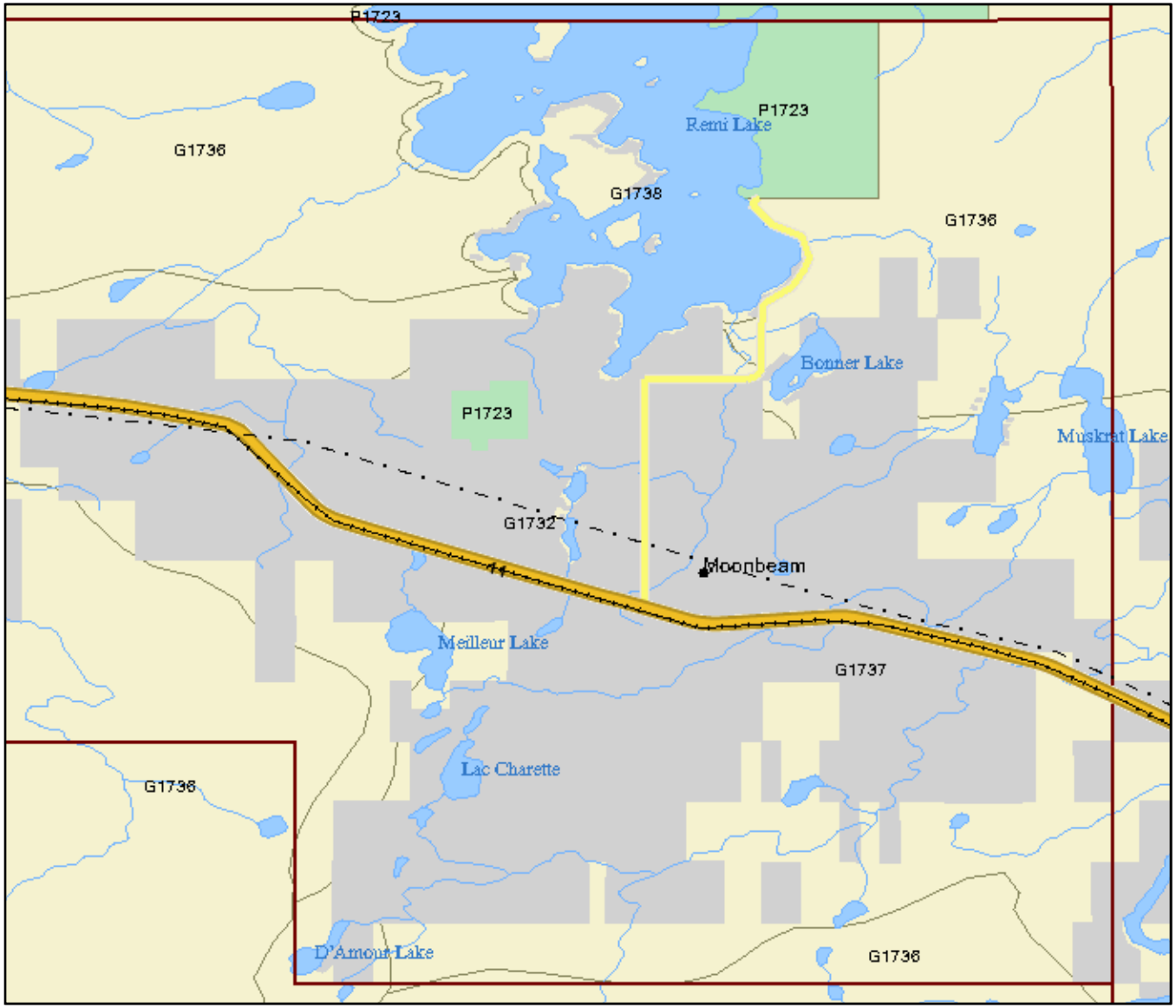
Scale: 1:300,000

Ontario

This map should not be relied on as a precise indicator of routes or locations, nor as a guide to navigation. The Ontario Ministry of Natural Resources (OMNR) shall not be liable in any way for the use of, or reliance upon, this map or any information on this map.

This map was produced automatically by the Crown Land Use Policy Atlas, a Ministry of Natural Resources website.

Moonbeam



Legend

Primary Land Use

- Provincial Park
- Recommended Provincial Park
- Conservation Reserve
- Recommended Conservation Reserve
- Forest Reserve
- Wilderness Area
- Enhanced Management Area
- General Use Area
- Provincial Wildlife Area

- Private Land
- Indian Reserve
- Other Federal Land
- National Park
- Overlay Area
- Lower or Single Tier Municipality
- Collector Roads
- Arterial Roads
- Highways
- Railway
- Power Line
- Ontario Boundary

Map centre: 49° 21' 44.4" N, 82° 10' 13.9" W

Map created: May 31, 2011

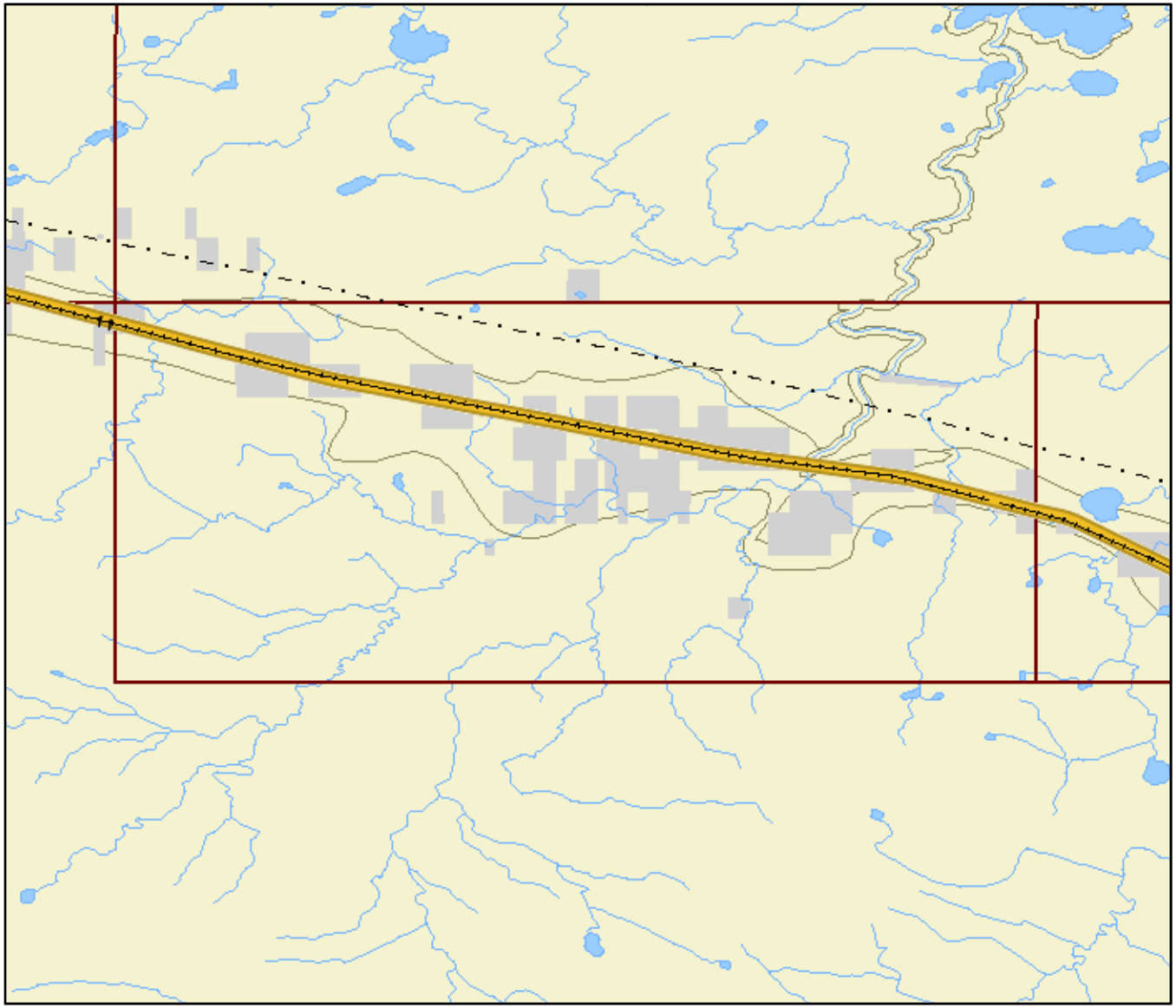
0 2 4 6 8 km

Scale: 1:131,151

Ontario

This map was produced automatically by the Crown Land Use Policy Atlas, a Ministry of Natural Resources website.

Opasatika



Legend

Primary Land Use

- Provincial Park
- Recommended Provincial Park
- Conservation Reserve
- Recommended Conservation Reserve
- Forest Reserve
- Wilderness Area
- Enhanced Management Area
- General Use Area
- Provincial Wildlife Area

- Private Land
- Indian Reserve
- Other Federal Land
- National Park
- Overlay Area
- Lower or Single Tier Municipality
- Arterial Roads
- Highways
- Railway
- Power Line
- Ontario Boundary
- Small Crown Parcel

Map centre: 49° 30' 37.3" N, 82° 54' 58.4" W

Map created: May 31, 2011

N

S

0 4 8 12 16 km

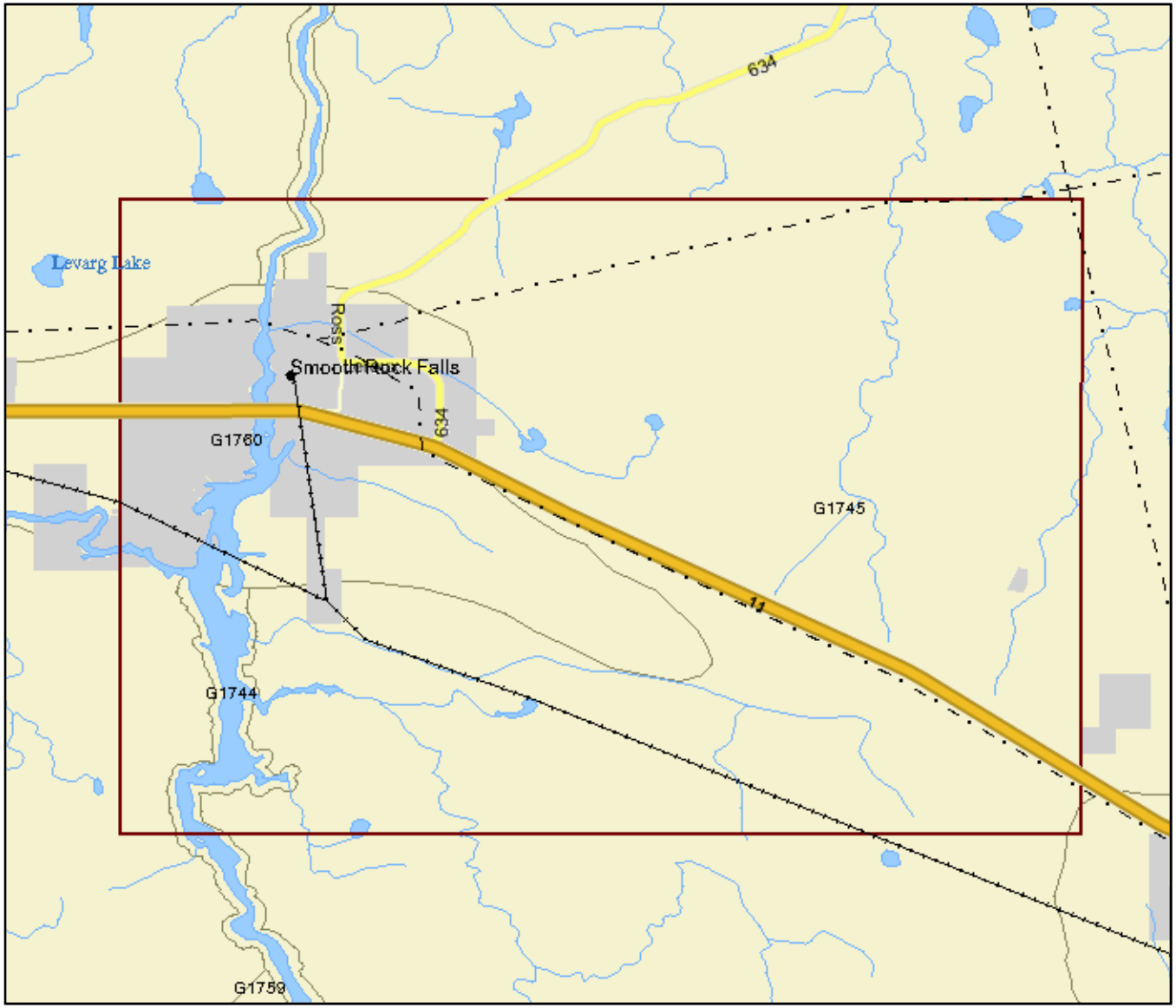
Scale: 1:250,000

Ontario

This map should not be relied on as a precise indicator of routes or locations, nor as a guide to navigation. The Ontario Ministry of Natural Resources (OMNR) shall not be liable in any way for the use of, or reliance upon, this map or any information on this map.

This map was produced automatically by the Crown Land Use Policy Atlas, a Ministry of Natural Resources website.

Smooth Rock Falls



Legend

Primary Land Use
- Provincial Park
- Recommended Provincial Park
- Conservation Reserve
- Recommended Conservation Reserve
- Forest Reserve
- Wilderness Area
- Enhanced Management Area
- General Use Area
- Provincial Wildlife Area

- Private Land
- Indian Reserve
- Other Federal Land
- National Park
- Overlay Area
- Lower or Single Tier Municipality
- Collector Roads
- Arterial Roads
- Highways
- Railway
- Power Line
- Ontario Boundary

Map centre: 49° 15' 24.6" N, 81° 34' 18.5" W

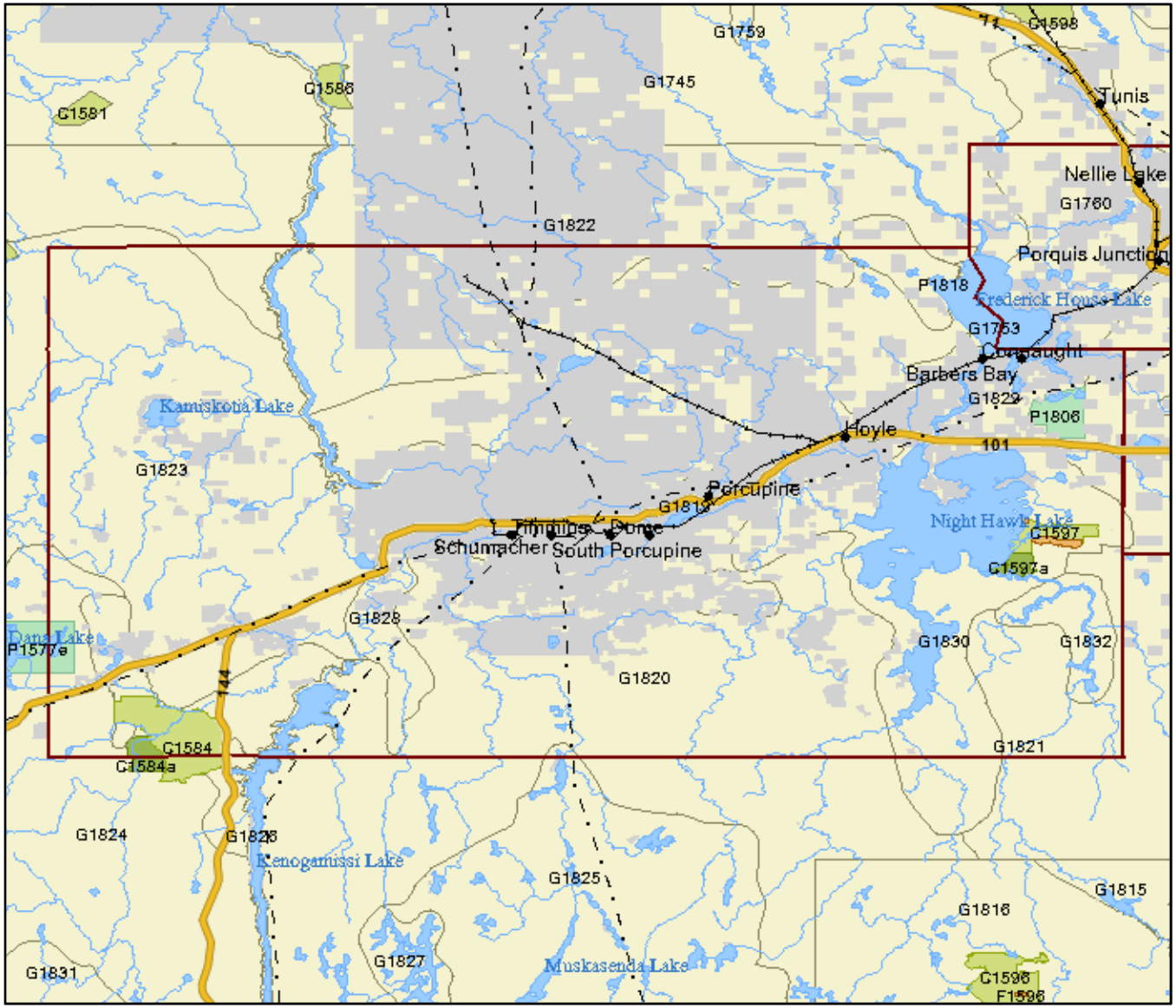
Map created: May 31, 2011

0 2 4 6 8 km

Scale: 1:150,000

Ontario

Timmins



Map centre: 48° 29' 33.4" N, 81° 16' 05.1" W

Map created: May 31, 2011

0 10 20 30 40 km

Scale: 1:620,000

Ontario

Legend

Primary Land Use

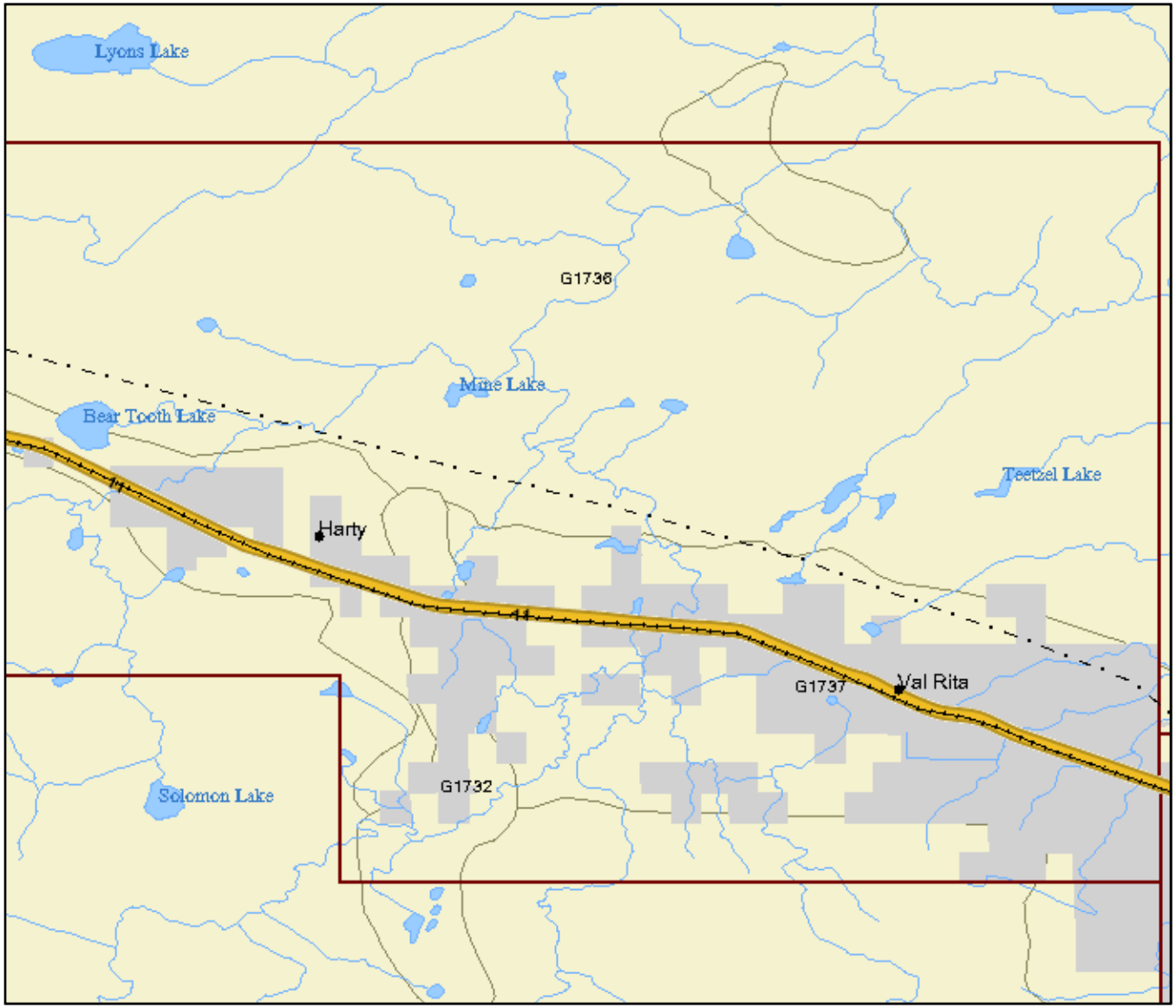
- Provincial Park
- Recommended Provincial Park
- Conservation Reserve
- Recommended Conservation Reserve
- Forest Reserve
- Wilderness Area
- Enhanced Management Area
- General Use Area
- Provincial Wildlife Area

- Private Land
- Indian Reserve
- Other Federal Land
- National Park
- Overlay Area
- Lake / River
- Lower or Single Tier Municipality
- Highways
- Railway
- Power Line
- Ontario Boundary
- Small Crown Parcel

This map should not be relied on as a precise indicator of routes or locations, nor as a guide to navigation. The Ontario Ministry of Natural Resources (OMNR) shall not be liable in any way for the use of, or reliance upon, this map or any information on this map.

This map was produced automatically by the Crown Land Use Policy Atlas, a Ministry of Natural Resources website.

Val Rita-Harty



Legend

Primary Land Use
- Provincial Park
- Recommended Provincial Park
- Conservation Reserve
- Recommended Conservation Reserve
- Forest Reserve
- Wilderness Area
- Enhanced Management Area
- General Use Area
- Provincial Wildlife Area

- Private Land
- Indian Reserve
- Other Federal Land
- National Park
- Overlay Area
- Lower or Single Tier Municipality
- Collector Roads
- Arterial Roads
- Highways
- Railway
- Power Line
- Ontario Boundary

Map centre: 49° 29' 28.0" N, 82° 37' 02.4" W

Map created: May 31, 2011

0 3 6 9 12 km

Scale: 1:178,259

Ontario

This map was produced automatically by the Crown Land Use Policy Atlas, a Ministry of Natural Resources website.