

# **Ontario Snowmobile Tourism: Responses to Climate Variability and Change**

**by**

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**A thesis**

**presented to the University of Waterloo**

**in fulfillment of the**

**thesis requirement for the degree of**

**Master of Environmental Studies**

**in**

**Geography - Tourism Policy and Planning**

**Waterloo, Ontario, Canada, 2010**

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## **Author's Declaration**

I hereby declare that I am the sole author of this thesis.

This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

I understand that my thesis may be made electronically available to the public.

## **Abstract**

A suitable climate, varied scenic terrain, and proximity of communities along Ontario's system of 39,742 km of snowmobile trails have provided for domestic and international snowmobile tourism. Outdoor winter tourism in many parts of the world has been identified to be at risk to changes in global climate. The Intergovernmental Panel on Climate Change in its Fourth Assessment Report (AR4) reported a global increase of temperature of 0.74 degrees Celsius for the period 1906 to 2005 and estimates that by the end of the 21<sup>st</sup> century the global mean temperature will increase between 1.8 degrees Celsius to 4.0 degrees Celsius. Temperature increases of only a few degrees may contribute to variances in snow-based tourism reliant on the reliability of natural snow cover.

This study examines the spatial and temporal impacts of climate change scenarios upon snowmobile season length and operations within the snowmobile industry in the Province of Ontario Canada to six climate change scenarios for the 21<sup>st</sup> century. Snowmobile trail operations in Ontario are reliant upon a minimum natural snow cover of 15 cm for smooth terrain trails and 30 cm to 60 cm for rough terrain trails, temperatures less than 0 degrees Celsius and, human and financial capital. Three or more consecutive snowmobile seasons with < 28 days have been identified as having serious implications for human and financial capital necessary to develop and maintain the snowmobile trail system. As early as the 2020s, north eastern snowmobile districts are projected to be least vulnerable to changes in climate with the longest snowmobile seasons > 28 days, while south central snowmobile districts are projected to be the most vulnerable to changes in climate with the shortest snowmobile seasons of < 28 days. Snowmobile trail managers identified possible strategies to adapt to a changing climate (2020s to 2080s) including: pre-season preparation of the terrain including early season packing of snow cover, re-location of the most vulnerable snowmobile trails, and strengthening inter-district alliances.

## **Acknowledgements**

Firstly, I wish to thank my supervisor, Dr. Daniel Scott (Canada Research Chair in Climate Change and Tourism) for his guidance and support through this process. I wish also to thank my committee

Dr. Barbara Carmichael (Wilfrid Laurier University) and Dr. Judith Cukier  
(University of Waterloo) for their valuable comments.

Secondly, I wish to thank the research participants who generously offered their expertise and insights into snowmobile tourism in Ontario.

## **Dedication**

This thesis is dedicated to the volunteer members of snowmobile clubs in the Province of Ontario, without their generous offering of their time and expertise; snowmobile tourism would not be possible.

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## Acronyms

AGCI	Aspen Global Change Institute
CCCSN	Canadian Climate Change Scenarios Network
CCME	Canadian Council of Ministers of the Environment
CCSO/CCOM	Canadian Council of Snowmobile Organizations
CTC	Canadian Tourism Commission
GCM	Global Climate Model
GDP	Gross Domestic Product
GHG	Greenhouse Gas
HFWR	Haliburton Forest & Wildlife Reserve
IASA	International Association of Snowmobile Administrators
INM	Institute of Numerical Mathematics
IPCC	Intergovernmental Panel on Climate Change
LARS-WG	Long Ashton Research Station – Weather Generator
MIROC	Model for Interdisciplinary Research on Climate
MNR	Ministry of Natural Resources
MPPACC	Model of Private Proactive Adaptation to Climate Change
MSC	Meteorological Service of Canada
OFATV	Ontario Federation of All Terrain Vehicles
OFSC	Ontario Federation of Snowmobile Clubs
OMT	Ontario Ministry of Tourism
PKFC	Pannell Kerr Forster Consulting
S.T.O.P.	Snowmobile Trail Officer Patrol
SWOT	Strengths Weaknesses Opportunities Threats
TGCI	Task Group on Scenarios for Climate Impact Assessment
TOP	Trans Ontario Provincial
UNWTO	United Nations World Tourism Organization

# Chapter 1

## Introduction

Snowmobiling in the Province of Ontario, as a winter outdoor adventure activity, generally occurs from December to March. Annual economic benefits of snowmobiling in Ontario are estimated at CAN \$1.2 billion and generate CAN \$112 million in provincial tax revenue (OFSC, 2008a). A suitable climate including adequate snow cover, freezing temperatures, varied scenic terrain, and proximity of communities along Ontario's system of snowmobile trails provide for domestic and international snowmobile tourism. However, changes in climate from both natural and anthropogenic causes are influencing the spatial and temporal distribution of the Ontario snow-pack and consequently snowmobiling (McBoyle, Scott, & Jones, 2007; Scott, Jones, Lemieux, McBoyle, Mills, Svenson, & Wall, 2002).

The Ontario Federation of Snowmobile Clubs (OFSC) consists of 234 volunteer member snowmobile clubs in 17 snowmobile districts, and manages the delivery of the snowmobile trail product upon which snowmobile tourism is predicated. These volunteers are unique, in that not only do they provide for the supply of the snowmobile trail product, but many are also active snowmobile participants. Prior to 1992 snowmobile clubs primarily developed local systems of snowmobile trails for the enjoyment of club members. Since 1992 the focus has been on snowmobile tourism trails with the development of Trans-Ontario-Provincial (TOP) snowmobile trails by the OFSC. These TOP trails link many snow-belt communities, border crossings and tourism regions and local and regional snowmobile trails. Climate variability and change are just one of many challenges, presently and in the future, facing Ontario snowmobile tourism; others include access to private and public lands, costs of participation (e.g. rising costs of fuel and snowmobile insurance), volunteer attraction and retention, environmental stewardship, and risk management.

The Intergovernmental Panel on Climate Change (IPCC) (IPCC, 2007a) reports a global increase in temperature of  $0.74^{\circ}\text{C}$  for the period 1906 to 2005. The trend in Canada for the period 1948 (since nationwide records were kept) to 2007 was an increase in temperature of  $1.4^{\circ}\text{C}$  (Statistics Canada, 2008). During the 1972 to 2003 period the extent of snow cover in the Northern Hemisphere has declined by 10% and in the Arctic region the duration of snow cover has declined by 20 days since the 1950s (Brown, 2000). Temperatures that remain above  $0^{\circ}\text{C}$  during the Ontario snowmobile season limit snowfall and depth of ground frost that may result in shorter snowmobile season lengths. The reliability of snowfalls has also been an important concern for snowmobile participants during the holiday periods of Christmas/New Years and March school break.

### **1.1 Goals and Objectives**

Climate change is a long-term phenomenon that may provide challenges and relative advantages for snowmobile tourism in Ontario. Recent studies conducted pertaining to snowmobile tourism in the Province of Ontario include (McBoyle et al., 2007; Scott et al., 2002). Each study explored the potential loss of snow cover and reduced snowmobile season lengths, related to projected changes in climate. Scott et al. (2002) considered seven sites within the Lakelands Tourism Region and McBoyle et al. (2007) four sites within Ontario and 2 sites in Saskatchewan and Manitoba, 3 sites in Quebec, and 1 site in Nova Scotia and Newfoundland. This study enhances the previous two studies by: (1) using climate thresholds for snowmobile trail operations identified by senior Ontario snowmobile trail managers/operators to model snowmobile seasons, (2) examining all seventeen of the OFSC snowmobile districts to identify where spatial and when temporal changes of the Ontario snow-pack may occur and how the snowmobile industry may evolve, and (3) identifying the potential response options of

snowmobile trail managers/operators to projected changes in the length of the snowmobile season.

The goal of this study is to explore the potential vulnerability of snowmobile tourism in each of the 17 OFSC snowmobile districts to changes in climate. To achieve this goal, three objectives have guided the research:

- (1) to discover the sensitivity of snowmobile trail operations and adaptations to past climate variability,
- (2) using a modelling approach examine the influence of climate change upon snowmobile season length in each OFSC snowmobile district during the future periods 2010 to 2039, 2040 to 2069, and 2070 to 2099, and
- (3) to discover the possible adaptations that senior Ontario snowmobile trail managers/operators may consider in the future to climate change.

## **1.2 Structure of Thesis**

This introduction chapter is the first of six chapters. Chapter two establishes the context of this study reviewing the literature pertaining to tourism, climate change and human responses to risks of climate change. Chapter three describes a three-phased, mixed-methods approach for data collection for this study. Chapter four presents the analysis of the collected data for each of the methods (qualitative and quantitative). Data from interviews is presented along with the results from climate change scenarios. Chapter five presents a discussion of the results and implications for snowmobile tourism. Finally, Chapter six provides conclusions and recommendations.







where human disturbance has been minimal (Eagles, 2003). Adventure travel has become popular for tourists desiring to explore personal challenges in the natural environment. Sung, Morrison, and O’Leary (1996, p. 66) offer a definition; “a trip or travel with the specific purpose of activity participation to explore new experiences, often involving personal risk or controlled danger associated with personal challenges, in a natural or exotic outdoor location.” The balance between perceived risk and perceived competence is essential for an optimal adventure experience (Cater, 2006; Morgan, Moore, & Mansell, 2005; Sung, et al., 1996). Fear due to its level of uncertainty, has also been considered a strong attractor in adventure tourism (Cater, 2006).

Environment Canada (1999) released the report, *The Importance of Nature to Canadians*, revealing that 10.3 million Canadians participated 166 million days and 3.9 million Ontarians participated 58.5 million days in outdoor activities in natural areas during 1996 (Table 2.1). Nature-related expenditures were estimated by Canadians at \$7,246.7 million and by Ontarians \$2,851 million (Environment Canada, 2000). For Canadians, relaxing in an outdoor setting (32.4%), sightseeing in a natural area (31.1%), and picnicking (26.0%) were the top three activities. Ontarians enjoyed relaxing in an outdoor setting (32.7%) sightseeing in a natural area (29.6%), and a swimming/beach activity (26.1%) (Environment Canada, 2000). Snowmobiling accounted for 2.5% of Canadian participants and 2.4% of Ontario participants in 1996. Southwick Associates (2006) estimated that in the United States 15.6 million participants in snow-based activities (excluding snowmobiling) contributed US \$66.3 billion to the economy and generated US \$8.8 billion in federal and state taxes.

**Table 2.1:** Importance of Nature to Canadians

<b>Region</b>	<b>Total Participation of Outdoor Activities in Natural Areas (millions) (EC, 1999)</b>	<b>Total Days (millions) (EC, 1999)</b>	<b>Total Trips (millions) (EC, 1999)</b>	<b>Total Expenditures (\$ millions) (EC, 2000)</b>
<b>Canada</b>	10.300	166.000	137.100	7,246.70
<b>Ontario</b>	3.878	58.525	46.910	2,851.00

Source: Environment Canada (1999), (2000)

### 2.2.2 Snowmobile Tourism

An estimated 3.1 million Canadian adults in 2000 were considered to be winter outdoor activity participants (Research Resolutions, 2003b). Day use snowmobiling on organized snowmobile trails represented 32% of participants and overnight touring 13% of participants (Research Resolutions, 2003b). Demographically males accounted for 56% and females 44% and 66% of participants were between 18-44 years of age. An average income of CAN \$55,800 was reported with 70% having some post secondary or completed secondary education levels (Research Resolutions, 2003b).

In Canada in 2009 743 non-profit volunteer snowmobile clubs operated 127,662 km of recreational snowmobile trails (Table 2.2) (Canadian Council of Snowmobile Organizations (CCSO/CCOM), 2009a). Overnight snowmobile tourism in Canada generally occurs from December to March and was estimated in 1999 at 845,000 domestic, 75,000 US, and 34,000 international participants, generating direct expenditures of \$122 million and \$256 million in total economic activity (Pannell Kerr Forster Consulting (PKFC), 2001). An overnight snowmobile tourist is “any person-trip taken to or within Canada, either inter-provincially or intra-provincially, with at least one overnight stay and where either snowmobiling is the main

purpose of the trip or one of a number of activities participated in during the trip” (PKFC, 2001, p. 28).

**Table 2.2:** Snowmobiling in Canada 2009

<b>Province / Territory</b>	<b>Snowmobile Clubs</b>	<b>Kilometres of Trails</b>
Newfoundland	17	4,000
Prince Edward Island	3	1,100
Nova Scotia	20	3,500
New Brunswick	51	7,100
Quebec	208	32,720
Ontario	234	39,742
Manitoba	48	12,000
Saskatchewan	67	10,000
Alberta	32	5,000
British Columbia	60	12,000
Yukon	3	500
Nunavut	N/A	N/A
<b>Totals</b>	<b>743</b>	<b>127,662</b>

Source: CCSO/CCOM (2009a)

PKFC (2001) determined that snowmobile tour operators providing all-inclusive snowmobile tours, including an experienced guide, snowmobile, insurance, clothing, accommodations, and meals in Canada for both the experienced (60%) and novice (40%) participants, averaged 210 clients per operator per season, and ranged from 4.5 to 5.5 days. PKFC (2001) estimated the all-inclusive snowmobile tour market to be made up of international participants (47%), US participants (38%) and, Canadian participants (15%).

Approximately 48% of all snowmobile trails in Canada in 1999 were classified as primary, meaning that trails are a minimum of 12 feet wide, groomed at least 2 times per week, fully signed and 52% as secondary, meaning trails not meeting the criteria of the primary trails (PKFC, 2001). Sixty percent of snowmobile trails in Ontario are used for tourism purposes, while local use is 40% (PKFC, 2001).

PKFC (2001) identified thirteen essential criteria necessary for snowmobiling to be tourism export ready (Table 2.3). The trail product and trail amenities categories are the responsibility of each provincial/territorial snowmobile association and the destination product/experience readiness the responsibility of the tourism/hospitality sector. Snowmobile trails that are well groomed and maintained, interconnected with varying loop distances, with high levels of safety and informational signage, established for longevity, and a level of standardization enhance the overall tourism experience.

**Table 2.3:** Snowmobiling Tourism Export Ready Requirements

<b>Trail Product</b>
1. Well groomed trails
2. Signage regarding safety, routing, and location of service
3. Interconnectivity
4. Permanence
5. Standardization of tourism trails
<b>Trail Amenities</b>
6. Staging areas
7. Warm up safety shelters
8. Snowmobile patrol safety/ rescue systems
<b>Destination Product/Experience Readiness</b>
9. Tourism & hospitality services
10. Proximity and access to markets
11. All inclusive snowmobile services
12. Safety procedures/training
13. "Snowmobile friendly" community attitude

**Source:** PKFC (2001)

The grooming of snowmobile trails is essential in providing a trail surface that any level of snowmobiler can ride comfortably and safely. Grooming is conducted in four stages (International Association of Snowmobile Administrators (IASA), 2005):

- (1) the removal of moguls formed in the trail surface perpendicular to snowmobile traffic and natural processes (e.g. warm ground and creeks beneath the snow surface and the effects of sun and shade),
- (2) processing of the snow; mixing, de-aerating, and the introduction of moisture,

- (3) compaction of the snow further de-aerating and increasing snow density, and
- (4) trail set-up; the undisturbed time required for the trail to re-freeze establishing a durable surface.

In the construction of snow roads and runways a robust surface can be achieved with processing techniques that create small snow grains with varying diameters (Lang, Blaisdell, D'Urso, Reinemer, & Leshner, 1997). Surfaces that would support land vehicles and aircraft with tire pressures of 1380 kPa would be ideal. Lang et al. (1997) concluded that ambient air temperatures and temperature gradients within the snow-pack had the greatest influence upon the daily strength of the processed surface. Increases in ambient air temperatures decreased temperature gradients within the snow-pack and subsequently increased the strength. Conversely as ambient temperatures decreased strength decreased. Snowmobile trails are prepared similarly, to withstand deterioration by snowmobile traffic.

An analysis of the Strengths, Weaknesses, Opportunities, and Threats (SWOT) of the delivery of snowmobile tourism in Canada; based upon the expectations/needs of the tourist market, was conducted by PKFC (2001). Strengths were considered to be internal advantages (organizational and available physical resources), weaknesses were identified in all three categories of export - readiness, opportunities were considered to be external indicators of potential growth, and threats were considered external challenges. The study overlooked the influence of climate variability and change upon snowmobile tourism in Canada.

**Strengths** (as identified by PKFC, 2001)

Throughout Canada strengths included: (1) a strong national organization (CCSO/CCOM) establishing a working relationship between provinces and territories, (2) a strong volunteer commitment for the snowmobile product delivery, (3) an effective user pay

system able to generate much of the needed operational revenues, (4) available open spaces, and (5) an overall longer snowmobile season compared to that of the United States.

In Ontario the strengths include: (1) a committed volunteer force with extensive snowmobile trail operations and management experience, (2) a well established user pay system, (3) an extensive, interconnected and well developed snowmobile trail system, (4) a high level of snowmobile advocacy, (5) quality and quantity of snow, (6) scenic wilderness, and (7) friendliness of hospitality.

**Weaknesses** (as identified by [PKFC, 2001](#))

Nationally, snowmobile organizations are reliant upon user pay fees and fundraising as the reinvestment of revenues generated by snowmobiling has been minimal. The generation of additional revenues diverts the volunteers from their primary objective of trail development and maintenance. The burnout of volunteers due to excessive workloads is a concern of the snowmobile organizations.

The user-pay system in Ontario alone does not provide adequate financial resources for trail development and maintenance. Ontario's dependence of volunteers in some areas for snowmobile trail operations has resulted in trail product inconsistencies. The remoteness of some of Ontario's snowmobile trails may limit the tourism potential for the majority of snowmobilers. In some areas there is a lack of quality accommodations that are snowmobile trail accessible.

**Opportunities** (as identified by [PKFC, 2001](#))

The declining snowmobile tourism opportunities in the United States, limiting or restricting of motorized recreational vehicles into backcountry or wilderness areas due to capacity issues and strong environmental advocacy provides Canada with a competitive advantage for the development of a snowmobile trail system with sound environmental concerns.

Additionally opportunities are emerging for snowmobile tourism as Canada's profile internationally as a winter tourism destination increases.

Opportunities in Ontario include: (1) a sharing of infrastructure costs with other trail user groups lessening the burden of trail development and maintenance by snowmobile clubs/associations, and (2) an increased interest in adventure-based tourism by international visitors and the proximity of a large US snowmobile market are opportunities for expansion of snowmobile tourism.

**Threats** (as identified by [PKFC, 2001](#))

Increasing demand for the use of recreational vehicles, including snowmobiles, all-terrain vehicles and personal watercraft has escalated real or perceived environmental threats, which consequently may lead to policies and legislation restricting their use, and declining snowmobile tourism. The annual availability and affordability of insurance for both the snowmobiler and the commercial tour operators is a concern. Overall consumer confidence, influenced by economic factors, costs of travel and terrorism were identified as other pertinent threats.

Increasing administrative workloads in addition to snowmobile trail operations in Ontario are contributing to volunteer burnout. The competition for trail use by other user groups, particularly all-terrain vehicles, may result in the loss of trail routes on private lands due to trail damage. The increasing cost of participation, including insurance, equipment/clothing, snowmobile trail permit fees, fuel costs, food, and accommodations are of particular concern for snowmobile tourism.

Snowmobile sales in Canada have declined from 602,697 units (mean annual 60,270 units) for the period 1990 to 1999 to 483,252 units (mean annual 48,325 units) for the period 2000 to 2009 ([CCSO/CCOM, 2009b](#)). The average cost of a snowmobile for the 1990 to 1999

period was US \$4,925 and for the 2000 to 2009 period US \$7,420 (CCSO/CCOM, 2009b). Total sales were US \$2.9 billion for 1990 to 1999 period and US \$3.6 billion for the 2000 to 2009 period (CCSO/CCOM, 2009b).

Internationally, snowmobile tourists to Ontario predominately originate in the United Kingdom, Germany and France. Ontario receives the greatest number of American snowmobile tourists from the border states of Michigan, Minnesota and New York. Direct expenditures for overnight trips of domestic, US, and international snowmobile tourists to Ontario in 1999 were estimated at CAN \$32.1 million with 75% of expenditures for transportation, accommodation and food and beverage (PKFC, 2001). Total economic activity from snowmobiling in Ontario in 1999 was estimated at CAN \$68.3 million, CAN \$29.9 million in GDP, CAN \$15.3 million in tax revenues, and 851 full-year employments (PKFC, 2001).

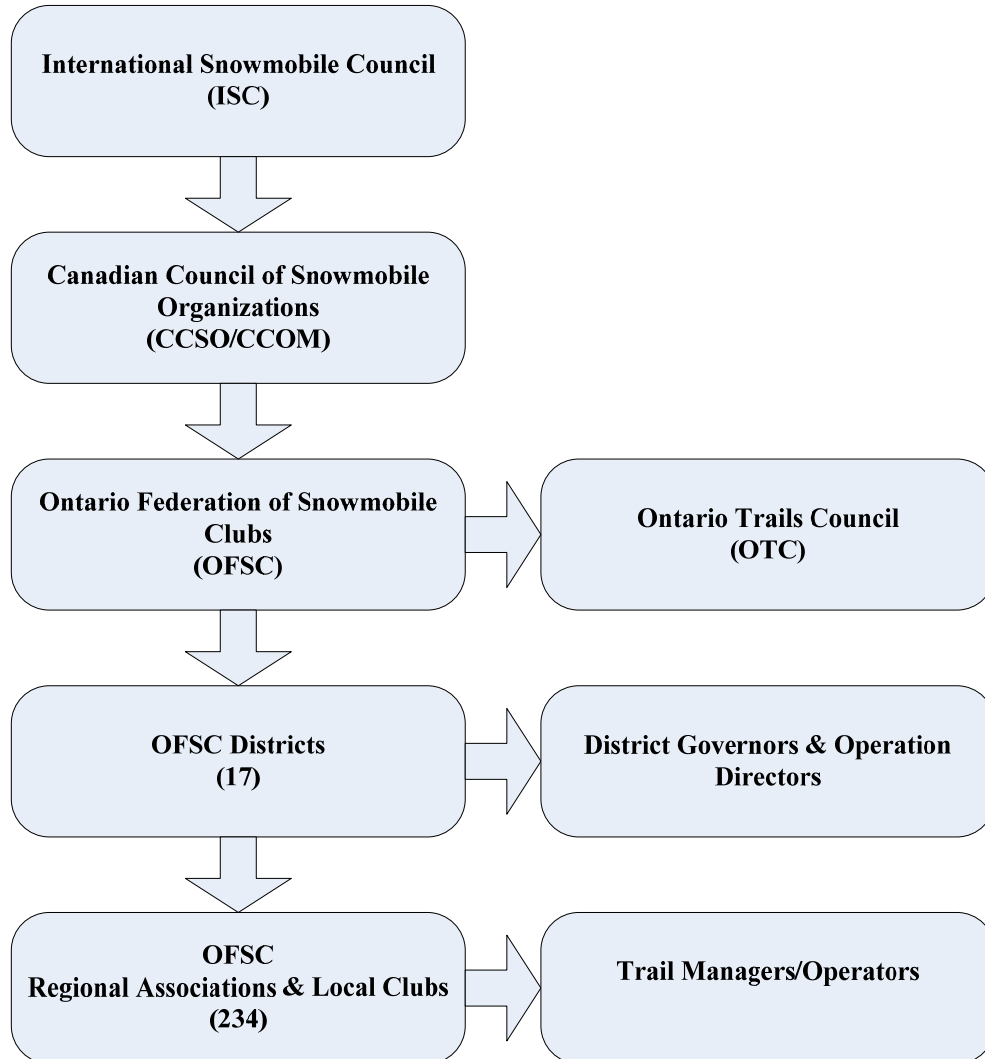
Member snowmobile clubs/associations of the OFSC operate 39,742 km of snowmobile trails in Ontario, nearly one third of the national total (OFSC, 2008a). The OFSC (2007) classifies trails as: (1) trunk trails; the primary routes for trans-provincial touring, (2) feeder trails; feeding traffic to and from trunk trails, (3) connector trails, connect two trunk trails, and (4) club trails; localized trails providing links to communities and tourism infrastructure. Ontario's 17,899 km (45%) of primary trails, Trans-Ontario-Provincial (TOP), includes trunk, feeder and connector trails (OFSC, 2008a).

The OFSC (2008b) is “dedicated to providing strong leadership and support to member clubs and volunteers, to establishing and maintaining quality snowmobile trails which are used in a safe and environmentally responsible manner, and to further the enjoyment of organized snowmobiling” The 234 local snowmobile clubs and regional associations form 17 Districts each electing a Governor and Operations Director (Figure 2.1). The Board of Governors undertakes



strategic planning, oversees provincial operations, and approves an annual budget; while Operation’s Directors manage trail related issues and District operational concerns.

**Figure 2.1:** OFSC Organizational Chart



During the 2007/2008 Ontario snowmobile season revenues from the sale of 90,085 seasonal and visitor snowmobile trail permits generated an estimated CAN \$16.4 million (OFSC, 2008a). Seasonal trail permit fees were CAN \$180 when purchased on or before December 1<sup>st</sup> and CAN \$230 after December 1<sup>st</sup>. A 3-day visitor permit was CAN \$90 and a 7-day visitor permit was CAN \$120. The operating budget of the OFSC was CAN \$9.1 million with CAN \$3.3 million directed to the Trail Fund and CAN \$80,605 directed to an Environment Fund. The



emit infrared radiation in all directions including downward trapping heat between the earth's surface and the atmosphere (IPCC, 2001a). The release of anthropogenic GHG, since the Industrial Revolution in the mid-18<sup>th</sup> century, largely through the burning of fossil fuels, deforestation and wetland drainage, has resulted in increased concentrations of atmospheric GHG, which have trapped more heat energy in the lower atmosphere altering precipitation and temperature patterns (IPCC, 2001a). Carbon dioxide (CO<sub>2</sub>), for example, has increased from 280 ppm in the pre-industrial period to 379 ppm in 2005 (IPCC, 2007a).

An average global temperature increase of 4<sup>0</sup>C to 6<sup>0</sup>C has been the difference between glacial and interglacial conditions prevailing on the earth's surface over the last 2.5 million years (Lemmen, Warren, Lacroix, & Bush, 2008). The IPCC (2007a) has reported a global increase in temperature for the period 1906 to 2005 of 0.74<sup>0</sup>C, and over the last 50 years a 0.65<sup>0</sup>C (a rate of 0.13<sup>0</sup>C per decade) increase was observed. In Canada, an average increase in temperature of 1.3<sup>0</sup>C for the period 1948 to 2006, nearly twice the global average for the same time period, has been observed (Lemmen, et al., 2008). During 1948 to 2003, winter temperatures have increased > 3<sup>0</sup>C in north western Canada (Lemmen, et al., 2008).

Ontario's annual average temperatures have increased from 0<sup>0</sup>C to 1.4<sup>0</sup>C between 1948 and 2006 with seasonal temperature increases having been greatest during the spring months (Lemmen, et al., 2008). Between 1950 and 2003 the greatest incidence of warm days and warm nights has been observed to occur in northern regions of Ontario (Lemmen, et al., 2008). In London, Ontario the frost free season has been observed to have increased > 18 days since the 1940s (Canadian Council of Ministers of the Environment (CCME), 2003). Warmer temperatures are benefitting the agricultural sector enabling a longer growing season and summer outdoor recreation activities. Shorter winter seasons are contributing to challenges for

northern regions and forestry and transportation companies needing to move goods and products over frozen ground and waterways.

In the Northern Hemisphere snow cover has decreased by approximately 10% since 1966 (IPCC, 2001b). Total annual snowfalls in Canada during 1950 to 2003 have declined in southern regions and increased in northern and north eastern regions (Lemmen, et al., 2008). In Canada's Arctic the duration of snow cover has declined, on average, by approximately 20 days since 1950 (Lemmen, et al., 2008). Snowfalls in Ontario have increased in the fall in northern regions, declined in the winter and spring in central regions and in southern regions increased in the west and decreased in the east (Lemmen, et al., 2008). Days with freezing rain events between 1953 and 2001, on averaged, occurred between 2 and 10 times with Ottawa, North Bay, and Sudbury the highest annual averages and Thunder Bay, Kenora, and Sioux Lookout the lowest (Lemmen, et al., 2008).

The 1998 ice storm deposited up to 100 mm of freezing rain between January 6<sup>th</sup> and 10<sup>th</sup> upon central and eastern Canada affecting 5,404,285 people (Statistics Canada, 1998). The greatest damage in Ontario occurred along the St. Lawrence River between Kingston and Cornwall. Most economic sectors in rural communities were hardest hit including: agriculture, manufacturing, transportation and tourism, primarily as a result of the loss of electricity due to damaged transmission towers and utility poles. The damage and loss to forests was the primary issue for the temporary closure of snowmobile trails in areas affected by the ice storm. Snowmobile tourism was disrupted until the snowmobile trails were cleared of debris and re-opened. An ice storms impact on forests is dependent upon the ice load, storm duration, strong winds, and stand and individual tree characteristics (Van Dyke, 1999). The vulnerability of a tree

species is dependent upon the crown surface area and the position within the canopy (Van Dyke, 1999).

Freeze-thaw events, when  $T_{\min} < 0^{\circ}\text{C}$  and  $T_{\max} > 0^{\circ}\text{C}$  occur in a single day, in Trenton Ontario has been observed to increase from 80 days in the 1940s to 95 days in the 1990s (CCME, 2003). These events contribute to water accumulating in low areas of snowmobile trails and in combination with rainfall may washout sections of snowmobile trails making them impassable. In icy conditions snowmobile trail maintenance is impaired particularly in hilly terrain, grooming equipment requires maintenance, and snowmobilers are more susceptible to personal injury and damage to equipment.

The annual duration of lake and river ice has declined by about two weeks in the mid and high latitudes (IPCC, 2001b). The trend in most Canadian regions during the period 1947 to 1966 was for lake and river ice to freeze-up and break-up earlier in the year (Zhang, Harvey, Hogg, & Yuzyk, 2001). Earlier freeze-ups were related to decreasing October, November, and December mean temperatures; while earlier break-ups were related to changes in spring temperatures. Lake Simcoe in the south central region of Ontario has been observed to freeze-up approximately 13 days later and break-up 4 days earlier than 140 years ago (CCME, 2003).

### **2.3.1 Climate Change in a Tourism Context**

Changes in climate may have positive and negative effects on global tourism. A range of potential impacts and implications for the tourism sector are illustrated in Table 2.4. Most important to this study are the potential implications of changes to temperature and precipitation/snow cover that may affect recreational activities in the winter season.



Climate and weather affects tourism planning by: (1) the environmental context in which tourism may be undertaken, (2) influences seasonality of demand, (3) influences tourism activities, (4) climate as an attraction, (5) extreme climatic events are not compatible with tourism activities, (6) influences tourist complexes and infrastructure, (7) affects the orderly working of transportation networks, (8) tourist enjoyment, (9) tourist's perceptions of comfort and health, and (10) level of satisfaction of the holiday (Gómez-Martin, 2005).

de Freitas (2003) considers climate as a resource exploited by tourism, an economic asset for tourism. Participation in recreational activities may occur when climate is perceived to be suitable and conversely decreases as discomfort or dissatisfaction increases (de Freitas, 2003).

A classification of tourism climate is offered in which three facets: (1) thermal (e.g. temperature, humidity), (2) physical (e.g. precipitation, wind), and (3) aesthetic (e.g. sunshine, visibility) are related to human attitudinal and behavioural responses (de Freitas, 2003).

Climate is a dominate attribute affecting the perceived attractiveness of resource based tourism destinations. Wall and Badke (1994) in a survey of national meteorological and tourism agencies found that 81% of respondents considered weather and climate to be major determinants of tourism and recreation and > 75% considered that climate change may be a significant issue within their countries. Kozak (2002) examined the motivations of British and German tourists travelling for summer vacations in Mallorca and Turkey and found that to *enjoy good weather* was the most important factor for the choice of destinations.

Hu and Ritchie (1993) examined the relative importance of touristic attributes contributing to the attractiveness of international destinations in the context of recreational and educational vacation experiences. Climate was perceived to be of greater importance

(rated higher and ranked higher) for those desiring a recreational vacation experience and less important for those desiring an educational vacation experience. Other attributes that influenced the relative attractiveness of a recreational vacation experience included: availability/quality of accommodations, sports and recreational opportunities, scenery, food, and entertainment.

An examination of the perceived preferable optimum climate variables (temperature, rain, sky conditions, and wind) was conducted in 2005/2006 of Canadian, New Zealand, and Swedish university students for three different environments (coastal beach, urban, and summer mountain) (Scott, Gössling, & de Freitas, 2008). The findings revealed that: (1) perceptions of optimal climate conditions varied in each of the tourism environments, (2) the relative importance of climatic variables varied in each of the tourism environments, and (3) preferences and the relative importance for climatic variables in each tourism environment varied amongst students from each country.

Agnew and Viner (2001) speculated on the potential consequences of climate change upon ten international tourist destinations reflecting variances in climate, environment and socio-economic conditions. Changes in climate may directly and indirectly affect tourism; directly during the decision-making process of when and where to travel due in part to weather and climate at the destination and the home location, and indirectly by affecting the local environmental conditions (e.g. snow cover, air quality, health threats) (Agnew & Viner, 2001). The vulnerability of resorts and regions were influenced by: (1) level and extent of the climate impact, (2) importance of tourism to the local economy, and (3) adaptive capacity (Agnew & Viner, 2001).

Climate is a primary influencing factor of the physical resources upon which nature-based tourism is dependent. Recent nature-based tourism studies in Canada's National Parks



have contributed to an understanding of projected climate change on ecosystems and visitor behaviour (Jones & Scott, 2006; Scott, Jones, & Konopek, 2007; Scott & Suffling, 2000). Canada's most popular parks are located in the western mountain regions. Projected warmer spring and fall temperatures may accelerate the rate of retreat of low elevation glaciers as a result of an increased melting season (Scott & Suffling, 2000). Changes in the extent of these glaciers may directly affect glacial-fed rivers and lakes and aquifers, vegetative colonization, and tourism operations dependent upon an accessible resource. Projected increases in temperatures, 1°C to 6°C may affect an upward shift of vegetative zones by 500m to 600m contributing to the loss of some alpine species due to competition of sub-alpine species (Scott & Suffling, 2000). The frequency of wildfires is projected to increase due to drier summer conditions affecting vegetative species distributions. During winter with projected increased snowfalls wildlife may migrate in search of accessible food. Alpine skiing may enjoy improved quality snow conditions at higher elevations; however increased temperatures may contribute to shorter season lengths and increased avalanche hazard (Scott & Suffling, 2000).

Scott, et al. (2007) examined the direct and indirect influences of climate change during three time periods (2020s, 2050s, 2080s) upon visitation in Waterton Lakes National Park. Increases in visitation related to direct affects of climate change were projected during all time periods; 6% to 10% (2020s), 10% to 36% (2050s), and 11% to 60% (2080s). Indirect affects of climate-induced environmental change revealed a nominal influence upon visitation; > 90% of respondents would not alter visitation plans during the 2020s and 2050s. In the 2080s, however; approximately 56% of respondents revealed that they would no longer visit the park or visit less frequently.

Jones and Scott (2006) considered changes of climate during the 2020s, 2050s, and 2080s and demographics during the 2020s upon the visitation levels of 15 high visitation Canadian National Parks. The study revealed increases in visitation levels due to climate change of 5.5% to 8.2% (2020s), 8.6% to 28.7% (2050s), and 10.2% to 41.0% (2080s). During the 2020s, demographic change accounted for an increase of 13.8% in visitation and the combined affect of climate change and demographic change revealed visitation increases of 19.9% to 22.9%.

### **2.3.2 Winter Tourism Seasonality**

Seasonality has been considered a temporal imbalance in the demand for tourism that generally has negative implications for the tourist industry (e.g. access capital, employment, and return-on-investment) (Butler, 1994). Tourism in urban areas may be less affected by seasonality than rural areas as facilities and attractions (e.g. museums, theatre, and sport events) are protected from the weather and are also visited by residents and business persons in addition to tourists (Wall & Mathieson, 2006). Five causes of seasonality have been identified: (1) natural (variations in climate and true seasons), (2) institutional (religious and public holidays), (3) social (for the elite class it was necessary to participate in certain activities in certain locations), (4) sporting seasons (e.g. golf, ski, surfing), and (5) tradition (vacations at the same time each year) (Butler, 1994). Snowmobile tourism is most affected by natural, institutional, and sporting seasons.

Climate is considered as a *push* factor and *pull* factor, often the primary resource for some destinations on which tourism is based (Scott, McBoyle, & Swartzentruber, 2004). Weather and climate influence nature-based tourism worldwide, directly by limiting season lengths, the quality of the experience, and influencing participation and indirectly by affecting the dependent environmental resources (e.g. snow cover and ice thickness) (Scott, et al., 2004).



every 1<sup>0</sup>C increase in temperature (Beniston, 2003; Koenig & Abegg, 1997). The likelihood of sufficient snow cover at lower altitudes during critical holiday periods may diminish with warmer winters (Beniston, 2003). The potential retreat of glaciers in the European Alps may also negatively affect the “mountain aesthetics” for summer tourism (Abegg, Agrawala, Crick, & de Montfalcon, 2007).

Snow-based tourism is dependent on natural features (terrain, altitude, etc.) and climatic conditions (temperature, precipitation, etc.) (Moen & Fredman, 2007). The reliability of snow cover is considered to be one crucial factor for snow-based tourism activities, including skiing, snowboarding, Nordic skiing and snowmobiling; another is the localized weather conditions particularly on weekends and holidays when demand for activities is strongest (Elsasser & Bürki, 2002).

The natural reliability of snow cover (i.e. without snowmaking) in the European Alps (Austria, France, Germany, Italy and Switzerland) was recently examined by Abegg, et al. (2007). Under present climatic conditions 609 (91%) of 666 of ski resorts examined may be considered snow reliable. Three scenarios were projected for snow reliability: (1) a +1<sup>0</sup>C, 500 (75%) of ski resorts may be snow reliable, (2) a +2<sup>0</sup>C, 404 (61%) may be snow reliable, and (3) a +4<sup>0</sup>C, 202 (30%) may be snow reliable. Under a +1<sup>0</sup>C scenario Germany is the most vulnerable with only 40% of ski resorts projected to be snow reliable, while Switzerland is the least vulnerable with 90% of ski resorts projected to be snow reliable.

Alpine ski resorts in Switzerland, without snowmaking, are considered snow reliable when a 30 cm to 50 cm of natural snow cover prevails for a minimum of 100 days, in 7 out of 10 winters (Elsasser & Bürki, 2002). A projected increase in the snow line from the current 1,200 masl to 1,800 masl may find a decrease in snow reliable resorts from 85% to 44%. Koenig and

Abegg (1997) projected 63% of Switzerland's alpine ski resorts would be snow reliable, without snowmaking, with a 2<sup>0</sup>C increase in temperature. Elsewhere in Europe, in Sweden, Moen and Fredman (2007) examining the alpine ski sector projected a decline in skier days, without snowmaking, between 64 (40%) and 96 (59%) for the period 2070 to 2100. In Japan, Fukushima, Kureha, Ozaki, Fujimori, and Harasawa (2002) projected a 30% decline in skiers, without snowmaking, at seven alpine ski resorts with a 3<sup>0</sup>C temperature increase. Snow-based tourism activities may focus at areas that are distinctly snow reliable, thus increasing relative advantages between areas.

In the United States, Casola (2005) in the northwest and Scott, Dawson, and Jones (2008) in the northeast projected trends of declining season lengths for ski resorts. Casola (2005) examined the effects of increasing temperature on three ski resorts, without snowmaking, in the Cascade Mountains in Washington State. As early as the 2020s, a projected 2<sup>0</sup>C temperature increase may reduce the season length of two resorts with elevations < 1238 masl by 14% to 28%. Days during the season with rain are projected to occur 50% of the time. The length of the ski season of one resort at an elevation of 1372 masl is not projected to be significantly affected by temperature increases. It is projected to receive an increase of approximately 15% of days with rain. Resorts at higher elevations may be more susceptible to variability in precipitation than regional warming.

Scott et al. (2008) examined 41 resorts in 14 areas in the states of Connecticut, Maine, Massachusetts, New Hampshire, New York, Pennsylvania, and Vermont. Climate change scenarios project trends of declining season lengths, without snowmaking, for the study areas, -6% to -23% in the 2020s, -8% to -38% in the 2050s, and -8% to -59% in the 2080s. It was concluded that within this region it will be individual ski resorts and communities reliant on ski

tourism that will be most vulnerable to changes in climate rather than the entire ski industry. This is because these individual resorts have varying technological (e.g. snowmaking capacity) and business (e.g. governance models and access to capital) capacities.

### **2.3.3 Climate Change and Snowmobiling**

Snowmobile tourism in Ontario at present relies entirely on natural features and suitable climatic conditions, including freezing temperatures and natural snowfalls. Changes in climate are influencing the spatial and temporal distribution of the Ontario snow-pack and consequently snowmobile tourism. The length of the snowmobile season is important to the sustainability of the activity, quality of experience, and the provincial economy.

[Scott et al. \(2002\)](#) examined the vulnerability of winter tourism to climate change within the Lakelands Tourism Region of Ontario. This region is located in south Central Ontario in the District of Muskoka and the counties of Bruce, Grey, Simcoe, and Haliburton. Snowmobiling is important to this region; an estimated \$5.5 million was generated from the sale of snowmobile trail permits during the 1998/1999 snowmobile season ([Scott et al., 2002](#)).

Mean snowmobile season length is projected to decline in the 2010 to 2039 period with the CGCM1 scenario -49% and with the HadCM3 scenario -29%. In the 2040 to 2069 period mean snowmobile season length is projected to decline with the CGCM1 scenario -69% and with the HadCM3 scenario -44%. Mean snowmobile season length is projected to decline in the 2070 to 2099 period with the CGCM1 scenario -80% and with the HadCM3 scenario -70% ([Scott et al., 2002](#)). Economic losses for snowmobiling in the Lakelands Tourism Region were projected for the 2010 to 2039 period to range from \$93.2 million to \$157.5 million.

[McBoyle et al. \(2007\)](#) examined snowmobiling in non-mountainous regions of Canada. Thirteen study sites, in four geographic regions (Prairies, Ontario, Quebec, and East Coast), were

selected. In consultation with snowmobile industry stakeholders, [McBoyle et al. \(2007\)](#) determined that snow cover thresholds of 15 cm for smooth terrain snowmobile trails and 30 cm for rough terrain snowmobile trails were required to open the trail systems. The Prairies and East Coast have the shortest observed average season length, 49 days and 30 days respectively. Ontario and Quebec have the longest observed average season length, 78 days and 69 days respectively. Projected season length in the 2010 to 2039 and 2040 to 2069 periods is anticipated to decline across all regions with each climate change scenario.

In the 2010 to 2039 period mean snowmobile season length is projected to decline with the NCARPCM B21 scenario -69% in the Prairies, -19% in Ontario, -29% in Quebec, and -49% in the East Coast and with the CCSRNIES A11 scenario in the Prairies -80%, Ontario -56%, Quebec -53%, and East Coast -45%. Mean snowmobile season length in the 2040 to 2069 period, is projected to decline with the NCARPCM A11 scenario -69% in the Prairies, -40% in Ontario, -37% in Quebec, and -79% in the East Coast and with the CCSRNIES A11 scenario in the Prairies -98%, Ontario -95%, Quebec -95%, and East Coast -93% ([McBoyle et al., 2007](#)).

Projections of shorter season length may result in fewer snowmobilers participating, fewer volunteers for snowmobile trail operations, and declining trail permit revenues ([McBoyle, et al., 2007](#)). Economic losses for Ontario and Quebec in the 2010 to 2039 period may reach \$US 252 million and \$US 377 million under the NCARPCM B21 scenario and \$US 486 million and \$US 689 million under the CCSRNIES A11 scenario.

In the Northeast of the United States, [Scott et al. \(2008\)](#) examined the vulnerability of snowmobiling at 15 study areas located throughout Maine, Massachusetts, New Hampshire, New York, Pennsylvania, and Vermont. In the 1961-1990 baseline period, modeled snowmobile season length, with a 15 cm snow cover threshold, ranged from 4 to 106 days (mean of 59 days)

among the 15 study areas. Season length > 70 days were reported in seven generally more northerly and higher elevation study areas during this same period.

Climate change scenarios project a trend towards shorter season length in all study areas through each time period (2010-2039, 2040-2069, and 2070-2099). In the 2010 to 2039 period a > 50% decline in season length is projected to occur in 4 of 15 study areas under the B1 emissions scenario and 6 of 15 study areas under the A1Fi emission scenario. Under the B1 emissions scenario in the 2040 to 2069 period 7 of 15 study areas are projected to lose > 50% of season length and 11 of 15 in the A1Fi emissions scenario. In the 2070 to 2099 period a > 50% decline in season length is projected to occur in 8 of 15 study areas under the B1 emissions scenario and 14 of 15 study areas under the A1Fi emissions scenario (Scott et al., 2008).

With projected marginal season length for local snowmobiling in 9 of 15 study areas as early as the 2040 to 2069 period, snowmobilers may consider travelling further to reach areas with sufficient snowmobile season length or substitute another form of recreation for snowmobiling that is not reliant upon snow cover (Scott et al., 2008). Areas with sufficient season length may consider marketing these areas to attract snowmobilers from snow deficient areas to increase the tourism benefits. The influence of distance costs and destination loyalty or environmental concerns with a greater concentration of snowmobile activity on the remaining areas is not yet known (Scott et al., 2008).

## **2.4 Human Responses to Climate Change**

Two types of human responses to the risks associated with climate change upon natural and anthropogenic systems include mitigation and adaptation. The characteristics of mitigation and adaptation are illustrated in Table 2.5. Localized sector benefits are often attained by adaptation with fewer time lags than mitigation, which operates at a global scale.











































Snowmobile trails located in open terrain and MSC climate stations are most vulnerable to the loss of snow cover earlier during the snowmobile season than more protected terrains due to exposure to sunlight, precipitation as rainfall, and wind. The snow model is valid only for each selected MSC climate station and nearby areas exhibiting similar climatic conditions, extrapolation to other areas may be limited as differing microclimates exist over the system of snowmobile trails in each OFSC district (McBoyle, 2007).

### **3.6 Summary**

To address the study objectives of (1) discovering the sensitivity of snowmobile trail operations and adaptations to past climate variability, (2) examining the influence of climate change upon snowmobile season length in each OFSC snowmobile district during the future periods 2010 to 2039, 2040 to 2069, and 2070 to 2099 using a modelling approach, and (3) discovering the possible adaptations that senior Ontario snowmobile trail managers/operators may consider in the future to climate change a sequential three-phased mixed methods approach was selected. Qualitative methods were used in Phase 1 and Phase 3 of the study discovering human responses of climate change. Quantitative methods were used in Phase 2 of the study to develop and compare climate change scenarios.

































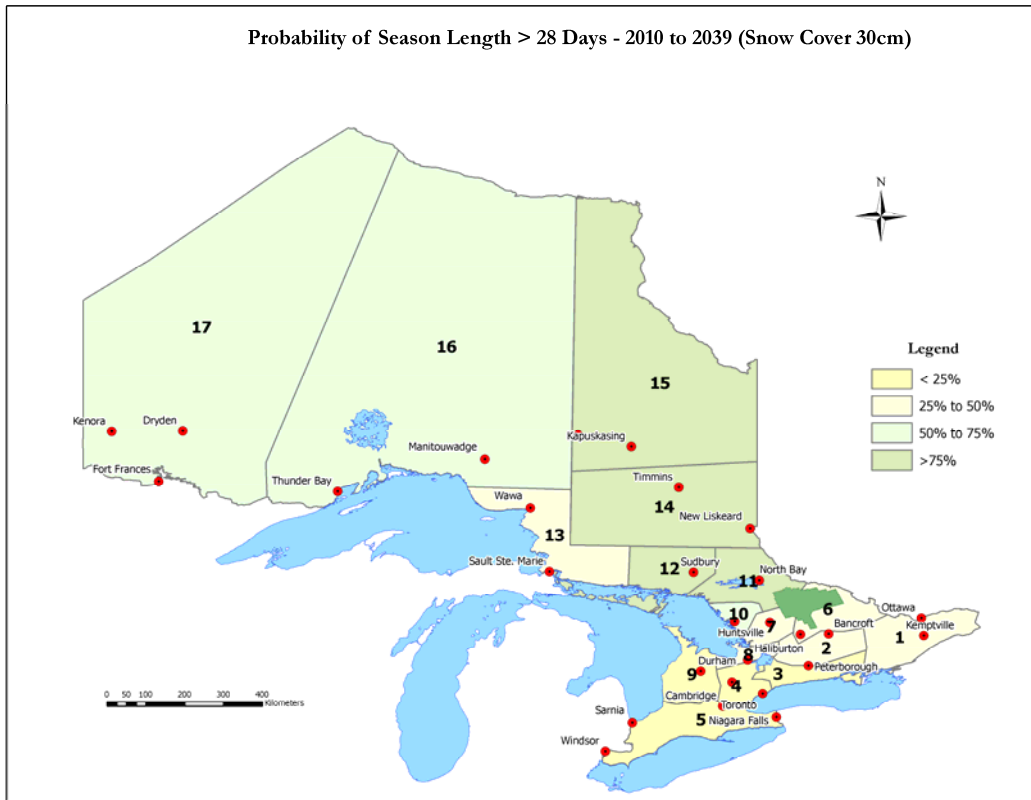




**Table 4.7:** Percentage of Season Length > 28 Days - 2010 to 2039

OFSC District	Snow Cover (15cm)			Snow Cover (30cm)			Snow Cover (60cm)		
	1961-1990	INMCM3.0	MIROC3.2	1961-1990	INMCM3.0	MIROC3.2	1961-1990	INMCM3.0	MIROC3.2
1	65.52%	48.28%	41.38%	34.48%	31.03%	13.79%	0.00%	3.45%	0.00%
2	79.31%	65.52%	24.14%	24.14%	34.48%	6.90%	0.00%	6.90%	0.00%
3	58.62%	31.03%	6.90%	3.45%	13.79%	3.45%	0.00%	0.00%	0.00%
4	34.48%	6.90%	3.45%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
5	51.72%	3.45%	6.90%	17.24%	3.45%	3.45%	0.00%	0.00%	0.00%
6	79.31%	62.07%	48.28%	51.72%	48.28%	20.69%	3.45%	13.79%	3.45%
7	79.31%	75.86%	41.38%	48.28%	31.03%	20.69%	3.45%	10.34%	0.00%
8	51.72%	34.48%	17.24%	13.79%	27.59%	3.45%	0.00%	0.00%	0.00%
9	82.76%	37.93%	6.90%	44.83%	17.24%	0.00%	0.00%	0.00%	0.00%
10	89.66%	82.76%	51.72%	72.41%	58.62%	20.69%	37.93%	20.69%	13.79%
11	96.55%	96.55%	86.21%	75.86%	79.31%	65.52%	10.34%	48.28%	20.69%
12	100.00%	100.00%	96.55%	65.52%	86.21%	72.41%	3.45%	27.59%	27.59%
13	100.00%	86.21%	44.83%	75.86%	44.83%	17.24%	10.34%	10.34%	0.00%
14	100.00%	96.55%	96.55%	89.66%	96.55%	96.55%	24.14%	65.52%	62.07%
15	100.00%	100.00%	100.00%	96.55%	100.00%	100.00%	6.90%	65.52%	65.52%
16	62.07%	86.21%	72.41%	17.24%	51.72%	34.48%	0.00%	3.45%	3.45%
17	75.86%	89.66%	82.76%	13.79%	65.52%	44.83%	0.00%	6.90%	3.45%
<b>Mean</b>	<b>76.88%</b>	<b>64.91%</b>	<b>48.68%</b>	<b>43.81%</b>	<b>46.45%</b>	<b>30.83%</b>	<b>5.88%</b>	<b>16.63%</b>	<b>11.76%</b>
<b>SD</b>	<b>20.13%</b>	<b>32.26%</b>	<b>34.78%</b>	<b>31.17%</b>	<b>31.11%</b>	<b>33.31%</b>	<b>10.40%</b>	<b>22.26%</b>	<b>21.22%</b>

**Figure 4.3:** Probability of Season Length > 28 Days - 2010 to 2039 - INMCM3.0 B1 (Snow Cover 30 cm)





**Table 4.8:** Mean Projected Change in Snowmobile Season Length - 2040 to 2069 (Days)

OFSC District	15cm Snow Cover			30cm Snow Cover			60cm Snow Cover		
	1961-1990	INMCM3.0	MIROC3.2	1961-1990	INMCM3.0	MIROC3.2	1961-1990	INMCM3.0	MIROC3.2
D1	43.03	-13.90	-25.34	18.38	-3.93	-14.62	0.28	1.72	-0.14
D2	50.79	-17.93	-37.59	15.59	1.00	-11.00	0.21	2.34	-0.21
D3	27.10	-9.21	-21.00	2.03	4.69	-0.69	0.00	0.52	0.00
D4	20.41	-15.59	-17.48	2.03	-1.69	-2.00	0.00	0.00	0.00
D5	27.31	-22.00	-23.66	9.00	-7.55	-7.79	0.00	0.00	0.00
D6	53.48	-17.52	-30.21	28.00	-4.83	-18.28	4.34	1.59	-2.34
D7	52.38	-15.45	-29.35	28.38	-5.76	-21.86	4.14	1.10	-4.14
D8	32.83	-9.14	-25.45	11.41	0.03	-9.76	0.31	-0.10	-0.31
D9	51.83	-27.76	-44.14	26.79	-17.48	-25.28	1.03	-0.86	-1.03
D10	64.14	-22.90	-40.93	45.83	-16.72	-35.72	19.07	-8.59	-15.86
D11	85.34	-18.24	-30.14	53.07	-2.59	-18.28	8.93	13.34	2.24
D12	75.41	-11.24	-16.93	42.86	2.28	-5.34	2.17	12.17	12.14
D13	75.38	-27.41	-52.86	46.34	-21.90	-41.14	7.52	-4.28	-7.38
D14	97.55	-8.17	-11.79	62.93	7.52	2.97	11.59	22.86	21.21
D15	109.10	-7.41	-10.41	73.45	5.76	3.69	11.10	29.79	30.69
D16	47.17	4.28	-10.24	10.48	16.14	8.34	0.00	2.03	1.45
D17	58.38	8.76	-3.21	9.83	29.59	16.00	0.00	3.66	1.55
<b>Mean</b>	<b>57.16</b>	<b>-13.58</b>	<b>-25.34</b>	<b>28.61</b>	<b>-0.91</b>	<b>-10.63</b>	<b>4.16</b>	<b>4.55</b>	<b>2.23</b>
<b>SD</b>	<b>24.98</b>	<b>9.82</b>	<b>13.33</b>	<b>21.87</b>	<b>12.36</b>	<b>15.21</b>	<b>5.62</b>	<b>9.71</b>	<b>10.59</b>

**Table 4.9:** Percentage of Season Length > 28 Days - 2040 to 2069

OFSC District	15cm Snow Cover			30cm Snow Cover			60cm Snow Cover		
	1961-1990	INMCM3.0	MIROC3.2	1961-1990	INMCM3.0	MIROC3.2	1961-1990	INMCM3.0	MIROC3.2
D1	65.52%	48.28%	24.14%	34.48%	27.59%	6.90%	0.00%	3.45%	0.00%
D2	79.31%	58.62%	13.79%	24.14%	24.14%	6.90%	0.00%	3.45%	0.00%
D3	58.62%	24.14%	3.45%	3.45%	10.34%	0.00%	0.00%	0.00%	0.00%
D4	34.48%	3.45%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
D5	51.72%	3.45%	6.90%	17.24%	3.45%	3.45%	0.00%	0.00%	0.00%
D6	79.31%	65.52%	37.93%	51.72%	48.28%	17.24%	3.45%	10.34%	6.90%
D7	79.31%	72.41%	37.93%	48.28%	34.48%	10.34%	3.45%	6.90%	0.00%
D8	51.72%	34.48%	3.45%	13.79%	17.24%	0.00%	0.00%	0.00%	0.00%
D9	82.76%	31.03%	3.45%	44.83%	10.34%	0.00%	0.00%	0.00%	0.00%
D10	89.66%	79.31%	34.48%	72.41%	44.83%	17.24%	37.93%	20.69%	6.90%
D11	96.55%	93.10%	86.21%	75.86%	79.31%	51.72%	10.34%	41.38%	20.69%
D12	100.00%	100.00%	96.55%	65.52%	82.76%	65.52%	3.45%	27.59%	34.48%
D13	100.00%	86.21%	31.03%	75.86%	44.83%	6.90%	10.34%	6.90%	0.00%
D14	100.00%	96.55%	96.55%	89.66%	96.55%	96.55%	24.14%	62.07%	62.07%
D15	100.00%	100.00%	100.00%	96.55%	100.00%	100.00%	6.90%	68.97%	65.52%
D16	62.07%	86.21%	58.62%	17.24%	44.83%	34.48%	0.00%	3.45%	3.45%
D17	75.86%	86.21%	79.31%	13.79%	68.97%	41.38%	0.00%	6.90%	3.45%
<b>Mean</b>	<b>76.88%</b>	<b>62.88%</b>	<b>41.99%</b>	<b>43.81%</b>	<b>43.41%</b>	<b>26.98%</b>	<b>5.88%</b>	<b>15.42%</b>	<b>11.97%</b>
<b>SD</b>	<b>20.13%</b>	<b>33.00%</b>	<b>36.84%</b>	<b>31.17%</b>	<b>32.21%</b>	<b>33.24%</b>	<b>10.40%</b>	<b>22.02%</b>	<b>21.57%</b>



length in the INMCM3.0 B1 scenario (-13.59 days) and in the MIROC3.2 A1B (-40.76 days). The provincial mean average season lengths are 29.11 days and 15.78 days. Eight districts (10, 11, 12, 13, 14, 15, 16, & 17) in the INMCM3.0 B1 and three districts (12, 14, & 15) in the MIROC3.2 A1B scenarios are projected to have average season lengths > 28 days.

At a snow cover threshold of 60 cm District 15 in the INMCM3.0 B1 and MIROC3.2 A1B scenarios is projected to have the greatest increase in average season length (34.31 days & 24.59 days) The greatest decline in average season length is projected to occur in the INMCM3.0 B1 and MIROC3.2 A1B scenarios in District 10 (-3.69 days & -16.83 days). The provincial mean values are 9.87 days and 5.22 days. Two districts (14 & 15) in the INMCM3.0 B1 scenario and one district (15) in the MIROC3.2 A1B scenario are projected to have average season lengths > 28 days.

**Table 4.10:** Mean Projected Change in Snowmobile Season Length - 2070 to 2099 (Days)

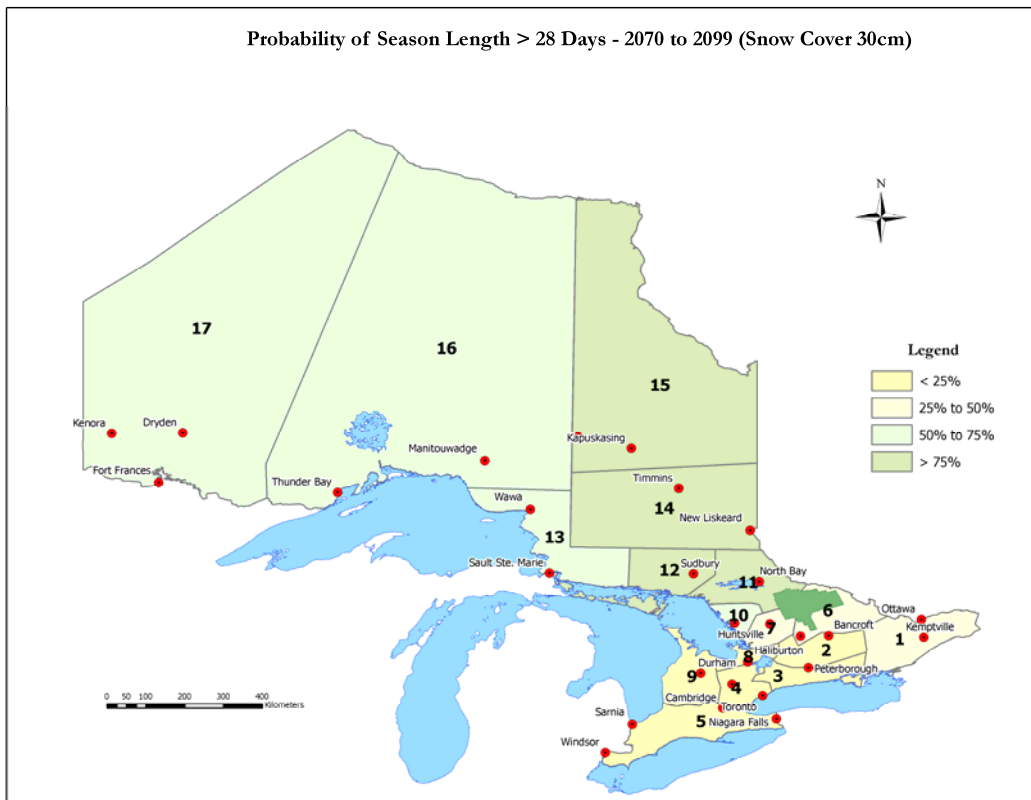
OFSC District	15cm Snow Cover			30cm Snow Cover			60cm Snow Cover		
	1961-1990	INMCM3.0	MIROC3.2	1961-1990	INMCM3.0	MIROC3.2	1961-1990	INMCM3.0	MIROC3.2
D1	43.03	-15.69	-29.69	18.38	-4.48	-16.28	0.28	1.79	-0.28
D2	50.79	-17.86	-39.52	15.59	0.24	-12.69	0.21	1.79	-0.21
D3	27.10	-9.93	-21.97	2.03	4.41	-0.97	0.00	0.55	0.00
D4	20.41	-15.34	-18.00	2.03	-1.90	-2.03	0.00	0.00	0.00
D5	27.31	-22.52	-24.48	9.00	-7.55	-8.76	0.00	0.00	0.00
D6	53.48	-17.93	-33.83	28.00	-5.72	-19.14	4.34	2.28	-3.07
D7	52.38	-15.48	-36.00	28.38	-6.31	-25.62	4.14	0.58	-4.14
D8	32.83	-10.14	-27.86	11.41	-0.93	-10.52	0.31	0.31	-0.31
D9	51.83	-21.07	-46.14	26.79	-12.14	-26.17	1.03	0.28	-1.03
D10	64.14	-18.10	-45.79	45.83	-10.59	-38.90	19.07	-3.69	-16.83
D11	85.34	-18.62	-33.59	53.07	-3.48	-25.66	8.93	12.41	-0.17
D12	75.41	-7.62	-21.90	42.86	7.07	-9.97	2.17	14.17	8.38
D13	75.38	-20.83	-56.03	46.34	-13.59	-40.76	7.52	-0.07	-7.45
D14	97.55	-8.31	-14.45	62.93	7.86	-0.17	11.59	25.14	15.66
D15	109.10	-6.45	-12.76	73.45	6.76	1.00	11.10	34.31	24.59
D16	47.17	5.52	-15.00	10.48	17.97	5.90	0.00	2.72	1.34
D17	58.38	9.79	-6.76	9.83	30.76	12.66	0.00	4.59	1.59
<b>Mean</b>	<b>57.16</b>	<b>-12.39</b>	<b>-28.46</b>	<b>28.61</b>	<b>0.49</b>	<b>-12.83</b>	<b>4.16</b>	<b>5.72</b>	<b>1.06</b>
<b>SD</b>	<b>24.98</b>	<b>9.04</b>	<b>13.50</b>	<b>21.87</b>	<b>11.32</b>	<b>15.12</b>	<b>5.62</b>	<b>10.20</b>	<b>8.91</b>



**Table 4.11: Percentage of Season Length > 28 Days - 2070 to 2099**

OFSC District	15cm Snow Cover			30cm Snow Cover			60cm Snow Cover		
	1961-1990	INMCM3.0	MIROC3.2	1961-1990	INMCM3.0	MIROC3.2	1961-1990	INMCM3.0	MIROC3.2
D1	65.52%	44.83%	13.79%	34.48%	27.59%	3.45%	0.00%	3.45%	0.00%
D2	79.31%	65.52%	10.34%	24.14%	24.14%	3.45%	0.00%	3.45%	0.00%
D3	58.62%	27.59%	6.90%	3.45%	10.34%	0.00%	0.00%	0.00%	0.00%
D4	34.48%	6.90%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
D5	51.72%	3.45%	3.45%	17.24%	3.45%	0.00%	0.00%	0.00%	0.00%
D6	79.31%	62.07%	34.48%	51.72%	44.83%	17.24%	3.45%	10.34%	0.00%
D7	79.31%	65.52%	13.79%	48.28%	34.48%	3.45%	3.45%	3.45%	0.00%
D8	51.72%	34.48%	3.45%	13.79%	17.24%	0.00%	0.00%	0.00%	0.00%
D9	82.76%	48.28%	3.45%	44.83%	20.69%	0.00%	0.00%	0.00%	0.00%
D10	89.66%	82.76%	24.14%	72.41%	68.97%	10.34%	37.93%	31.03%	3.45%
D11	96.55%	93.10%	86.21%	75.86%	79.31%	44.83%	10.34%	37.93%	13.79%
D12	100.00%	100.00%	96.55%	65.52%	93.10%	62.07%	3.45%	31.03%	10.34%
D13	100.00%	96.55%	27.59%	75.86%	58.62%	6.90%	10.34%	10.34%	0.00%
D14	100.00%	96.55%	96.55%	89.66%	96.55%	93.10%	24.14%	65.52%	55.17%
D15	100.00%	100.00%	100.00%	96.55%	100.00%	100.00%	6.90%	75.86%	58.62%
D16	62.07%	86.21%	41.38%	17.24%	51.72%	31.03%	0.00%	6.90%	3.45%
D17	75.86%	93.10%	72.41%	13.79%	68.97%	37.93%	0.00%	6.90%	3.45%
<b>Mean</b>	<b>76.88%</b>	<b>65.11%</b>	<b>37.32%</b>	<b>43.81%</b>	<b>47.06%</b>	<b>24.34%</b>	<b>5.88%</b>	<b>16.84%</b>	<b>8.72%</b>
<b>SD</b>	<b>20.13%</b>	<b>32.57%</b>	<b>37.46%</b>	<b>31.17%</b>	<b>33.21%</b>	<b>32.93%</b>	<b>10.40%</b>	<b>23.64%</b>	<b>18.57%</b>

**Figure 4.5: Probability of Season Length > 28 Days - 2070 to 2099 - INMCM3.0 B1 (Snow Cover 30 cm)**



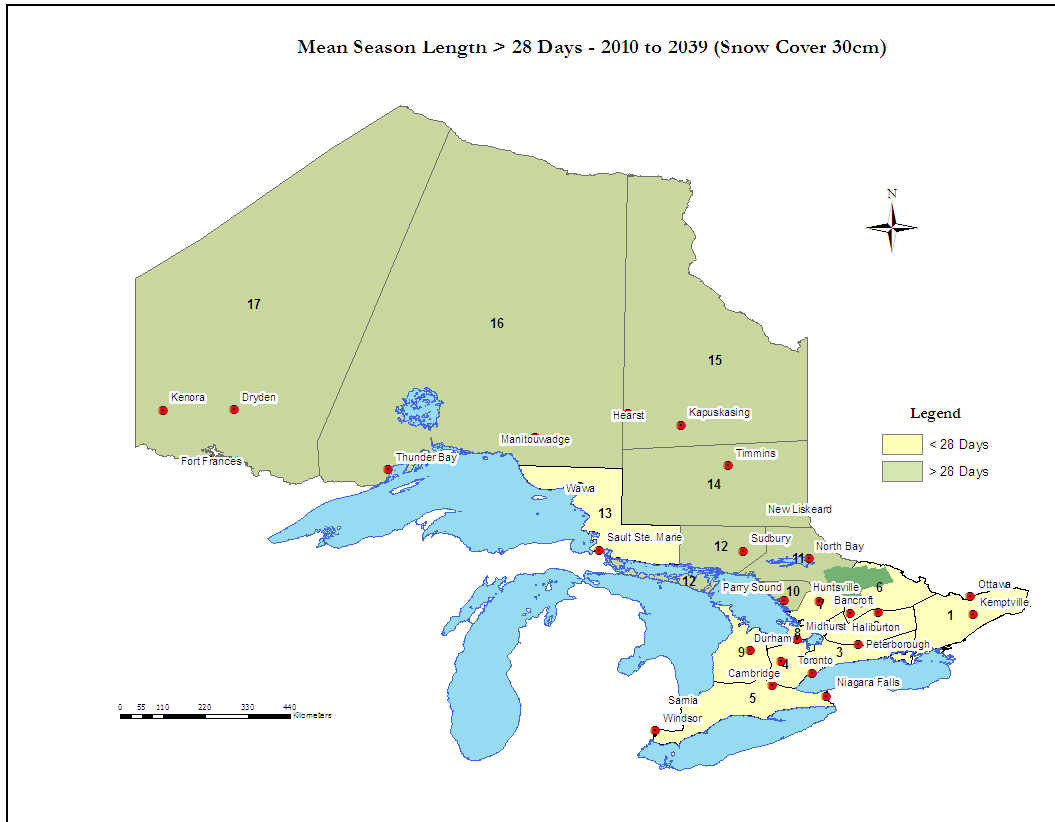








**Figure 4.7:** Mean Season Length > 28 Days - 2010 to 2039 (Snow Cover 30 cm)



Respondents considered potential technological and business responses to climate change. Potential risks of climate change for snowmobile tourism include: (1) spatial and temporal change in snow cover and season length, (2) declining human and financial capital (see Chapter 5 for a discussion), (3) land use agreements (see Chapter 5 for a discussion), (4) concerns of liability, and (5) institutional arrangements (see Chapter 5 for a discussion).













































is neither presently nor in the future to be a viable option for wide spread use to supplement natural snow cover and increase the length of snowmobile seasons.

### **5.11 Summary**

This chapter has discussed the results of the research and the possible impacts upon the supply-side of snowmobile tourism. Snowmobile trail managers perceive climate variability to be more important than climate change to the development and maintenance of snowmobile trails. These trail managers are cognisant of the limitations of reliance upon natural snowfalls and freezing temperatures upon snowmobile season length. With an average of 30 years of snowmobile trail development experience, managers are optimistic in their ability to meet the challenges of projected climate variability and change upon snowmobile season length and snowmobile tourism.

The recruitment and retention of human capital will continue to be a challenge as early as the 2020s in southern snowmobile districts as local snowmobiling declines due to changes in climate. In northern snowmobile districts, out migration is anticipated due in part to declining employment. Declines in financial capital are anticipated in southern snowmobile districts where 64% of snowmobilers live. New sources of revenue or operating grants will be required to develop and maintain a snowmobile trail system in snowmobile districts that are projected to have reliable seasons for snowmobile tourism.





horizons of 3 to 5 years have been used in the past to develop and maintain snowmobile trails. Snowmobile trail managers/operators were optimistic that their past experiences with climate variability will enable them to effectively respond to the challenges of projections of reduced snowmobile season lengths.

The most effective adaptation strategies identified by snowmobile trail managers/operators were the pre-season preparation of the terrain to maximize the use of early snowfalls, early season packing of snow cover to assist the penetration of ground frost, re-location of snowmobile trails from areas most vulnerable (e.g. water crossings and open areas) to locations which are snow and temperature reliable, the embracement of new technologies, and the strengthening of inter-district alliances. New programs may be required that leverage financial and human capital for the development of adaptation strategies (e.g. education and risk management) for most vulnerable and least vulnerable snowmobile districts. Government programs in support of snowmobile trail development may also need to be re-evaluated based upon return-on-investment and potential for four season recreational use.

## **6.2 Recommendations**

Recommendations for future consideration include:

- (1) projected climate change and influence on snowmobile season length be monitored as new advanced Global Climate Models become available,
- (2) increase the awareness of the risks to snowmobile tourism of climate variability and change amongst the OFSC, snowmobile districts, public agencies, and community stakeholders to facilitate the development of effective adaptation strategies,
- (3) integrate climate variability and change into the OFSC's strategic trails planning process and risk assessment and management program,
- (4) immediately undertake an adaptation assessment of southern snowmobile districts (3, 4, 5, & 9) where the probability of season length greater than 28 days in the 2020s is less than 25%, followed by snowmobile districts (1, 2, 6, 7, 8, & 13) where the probability of season length greater than 28 days is between 25% to 50%,

- (5) determine the effects of increased snowmobiling on snowmobile trails in least vulnerable snowmobile districts,
- (6) examine the motivational factors of snowmobile tourists including: activity substitution, attachment to destinations, distance-time-costs thresholds, involvement, lifestyle, for snowmobile tourism,
- (7) examine risk perceptions and possible responses of snowmobile tourists to climate change,
- (8) educate snowmobile tourists of the risks of climate variability and change to environmental sensitivity in most vulnerable snowmobile districts, and
- (9) examine how communities in Ontario may respond to reduced snowmobile season lengths.

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## Appendices

### Appendix 1: Benefits of Snowmaking (Turbocrystal, 2008)

Depending on the situation, snowmaking helps you to accomplish the following goals:

1. Ensure snow coverage at the beginning of the season to ensure revenues,
2. Improve snow quality during the season,
3. Maintain snow coverage in sectors that are critical due to their orientation or topography,
4. Ensure skiers return at the beginning and the end of the season,
5. Guaranty the quality of sporting events,
6. Extend the season beyond the limits imposed by natural snow coverage, and
7. Satisfy customers' increasing demand.



## **Appendix 2: Information Letter for Study Participants (Phase 1) (Date)**

### **Reference: Ontario Snowmobile Tourism: Responses to Climate Variability and Change**

I am writing to invite you to participate in a study on Ontario Snowmobile Tourism: Responses to Climate Variability and Change. Changes in climate from both natural and human causes are influencing the Ontario snow-pack (e.g. timing, amount and quality), and consequently snowmobile tourism opportunities. This study is intended to provide insights into past and future responses of snowmobile trail managers/operators to changes in climate. In addition to being published in a thesis form, the outcomes of the research will be aimed at informing a set of practical strategies to meet the challenges of projected climate change. This study is being conducted by Stephen H. Gilmour, Master's Candidate – Tourism Policy & Planning at the University of Waterloo. Dr. Daniel Scott, Canada Research Chair in Global Change and Tourism is supervising the study.

The study asks you to share your past experiences with environmental stewardship, weather and climate as it has affected past snowmobile trail operations, and snowmobile tourism. The interview may take approximately 1 hour of your time to complete. Information provided in the phase one interview will assist in phase 2 to develop climate change scenarios for the periods 2010 to 2039 and 2040 to 2069. Finally, in phase three of the study if you choose to participate you will be asked to project your future responses to these scenarios.

All of the information that you provide will be treated with strict confidentiality. No information concerning individuals or organizations will appear in a published thesis, or any document resulting from this study. With your permission, anonymous quotations may be used in the thesis or any publications. Your participation is purely voluntary and you will be free to withdraw at any time or decline to answer any question. There are no known or anticipated risks to participation in the study. To withdraw from the study please contact me directly by telephone or email. The data collected through this study will be kept for a period of four years in a secure location and then confidentially destroyed.

Should you have any questions or concerns about the study or your involvement, please contact Stephen H. Gilmour, Master's Candidate, Tourism Policy & Planning, Faculty of Environment, University of Waterloo, 200 University Avenue West Waterloo, Ontario N2L 3G1 or Associate Professor Daniel Scott (519) 888-4567 (Ext. 35497) [dj2scott@uwaterloo.ca](mailto:dj2scott@uwaterloo.ca). The study has ethics clearance through the University of Waterloo's Office of Research Ethics. Should you have any ethical concerns concerning your participation, please contact Dr. Susan E. Sykes, Director Office of Research Ethics, (519) 888-4567 (Ext. 36005) [ssykes@uwaterloo.ca](mailto:ssykes@uwaterloo.ca).

Thank you for your contribution to this study.

Sincerely,

**Stephen H. Gilmour**

Master's Candidate – Tourism Policy & Planning

University of Waterloo

[shgilmou@uwaterloo.ca](mailto:shgilmou@uwaterloo.ca)

(519) 888-4567 (Ext. 35928)

**Appendix 3: Consent Form for Study Participants (Phase 1)**

**Study Title:** Ontario Snowmobile Tourism – Responses to Climate Variability and Change

**Researchers Name:** Stephen H. Gilmour, Master’s Candidate, Tourism Policy and Planning, University of Waterloo

**Supervisors Name:** Daniel Scott, Associate Professor, Department of Geography, University of Waterloo

- ✓ I have read the Information Letter, and the nature and purpose of the research study have been explained to me. I understand and agree to take part.
- ✓ I was informed that I may not directly benefit from taking part in the study.
- ✓ I understand that I can withdraw from the study or decline to answer any question at any stage and that this will not affect my status now or in the future.
- ✓ I confirm that I am over 18 years of age.
- ✓ I agree to audio recording the interview.
- ✓ I was informed that the audio recording will be transcribed; both the recording and transcript will be stored securely at the University of Waterloo for four years, then destroyed, and only the research study supervisor and the researcher will have access to them. All records containing personal information will remain confidential and no information that could identify me will be released.
- ✓ Yes \_\_\_ / No \_\_\_ I agree to the use of anonymous quotations in the thesis or any publications.
- ✓ I was informed that this study has been reviewed by, and received ethics clearance through, the Office of Research Ethics at the University of Waterloo, and I may contact Dr. Susan Sykes at (519) 888-4567 (Ext. 36005) if I have concerns or comments resulting from my participation in this study.

Name of Participant \_\_\_\_\_

Signed \_\_\_\_\_

Date \_\_\_\_\_

I have explained the study to the participant and consider that he/she understands what is involved.

Researcher’s Signature and Date \_\_\_\_\_

#### **Appendix 4: Information Letter for Study Participants (Phase 3)**

(Date)

#### **Reference: Ontario Snowmobile Tourism: Responses to Climate Variability and Change**

I am writing to invite you to participate in a study on Ontario Snowmobile Tourism: Responses to Climate Variability and Change. Changes in climate from both natural and human causes are influencing the Ontario snow-pack (e.g. timing, amount and quality), and consequently snowmobile tourism opportunities. This study is intended to provide insights into past and future responses of snowmobile trail managers/operators to changes in climate. In addition to being published in a thesis form, the outcomes of the research will be aimed at informing a set of practical strategies to meet the challenges of projected climate change. This study is being conducted by Stephen H. Gilmour, Master's Candidate – Tourism Policy & Planning at the University of Waterloo. Dr. Daniel Scott, Canada Research Chair in Global Change and Tourism is supervising the study.

In Phase III of the study, if you choose to participate, you will be asked to project your future responses to climate change scenarios for the periods 2010 to 2039 and 2040 to 2069. The interview may take approximately 1 hour of your time to complete. These scenarios were developed from information provided by senior snowmobile trail managers/operators in Phase I of the study.

All of the information that you provide will be treated with strict confidentiality. No information concerning individuals or organizations will appear in a published thesis, or any document resulting from this study. With your permission, anonymous quotations may be used in the thesis or any publications. Your participation is purely voluntary and you will be free to withdraw at any time or decline to answer any question. There are no known or anticipated risks to participation in the study. To withdraw from the study please contact me directly by telephone or email. The data collected through this study will be kept for a period of four years in a secure location and then confidentially destroyed.

Should you have any questions or concerns about the study or your involvement, please contact Stephen H. Gilmour, Master's Candidate, Tourism Policy & Planning, Faculty of Environment, University of Waterloo, 200 University Avenue West Waterloo, Ontario N2L 3G1 or Associate Professor Daniel Scott (519) 888-4567 (Ext. 35497) [dj2scott@uwaterloo.ca](mailto:dj2scott@uwaterloo.ca). The study has ethics clearance through the University of Waterloo's Office of Research Ethics. Should you have any ethical concerns concerning your participation, please contact Dr. Susan E. Sykes, Director Office of Research Ethics, (519) 888-4567 (Ext. 36005) [ssykes@uwaterloo.ca](mailto:ssykes@uwaterloo.ca).

Thank you for your contribution to this study.

Sincerely,

**Stephen H. Gilmour**

Master's Candidate – Tourism Policy & Planning

University of Waterloo

[shgilmou@uwaterloo.ca](mailto:shgilmou@uwaterloo.ca)

(519) 888-4567 (Ext. 35928)

**Appendix 5: Consent Form for Study Participants (Phase 3)**

**Study Title:** Ontario Snowmobile Tourism – Responses to Climate Variability and Change

**Researchers Name:** Stephen H. Gilmour, Master’s Candidate, Tourism Policy and Planning, University of Waterloo

**Supervisors Name:** Daniel Scott, Associate Professor, Department of Geography, University of Waterloo

- ✓ I have read the Information Letter, and the nature and purpose of the research study have been explained to me. I understand and agree to take part.
- ✓ I was informed that I may not directly benefit from taking part in the study.
- ✓ I understand that I can withdraw from the study or decline to answer any question at any stage and that this will not affect my status now or in the future.
- ✓ I confirm that I am over 18 years of age.
- ✓ I agree to audio recording the interview.
- ✓ I was informed that the audio recording will be transcribed; both the recording and transcript will be stored securely at the University of Waterloo for four years, then destroyed, and only the research study supervisor and the researcher will have access to them. All records containing personal information will remain confidential and no information that could identify me will be released.
- ✓ Yes \_\_\_ / No \_\_\_ I agree to the use of anonymous quotations in the thesis or any publications.
- ✓ I was informed that this study has been reviewed by, and received ethics clearance through, the Office of Research Ethics at the University of Waterloo, and I may contact Dr. Susan Sykes at (519) 888-4567 (Ext. 36005) if I have concerns or comments resulting from my participation in this study.

Name of Participant \_\_\_\_\_

Signed \_\_\_\_\_

Date \_\_\_\_\_

I have explained the study to the participant and consider that he/she understands what is involved.

Researcher’s Signature and Date \_\_\_\_\_

## **Appendix 6: Interview Questions (Phase 1)**

1. What has been your personal involvement with snowmobiling in Ontario?
2. Is snowmobiling a great part of your lifestyle?
3. What role do you play in environmental stewardship and how has it evolved?
4. Describe the weather in an ideal and the worst snowmobile season you have experienced?
5. How does the weather in the snowmobile season and in the other seasons affected snowmobile trail operations?
6. Have you observed any record warm winters and how have these affected snowmobile trail operations? How much rain or freezing rain can the trail system sustain?
7. Is there an optimal temperature range for trail grooming?
8. What is the minimum snow cover required to begin trail grooming? How does this vary over different terrain? Do you have any 'rules of thumb' for trail operations?
9. What other weather and non-weather factors may affect trail operations?
10. Is the reliability of snowfall a factor for trail and club operations?
11. How does the length of the season affect trail operations?
12. How have trail operations evolved since the 1990's with respect to snowmobile tourism?
13. What have been the roles of the clubs/districts played in the development of snowmobile tourism? How have these roles evolved over time?
14. What are other major challenges affecting snowmobiling in Ontario presently and the next 5 to 10 years?

## **Appendix 7: Interview Questions (Phase 3)**

1. After being informed of the projected climate in the periods 2010 to 2039, 2040 to 2069, and 2070 to 2099 in the Province of Ontario, what snowmobile trail management strategies do you foresee employing in each of these periods of time?
2. How will the climate in the snowmobile season and in the other seasons affected snowmobile trail operations?
3. What other climate and non-climate factors may affect trail operations?
4. During the three future time periods, is there a minimum number of grooming days in **X** out of **Y** winters necessary for sustainable snowmobile tourism?
5. How will the length of the snowmobile season affect trail operations?
6. What roles will snowmobile clubs/districts play in snowmobile tourism in these future periods of time?
7. What will be other major challenges affecting snowmobiling in Ontario during the periods 2010 to 2039, 2040 to 2069, and 2070 to 2099?

District 1 Projected Snowmobile Season Length (Days)

Baseline				INMCM3.0 B1												MIROC3.2 HIRES A1B											
				2020s				2050s				2080s				2020s				2050s				2080s			
Season	15 cm	30 cm	60 cm	Season	15 cm	30 cm	60 cm	Season	15 cm	30 cm	60 cm	Season	15 cm	30 cm	60 cm	Season	15 cm	30 cm	60 cm	Season	15 cm	30 cm	60 cm	Season	15 cm	30 cm	60 cm
61-62	10	0	0	10-11	13	0	0	40-41	13	0	0	70-71	13	0	0	10-11	10	0	0	40-41	8	0	0	70-71	6	0	0
62-63	14	0	0	11-12	6	0	0	41-42	4	0	0	71-72	4	0	0	11-12	1	0	0	41-42	0	0	0	71-72	0	0	0
63-64	18	0	0	12-13	7	0	0	42-43	7	0	0	72-73	7	0	0	12-13	5	0	0	42-43	4	0	0	72-73	2	0	0
64-65	73	49	0	13-14	52	44	0	43-44	51	40	0	73-74	51	41	0	13-14	41	12	0	43-44	37	8	0	73-74	31	3	0
65-66	50	0	0	14-15	24	6	0	44-45	19	7	0	74-75	17	5	0	14-15	16	0	0	44-45	8	0	0	74-75	6	0	0
66-67	72	60	2	15-16	55	53	9	45-49	54	45	3	75-76	53	42	3	15-16	54	17	0	45-49	26	2	0	75-76	4	0	0
67-68	17	1	0	16-17	23	14	0	49-47	18	0	0	76-77	16	0	0	16-17	13	0	0	49-47	10	0	0	76-77	10	0	0
68-69	46	6	0	17-18	40	3	0	47-48	39	4	0	77-78	40	4	0	17-18	36	0	0	47-48	27	0	0	77-78	19	0	0
69-70	94	51	0	18-19	46	29	0	48-49	43	0	0	78-79	41	0	0	18-19	5	0	0	48-49	5	0	0	78-79	5	0	0
70-71	72	26	0	19-20	61	46	0	49-50	60	45	0	79-80	58	45	0	19-20	50	31	0	49-50	39	3	0	79-80	15	2	0
71-72	35	5	0	20-21	31	16	0	50-51	31	16	0	80-81	31	8	0	20-21	29	5	0	50-51	27	5	0	80-81	25	0	0
72-73	45	0	0	21-22	23	0	0	51-52	25	0	0	81-82	21	0	0	21-22	21	0	0	51-52	22	0	0	81-82	22	0	0
73-74	41	3	0	22-23	34	3	0	52-53	29	3	0	82-83	13	0	0	22-23	10	0	0	52-53	10	0	0	82-83	7	0	0
74-75	83	62	6	23-24	66	58	36	53-54	63	53	34	83-84	60	53	34	23-24	56	41	0	53-54	42	29	0	83-84	37	10	0
75-76	0	0	0	24-25	2	0	0	54-55	1	0	0	84-85	0	0	0	24-25	0	0	0	54-55	0	0	0	84-85	0	0	0
76-77	56	14	0	25-26	58	53	28	55-56	56	43	8	85-86	54	40	5	25-26	45	35	0	55-56	36	6	0	85-86	11	3	0
77-78	59	35	0	26-27	48	32	0	56-57	46	30	0	86-87	44	30	0	26-27	32	11	0	56-57	32	1	0	86-87	24	0	0
78-79	27	0	0	27-28	20	0	0	57-58	18	0	0	87-88	17	0	0	27-28	0	0	0	57-58	0	0	0	87-88	0	0	0
79-80	63	55	0	28-29	41	9	0	58-59	41	8	0	88-89	40	8	0	28-29	31	0	0	58-59	32	2	0	88-89	32	0	0
80-81	0	0	0	29-30	0	0	0	59-60	0	0	0	89-90	0	0	0	29-30	0	0	0	59-60	0	0	0	89-90	0	0	0
80-81	5	0	0	30-31	12	0	0	60-61	8	0	0	90-91	10	0	0	30-31	2	0	0	60-61	3	0	0	90-91	3	0	0
81-82	40	6	0	31-32	4	0	0	61-62	6	0	0	91-92	4	0	0	31-32	3	0	0	61-62	1	0	0	91-92	0	0	0
83-84	26	0	0	32-33	22	3	0	62-63	13	2	0	92-93	8	0	0	32-33	2	0	0	62-63	2	0	0	92-93	1	0	0
84-85	60	41	0	33-34	41	37	11	63-64	38	34	9	93-94	37	34	11	33-34	32	23	7	63-64	23	20	4	93-94	17	14	0
85-86	50	33	0	34-35	26	20	0	64-65	26	20	0	94-95	25	20	0	34-35	24	14	0	64-65	25	0	0	94-95	24	0	0
86-87	4	0	0	35-36	9	0	0	65-66	11	0	0	95-96	9	0	0	35-36	8	0	0	65-66	8	0	0	95-96	9	0	0
87-88	75	54	0	36-37	63	52	6	66-67	63	47	4	96-97	64	50	7	36-37	59	45	0	66-67	54	33	0	96-97	51	29	0
88-89	66	32	0	37-38	25	12	0	67-68	18	3	0	97-98	14	0	0	37-38	10	0	0	67-68	7	0	0	97-98	1	0	0
89-90	47	0	0	38-39	45	25	0	68-69	44	19	0	98-99	42	23	0	38-39	30	0	0	68-69	25	0	0	98-99	25	0	0
Mean	43.03	18.38	0.28	Mean	30.93	17.76	3.10	Mean	29.14	14.45	2.00	Mean	27.34	13.90	2.07	Mean	21.55	8.07	0.24	Mean	17.69	3.76	0.14	Mean	13.34	2.10	0.00
SD	26.79	22.83	1.16	SD	20.03	20.35	8.53	SD	19.98	18.60	6.57	SD	20.15	18.83	6.64	SD	19.08	13.77	1.30	SD	15.51	8.58	0.74	SD	13.40	6.07	0.00

District 2 Projected Snowmobile Season Length (Days)

Baseline				INMCM3.0 B1												MIROC3.2 HIRES A1B											
				2020s				2050s				2080s				2020s				2050s				2080s			
Season	15cm	30cm	60cm	Season	15cm	30cm	60cm	Season	15cm	30cm	60cm	Season	15cm	30cm	60cm	Season	15cm	30cm	60cm	Season	15cm	30cm	60cm	Season	15cm	30cm	60cm
61-62	16	0	0	10-11	12	0	0	40-41	9	0	0	70-71	9	0	0	10-11	0	0	0	40-41	0	0	0	70-71	0	0	0
62-63	78	53	0	11-12	19	0	0	41-42	17	0	0	71-72	17	0	0	11-12	14	0	0	41-42	13	0	0	71-72	10	0	0
63-64	88	71	6	12-13	37	9	0	42-43	34	9	0	72-73	32	9	0	12-13	27	9	0	42-43	25	9	0	72-73	23	7	0
64-65	76	57	0	13-14	49	47	16	43-44	50	46	4	73-74	50	46	4	13-14	33	2	0	43-44	20	0	0	73-74	8	0	0
65-66	43	0	0	14-15	29	16	0	44-45	18	15	0	74-75	18	15	0	14-15	18	10	0	44-45	16	2	0	74-75	14	4	0
66-67	54	4	0	15-16	65	55	26	45-49	65	52	10	75-76	63	51	10	15-16	60	49	4	45-49	56	45	0	75-76	56	44	0
67-68	68	0	0	16-17	52	30	0	49-47	50	28	0	76-77	48	21	0	16-17	22	0	0	49-47	15	0	0	76-77	16	0	0
68-69	52	0	0	17-18	48	17	0	47-48	46	16	0	77-78	46	14	0	17-18	22	0	0	47-48	20	0	0	77-78	16	0	0
69-70	54	29	0	18-19	43	39	15	48-49	42	34	14	78-79	41	31	0	18-19	32	19	0	48-49	31	14	0	78-79	17	0	0
70-71	18	0	0	19-20	27	0	0	49-50	13	0	0	79-80	29	0	0	19-20	9	0	0	49-50	5	0	0	79-80	4	0	0
71-72	42	0	0	20-21	4	0	0	50-51	5	0	0	80-81	5	0	0	20-21	2	0	0	50-51	2	0	0	80-81	4	0	0
72-73	80	45	0	21-22	54	33	0	51-52	54	32	0	81-82	48	31	0	21-22	36	17	0	51-52	31	11	0	81-82	33	12	0
73-74	74	26	0	22-23	19	3	0	52-53	17	3	0	82-83	14	3	0	22-23	11	0	0	52-53	8	0	0	82-83	5	0	0
74-75	61	0	0	23-24	46	29	0	53-54	42	4	0	83-84	41	1	0	23-24	4	0	0	53-54	4	0	0	83-84	2	0	0
75-76	41	15	0	24-25	36	30	7	54-55	35	27	0	84-85	34	24	0	24-25	6	0	0	54-55	0	0	0	84-85	0	0	0
76-77	62	25	0	25-26	47	45	22	55-56	47	40	11	85-86	46	38	6	25-26	31	0	0	55-56	0	0	0	85-86	6	0	0
77-78	0	0	0	26-27	40	20	0	56-57	30	0	0	86-87	30	0	0	26-27	0	0	0	56-57	0	0	0	86-87	0	0	0
78-79	54	0	0	27-28	39	22	0	57-58	30	15	0	87-88	30	20	0	27-28	9	0	0	57-58	5	0	0	87-88	7	0	0
79-80	37	20	0	28-29	29	16	0	58-59	25	11	0	88-89	24	7	0	28-29	9	0	0	58-59	5	0	0	88-89	3	0	0
80-81	89	52	0	29-30	85	70	39	59-60	78	70	35	89-90	80	71	38	29-30	76	63	0	59-60	73	50	0	89-90	54	15	0
80-81	20	0	0	30-31	10	0	0	60-61	11	0	0	90-91	10	0	0	30-31	6	0	0	60-61	5	0	0	90-91	0	0	0
81-82	61	35	0	31-32	32	26	0	61-62	29	21	0	91-92	29	20	0	31-32	14	1	0	61-62	4	0	0	91-92	1	0	0
83-84	49	0	0	32-33	68	48	0	62-63	68	44	0	92-93	65	41	0	32-33	22	0	0	62-63	18	0	0	92-93	18	0	0
84-85	55	1	0	33-34	40	14	0	63-64	37	6	0	93-94	38	4	0	33-34	6	0	0	63-64	3	0	0	93-94	6	0	0
85-86	37	0	0	34-35	4	0	0	64-65	5	0	0	94-95	5	0	0	34-35	4	0	0	64-65	5	0	0	94-95	4	0	0
86-87	70	12	0	35-36	22	0	0	65-66	22	0	0	95-96	22	0	0	35-36	7	0	0	65-66	5	0	0	95-96	4	0	0
87-88	23	7	0	36-37	33	15	0	66-67	33	5	0	96-97	33	9	0	36-37	10	0	0	66-67	8	0	0	96-97	11	0	0
88-89	26	0	0	37-38	32	0	0	67-68	23	0	0	97-98	30	0	0	37-38	0	0	0	67-68	0	0	0	97-98	0	0	0
89-90	45	0	0	38-39	22	4	0	68-69	18	3	0	98-99	18	3	0	38-39	6	2	0	68-69	6	2	0	98-99	5	2	0
Mean	50.79	15.59	0.21	Mean	35.97	20.28	4.31	Mean	32.86	16.59	2.55	Mean	32.93	15.83	2.00	Mean	17.10	5.93	0.14	Mean	13.21	4.59	0.00	Mean	11.28	2.90	0.00
SD	22.77	21.53	1.11	SD	18.86	19.53	9.77	SD	19.04	19.29	7.24	SD	18.29	18.92	7.27	SD	17.78	14.87	0.74	SD	16.99	12.42	0.00	SD	14.44	8.72	0.00



District 3 Projected Snowmobile Season Length (Days)

Baseline				INMCM3.0 B1												MIROC3.2 HIRES A1B											
				2020s				2050s				2080s				2020s				2050s				2080s			
Season	15cm	30cm	60cm	Season	15cm	30cm	60cm	Season	15cm	30cm	60cm	Season	15cm	30cm	60cm	Season	15cm	30cm	60cm	Season	15cm	30cm	60cm	Season	15cm	30cm	60cm
61-62	30	0	0	10-11	16	0	0	40-41	8	0	0	70-71	8	0	0	10-11	6	0	0	40-41	6	0	0	70-71	6	0	0
62-63	40	0	0	11-12	4	0	0	41-42	2	0	0	71-72	2	0	0	11-12	0	0	0	41-42	0	0	0	71-72	0	0	0
63-64	50	0	0	12-13	9	0	0	42-43	6	0	0	72-73	1	0	0	12-13	0	0	0	42-43	0	0	0	72-73	0	0	0
64-65	65	1	0	13-14	34	6	0	43-44	32	3	0	73-74	31	1	0	13-14	16	0	0	43-44	15	0	0	73-74	9	0	0
65-66	29	0	0	14-15	34	12	0	44-45	34	13	0	74-75	34	10	0	14-15	30	10	0	44-45	27	13	0	74-75	29	9	0
66-67	0	0	0	15-16	29	3	0	45-49	28	3	0	75-76	29	1	0	15-16	23	0	0	45-49	5	0	0	75-76	7	0	0
67-68	15	0	0	16-17	37	1	0	49-47	23	1	0	76-77	22	0	0	16-17	7	0	0	49-47	0	0	0	76-77	0	0	0
68-69	6	0	0	17-18	20	0	0	47-48	20	0	0	77-78	20	0	0	17-18	18	0	0	47-48	18	0	0	77-78	18	0	0
69-70	0	0	0	18-19	8	0	0	48-49	10	0	0	78-79	5	0	0	18-19	3	0	0	48-49	0	0	0	78-79	0	0	0
70-71	39	0	0	19-20	18	1	0	49-50	20	1	0	79-80	21	4	0	19-20	8	0	0	49-50	7	0	0	79-80	0	0	0
71-72	48	0	0	20-21	5	0	0	50-51	0	0	0	80-81	0	0	0	20-21	0	0	0	50-51	0	0	0	80-81	0	0	0
72-73	0	0	0	21-22	5	0	0	51-52	5	0	0	81-82	5	0	0	21-22	0	0	0	51-52	0	0	0	81-82	0	0	0
73-74	10	0	0	22-23	0	0	0	52-53	0	0	0	82-83	0	0	0	22-23	0	0	0	52-53	0	0	0	82-83	0	0	0
74-75	60	8	0	23-24	49	30	0	53-54	47	5	0	83-84	41	4	0	23-24	10	0	0	53-54	9	0	0	83-84	3	0	0
75-76	0	0	0	24-25	9	0	0	54-55	5	0	0	84-85	5	0	0	24-25	2	0	0	54-55	1	0	0	84-85	1	0	0
76-77	51	0	0	25-26	48	40	0	55-56	48	40	0	85-86	46	36	0	25-26	10	0	0	55-56	1	0	0	85-86	4	0	0
77-78	29	0	0	26-27	21	12	0	56-57	20	6	0	86-87	19	5	0	26-27	10	0	0	56-57	7	0	0	86-87	5	0	0
78-79	38	7	0	27-28	34	27	0	57-58	30	21	0	87-88	30	21	0	27-28	13	0	0	57-58	4	0	0	87-88	7	0	0
79-80	43	4	0	28-29	11	0	0	58-59	7	0	0	88-89	5	0	0	28-29	2	0	0	58-59	0	0	0	88-89	0	0	0
80-81	36	0	0	29-30	67	47	15	59-60	67	44	15	89-90	67	46	16	29-30	64	39	5	59-60	48	26	0	89-90	48	22	0
80-81	7	0	0	30-31	4	0	0	60-61	1	0	0	90-91	1	0	0	30-31	0	0	0	60-61	0	0	0	90-91	0	0	0
81-82	0	0	0	31-32	0	0	0	61-62	1	0	0	91-92	0	0	0	31-32	0	0	0	61-62	0	0	0	91-92	0	0	0
83-84	66	30	0	32-33	61	50	0	62-63	59	48	0	92-93	59	49	0	32-33	27	1	0	62-63	18	0	0	92-93	10	0	0
84-85	14	0	0	33-34	19	0	0	63-64	15	0	0	93-94	16	0	0	33-34	0	0	0	63-64	0	0	0	93-94	0	0	0
85-86	2	0	0	34-35	0	0	0	64-65	0	0	0	94-95	0	0	0	34-35	0	0	0	64-65	0	0	0	94-95	0	0	0
86-87	42	0	0	35-36	2	0	0	65-66	2	0	0	95-96	2	0	0	35-36	0	0	0	65-66	0	0	0	95-96	0	0	0
87-88	37	9	0	36-37	23	15	0	66-67	20	10	0	96-97	20	10	0	36-37	3	0	0	66-67	2	0	0	96-97	2	0	0
88-89	29	0	0	37-38	9	0	0	67-68	9	0	0	97-98	9	0	0	37-38	5	0	0	67-68	9	0	0	97-98	0	0	0
89-90	0	0	0	38-39	3	0	0	68-69	0	0	0	98-99	0	0	0	38-39	0	0	0	68-69	0	0	0	98-99	0	0	0
Mean	27.10	2.03	0.00	Mean	19.97	8.41	0.52	Mean	17.90	6.72	0.52	Mean	17.17	6.45	0.55	Mean	8.86	1.72	0.17	Mean	6.10	1.34	0.00	Mean	5.14	1.07	0.00
SD	21.68	5.95	0.00	SD	18.77	15.17	2.79	SD	18.71	13.78	2.79	SD	18.58	13.77	2.97	SD	13.66	7.41	0.93	SD	10.64	5.32	0.00	SD	10.48	4.36	0.00

District 4 Projected Snowmobile Season Length (Days)

Baseline				INMCM3.0 B1												MIROC3.2 HIRES A1B											
				2020s				2050s				2080s				2020s				2050s				2080s			
Season	15cm	30cm	60cm	Season	15cm	30cm	60cm	Season	15cm	30cm	60cm	Season	15cm	30cm	60cm	Season	15cm	30cm	60cm	Season	15cm	30cm	60cm	Season	15cm	30cm	60cm
61-62	0	0	0	10-11	0	0	0	40-41	0	0	0	70-71	0	0	0	10-11	0	0	0	40-41	0	0	0	70-71	0	0	0
62-63	9	0	0	11-12	7	0	0	41-42	5	0	0	71-72	0	0	0	11-12	6	0	0	41-42	0	0	0	71-72	0	0	0
63-64	0	0	0	12-13	2	0	0	42-43	0	0	0	72-73	1	0	0	12-13	0	0	0	42-43	0	0	0	72-73	0	0	0
64-65	44	0	0	13-14	8	0	0	43-44	6	0	0	73-74	3	0	0	13-14	2	0	0	43-44	3	0	0	73-74	2	0	0
65-66	34	16	0	14-15	11	0	0	44-45	14	0	0	74-75	15	0	0	14-15	11	0	0	44-45	6	0	0	74-75	10	0	0
66-67	39	0	0	15-16	2	0	0	45-49	0	0	0	75-76	0	0	0	15-16	0	0	0	45-49	0	0	0	75-76	0	0	0
67-68	26	0	0	16-17	24	0	0	49-47	20	0	0	76-77	20	0	0	16-17	22	0	0	49-47	23	0	0	76-77	23	0	0
68-69	45	0	0	17-18	10	0	0	47-48	5	0	0	77-78	7	0	0	17-18	0	0	0	47-48	0	0	0	77-78	0	0	0
69-70	33	0	0	18-19	5	0	0	48-49	5	0	0	78-79	5	0	0	18-19	6	0	0	48-49	6	0	0	78-79	6	0	0
70-71	23	0	0	19-20	5	0	0	49-50	2	0	0	79-80	5	0	0	19-20	7	0	0	49-50	2	0	0	79-80	4	0	0
71-72	4	0	0	20-21	7	0	0	50-51	4	0	0	80-81	6	0	0	20-21	4	0	0	50-51	6	0	0	80-81	2	0	0
72-73	14	0	0	21-22	7	0	0	51-52	2	0	0	81-82	3	0	0	21-22	7	0	0	51-52	4	0	0	81-82	4	0	0
73-74	3	0	0	22-23	0	0	0	52-53	0	0	0	82-83	2	0	0	22-23	0	0	0	52-53	0	0	0	82-83	0	0	0
74-75	17	0	0	23-24	0	0	0	53-54	0	0	0	83-84	0	0	0	23-24	0	0	0	53-54	0	0	0	83-84	0	0	0
75-76	3	0	0	24-25	0	0	0	54-55	0	0	0	84-85	0	0	0	24-25	0	0	0	54-55	0	0	0	84-85	0	0	0
76-77	58	11	0	25-26	11	0	0	55-56	4	0	0	85-86	4	0	0	25-26	7	0	0	55-56	2	0	0	85-86	1	0	0
77-78	14	0	0	26-27	22	0	0	56-57	5	0	0	86-87	5	0	0	26-27	4	0	0	56-57	0	0	0	86-87	4	0	0
78-79	39	0	0	27-28	0	0	0	57-58	0	0	0	87-88	0	0	0	27-28	0	0	0	57-58	0	0	0	87-88	0	0	0
79-80	22	0	0	28-29	1	0	0	58-59	2	0	0	88-89	0	0	0	28-29	0	0	0	58-59	0	0	0	88-89	0	0	0
80-81	13	0	0	29-30	32	0	0	59-60	18	0	0	89-90	29	0	0	29-30	28	0	0	59-60	2	0	0	89-90	0	0	0
80-81	18	0	0	30-31	9	0	0	60-61	5	0	0	90-91	4	0	0	30-31	1	0	0	60-61	0	0	0	90-91	0	0	0
81-82	24	6	0	31-32	0	0	0	61-62	0	0	0	91-92	0	0	0	31-32	0	0	0	61-62	0	0	0	91-92	0	0	0
83-84	48	5	0	32-33	36	17	0	62-63	34	10	0	92-93	30	4	0	32-33	35	9	0	62-63	26	1	0	92-93	14	0	0
84-85	0	0	0	33-34	4	0	0	63-64	4	0	0	93-94	4	0	0	33-34	6	0	0	63-64	4	0	0	93-94	0	0	0
85-86	5	0	0	34-35	1	0	0	64-65	1	0	0	94-95	1	0	0	34-35	0	0	0	64-65	1	0	0	94-95	0	0	0
86-87	51	21	0	35-36	3	0	0	65-66	4	0	0	95-96	3	0	0	35-36	4	0	0	65-66	0	0	0	95-96	0	0	0
87-88	0	0	0	36-37	4	0	0	66-67	0	0	0	96-97	0	0	0	36-37	4	0	0	66-67	0	0	0	96-97	0	0	0
88-89	6	0	0	37-38	0	0	0	67-68	0	0	0	97-98	0	0	0	37-38	0	0	0	67-68	0	0	0	97-98	0	0	0
89-90	0	0	0	38-39	0	0	0	68-69	0	0	0	98-99	0	0	0	38-39	0	0	0	68-69	0	0	0	98-99	0	0	0
Mean	20.41	2.03	0.00	Mean	7.28	0.59	0.00	Mean	4.83	0.34	0.00	Mean	5.07	0.14	0.00	Mean	5.31	0.31	0.00	Mean	2.93	0.03	0.00	Mean	2.41	0.00	0.00
SD	17.98	5.21	0.00	SD	9.60	3.16	0.00	SD	7.65	1.86	0.00	SD	8.15	0.74	0.00	SD	8.70	1.67	0.00	SD	6.32	0.19	0.00	SD	5.17	0.00	0.00

District 5 Projected Snowmobile Season Length (Days)

Baseline				INMCM3.0 B1												MIROC3.2 HIRES A1B											
				2020s				2050s				2080s				2020s				2050s				2080s			
Season	15cm	30cm	60cm	Season	15cm	30cm	60cm	Season	15cm	30cm	60cm	Season	15cm	30cm	60cm	Season	15cm	30cm	60cm	Season	15cm	30cm	60cm	Season	15cm	30cm	60cm
61-62	0	0	0	10-11	0	0	0	40-41	0	0	0	70-71	0	0	0	10-11	0	0	0	40-41	0	0	0	70-71	0	0	0
62-63	67	17	0	11-12	10	0	0	41-42	10	0	0	71-72	5	0	0	11-12	0	0	0	41-42	0	0	0	71-72	0	0	0
63-64	42	3	0	12-13	0	0	0	42-43	0	0	0	72-73	0	0	0	12-13	0	0	0	42-43	0	0	0	72-73	0	0	0
64-65	27	0	0	13-14	3	0	0	43-44	2	0	0	73-74	1	0	0	13-14	3	0	0	43-44	0	0	0	73-74	0	0	0
65-66	32	0	0	14-15	0	0	0	44-45	0	0	0	74-75	0	0	0	14-15	0	0	0	44-45	0	0	0	74-75	0	0	0
66-67	0	0	0	15-16	17	0	0	45-49	9	0	0	75-76	0	0	0	15-16	0	0	0	45-49	0	0	0	75-76	0	0	0
67-68	0	0	0	16-17	0	0	0	49-47	0	0	0	76-77	0	0	0	16-17	0	0	0	49-47	0	0	0	76-77	0	0	0
68-69	46	23	0	17-18	28	0	0	47-48	28	0	0	77-78	28	0	0	17-18	29	0	0	47-48	30	0	0	77-78	19	0	0
69-70	13	0	0	18-19	0	0	0	48-49	0	0	0	78-79	0	0	0	18-19	0	0	0	48-49	0	0	0	78-79	0	0	0
70-71	6	0	0	19-20	0	0	0	49-50	0	0	0	79-80	0	0	0	19-20	0	0	0	49-50	0	0	0	79-80	0	0	0
71-72	57	33	0	20-21	0	0	0	50-51	1	0	0	80-81	1	0	0	20-21	1	0	0	50-51	1	0	0	80-81	0	0	0
72-73	0	0	0	21-22	0	0	0	51-52	0	0	0	81-82	0	0	0	21-22	0	0	0	51-52	0	0	0	81-82	0	0	0
73-74	22	1	0	22-23	8	0	0	52-53	8	0	0	82-83	8	0	0	22-23	8	0	0	52-53	8	0	0	82-83	8	0	0
74-75	53	18	0	23-24	9	1	0	53-54	9	1	0	83-84	8	1	0	23-24	10	2	0	53-54	7	1	0	83-84	9	1	0
75-76	40	29	0	24-25	7	0	0	54-55	7	0	0	84-85	7	0	0	24-25	7	0	0	54-55	4	0	0	84-85	1	0	0
76-77	33	8	0	25-26	7	0	0	55-56	7	0	0	85-86	5	0	0	25-26	9	0	0	55-56	2	0	0	85-86	0	0	0
77-78	9	0	0	26-27	9	3	0	56-57	8	2	0	86-87	8	2	0	26-27	9	4	0	56-57	5	2	0	86-87	3	1	0
78-79	18	14	0	27-28	10	4	0	57-58	10	4	0	87-88	9	3	0	27-28	10	2	0	57-58	6	0	0	87-88	4	0	0
79-80	47	30	0	28-29	0	0	0	58-59	0	0	0	88-89	0	0	0	28-29	0	0	0	58-59	0	0	0	88-89	0	0	0
80-81	56	38	0	29-30	42	37	0	59-60	40	35	0	89-90	41	36	0	29-30	41	35	0	59-60	39	32	0	89-90	33	5	0
80-81	39	0	0	30-31	3	0	0	60-61	2	0	0	90-91	2	0	0	30-31	1	0	0	60-61	0	0	0	90-91	0	0	0
81-82	44	0	0	31-32	0	0	0	61-62	0	0	0	91-92	0	0	0	31-32	0	0	0	61-62	0	0	0	91-92	0	0	0
83-84	4	0	0	32-33	5	0	0	62-63	4	0	0	92-93	3	0	0	32-33	12	0	0	62-63	2	0	0	92-93	3	0	0
84-85	47	29	0	33-34	13	2	0	63-64	9	0	0	93-94	10	0	0	33-34	9	0	0	63-64	2	0	0	93-94	2	0	0
85-86	32	6	0	34-35	0	0	0	64-65	0	0	0	94-95	0	0	0	34-35	0	0	0	64-65	0	0	0	94-95	0	0	0
86-87	10	0	0	35-36	0	0	0	65-66	0	0	0	95-96	0	0	0	35-36	0	0	0	65-66	0	0	0	95-96	0	0	0
87-88	9	0	0	36-37	0	0	0	66-67	0	0	0	96-97	0	0	0	36-37	0	0	0	66-67	0	0	0	96-97	0	0	0
88-89	0	0	0	37-38	0	0	0	67-68	0	0	0	97-98	0	0	0	37-38	0	0	0	67-68	0	0	0	97-98	0	0	0
89-90	39	12	0	38-39	3	0	0	68-69	0	0	0	98-99	3	0	0	38-39	0	0	0	68-69	0	0	0	98-99	0	0	0
Mean	27.31	9.00	0.00	Mean	6.00	1.62	0.00	Mean	5.31	1.45	0.00	Mean	4.79	1.45	0.00	Mean	5.14	1.48	0.00	Mean	3.66	1.21	0.00	Mean	2.83	0.24	0.00
SD	20.78	12.48	0.00	SD	9.52	6.87	0.00	SD	8.98	6.51	0.00	SD	9.05	6.68	0.00	SD	9.39	6.51	0.00	SD	8.94	5.94	0.00	SD	7.08	0.95	0.00

District 6 Projected Snowmobile Season Length (Days)

Baseline				INMCM3.0 B1												MIROC3.2 HIRES A1B											
				2020s				2050s				2080s				2020s				2050s				2080s			
Season	15cm	30cm	60cm	Season	15cm	30cm	60cm	Season	15cm	30cm	60cm	Season	15cm	30cm	60cm	Season	15cm	30cm	60cm	Season	15cm	30cm	60cm	Season	15cm	30cm	60cm
61-62	13	0	0	10-11	12	0	0	40-41	8	0	0	70-71	7	0	0	10-11	2	0	0	40-41	0	0	0	70-71	0	0	0
62-63	92	56	10	11-12	41	22	0	41-42	37	14	0	71-72	35	13	0	11-12	18	6	0	41-42	15	2	0	71-72	14	2	0
63-64	59	0	0	12-13	3	0	0	42-43	2	0	0	72-73	2	0	0	12-13	1	0	0	42-43	1	0	0	72-73	0	0	0
64-65	76	40	27	13-14	61	48	27	43-44	57	42	16	73-74	55	43	25	13-14	50	17	0	43-44	43	12	0	73-74	35	10	0
65-66	84	67	9	14-15	52	43	17	44-45	52	37	9	74-75	51	36	7	14-15	35	20	0	44-45	21	8	0	74-75	22	10	0
66-67	80	64	23	15-16	58	51	31	45-49	56	49	30	75-76	54	47	30	15-16	51	38	17	45-49	45	35	0	75-76	38	28	0
67-68	51	44	0	16-17	38	28	0	49-47	36	28	0	76-77	36	28	0	16-17	28	8	0	49-47	21	0	0	76-77	15	0	0
68-69	15	0	0	17-18	41	31	0	47-48	40	30	0	77-78	38	29	0	17-18	34	4	0	47-48	33	0	0	77-78	31	0	0
69-70	80	14	0	18-19	59	43	0	48-49	54	36	0	78-79	52	13	0	18-19	16	0	0	48-49	13	0	0	78-79	6	0	0
70-71	78	37	0	19-20	58	37	2	49-50	52	33	0	79-80	56	37	3	19-20	37	2	0	49-50	19	0	0	79-80	4	0	0
71-72	15	0	0	20-21	18	0	0	50-51	18	0	0	80-81	17	0	0	20-21	12	0	0	50-51	6	0	0	80-81	6	0	0
72-73	47	0	0	21-22	43	24	0	51-52	41	24	0	81-82	39	14	0	21-22	20	0	0	51-52	6	0	0	81-82	7	0	0
73-74	85	55	17	22-23	27	19	0	52-53	26	9	0	82-83	23	7	0	22-23	14	0	0	52-53	13	0	0	82-83	13	0	0
74-75	66	46	3	23-24	63	53	32	53-54	60	50	30	83-84	62	54	34	23-24	60	51	29	53-54	58	48	29	83-84	58	49	25
75-76	0	0	0	24-25	30	0	0	54-55	29	0	0	84-85	30	0	0	24-25	26	0	0	54-55	28	0	0	84-85	13	0	0
76-77	30	0	0	25-26	46	32	0	55-56	47	31	0	85-86	45	32	0	25-26	37	4	0	55-56	32	0	0	85-86	32	0	0
77-78	75	47	0	26-27	51	40	0	56-57	49	38	0	86-87	48	35	0	26-27	41	14	0	56-57	33	0	0	86-87	8	0	0
78-79	74	40	0	27-28	42	38	11	57-58	40	29	0	87-88	40	34	0	27-28	41	30	0	57-58	39	29	0	87-88	40	30	0
79-80	51	19	0	28-29	47	34	0	58-59	45	31	0	88-89	45	31	0	28-29	41	18	0	58-59	40	15	0	88-89	29	0	0
80-81	37	18	0	29-30	24	12	0	59-60	21	12	0	89-90	24	13	0	29-30	17	11	0	59-60	16	7	0	89-90	14	5	0
80-81	51	9	0	30-31	0	0	0	60-61	0	0	0	90-91	1	0	0	30-31	0	0	0	60-61	0	0	0	90-91	0	0	0
81-82	29	1	0	31-32	25	0	0	61-62	23	0	0	91-92	24	0	0	31-32	6	0	0	61-62	5	0	0	91-92	4	0	0
83-84	101	87	30	32-33	82	69	41	62-63	81	68	39	92-93	81	68	39	32-33	71	56	14	62-63	67	49	0	92-93	66	47	0
84-85	69	57	0	33-34	60	52	31	63-64	59	47	20	93-94	59	48	26	33-34	47	34	0	63-64	44	28	0	93-94	43	30	0
85-86	71	35	0	34-35	5	0	0	64-65	5	0	0	94-95	5	0	0	34-35	3	0	0	64-65	3	0	0	94-95	1	0	0
86-87	0	0	0	35-36	0	0	0	65-66	0	0	0	95-96	0	0	0	35-36	0	0	0	65-66	0	0	0	95-96	0	0	0
87-88	61	32	7	36-37	69	58	28	66-67	69	57	28	96-97	68	57	28	36-37	64	54	28	66-67	63	49	29	96-97	63	46	12
88-89	61	44	0	37-38	31	7	0	67-68	30	7	0	97-98	28	7	0	37-38	11	0	0	67-68	11	0	0	97-98	8	0	0
89-90	0	0	0	38-39	8	0	0	68-69	6	0	0	98-99	6	0	0	38-39	2	0	0	68-69	0	0	0	98-99	0	0	0
Mean	53.48	28.00	4.34	Mean	37.72	25.55	7.59	Mean	35.97	23.17	5.93	Mean	35.55	22.28	6.62	Mean	27.07	12.66	3.03	Mean	23.28	9.72	2.00	Mean	19.66	8.86	1.28
SD	29.63	25.92	8.74	SD	22.46	21.76	13.21	SD	22.06	20.59	11.68	SD	21.91	20.89	12.61	SD	20.88	17.90	8.11	SD	20.10	16.58	7.48	SD	19.96	16.10	5.08

District 7 Projected Snowmobile Season Length (Days)

Baseline				INMCM3.0 B1												MIROC3.2 HIRES A1B											
				2020s				2050s				2080s				2020s				2050s				2080s			
Season	15cm	30cm	60cm	Season	15cm	30cm	60cm	Season	15cm	30cm	60cm	Season	15cm	30cm	60cm	Season	15cm	30cm	60cm	Season	15cm	30cm	60cm	Season	15cm	30cm	60cm
61-62	41	27	0	10-11	31	24	2	40-41	30	24	0	70-71	29	23	0	10-11	25	9	0	40-41	23	4	0	70-71	20	3	0
62-63	47	43	11	11-12	31	21	0	41-42	32	12	0	71-72	30	10	0	11-12	19	7	0	41-42	8	0	0	71-72	7	0	0
63-64	54	38	1	12-13	30	16	0	42-43	29	16	0	72-73	29	16	0	12-13	19	2	0	42-43	16	2	0	72-73	14	1	0
64-65	63	47	3	13-14	62	48	20	43-44	59	44	13	73-74	58	44	17	13-14	44	23	0	43-44	37	4	0	73-74	28	2	0
65-66	73	43	0	14-15	61	58	38	44-45	61	58	34	74-75	60	57	32	14-15	54	47	4	44-45	38	19	0	74-75	27	1	0
66-67	72	49	7	15-16	56	43	17	45-49	55	39	2	75-76	51	33	0	15-16	28	1	0	45-49	26	0	0	75-76	26	1	0
67-68	28	0	0	16-17	32	8	0	49-47	30	9	0	76-77	25	2	0	16-17	3	0	0	49-47	0	0	0	76-77	0	0	0
68-69	4	0	0	17-18	9	0	0	47-48	12	0	0	77-78	10	0	0	17-18	3	0	0	47-48	7	0	0	77-78	5	0	0
69-70	81	67	41	18-19	58	48	37	48-49	58	48	34	78-79	57	47	21	18-19	56	35	0	48-49	53	34	0	78-79	18	0	0
70-71	54	1	0	19-20	40	15	0	49-50	40	7	0	79-80	41	23	0	19-20	20	1	0	49-50	17	2	0	79-80	3	0	0
71-72	0	0	0	20-21	0	0	0	50-51	0	0	0	80-81	0	0	0	20-21	0	0	0	50-51	0	0	0	80-81	0	0	0
72-73	61	41	0	21-22	47	23	0	51-52	48	24	0	81-82	46	16	0	21-22	42	0	0	51-52	34	0	0	81-82	26	0	0
73-74	57	26	8	22-23	25	22	0	52-53	25	22	0	82-83	24	22	0	22-23	20	0	0	52-53	10	0	0	82-83	0	0	0
74-75	64	43	0	23-24	56	44	29	53-54	55	44	23	83-84	56	45	26	23-24	52	43	5	53-54	44	32	0	83-84	44	28	0
75-76	25	0	0	24-25	19	16	0	54-55	19	15	0	84-85	18	14	0	24-25	16	0	0	54-55	16	0	0	84-85	11	0	0
76-77	40	2	0	25-26	46	38	11	55-56	44	37	9	85-86	45	38	4	25-26	32	19	0	55-56	24	9	0	85-86	23	1	0
77-78	89	80	12	26-27	70	61	22	56-57	67	58	20	86-87	68	57	19	26-27	65	32	0	56-57	55	14	0	86-87	22	2	0
78-79	54	3	0	27-28	30	4	0	57-58	11	0	0	87-88	12	0	0	27-28	6	0	0	57-58	1	0	0	87-88	2	0	0
79-80	56	1	0	28-29	58	38	0	58-59	58	38	0	88-89	59	36	0	28-29	56	30	0	58-59	39	3	0	88-89	33	0	0
80-81	86	78	26	29-30	66	58	21	59-60	66	57	17	89-90	64	56	18	29-30	61	46	13	59-60	52	34	0	89-90	56	36	0
80-81	53	39	0	30-31	33	25	0	60-61	32	23	0	90-91	28	22	0	30-31	18	0	0	60-61	19	0	0	90-91	0	0	0
81-82	44	18	0	31-32	19	10	0	61-62	17	9	0	91-92	18	9	0	31-32	12	2	0	61-62	12	0	0	91-92	2	0	0
83-84	86	25	0	32-33	52	2	0	62-63	40	2	0	92-93	52	2	0	32-33	22	0	0	62-63	17	0	0	92-93	16	0	0
84-85	37	0	0	33-34	41	22	0	63-64	40	30	0	93-94	40	30	0	33-34	40	22	0	63-64	36	20	0	93-94	35	4	0
85-86	71	59	11	34-35	31	8	0	64-65	30	8	0	94-95	29	5	0	34-35	29	0	0	64-65	29	0	0	94-95	18	0	0
86-87	16	5	0	35-36	17	0	0	65-66	9	0	0	95-96	16	0	0	35-36	4	0	0	65-66	0	0	0	95-96	0	0	0
87-88	67	50	0	36-37	53	11	0	66-67	51	10	0	96-97	51	11	0	36-37	17	4	0	66-67	12	1	0	96-97	12	1	0
88-89	83	38	0	37-38	49	21	0	67-68	47	21	0	97-98	48	21	0	37-38	42	11	0	67-68	43	11	0	97-98	27	0	0
89-90	13	0	0	38-39	8	1	0	68-69	6	1	0	98-99	6	1	0	38-39	1	0	0	68-69	0	0	0	98-99	0	0	0
Mean	52.38	28.38	4.14	Mean	38.97	23.62	6.79	Mean	36.93	22.62	5.24	Mean	36.90	22.07	4.72	Mean	27.79	11.52	0.76	Mean	23.03	6.52	0.00	Mean	16.38	2.76	0.00
SD	24.65	25.52	9.20	SD	18.79	19.12	12.03	SD	19.24	19.05	10.33	SD	19.17	18.82	9.42	SD	19.70	15.95	2.63	SD	17.21	10.88	0.00	SD	14.72	8.23	0.00

District 8 Projected Snowmobile Season Length (Days)

Baseline				INMCM3.0 B1												MIROC3.2 HIRES A1B											
				2020s				2050s				2080s				2020s				2050s				2080s			
Season	15cm	30cm	60cm	Season	15cm	30cm	60cm	Season	15cm	30cm	60cm	Season	15cm	30cm	60cm	Season	15cm	30cm	60cm	Season	15cm	30cm	60cm	Season	15cm	30cm	60cm
61-62	0	0	0	10-11	17	7	0	40-41	17	0	0	70-71	17	0	0	10-11	0	0	0	40-41	0	0	0	70-71	0	0	0
62-63	6	0	0	11-12	17	0	0	41-42	7	0	0	71-72	8	0	0	11-12	1	0	0	41-42	1	0	0	71-72	0	0	0
63-64	33	14	0	12-13	4	0	0	42-43	4	0	0	72-73	2	0	0	12-13	1	0	0	42-43	0	0	0	72-73	0	0	0
64-65	21	0	0	13-14	20	6	0	43-44	20	6	0	73-74	20	5	0	13-14	17	5	0	43-44	16	4	0	73-74	16	4	0
65-66	60	38	0	14-15	41	34	0	44-45	40	29	0	74-75	36	24	0	14-15	33	17	0	44-45	24	10	0	74-75	8	0	0
66-67	59	10	0	15-16	49	38	1	45-49	47	37	0	75-76	52	43	5	15-16	39	1	0	45-49	9	0	0	75-76	5	0	0
67-68	4	0	0	16-17	15	1	0	49-47	13	0	0	76-77	13	0	0	16-17	0	0	0	49-47	0	0	0	76-77	0	0	0
68-69	49	26	0	17-18	40	28	0	47-48	39	23	0	77-78	32	2	0	17-18	14	6	0	47-48	12	6	0	77-78	10	0	0
69-70	73	10	0	18-19	0	0	0	48-49	0	0	0	78-79	0	0	0	18-19	0	0	0	48-49	0	0	0	78-79	0	0	0
70-71	44	15	0	19-20	49	35	0	49-50	46	21	0	79-80	45	34	0	19-20	21	6	0	49-50	17	4	0	79-80	6	0	0
71-72	0	0	0	20-21	0	0	0	50-51	0	0	0	80-81	0	0	0	20-21	0	0	0	50-51	0	0	0	80-81	0	0	0
72-73	20	0	0	21-22	36	0	0	51-52	28	0	0	81-82	22	0	0	21-22	0	0	0	51-52	0	0	0	81-82	0	0	0
73-74	1	0	0	22-23	1	0	0	52-53	1	0	0	82-83	1	0	0	22-23	1	0	0	52-53	1	0	0	82-83	1	0	0
74-75	20	0	0	23-24	31	1	0	53-54	29	0	0	83-84	31	0	0	23-24	12	0	0	53-54	1	0	0	83-84	0	0	0
75-76	39	12	0	24-25	27	17	0	54-55	22	16	0	84-85	22	16	0	24-25	9	0	0	54-55	6	0	0	84-85	7	0	0
76-77	34	0	0	25-26	47	11	0	55-56	43	0	0	85-86	43	0	0	25-26	8	0	0	55-56	9	0	0	85-86	10	0	0
77-78	65	10	0	26-27	43	31	0	56-57	42	25	0	86-87	42	20	0	26-27	37	4	0	56-57	18	1	0	86-87	6	0	0
78-79	0	0	0	27-28	21	0	0	57-58	10	0	0	87-88	12	0	0	27-28	0	0	0	57-58	0	0	0	87-88	0	0	0
79-80	0	0	0	28-29	17	1	0	58-59	17	2	0	88-89	17	1	0	28-29	14	1	0	58-59	12	0	0	88-89	8	0	0
80-81	90	71	0	29-30	75	65	8	59-60	75	65	6	89-90	75	65	13	29-30	61	32	0	59-60	46	21	0	89-90	41	22	0
80-81	15	0	0	30-31	8	2	0	60-61	8	2	0	90-91	7	1	0	30-31	5	0	0	60-61	4	0	0	90-91	0	0	0
81-82	84	71	9	31-32	58	56	2	61-62	57	47	0	91-92	56	43	0	31-32	20	3	0	61-62	13	2	0	91-92	10	0	0
83-84	72	45	0	32-33	56	44	17	62-63	54	41	0	92-93	52	40	0	32-33	34	4	0	62-63	13	0	0	92-93	9	0	0
84-85	0	0	0	33-34	0	0	0	63-64	4	0	0	93-94	0	0	0	33-34	0	0	0	63-64	0	0	0	93-94	0	0	0
85-86	46	1	0	34-35	24	10	0	64-65	24	9	0	94-95	21	2	0	34-35	2	0	0	64-65	2	0	0	94-95	1	0	0
86-87	48	1	0	35-36	1	0	0	65-66	0	0	0	95-96	0	0	0	35-36	0	0	0	65-66	0	0	0	95-96	0	0	0
87-88	16	6	0	36-37	21	7	0	66-67	19	6	0	96-97	15	5	0	36-37	7	0	0	66-67	2	0	0	96-97	2	0	0
88-89	35	1	0	37-38	18	4	0	67-68	16	3	0	97-98	14	3	0	37-38	11	2	0	67-68	6	0	0	97-98	4	0	0
89-90	18	0	0	38-39	6	0	0	68-69	5	0	0	98-99	3	0	0	38-39	3	0	0	68-69	2	0	0	98-99	0	0	0
Mean	32.83	11.41	0.31	Mean	25.59	13.72	0.97	Mean	23.69	11.45	0.21	Mean	22.69	10.48	0.62	Mean	12.07	2.79	0.00	Mean	7.38	1.66	0.00	Mean	4.97	0.90	0.00
SD	27.76	20.14	1.67	SD	20.41	18.97	3.44	SD	20.08	17.47	1.11	SD	20.18	17.72	2.56	SD	15.42	6.63	0.00	SD	10.13	4.37	0.00	SD	8.24	4.13	0.00

District 9 Projected Snowmobile Season Length (Days)

Baseline				INMCM3.0 B1												MIROC3.2 HIRES A1B											
				2020s				2050s				2080s				2020s				2050s				2080s			
Season	15cm	30cm	60cm	Season	15cm	30cm	60cm	Season	15cm	30cm	60cm	Season	15cm	30cm	60cm	Season	15cm	30cm	60cm	Season	15cm	30cm	60cm	Season	15cm	30cm	60cm
61-62	13	4	0	10-11	1	0	0	40-41	1	0	0	70-71	6	0	0	10-11	0	0	0	40-41	1	0	0	70-71	0	0	0
62-63	72	48	0	11-12	10	0	0	41-42	7	0	0	71-72	10	0	0	11-12	8	0	0	41-42	5	0	0	71-72	0	0	0
63-64	59	13	0	12-13	11	0	0	42-43	8	0	0	72-73	20	0	0	12-13	4	0	0	42-43	4	0	0	72-73	1	0	0
64-65	59	38	0	13-14	27	21	0	43-44	24	20	0	73-74	28	23	0	13-14	14	7	0	43-44	12	6	0	73-74	0	0	0
65-66	65	41	7	14-15	38	0	0	44-45	33	0	0	74-75	40	10	0	14-15	4	0	0	44-45	1	0	0	74-75	1	0	0
66-67	69	19	0	15-16	53	26	0	45-49	45	23	0	75-76	55	28	11	15-16	28	21	0	45-49	23	17	0	75-76	22	4	0
67-68	0	0	0	16-17	17	3	0	49-47	14	0	0	76-77	21	5	0	16-17	0	0	0	49-47	0	0	0	76-77	0	0	0
68-69	65	42	0	17-18	59	43	0	47-48	56	42	0	77-78	60	48	0	17-18	41	24	0	47-48	37	13	0	77-78	37	8	0
69-70	21	0	0	18-19	3	0	0	48-49	3	0	0	78-79	11	0	0	18-19	3	0	0	48-49	9	0	0	78-79	0	0	0
70-71	77	52	0	19-20	45	4	0	49-50	50	4	0	79-80	61	11	0	19-20	0	0	0	49-50	0	0	0	79-80	0	0	0
71-72	48	21	0	20-21	9	0	0	50-51	13	0	0	80-81	16	0	0	20-21	4	0	0	50-51	4	0	0	80-81	2	0	0
72-73	51	20	0	21-22	24	12	0	51-52	23	4	0	81-82	25	14	0	21-22	4	0	0	51-52	0	0	0	81-82	1	0	0
73-74	50	33	0	22-23	0	0	0	52-53	0	0	0	82-83	0	0	0	22-23	0	0	0	52-53	0	0	0	82-83	0	0	0
74-75	58	24	0	23-24	43	20	0	53-54	43	21	0	83-84	50	35	0	23-24	12	0	0	53-54	9	0	0	83-84	8	0	0
75-76	26	7	0	24-25	26	13	0	54-55	28	13	0	84-85	30	19	0	24-25	11	6	0	54-55	12	0	0	84-85	6	0	0
76-77	62	46	0	25-26	43	33	0	55-56	43	34	0	85-86	48	42	20	25-26	3	0	0	55-56	0	0	0	85-86	2	0	0
77-78	72	41	0	26-27	43	33	0	56-57	42	32	5	86-87	46	36	7	26-27	34	8	0	56-57	13	1	0	86-87	7	0	0
78-79	31	0	0	27-28	29	0	0	57-58	21	0	0	87-88	36	11	0	27-28	3	0	0	57-58	2	0	0	87-88	0	0	0
79-80	63	49	0	28-29	10	3	0	58-59	9	0	0	88-89	20	3	0	28-29	0	0	0	58-59	0	0	0	88-89	0	0	0
80-81	63	15	0	29-30	56	30	0	59-60	55	26	0	89-90	63	38	0	29-30	23	0	0	59-60	19	0	0	89-90	21	0	0
80-81	53	5	0	30-31	18	0	0	60-61	13	0	0	90-91	22	0	0	30-31	0	0	0	60-61	0	0	0	90-91	0	0	0
81-82	58	44	0	31-32	29	11	0	61-62	28	2	0	91-92	35	24	0	31-32	6	1	0	61-62	6	0	0	91-92	0	0	0
83-84	55	42	0	32-33	44	34	0	62-63	43	24	0	92-93	46	36	0	32-33	10	0	0	62-63	9	0	0	92-93	14	0	0
84-85	36	0	0	33-34	20	0	0	63-64	9	0	0	93-94	28	0	0	33-34	0	0	0	63-64	0	0	0	93-94	0	0	0
85-86	77	63	14	34-35	21	11	0	64-65	21	11	0	94-95	21	12	0	34-35	15	1	0	64-65	16	0	0	94-95	11	0	0
86-87	77	70	6	35-36	19	8	0	65-66	12	6	0	95-96	19	8	0	35-36	9	4	0	65-66	7	3	0	95-96	8	2	0
87-88	53	5	0	36-37	27	3	0	66-67	23	0	0	96-97	33	9	0	36-37	14	0	0	66-67	10	0	0	96-97	9	0	0
88-89	19	1	0	37-38	10	0	0	67-68	6	0	0	97-98	10	0	0	37-38	6	0	0	67-68	4	0	0	97-98	0	0	0
89-90	51	34	3	38-39	26	13	0	68-69	25	8	0	98-99	32	13	0	38-39	23	4	0	68-69	20	4	0	98-99	15	4	0
Mean	51.83	26.79	1.03	Mean	26.24	11.07	0.00	Mean	24.07	9.31	0.17	Mean	30.76	14.66	1.31	Mean	9.62	2.62	0.00	Mean	7.69	1.52	0.00	Mean	5.69	0.62	0.00
SD	20.26	21.03	3.04	SD	16.69	13.20	0.00	SD	16.90	12.65	0.93	SD	17.30	15.10	4.31	SD	10.83	5.98	0.00	SD	8.79	4.02	0.00	SD	8.87	1.78	0.00

District 10 Projected Snowmobile Season Length (Days)

Baseline				INMCM3.0 B1												MIROC3.2 HIRES A1B											
				2020s				2050s				2080s				2020s				2050s				2080s			
Season	15cm	30cm	60cm	Season	15cm	30cm	60cm	Season	15cm	30cm	60cm	Season	15cm	30cm	60cm	Season	15cm	30cm	60cm	Season	15cm	30cm	60cm	Season	15cm	30cm	60cm
61-62	19	0	0	10-11	10	0	0	40-41	8	0	0	70-71	13	0	0	10-11	4	0	0	40-41	4	0	0	70-71	4	0	0
62-63	86	81	59	11-12	43	24	3	41-42	36	19	0	71-72	51	36	6	11-12	22	13	0	41-42	18	6	0	71-72	5	0	0
63-64	28	8	0	12-13	8	0	0	42-43	8	1	0	72-73	9	2	0	12-13	7	0	0	42-43	6	0	0	72-73	5	0	0
64-65	87	70	53	13-14	61	51	39	43-44	58	49	41	73-74	63	52	42	13-14	52	45	30	43-44	46	38	0	73-74	21	5	0
65-66	83	78	52	14-15	65	59	52	44-45	65	59	52	74-75	67	61	52	14-15	59	52	30	44-45	51	44	27	74-75	51	39	11
66-67	72	64	40	15-16	51	50	42	45-49	50	49	41	75-76	52	51	44	15-16	41	40	36	45-49	39	37	31	75-76	37	36	22
67-68	50	43	2	16-17	33	12	0	49-47	26	9	0	76-77	45	36	6	16-17	18	4	0	49-47	10	0	0	76-77	9	0	0
68-69	69	56	22	17-18	58	48	22	47-48	54	47	6	77-78	59	54	45	17-18	28	12	0	47-48	22	0	0	77-78	20	0	0
69-70	76	62	38	18-19	46	38	0	48-49	45	36	0	78-79	47	43	19	18-19	14	0	0	48-49	7	0	0	78-79	4	0	0
70-71	71	25	0	19-20	55	20	0	49-50	52	26	0	79-80	58	27	0	19-20	49	10	0	49-50	22	10	0	79-80	12	10	0
71-72	43	12	0	20-21	39	26	0	50-51	40	26	0	80-81	39	26	0	20-21	25	9	0	50-51	26	0	0	80-81	26	0	0
72-73	46	32	0	21-22	35	30	0	51-52	32	27	0	81-82	37	33	2	21-22	29	23	0	51-52	25	2	0	81-82	26	7	0
73-74	75	63	47	22-23	40	33	0	52-53	35	28	0	82-83	41	33	0	22-23	33	27	0	52-53	30	23	0	82-83	27	13	0
74-75	82	69	20	23-24	68	60	27	53-54	66	60	33	83-84	71	65	43	23-24	57	45	0	53-54	53	34	0	83-84	37	8	0
75-76	70	27	0	24-25	31	5	0	54-55	31	5	0	84-85	46	16	0	24-25	22	6	0	54-55	21	5	0	84-85	20	4	0
76-77	84	68	35	25-26	63	52	35	55-56	61	52	39	85-86	63	52	41	25-26	49	46	12	55-56	31	4	0	85-86	34	8	0
77-78	76	42	0	26-27	51	16	0	56-57	47	30	0	86-87	54	38	0	26-27	29	0	0	56-57	19	0	0	86-87	13	0	0
78-79	81	68	49	27-28	53	49	33	57-58	51	46	20	87-88	57	52	45	27-28	22	10	0	57-58	16	2	0	87-88	9	0	0
79-80	74	36	0	28-29	54	29	0	58-59	54	26	0	88-89	62	42	0	28-29	48	21	0	58-59	43	9	0	88-89	37	8	0
80-81	74	60	3	29-30	58	36	5	59-60	57	25	5	89-90	60	49	5	29-30	37	12	0	59-60	29	3	0	89-90	30	4	0
80-81	62	32	13	30-31	21	14	0	60-61	21	15	0	90-91	23	15	0	30-31	19	14	0	60-61	15	11	0	90-91	13	3	0
81-82	65	52	0	31-32	4	1	0	61-62	3	0	0	91-92	6	1	0	31-32	1	0	0	61-62	1	0	0	91-92	0	0	0
83-84	69	59	39	32-33	40	38	16	62-63	39	35	9	92-93	43	41	24	32-33	5	0	0	62-63	1	0	0	92-93	1	0	0
84-85	70	41	0	33-34	63	53	20	63-64	61	49	18	93-94	65	55	32	33-34	42	19	0	63-64	24	10	0	93-94	24	6	0
85-86	67	60	46	34-35	46	40	0	64-65	46	37	0	94-95	48	41	1	34-35	9	0	0	64-65	2	0	0	94-95	0	0	0
86-87	33	4	0	35-36	36	5	0	65-66	33	3	0	95-96	38	5	0	35-36	30	3	0	65-66	23	3	0	95-96	12	3	0
87-88	77	68	35	36-37	63	55	38	66-67	62	52	40	96-97	62	55	39	36-37	61	56	40	66-67	53	49	35	96-97	52	47	32
88-89	13	1	0	37-38	6	0	0	67-68	6	0	0	97-98	7	0	0	37-38	0	0	0	67-68	0	0	0	97-98	0	0	0
89-90	58	48	0	38-39	49	38	0	68-69	49	33	0	98-99	49	41	0	38-39	40	4	0	68-69	36	3	0	98-99	3	0	0
Mean	64.14	45.83	19.07	Mean	43.10	30.41	11.45	Mean	41.24	29.10	10.48	Mean	46.03	35.24	15.38	Mean	29.38	16.24	5.10	Mean	23.21	10.10	3.21	Mean	18.34	6.93	2.24
SD	20.08	24.07	21.76	SD	18.62	19.78	16.74	SD	18.47	19.09	16.86	SD	18.54	19.64	19.56	SD	18.15	17.96	12.08	SD	16.12	15.11	9.67	SD	15.22	12.33	7.28



District 11 Projected Snowmobile Season Length (Days)

Baseline				INMCM3.0 B1												MIROC3.2 HIRES A1B											
				2020s				2050s				2080s				2020s				2050s				2080s			
Season	15cm	30cm	60cm	Season	15cm	30cm	60cm	Season	15cm	30cm	60cm	Season	15cm	30cm	60cm	Season	15cm	30cm	60cm	Season	15cm	30cm	60cm	Season	15cm	30cm	60cm
61-62	0	0	0	10-11	30	10	0	40-41	20	4	0	70-71	19	0	0	10-11	9	0	0	40-41	8	0	0	70-71	8	0	0
62-63	114	86	28	11-12	89	65	33	41-42	87	64	28	71-72	85	62	20	11-12	83	57	0	41-42	80	47	0	71-72	79	41	0
63-64	95	75	0	12-13	70	18	0	42-43	54	5	0	72-73	54	5	0	12-13	19	1	0	42-43	16	0	0	72-73	13	0	0
64-65	91	50	0	13-14	81	70	46	43-44	79	67	33	73-74	76	65	31	13-14	72	61	27	43-44	74	60	18	73-74	71	47	11
65-66	110	81	35	14-15	99	85	67	44-45	98	81	65	74-75	99	81	65	14-15	99	81	65	44-45	94	78	62	74-75	85	73	60
66-67	117	78	3	15-16	96	65	23	45-49	95	62	21	75-76	96	62	21	15-16	95	29	0	45-49	70	10	0	75-76	66	7	0
67-68	65	0	0	16-17	60	50	23	49-47	60	50	1	76-77	57	48	0	16-17	57	44	0	49-47	52	24	0	76-77	48	0	0
68-69	79	63	1	17-18	73	68	50	47-48	72	67	50	77-78	74	67	49	17-18	70	68	50	47-48	66	63	48	77-78	65	61	47
69-70	75	43	0	18-19	70	59	41	48-49	67	57	14	78-79	67	57	12	18-19	65	55	0	48-49	66	43	0	78-79	54	10	0
70-71	40	12	0	19-20	36	26	0	49-50	35	25	0	79-80	34	27	0	19-20	34	22	0	49-50	30	20	0	79-80	29	22	0
71-72	82	45	0	20-21	43	18	0	50-51	37	20	0	80-81	39	18	0	20-21	26	11	0	50-51	25	11	0	80-81	23	11	0
72-73	105	82	0	21-22	78	69	0	51-52	76	65	0	81-82	77	56	0	21-22	54	6	0	51-52	29	5	0	81-82	25	2	0
73-74	99	59	2	22-23	78	58	3	52-53	76	46	0	82-83	76	46	0	22-23	50	11	0	52-53	44	8	0	82-83	46	8	0
74-75	96	73	23	23-24	80	67	51	53-54	79	65	49	83-84	79	65	48	23-24	73	60	40	53-54	73	58	41	83-84	66	54	11
75-76	71	7	0	24-25	72	63	23	54-55	71	62	9	84-85	70	61	9	24-25	66	56	0	54-55	62	47	0	84-85	56	20	0
76-77	63	22	0	25-26	87	75	40	55-56	87	73	40	85-86	84	73	36	25-26	82	69	21	55-56	81	69	21	85-86	80	66	5
77-78	84	64	19	26-27	52	43	8	56-57	51	43	8	86-87	51	43	7	26-27	44	37	0	56-57	43	23	0	86-87	51	0	0
78-79	76	59	0	27-28	73	66	46	57-58	74	67	44	87-88	72	67	43	27-28	68	50	14	57-58	57	43	0	87-88	53	33	0
79-80	111	91	13	28-29	83	60	0	58-59	79	54	0	88-89	79	54	0	28-29	77	31	0	58-59	78	50	0	88-89	77	43	0
80-81	81	26	0	29-30	80	70	42	59-60	81	70	40	89-90	80	69	43	29-30	76	66	25	59-60	71	64	12	89-90	66	49	4
80-81	99	96	63	30-31	64	61	38	60-61	63	59	31	90-91	63	56	24	30-31	50	16	0	60-61	46	12	0	90-91	44	11	0
81-82	93	69	42	31-32	82	73	54	61-62	81	75	55	91-92	82	74	55	31-32	83	74	49	61-62	80	73	49	91-92	79	72	49
83-84	103	68	6	32-33	89	55	28	62-63	87	52	28	92-93	86	51	26	32-33	81	37	3	62-63	75	27	0	92-93	61	7	0
84-85	77	48	0	33-34	65	47	32	63-64	61	46	30	93-94	61	45	30	33-34	45	35	0	63-64	42	29	0	93-94	38	29	0
85-86	84	17	0	34-35	54	19	0	64-65	55	20	0	94-95	54	20	0	34-35	48	7	0	64-65	43	3	0	94-95	37	3	0
86-87	90	58	0	35-36	63	38	0	65-66	58	34	0	95-96	62	37	0	35-36	54	15	0	65-66	51	27	0	95-96	49	16	0
87-88	76	55	0	36-37	79	70	56	66-67	76	68	55	96-97	75	68	55	36-37	70	65	42	66-67	68	64	39	96-97	64	61	39
88-89	99	37	0	37-38	17	3	0	67-68	15	2	0	97-98	13	1	0	37-38	12	0	0	67-68	9	0	0	97-98	4	0	0
89-90	100	75	24	38-39	73	62	47	68-69	72	61	45	98-99	71	60	45	38-39	71	55	38	68-69	68	51	34	98-99	64	49	28
Mean	85.34	53.07	8.93	Mean	69.52	52.86	25.90	Mean	67.10	50.48	22.28	Mean	66.72	49.59	21.34	Mean	59.76	38.59	12.90	Mean	55.21	34.79	11.17	Mean	51.76	27.41	8.76
SD	23.73	27.81	15.94	SD	19.35	21.81	22.10	SD	20.45	22.45	21.75	SD	20.54	22.41	21.56	SD	23.42	25.41	19.92	SD	23.07	25.13	19.08	SD	22.26	25.04	17.50

District 12 Projected Snowmobile Season Length (Days)

Baseline				INMCM3.0 B1												MIROC3.2 HIRES A1B											
				2020s				2050s				2080s				2020s				2050s				2080s			
Season	15cm	30cm	60cm	Season	15cm	30cm	60cm	Season	15cm	30cm	60cm	Season	15cm	30cm	60cm	Season	15cm	30cm	60cm	Season	15cm	30cm	60cm	Season	15cm	30cm	60cm
61-62	56	21	0	10-11	39	24	0	40-41	40	28	0	70-71	40	25	0	10-11	39	29	0	40-41	39	33	0	70-71	38	27	0
62-63	64	36	0	11-12	40	35	0	41-42	42	36	0	71-72	42	34	0	11-12	40	33	0	41-42	40	24	0	71-72	39	17	0
63-64	47	14	0	12-13	61	34	0	42-43	62	36	0	72-73	63	33	0	12-13	64	38	1	42-43	61	36	0	72-73	62	37	2
64-65	80	60	0	13-14	71	61	33	43-44	71	63	38	73-74	75	62	38	13-14	74	63	38	43-44	72	59	30	73-74	70	58	16
65-66	94	86	0	14-15	78	74	36	44-45	76	72	42	74-75	81	78	35	14-15	78	74	29	44-45	75	73	42	74-75	74	69	25
66-67	94	56	16	15-16	75	58	40	45-49	74	56	39	75-76	85	67	46	15-16	72	57	41	45-49	67	55	39	75-76	64	52	28
67-68	65	51	5	16-17	63	55	37	49-47	63	55	37	76-77	64	57	44	16-17	65	55	39	49-47	64	56	40	76-77	64	55	39
68-69	83	57	0	17-18	67	56	19	47-48	66	55	19	77-78	68	60	26	17-18	68	60	27	47-48	65	58	29	77-78	66	54	25
69-70	100	76	0	18-19	78	44	5	48-49	79	40	0	78-79	78	47	24	18-19	64	13	0	48-49	43	0	0	78-79	36	0	0
70-71	59	32	0	19-20	60	43	0	49-50	62	47	1	79-80	61	43	0	19-20	63	33	0	49-50	60	33	0	79-80	47	14	0
71-72	68	59	0	20-21	59	51	0	50-51	58	50	4	80-81	62	54	1	20-21	42	26	0	50-51	42	24	0	80-81	40	11	0
72-73	62	39	0	21-22	55	35	0	51-52	52	35	0	81-82	57	34	0	21-22	53	35	0	51-52	53	37	0	81-82	52	37	0
73-74	93	26	0	22-23	67	4	0	52-53	45	0	0	82-83	70	15	0	22-23	17	0	0	52-53	17	0	0	82-83	5	0	0
74-75	108	85	0	23-24	94	87	48	53-54	94	87	54	83-84	95	87	52	23-24	95	85	53	53-54	94	75	48	83-84	90	70	44
75-76	46	4	0	24-25	52	26	0	54-55	54	36	0	84-85	56	36	0	24-25	54	31	0	54-55	62	31	0	84-85	47	16	0
76-77	89	47	0	25-26	88	71	23	55-56	86	74	25	85-86	90	74	29	25-26	80	70	25	55-56	79	68	21	85-86	74	64	17
77-78	97	9	0	26-27	63	16	0	56-57	68	27	0	86-87	75	35	0	26-27	53	9	0	56-57	42	2	0	86-87	36	0	0
78-79	56	13	0	27-28	50	34	0	57-58	51	39	0	87-88	50	38	0	27-28	51	40	0	57-58	54	43	0	87-88	48	37	0
79-80	96	72	2	28-29	88	75	50	58-59	88	73	49	88-89	85	74	52	28-29	84	67	48	58-59	81	66	50	88-89	77	65	40
80-81	81	64	10	29-30	70	65	31	59-60	70	65	31	89-90	74	68	35	29-30	69	64	31	59-60	64	58	31	89-90	54	44	0
80-81	97	80	30	30-31	75	59	38	60-61	75	55	39	90-91	78	64	41	30-31	76	54	42	60-61	74	50	37	90-91	73	46	28
81-82	94	70	0	31-32	58	34	0	61-62	54	30	0	91-92	62	45	8	31-32	38	0	0	61-62	35	4	0	91-92	32	2	0
83-84	62	0	0	32-33	53	35	0	62-63	53	22	0	92-93	54	41	0	32-33	51	19	0	62-63	50	13	0	92-93	52	9	0
84-85	85	30	0	33-34	83	71	1	63-64	83	37	0	93-94	85	74	3	33-34	83	54	2	63-64	75	27	0	93-94	35	12	0
85-86	90	54	0	34-35	57	44	0	64-65	57	44	0	94-95	63	44	0	34-35	55	44	0	64-65	52	43	0	94-95	52	44	0
86-87	46	11	0	35-36	44	0	0	65-66	35	0	0	95-96	48	7	0	35-36	30	0	0	65-66	33	0	0	95-96	31	0	0
87-88	44	14	0	36-37	68	51	26	66-67	67	53	25	96-97	68	52	27	36-37	70	52	25	66-67	72	57	33	96-97	71	50	28
88-89	78	56	0	37-38	58	48	0	67-68	56	47	0	97-98	57	51	0	37-38	52	13	0	67-68	51	14	0	97-98	51	13	0
89-90	53	21	0	38-39	76	44	13	68-69	80	47	13	98-99	80	49	13	38-39	77	43	14	68-69	80	49	15	98-99	72	51	14
Mean	75.41	42.86	2.17	Mean	65.17	46.00	13.79	Mean	64.17	45.14	14.34	Mean	67.79	49.93	16.34	Mean	60.59	40.03	14.31	Mean	58.48	37.52	14.31	Mean	53.52	32.90	10.55
SD	19.53	26.12	6.40	SD	14.12	20.85	17.73	SD	15.04	20.04	18.64	SD	14.25	19.15	19.23	SD	17.95	23.58	18.48	SD	17.57	23.45	18.49	SD	18.43	23.75	14.85

District 13 Projected Snowmobile Season Length (Days)

Baseline				INMCM3.0 B1												MIROC3.2 HIRES A1B											
				2020s				2050s				2080s				2020s				2050s				2080s			
Season	15cm	30cm	60cm	Season	15cm	30cm	60cm	Season	15cm	30cm	60cm	Season	15cm	30cm	60cm	Season	15cm	30cm	60cm	Season	15cm	30cm	60cm	Season	15cm	30cm	60cm
61-62	46	4	0	10-11	28	20	0	40-41	29	19	0	70-71	35	21	0	10-11	19	0	0	40-41	3	0	0	70-71	0	0	0
62-63	109	92	58	11-12	72	50	0	41-42	71	43	0	71-72	74	60	13	11-12	42	13	0	41-42	40	13	0	71-72	32	1	0
63-64	72	5	0	12-13	19	0	0	42-43	24	0	0	72-73	20	0	0	12-13	14	0	0	42-43	8	0	0	72-73	2	0	0
64-65	77	63	36	13-14	53	44	35	43-44	51	43	35	73-74	57	47	39	13-14	41	37	26	43-44	40	31	4	73-74	36	35	2
65-66	100	93	18	14-15	79	62	25	44-45	79	59	23	74-75	82	76	39	14-15	60	37	0	44-45	27	0	0	74-75	35	24	0
66-67	99	90	55	15-16	80	64	40	45-49	76	61	32	75-76	85	71	46	15-16	46	0	0	45-49	11	0	0	75-76	20	0	0
67-68	70	17	0	16-17	60	38	6	49-47	59	38	1	76-77	60	40	13	16-17	21	6	0	49-47	21	0	0	76-77	6	0	0
68-69	71	33	0	17-18	66	48	0	47-48	68	49	0	77-78	68	52	17	17-18	66	49	0	47-48	65	37	0	77-78	65	41	0
69-70	76	49	6	18-19	54	34	0	48-49	50	31	0	78-79	61	48	17	18-19	20	0	0	48-49	22	0	0	78-79	1	0	0
70-71	73	27	0	19-20	35	17	0	49-50	35	22	0	79-80	42	17	0	19-20	33	17	0	49-50	33	18	0	79-80	31	12	0
71-72	72	42	0	20-21	45	16	0	50-51	48	20	0	80-81	55	26	0	20-21	28	0	0	50-51	26	0	0	80-81	0	0	0
72-73	55	22	0	21-22	38	22	0	51-52	36	21	0	81-82	37	23	0	21-22	22	4	0	51-52	14	0	0	81-82	20	4	0
73-74	82	59	0	22-23	32	0	0	52-53	27	0	0	82-83	37	0	0	22-23	12	0	0	52-53	8	0	0	82-83	2	0	0
74-75	78	49	0	23-24	54	2	0	53-54	53	12	0	83-84	67	40	0	23-24	8	0	0	53-54	8	0	0	83-84	7	0	0
75-76	77	52	14	24-25	69	39	3	54-55	65	39	3	84-85	71	58	23	24-25	54	31	0	54-55	46	24	0	84-85	51	22	0
76-77	81	35	0	25-26	63	38	0	55-56	63	41	0	85-86	68	43	2	25-26	22	0	0	55-56	7	0	0	85-86	16	0	0
77-78	91	72	0	26-27	58	29	0	56-57	58	33	0	86-87	62	46	0	26-27	37	9	0	56-57	35	7	0	86-87	25	0	0
78-79	75	60	0	27-28	54	41	0	57-58	54	41	0	87-88	56	43	0	27-28	50	33	0	57-58	37	5	0	87-88	44	21	0
79-80	70	54	0	28-29	47	5	0	58-59	36	6	0	88-89	55	10	0	28-29	15	0	0	58-59	10	0	0	88-89	6	0	0
80-81	71	59	0	29-30	65	15	0	59-60	60	4	0	89-90	70	34	0	29-30	17	2	0	59-60	8	0	0	89-90	16	0	0
80-81	94	63	5	30-31	40	3	0	60-61	36	3	0	90-91	43	8	0	30-31	22	0	0	60-61	25	0	0	90-91	21	0	0
81-82	67	22	0	31-32	19	0	0	61-62	19	0	0	91-92	29	4	0	31-32	0	0	0	61-62	0	0	0	91-92	0	0	0
83-84	83	54	0	32-33	32	4	0	62-63	28	0	0	92-93	35	4	0	32-33	19	0	0	62-63	12	0	0	92-93	18	0	0
84-85	51	5	0	33-34	63	28	0	63-64	61	25	0	93-94	64	37	0	33-34	44	1	0	63-64	23	0	0	93-94	36	0	0
85-86	88	60	0	34-35	42	28	0	64-65	40	22	0	94-95	47	31	0	34-35	30	0	0	64-65	36	1	0	94-95	0	0	0
86-87	42	29	0	35-36	20	7	0	65-66	15	5	0	95-96	34	12	0	35-36	11	0	0	65-66	12	0	0	95-96	0	0	0
87-88	69	18	0	36-37	38	11	0	66-67	39	10	0	96-97	50	14	0	36-37	32	3	0	66-67	16	0	0	96-97	33	2	0
88-89	79	65	26	37-38	57	33	0	67-68	56	31	0	97-98	60	36	7	37-38	32	0	0	67-68	44	15	0	97-98	21	0	0
89-90	68	51	0	38-39	54	34	0	68-69	55	31	0	98-99	58	49	0	38-39	19	0	0	68-69	16	0	0	98-99	17	0	0
Mean	75.38	46.34	7.52	Mean	49.52	25.24	3.76	Mean	47.97	24.45	3.24	Mean	54.55	32.76	7.45	Mean	28.83	8.34	0.90	Mean	22.52	5.21	0.14	Mean	19.34	5.59	0.07
SD	15.21	25.12	16.15	SD	17.27	18.88	10.50	SD	17.28	18.31	9.42	SD	16.22	21.17	13.43	SD	16.23	14.36	4.83	SD	15.55	10.20	0.74	SD	17.28	11.44	0.37

District 14 Projected Snowmobile Season Length (Days)

Baseline				INMCM3.0 B1												MIROC3.2 HIRES A1B											
				2020s				2050s				2080s				2020s				2050s				2080s			
Season	15cm	30cm	60cm	Season	15cm	30cm	60cm	Season	15cm	30cm	60cm	Season	15cm	30cm	60cm	Season	15cm	30cm	60cm	Season	15cm	30cm	60cm	Season	15cm	30cm	60cm
61-62	79	43	0	10-11	81	59	38	40-41	79	57	34	70-71	79	62	36	10-11	72	60	37	40-41	70	56	38	70-71	63	52	32
62-63	102	78	48	11-12	88	76	51	41-42	86	73	51	71-72	85	72	52	11-12	82	68	51	41-42	78	65	46	71-72	84	75	45
63-64	121	87	37	12-13	122	114	50	42-43	122	114	42	72-73	121	114	44	12-13	119	107	32	42-43	118	86	7	72-73	110	78	0
64-65	121	107	41	13-14	106	92	55	43-44	105	91	51	73-74	105	91	56	13-14	104	94	57	43-44	99	89	54	73-74	97	87	52
65-66	97	58	6	14-15	99	80	46	44-45	99	80	46	74-75	99	79	45	14-15	98	80	51	44-45	96	80	59	74-75	94	77	47
66-67	83	12	0	15-16	80	72	21	45-49	80	69	20	75-76	80	73	25	15-16	80	69	26	45-49	80	71	40	75-76	73	64	11
67-68	101	82	0	16-17	93	77	27	49-47	92	75	21	76-77	90	75	36	16-17	84	69	5	49-47	83	69	6	76-77	83	68	0
68-69	67	5	0	17-18	80	65	17	47-48	80	65	16	77-78	80	67	21	17-18	82	68	23	47-48	81	68	29	77-78	80	68	23
69-70	109	70	0	18-19	88	65	40	48-49	87	65	38	78-79	83	59	14	18-19	84	57	24	48-49	80	54	8	78-79	78	54	0
70-71	98	34	0	19-20	87	72	30	49-50	86	72	25	79-80	86	71	24	19-20	83	69	26	49-50	81	67	26	79-80	80	67	25
71-72	98	70	40	20-21	81	64	53	50-51	80	63	52	80-81	81	64	54	20-21	80	65	54	50-51	81	65	49	80-81	78	58	40
72-73	107	74	0	21-22	96	65	0	51-52	91	62	0	81-82	91	64	18	21-22	89	56	4	51-52	87	53	0	81-82	86	44	0
73-74	111	71	1	22-23	97	64	12	52-53	97	62	5	82-83	100	63	6	22-23	93	44	0	52-53	91	30	0	82-83	76	14	0
74-75	97	68	15	23-24	95	83	51	53-54	95	83	52	83-84	95	81	51	23-24	91	80	45	53-54	85	74	43	83-84	82	66	35
75-76	109	64	0	24-25	97	73	44	54-55	97	74	45	84-85	98	77	49	24-25	94	75	50	54-55	94	77	53	84-85	90	74	53
76-77	88	67	0	25-26	94	81	56	55-56	93	80	57	85-86	95	81	58	25-26	99	84	61	55-56	99	85	65	85-86	99	86	67
77-78	103	68	0	26-27	96	76	43	56-57	97	73	42	86-87	95	71	41	26-27	93	68	45	56-57	85	67	39	86-87	80	65	41
78-79	132	105	49	27-28	127	93	64	57-58	127	92	64	87-88	126	92	66	27-28	125	86	59	57-58	120	82	60	87-88	120	81	59
79-80	103	86	12	28-29	96	84	46	58-59	96	85	48	88-89	96	84	52	28-29	94	80	46	58-59	94	78	42	88-89	92	77	37
80-81	105	72	11	29-30	103	70	47	59-60	103	69	45	89-90	103	69	45	29-30	100	71	44	59-60	99	72	42	89-90	97	68	39
80-81	91	80	0	30-31	81	73	40	60-61	79	72	37	90-91	79	72	45	30-31	79	72	42	60-61	79	65	25	90-91	74	59	0
81-82	125	101	30	31-32	113	91	68	61-62	113	91	61	91-92	113	91	69	31-32	111	85	43	61-62	112	88	45	91-92	111	84	33
83-84	108	56	30	32-33	101	73	43	62-63	99	68	38	92-93	99	70	40	32-33	94	64	42	62-63	91	64	41	92-93	87	57	38
84-85	83	57	0	33-34	90	77	52	63-64	88	75	48	93-94	87	76	54	33-34	89	77	55	63-64	91	77	55	93-94	85	75	54
85-86	94	79	16	34-35	54	33	8	64-65	54	33	8	94-95	53	33	8	34-35	50	33	9	64-65	50	33	12	94-95	50	33	12
86-87	35	14	0	35-36	86	73	21	65-66	84	67	21	95-96	84	68	21	35-36	82	67	26	65-66	78	65	26	95-96	76	61	14
87-88	88	39	0	36-37	82	70	24	66-67	82	70	28	96-97	82	70	33	36-37	82	69	34	66-67	82	70	37	96-97	83	70	33
88-89	75	29	0	37-38	10	0	0	67-68	10	0	0	97-98	10	0	0	37-38	18	0	0	67-68	21	0	0	97-98	22	0	0
89-90	99	49	0	38-39	94	63	1	68-69	91	63	4	98-99	93	64	2	38-39	90	64	5	68-69	82	61	4	98-99	80	58	0
Mean	97.55	62.93	11.59	Mean	90.24	71.66	36.14	Mean	89.38	70.45	34.45	Mean	89.24	70.79	36.72	Mean	87.62	68.31	34.34	Mean	85.76	65.90	32.79	Mean	83.10	62.76	27.24
SD	19.08	26.36	16.95	SD	20.75	19.55	19.39	SD	20.76	19.56	18.93	SD	20.79	19.42	19.30	SD	19.51	19.32	19.08	SD	18.72	18.86	20.29	SD	18.31	19.81	21.36

District 15 Projected Snowmobile Season Length (Days)

Baseline				INMCM3.0 B1												MIROC3.2 HIRES A1B											
				2020s				2050s				2080s				2020s				2050s				2080s			
Season	15cm	30cm	60cm	Season	15cm	30cm	60cm	Season	15cm	30cm	60cm	Season	15cm	30cm	60cm	Season	15cm	30cm	60cm	Season	15cm	30cm	60cm	Season	15cm	30cm	60cm
61-62	98	51	0	10-11	91	59	17	40-41	89	56	12	70-71	89	57	30	10-11	89	53	8	40-41	86	53	8	70-71	75	48	5
62-63	112	96	0	11-12	104	78	23	41-42	102	76	23	71-72	102	76	25	11-12	98	71	24	41-42	94	66	24	71-72	89	58	12
63-64	104	77	0	12-13	83	67	43	42-43	83	65	31	72-73	83	65	34	12-13	83	59	2	42-43	76	55	2	72-73	76	49	0
64-65	120	89	32	13-14	111	80	57	43-44	110	79	51	73-74	109	78	58	13-14	106	76	58	43-44	105	75	54	73-74	106	76	50
65-66	96	62	0	14-15	99	74	39	44-45	98	72	38	74-75	98	71	36	14-15	99	76	39	44-45	97	75	43	74-75	97	75	39
66-67	122	74	0	15-16	108	86	56	45-49	114	86	57	75-76	117	86	59	15-16	118	88	64	45-49	118	91	70	75-76	121	91	68
67-68	93	32	0	16-17	91	71	9	49-47	85	64	1	76-77	89	71	18	16-17	87	68	10	49-47	86	69	21	76-77	90	71	12
68-69	75	34	0	17-18	78	56	25	47-48	74	52	13	77-78	74	52	28	17-18	72	52	32	47-48	64	51	15	77-78	58	47	0
69-70	115	79	4	18-19	110	85	60	48-49	110	85	59	78-79	110	84	57	18-19	109	83	62	48-49	105	79	55	78-79	103	77	50
70-71	98	67	7	19-20	91	79	43	49-50	91	82	42	79-80	91	84	43	19-20	90	83	44	49-50	88	79	47	79-80	87	77	45
71-72	101	70	0	20-21	103	79	25	50-51	100	77	14	80-81	103	79	29	20-21	97	77	15	50-51	91	71	13	80-81	92	70	4
72-73	95	62	0	21-22	92	69	32	51-52	92	69	31	81-82	93	70	41	21-22	91	66	18	51-52	90	66	35	81-82	84	61	1
73-74	135	108	20	22-23	117	96	23	52-53	117	96	29	82-83	132	102	38	22-23	129	99	38	52-53	126	97	32	82-83	125	97	18
74-75	99	62	24	23-24	91	81	58	53-54	90	80	57	83-84	90	80	57	23-24	91	84	60	53-54	92	85	61	83-84	91	81	58
75-76	111	67	0	24-25	104	82	47	54-55	104	84	49	84-85	104	86	52	24-25	105	85	51	54-55	105	85	55	84-85	105	87	53
76-77	132	92	20	25-26	131	98	70	55-56	131	98	70	85-86	131	100	72	25-26	131	100	72	55-56	131	100	75	85-86	127	97	71
77-78	126	75	13	26-27	107	85	57	56-57	108	82	58	86-87	112	86	60	26-27	113	87	65	56-57	104	84	63	86-87	103	83	63
78-79	120	88	19	27-28	115	82	50	57-58	115	73	42	87-88	115	75	47	27-28	109	69	39	57-58	105	67	42	87-88	95	64	31
79-80	133	112	31	28-29	127	115	80	58-59	127	115	83	88-89	126	115	82	28-29	126	110	85	58-59	122	106	79	88-89	120	104	73
80-81	104	43	0	29-30	109	80	28	59-60	109	80	26	89-90	107	79	27	29-30	103	74	26	59-60	102	74	24	89-90	100	72	13
80-81	116	97	12	30-31	101	84	60	60-61	101	84	55	90-91	101	84	63	30-31	101	84	56	60-61	99	82	55	90-91	95	79	50
81-82	148	139	75	31-32	134	125	83	61-62	134	125	83	91-92	133	124	84	31-32	134	126	83	61-62	134	125	79	91-92	132	123	71
83-84	89	63	0	32-33	85	68	43	62-63	84	67	41	92-93	85	68	44	32-33	83	65	40	62-63	79	65	40	92-93	74	60	36
84-85	90	51	0	33-34	99	81	56	63-64	96	79	49	93-94	97	79	56	33-34	100	82	58	63-64	97	79	56	93-94	94	75	55
85-86	103	79	0	34-35	78	47	0	64-65	78	47	0	94-95	80	47	0	34-35	68	42	0	64-65	66	42	0	94-95	62	38	0
86-87	126	95	44	35-36	119	94	74	65-66	119	93	74	95-96	119	93	74	35-36	118	94	78	65-66	118	93	79	95-96	117	91	76
87-88	76	4	0	36-37	84	61	15	66-67	83	63	17	96-97	84	67	22	36-37	85	69	18	66-67	85	68	18	96-97	85	68	14
88-89	105	81	10	37-38	89	69	12	67-68	90	70	20	97-98	89	69	18	37-38	88	59	0	67-68	85	54	0	97-98	79	42	0
89-90	122	81	11	38-39	114	99	57	68-69	115	98	61	98-99	114	99	63	38-39	113	99	67	68-69	112	101	67	98-99	112	98	67
Mean	109.10	73.45	11.10	Mean	102.24	80.34	42.83	Mean	101.69	79.21	40.90	Mean	102.66	80.21	45.41	Mean	101.24	78.62	41.79	Mean	98.69	77.14	41.79	Mean	96.34	74.45	35.69
SD	17.62	26.81	17.22	SD	15.21	16.52	22.11	SD	15.96	17.07	23.12	SD	16.34	17.01	20.64	SD	17.04	18.20	25.90	SD	17.82	18.41	25.32	SD	18.88	19.81	27.29

District 16 Projected Snowmobile Season Length (Days)

Baseline				INMCM3.0 B1												MIROC3.2 HIRES A1B											
				2020s				2050s				2080s				2020s				2050s				2080s			
Season	15cm	30cm	60cm	Season	15cm	30cm	60cm	Season	15cm	30cm	60cm	Season	15cm	30cm	60cm	Season	15cm	30cm	60cm	Season	15cm	30cm	60cm	Season	15cm	30cm	60cm
61-62	0	0	0	10-11	0	0	0	40-41	0	0	0	70-71	0	0	0	10-11	0	0	0	40-41	0	0	0	70-71	0	0	0
62-63	92	32	0	11-12	74	55	0	41-42	73	49	0	71-72	73	40	0	11-12	62	5	0	41-42	31	1	0	71-72	25	0	0
63-64	68	0	0	12-13	71	49	0	42-43	68	36	0	72-73	71	48	0	12-13	56	0	0	42-43	22	0	0	72-73	13	0	0
64-65	96	16	0	13-14	76	56	0	43-44	79	50	0	73-74	79	55	0	13-14	84	59	0	43-44	83	52	0	73-74	79	24	0
65-66	29	0	0	14-15	39	22	0	44-45	39	21	0	74-75	42	25	0	14-15	31	18	0	44-45	25	14	0	74-75	17	12	0
66-67	61	0	0	15-16	74	56	0	45-49	72	53	0	75-76	74	56	0	15-16	68	54	0	45-49	65	50	0	75-76	62	47	0
67-68	0	0	0	16-17	54	33	0	49-47	55	23	0	76-77	58	37	0	16-17	22	0	0	49-47	18	0	0	76-77	10	0	0
68-69	83	63	0	17-18	81	61	15	47-48	82	62	15	77-78	82	65	37	17-18	73	57	0	47-48	71	47	0	77-78	70	37	0
69-70	43	0	0	18-19	50	0	0	48-49	35	0	0	78-79	44	0	0	18-19	16	0	0	48-49	2	0	0	78-79	1	0	0
70-71	16	0	0	19-20	35	0	0	49-50	29	0	0	79-80	30	0	0	19-20	0	0	0	49-50	0	0	0	79-80	0	0	0
71-72	55	0	0	20-21	21	0	0	50-51	19	0	0	80-81	21	0	0	20-21	10	0	0	50-51	5	0	0	80-81	4	0	0
72-73	36	0	0	21-22	44	0	0	51-52	44	0	0	81-82	46	0	0	21-22	45	0	0	51-52	22	0	0	81-82	3	0	0
73-74	78	56	0	22-23	28	0	0	52-53	26	0	0	82-83	26	0	0	22-23	24	0	0	52-53	2	0	0	82-83	1	0	0
74-75	87	8	0	23-24	79	45	0	53-54	78	27	0	83-84	78	35	0	23-24	84	45	0	53-54	82	47	0	83-84	79	42	0
75-76	25	0	0	24-25	40	20	0	54-55	48	18	0	84-85	38	18	0	24-25	33	17	0	54-55	29	13	0	84-85	26	11	0
76-77	0	0	0	25-26	55	1	0	55-56	38	0	0	85-86	51	1	0	25-26	18	2	0	55-56	18	0	0	85-86	14	0	0
77-78	17	0	0	26-27	61	46	0	56-57	59	44	0	86-87	60	46	0	26-27	61	48	0	56-57	55	47	0	86-87	55	47	0
78-79	99	55	0	27-28	66	53	0	57-58	64	37	0	87-88	65	49	0	27-28	65	52	0	57-58	62	48	0	87-88	58	48	0
79-80	51	0	0	28-29	49	35	0	58-59	48	31	0	88-89	48	31	0	28-29	44	5	0	58-59	45	0	0	88-89	43	0	0
80-81	107	47	0	29-30	102	78	45	59-60	102	78	44	89-90	102	77	42	29-30	102	74	41	59-60	109	81	42	89-90	109	81	39
80-81	19	0	0	30-31	38	15	0	60-61	32	14	0	90-91	34	14	0	30-31	39	14	0	60-61	35	4	0	90-91	26	0	0
81-82	84	0	0	31-32	77	28	0	61-62	76	25	0	91-92	76	22	0	31-32	42	0	0	61-62	33	0	0	91-92	16	0	0
83-84	21	0	0	32-33	54	25	0	62-63	52	24	0	92-93	52	24	0	32-33	45	10	0	62-63	36	8	0	92-93	36	8	0
84-85	5	0	0	33-34	31	2	0	63-64	31	2	0	93-94	34	2	0	33-34	36	2	0	63-64	33	2	0	93-94	27	2	0
85-86	4	0	0	34-35	0	0	0	64-65	0	0	0	94-95	0	0	0	34-35	0	0	0	64-65	0	0	0	94-95	0	0	0
86-87	57	13	0	35-36	62	46	5	65-66	61	44	0	95-96	61	45	0	35-36	53	42	0	65-66	50	39	0	95-96	45	33	0
87-88	42	0	0	36-37	66	46	0	66-67	67	47	0	96-97	68	47	0	36-37	67	47	0	66-67	60	46	0	96-97	56	35	0
88-89	64	14	0	37-38	67	53	0	67-68	64	52	0	97-98	62	52	0	37-38	60	50	0	67-68	59	47	0	97-98	58	48	0
89-90	29	0	0	38-39	59	40	0	68-69	51	35	0	98-99	53	36	0	38-39	29	0	0	68-69	19	0	0	98-99	0	0	0
Mean	47.17	10.48	0.00	Mean	53.55	29.83	2.24	Mean	51.45	26.62	2.03	Mean	52.69	28.45	2.72	Mean	43.76	20.72	1.41	Mean	36.93	18.83	1.45	Mean	32.17	16.38	1.34
SD	33.76	19.70	0.00	SD	23.65	24.00	8.72	SD	24.21	22.48	8.54	SD	23.87	23.35	10.21	SD	26.70	24.74	7.61	SD	28.55	24.43	7.80	SD	29.82	22.49	7.24

District 17 Projected Snowmobile Season Length (Days)

Baseline				INMCM3.0 B1												MIROC3.2 HIRES A1B											
				2020s				2050s				2080s				2020s				2050s				2080s			
Season	15cm	30cm	60cm	Season	15cm	30cm	60cm	Season	15cm	30cm	60cm	Season	15cm	30cm	60cm	Season	15cm	30cm	60cm	Season	15cm	30cm	60cm	Season	15cm	30cm	60cm
61-62	4	0	0	10-11	38	0	0	40-41	22	0	0	70-71	29	0	0	10-11	16	0	0	40-41	15	0	0	70-71	13	0	0
62-63	110	24	0	11-12	102	72	0	41-42	102	72	0	71-72	102	73	0	11-12	100	52	0	41-42	97	47	0	71-72	94	30	0
63-64	88	0	0	12-13	79	40	0	42-43	78	30	0	72-73	78	25	0	12-13	71	10	0	42-43	53	7	0	72-73	49	5	0
64-65	93	28	0	13-14	84	59	0	43-44	82	57	0	73-74	82	58	0	13-14	70	22	0	43-44	60	25	0	73-74	52	21	0
65-66	61	32	0	14-15	82	53	12	44-45	80	50	12	74-75	79	48	9	14-15	80	42	0	44-45	80	46	0	74-75	76	46	0
66-67	20	0	0	15-16	77	53	0	45-49	77	51	0	75-76	74	47	0	15-16	67	16	0	45-49	48	11	0	75-76	17	0	0
67-68	42	0	0	16-17	83	52	0	49-47	77	42	0	76-77	77	47	0	16-17	60	4	0	49-47	50	0	0	76-77	50	0	0
68-69	73	17	0	17-18	79	56	0	47-48	75	51	0	77-78	75	51	0	17-18	66	28	0	47-48	39	12	0	77-78	40	5	0
69-70	0	0	0	18-19	1	0	0	48-49	1	0	0	78-79	3	0	0	18-19	1	0	0	48-49	0	0	0	78-79	0	0	0
70-71	20	0	0	19-20	79	39	0	49-50	78	37	0	79-80	77	34	0	19-20	78	28	0	49-50	62	0	0	79-80	70	0	0
71-72	52	0	0	20-21	48	3	0	50-51	48	12	0	80-81	48	7	0	20-21	46	0	0	50-51	25	0	0	80-81	20	0	0
72-73	68	0	0	21-22	69	44	0	51-52	68	43	0	81-82	70	43	0	21-22	67	33	0	51-52	65	31	0	81-82	62	26	0
73-74	91	53	0	22-23	57	28	0	52-53	57	23	0	82-83	60	25	0	22-23	38	3	0	52-53	29	2	0	82-83	9	2	0
74-75	103	50	0	23-24	110	86	35	53-54	111	87	44	83-84	111	87	50	23-24	111	85	42	53-54	110	87	43	83-84	110	87	46
75-76	42	0	0	24-25	70	50	0	54-55	69	48	0	84-85	65	46	0	24-25	59	43	0	54-55	55	32	0	84-85	55	40	0
76-77	61	6	0	25-26	80	61	6	55-56	79	60	6	85-86	80	60	6	25-26	80	60	4	55-56	77	58	0	85-86	81	60	0
77-78	69	0	0	26-27	90	73	0	56-57	90	76	0	86-87	90	76	21	26-27	86	71	0	56-57	84	70	0	86-87	81	68	0
78-79	49	0	0	27-28	62	47	0	57-58	62	43	0	87-88	62	47	0	27-28	59	41	0	57-58	58	44	0	87-88	55	31	0
79-80	80	0	0	28-29	79	49	0	58-59	79	49	0	88-89	78	49	0	28-29	78	49	0	58-59	79	48	0	88-89	75	44	0
80-81	98	0	0	29-30	95	67	0	59-60	94	66	0	89-90	94	68	0	29-30	95	66	0	59-60	95	64	0	89-90	93	64	0
80-81	105	72	0	30-31	93	83	48	60-61	93	82	44	90-91	93	81	47	30-31	91	80	3	60-61	87	77	2	90-91	87	76	0
81-82	0	0	0	31-32	8	0	0	61-62	6	0	0	91-92	7	0	0	31-32	4	0	0	61-62	0	0	0	91-92	2	0	0
83-84	15	0	0	32-33	62	33	0	62-63	63	34	0	92-93	62	33	0	32-33	50	22	0	62-63	49	17	0	92-93	46	13	0
84-85	58	0	0	33-34	79	55	0	63-64	77	55	0	93-94	81	55	0	33-34	78	50	0	63-64	77	54	0	93-94	74	28	0
85-86	100	2	0	34-35	70	4	0	64-65	69	1	0	94-95	68	4	0	34-35	25	0	0	64-65	25	0	0	94-95	25	0	0
86-87	61	0	0	35-36	63	37	0	65-66	60	1	0	95-96	64	37	0	35-36	56	1	0	65-66	48	0	0	95-96	47	0	0
87-88	19	0	0	36-37	59	20	0	66-67	49	19	0	96-97	49	18	0	36-37	40	16	0	66-67	39	15	0	96-97	37	6	0
88-89	62	1	0	37-38	23	0	0	67-68	28	0	0	97-98	44	0	0	37-38	25	0	0	67-68	25	0	0	97-98	21	0	0
89-90	49	0	0	38-39	72	47	0	68-69	73	54	0	98-99	75	58	0	38-39	68	19	0	68-69	69	2	0	98-99	56	0	0
Mean	58.38	9.83	0.00	Mean	68.72	41.76	3.48	Mean	67.14	39.41	3.66	Mean	68.17	40.59	4.59	Mean	60.86	29.00	1.69	Mean	55.17	25.83	1.55	Mean	51.62	22.48	1.59
SD	33.33	19.28	0.00	SD	25.35	25.67	10.95	SD	26.00	26.51	11.44	SD	24.56	25.77	12.90	SD	27.67	26.56	7.81	SD	28.35	27.67	7.98	SD	29.71	27.18	8.54

Ontario Projected Snowmobile Season Length (Days)

Baseline				INMCM3.0 B1												MIROC3.2 HIRES A1B											
				2020s				2050s				2080s				2020s				2050s				2080s			
Season	15cm	30cm	60cm	Season	15cm	30cm	60cm	Season	15cm	30cm	60cm	Season	15cm	30cm	60cm	Season	15cm	30cm	60cm	Season	15cm	30cm	60cm	Season	15cm	30cm	60cm
61-62	25.00	8.82	0.00	10-11	24.65	11.94	3.35	40-41	21.94	11.06	2.71	70-71	23.12	11.06	3.88	10-11	17.12	8.88	2.65	40-41	15.47	8.59	2.71	70-71	13.71	7.65	2.18
62-63	71.41	43.65	12.59	11-12	44.53	29.29	6.47	41-42	42.35	26.94	6.00	71-72	42.65	28.00	6.82	11-12	35.06	19.12	4.41	41-42	30.59	15.94	4.12	71-72	28.12	13.18	3.35
63-64	60.35	23.82	2.59	12-13	36.24	20.41	5.47	42-43	34.65	18.35	4.29	72-73	34.88	18.65	4.59	12-13	28.82	13.29	2.06	42-43	24.12	11.47	0.53	72-73	21.76	10.41	0.12
64-65	74.65	42.06	11.29	13-14	56.41	43.12	19.29	43-44	55.06	41.18	16.59	73-74	55.47	41.82	18.24	13-14	48.41	30.76	13.88	43-44	44.82	27.24	9.41	73-74	38.88	21.88	7.71
65-66	67.06	40.88	7.47	14-15	54.71	39.88	19.53	44-45	53.24	38.41	18.88	74-75	54.00	39.76	18.82	14-15	47.35	33.18	12.82	44-45	40.35	27.18	13.71	74-75	38.00	25.82	10.71
66-67	65.47	34.12	8.59	15-16	60.29	45.47	18.00	45-49	58.65	43.24	15.00	75-76	60.00	44.59	17.65	15-16	51.18	28.24	11.06	45-49	40.47	24.94	10.59	75-76	36.35	22.00	7.59
67-68	40.88	15.88	0.41	16-17	45.59	27.82	6.00	49-47	42.41	24.82	3.59	76-77	43.59	27.47	6.88	16-17	29.94	15.18	3.18	49-47	26.65	12.82	3.94	76-77	24.94	11.41	3.00
68-69	54.59	25.00	1.35	17-18	51.59	34.12	8.71	47-48	50.35	33.12	7.00	77-78	50.65	33.24	13.12	17-18	42.47	25.18	7.76	47-48	38.65	20.88	7.12	77-78	36.41	18.88	5.59
69-70	61.35	32.35	5.24	18-19	42.29	28.47	11.65	48-49	40.53	25.41	9.35	78-79	41.47	25.24	9.65	18-19	29.06	15.41	5.06	48-49	26.00	13.18	3.71	78-79	19.35	8.29	2.94
70-71	52.12	19.29	0.41	19-20	45.94	25.53	4.41	49-50	44.18	24.82	4.00	79-80	46.76	26.88	4.12	19-20	34.24	17.76	4.12	49-50	28.35	13.88	4.29	79-80	23.06	12.00	4.12
71-72	48.24	21.00	2.35	20-21	30.18	16.06	4.59	50-51	29.53	16.71	4.12	80-81	30.82	16.59	4.94	20-21	23.88	11.35	4.06	50-51	21.59	10.35	3.65	80-81	18.94	8.82	2.59
72-73	52.47	24.53	0.00	21-22	43.88	25.06	1.88	51-52	42.18	23.88	1.82	81-82	42.18	23.41	3.59	21-22	34.12	14.12	1.29	51-52	28.35	12.06	2.06	81-82	26.53	11.35	0.06
73-74	65.12	37.59	5.59	22-23	37.06	19.41	2.24	52-53	34.47	17.18	2.00	82-83	36.88	18.59	2.59	22-23	27.06	10.82	2.24	52-53	23.35	9.41	1.88	82-83	19.12	7.88	1.06
74-75	72.47	39.12	5.35	23-24	60.82	43.94	21.59	53-54	59.65	39.94	22.12	83-84	60.88	43.12	23.24	23-24	48.59	36.53	16.12	53-54	45.35	33.53	15.59	83-84	42.53	29.18	12.88
75-76	42.65	16.71	0.82	24-25	40.65	25.53	7.29	54-55	40.29	25.71	6.24	84-85	40.82	27.71	7.82	24-25	33.18	20.59	5.94	54-55	31.82	18.47	6.35	84-85	28.76	16.12	6.24
76-77	60.24	26.06	3.24	25-26	59.65	42.88	17.12	55-56	57.47	41.35	15.59	85-86	58.71	41.76	16.41	25-26	43.71	28.76	11.47	55-56	37.00	23.47	10.71	85-86	36.12	22.65	9.41
77-78	63.24	31.94	2.59	26-27	54.41	36.24	7.65	56-57	52.18	35.24	7.82	86-87	53.47	36.82	9.12	26-27	44.00	23.65	6.47	56-57	37.06	18.76	6.00	86-87	30.76	15.65	6.12
78-79	60.18	30.12	6.88	27-28	48.53	32.94	12.00	57-58	45.18	29.82	10.00	87-88	46.41	32.47	11.82	27-28	37.12	24.29	6.59	57-58	33.29	21.35	6.00	87-88	31.88	20.29	5.29
79-80	64.71	37.00	3.41	28-29	49.24	32.53	10.35	58-59	47.71	31.12	10.59	88-89	49.35	32.06	10.94	28-29	42.29	24.24	10.53	58-59	40.00	22.18	10.06	88-89	37.18	20.06	8.82
80-81	70.06	37.82	2.94	29-30	66.41	47.06	16.53	59-60	64.47	45.06	15.53	89-90	66.65	49.29	16.59	29-30	57.06	38.53	10.88	59-60	51.29	34.47	8.88	89-90	48.94	28.65	5.59
80-81	55.53	33.71	7.24	30-31	35.88	24.65	13.18	60-61	34.12	24.06	12.12	90-91	35.24	24.53	12.94	30-31	30.00	19.65	8.41	60-61	28.88	17.71	7.00	90-91	25.65	16.12	4.59
81-82	62.35	37.29	9.18	31-32	38.94	26.76	12.18	61-62	38.06	25.00	11.71	91-92	39.65	26.88	12.71	31-32	27.88	17.18	10.29	61-62	25.65	17.18	10.18	91-92	22.88	16.53	9.00
83-84	62.18	31.41	6.18	32-33	55.41	35.18	11.06	62-63	53.00	31.82	9.12	92-93	53.65	33.65	10.18	32-33	39.00	16.88	5.82	62-63	33.24	14.35	4.76	92-93	30.94	11.82	4.35
84-85	49.24	21.18	0.00	33-34	47.71	31.82	11.94	63-64	45.47	28.53	10.24	93-94	47.41	31.71	12.47	33-34	38.65	23.47	7.18	63-64	33.76	20.35	6.76	93-94	30.35	16.18	6.41
85-86	60.06	32.24	5.12	34-35	30.18	15.53	0.47	64-65	30.06	14.82	0.47	94-95	30.59	15.24	0.53	34-35	21.29	8.29	0.53	64-65	20.88	7.18	0.71	94-95	16.76	6.94	0.71
86-87	47.53	19.59	2.94	35-36	33.29	18.12	5.88	65-66	30.88	14.88	5.59	95-96	34.18	18.35	5.59	35-36	27.41	13.29	6.12	65-66	25.47	13.53	6.18	95-96	23.41	12.12	5.29
87-88	48.94	21.24	2.47	36-37	48.94	32.06	11.35	66-67	47.24	30.41	11.59	96-97	48.35	31.88	12.41	36-37	40.29	28.24	11.00	66-67	36.82	26.59	11.24	96-97	37.12	24.41	9.29
88-89	52.94	23.53	2.12	37-38	29.47	14.71	0.71	67-68	27.88	13.88	1.18	97-98	29.12	14.12	1.47	37-38	21.88	7.94	0.00	67-68	22.00	8.29	0.00	97-98	17.41	6.06	0.00
89-90	46.53	21.82	2.24	38-39	41.88	27.65	6.94	68-69	40.59	26.65	7.24	98-99	41.35	29.18	7.24	38-39	33.65	17.06	7.29	68-69	31.47	16.06	7.06	98-99	26.41	15.41	6.41
Mean	57.16	28.61	4.16	Mean	45.34	29.45	9.58	Mean	43.58	27.70	8.71	Mean	44.77	29.11	9.87	Mean	35.68	20.41	6.87	Mean	31.82	17.98	6.39	Mean	28.70	15.78	5.22
SD	10.92	8.96	3.41	SD	10.69	9.79	5.95	SD	10.62	9.42	5.63	SD	10.61	9.87	5.80	SD	9.79	8.39	4.19	SD	8.39	7.31	3.95	SD	8.61	6.59	3.36