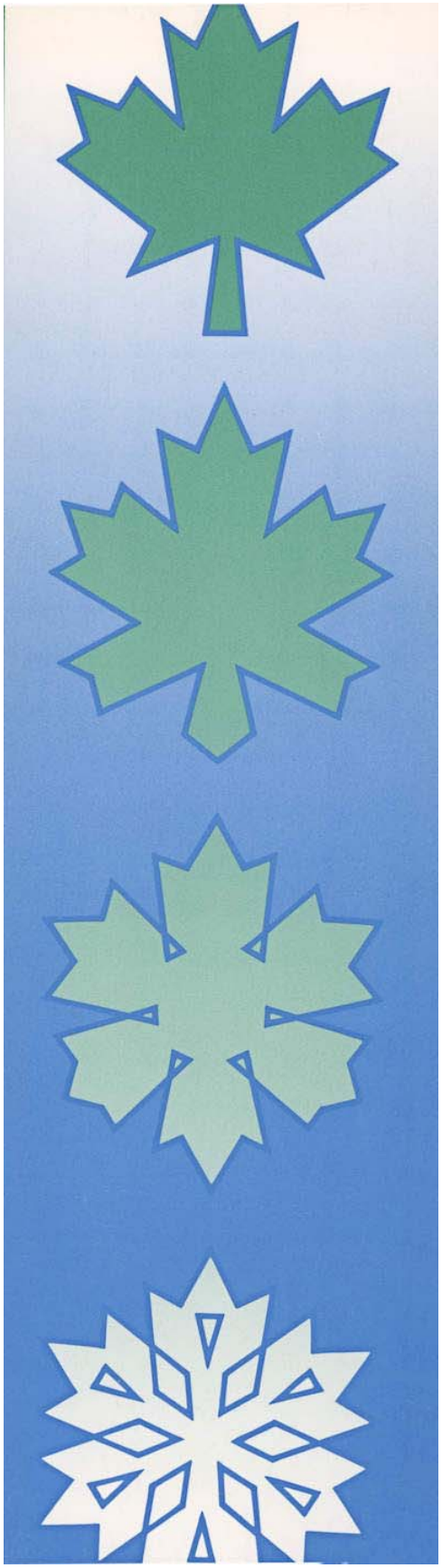
Environment Canada Environnement Canada

CLIMATE CHANGE DIGEST

Implications of
Climatic Change
for Tourism
and Recreation
in Ontario

CCD 88-05



Canada

CLIMATE CHANGE DIGEST

CCD 87-01 Canadian Climate Impacts Program

CCD 87-02 Implications of Climatic Change for Agriculture in Ontario

CCD 87-03 Implications of Climatic Change for Navigation and Power Generation in the Great Lakes

CCD 87-04 Effects of a One Metre Rise in Mean Sea-Level at Saint John, New Brunswick and the Lower Reaches of the Saint John River

CCD 88-01 The Implication of Climate Change for Agriculture in the Prairie Provinces

CCD 88-02 Preliminary Study of the Possible Impacts of a One Metre Rise in Sea Level at Charlottetown, Prince Edward Island

CCD 88-03 Implications of Climate Change for Downhill Skiing in Quebec

CCD 88-04 Economic Perspectives on the Impact of Climate Variability and Change: A Summary Report

CCD 88-05 Implications of Climatic Change for Tourism and Recreation in Ontario

IMPLICATIONS OF CLIMATIC CHANGE FOR TOURISM AND RECREATION IN ONTARIO

Summary of Phase 1 and Phase 2 -
Climatic Change and Its Impact on Ontario: Tourism and Recreation

Phase 1 by G. Wall submitted March 1985

Phase 2 by G. Wall, R. Harrison, V. Kinnaird, G. McBoyle and C. Quinlan

submitted October 1985

Prepared for
Climate Change Digest
Atmospheric Environment Service

by
Geoffrey Wall
Department of Geography
University of Waterloo
Waterloo, Ontario

DISCLAIMER

This publication contains a summary of the results of two studies prepared under contract, by the University of Waterloo, to the Canadian Climate Centre. The views and opinions expressed herein are those of the authors and do not necessarily state or reflect those of the Government of Canada or any agency thereof.

Single copies of this publication may be obtained, free of charge, by writing to the:

Climate Program Office
Canadian Climate Centre
4905 Dufferin Street
Downsview, Ontario
M3H 5T4
(416)739-4431

Copies of the complete reports, "Climate Change and Its Impact on Ontario: Tourism and Recreation, Phase I and Phase II", may be purchased by writing to:

Dr. Geoffrey Wall
Department of Geography
University of Waterloo
Waterloo, Ontario
N2L 3G1

Published by Authority of the
Minister of the Environment

Catalogue No. En57-27/1988-05
ISBN 0-662-55897-9
ISSN 0835-3980

FOREWORD

The composition of the earth's atmosphere is undergoing a major global change. Human activities, such as deforestation, the burning of fossil fuels and even agricultural practices have significantly increased the amount of carbon dioxide and other "greenhouse gases" in the atmosphere. There is now growing scientific evidence that increasing concentrations of these gases could result, over the next few decades, in a rise of global mean temperature which is greater than any in man's history (Villach Conference, Austria, October 1985). Studies indicate that warming in the range of 1.5 - 4.5°C could be expected; in Arctic regions it is likely to be even greater.

In the past few years, there has been an escalating international awareness of the dependence of various economic sectors on climatic fluctuations and on the implications of long-term climate change. Concerns have been expressed for the potential loss of coastal areas due to anticipated global sea level rises, destruction of the habitats of innumerable plant and animal species, and disruption of world agriculture, to name a few. At the same time, climate change offers the potential for significant economic opportunity. For Canada, this is likely to include an extension of the growing season and year-round shipping on the Great Lakes. The key element in successfully adapting to these changes will be our ability to mitigate the negative effects and to take advantage of the benefits.

In recognition of the impact of climate and climatic fluctuations on society, Canada established a Canadian Climate Program (CCP) in 1978 to integrate the efforts of various federal and provincial agencies as well as the universities and the private sector in the field of climatology. The Atmospheric Environment Service (AES) of Environment Canada was given responsibility as the lead agency for the program. One of the program's components has, since 1984, focussed on research studies to assess and identify the potential social and economic impacts of climate warming expected under a doubled carbon dioxide scenario. Most of these studies have been conducted under contract by Canadian universities.

While these and other studies over the last several years have clearly shown that increasing "greenhouse gas" concentrations have the potential for profound impacts on our physical environment, the results must still be treated as preliminary. There is general scientific agreement on the direction of longterm climate change, but uncertainty in the estimates of the magnitude and timing.

It is evident that additional studies are required in order to provide planning and policy information to all levels of government and private sector users. These would further serve to identify potential mitigative and adaptive strategies and be in keeping with Environment Canada's theme of "anticipate and prevent".

G. A. Sainte-Marie

Deputy Minister
Environment Canada

PREFACE

The Canadian Climate Centre (CCC) has funded a number of studies to investigate the potential impacts, on various sectors of the Canadian economy, of climate warming expected because of the increasing concentrations in the atmosphere of the "greenhouse gases". The equivalent of a doubling of the amount of CO2 was the situation selected.

The first issue of the Climate Change Digest identified the major socio-economic impact studies undertaken since 1984. A list of earlier titles in the series appears on the inside front cover. This issue presents the summary results of a study to determine the likely impact of climate change on tourism and recreation in Ontario.

The conclusions of this study are that a warmer climate, over the next several decades, could eliminate the reliable downhill ski season in southern Ontario and would also result in a decline of wetland species diversity. On the other hand, the summer season for recreational camping would be extended. An earlier study in this series, "Implications of Climate Change for Downhill Skiing in Quebec", indicated a potential reduction of up to 70 percent for the ski season in Quebec.

J.A.W. McCulloch
Director General
Canadian Climate Centre

IMPLICATIONS OF CLIMATIC CHANGE FOR TOURISM AND RECREATION IN ONTARIO

1. STUDY HIGHLIGHTS

- A warmer climate may mean declining lake levels with associated changes in the ecological interest and recreational potential of wetlands.
- Impacts will vary considerably with the physiography of the littoral.
- The length of ski seasons will be reduced at the Lakehead but the key holiday periods, when a large proportion of business is conducted, will still fall within the reliable ski season.
- Diversification of activities is a suggested management response.
- The downhill ski season in the South Georgian Bay region could be eliminated with an associated loss of $36.55 million per annum in skier spending at the resorts and a $12.8 million reduction in the trade of Collingwood (figures in 1985 dollars).
- Summer recreational activities are likely to have extended seasons and the viability of summer recreational enterprises may increase with associated positive benefits to neighbouring economies. However, the magnitude of potential gains varies throughout the province.

2. INTRODUCTION

The purpose of this document is to present the findings of an investigation of the possible implications of climatic change for tourism and recreation in Ontario. The study was conducted in two phases. The initial phase defined terms and assessed the literature directed at furthering our understanding of the relationships between climate, weather and outdoor recreation. A variety of research strategies with the potential to shed light on the implications of climatic change was assessed and a number of these was recommended for implementation. The application of these methodologies was undertaken in phase two of the study and the results of these investigations are presented here.

As in previous research reported in Climate Change Digest, two scenarios for climatic change associated with an increase in atmospheric concentrations of CO_2 were employed and their implications assessed. Scenario A was based upon a model developed by the Geophysical Fluid Dynamics Laboratory at Princeton, whereas Scenario B used output from a similar analysis undertaken by the Goddard Institute for Space Studies.

Because recreation and tourism are comprised of a multitude of different activities which take place in a diversity of environmental settings, it was not possible to undertake a comprehensive investigation and a case study approach was adopted to make the research more manageable and to provide examples of possible impacts. Much recreation takes place at or near shorelines and other investigators had previously suggested that future changes in climate could have considerable implications for water levels in the Great Lakes. These circumstances provided justification for an investigation of wetlands on the edge of Lake Ontario as an example of the implications of climatic change for recreation resources. In addition, downhill skiing was chosen for examination as an example of a winter activity and camping was selected to illustrate the nature of impacts upon summer recreation.

Even should the scenarios evolve as projected, they are unlikely to be experienced in a world which has not also changed in other ways. Given that we are unable to predict the future, in order to proceed the assumption was made that, other than the changes in climate, all other things will remain as they are. Thus, no allowances were made for technological changes or policy initiatives which could modify the potential impacts of climatic change. Furthermore, it was assumed that future recreationists will respond to the new climates in a similar fashion to which they respond to weather and climate at present. It was further assumed that variability about future climatic norms will be similar to that which is now experienced.

3. THE NATURAL RESOURCE BASE

3.1 Wetlands

The consensus of opinion among climatologists is that the future climate of Canada may be warmer and drier than at present. One of the consequences of this is likely to be a lowering of lake levels with implications for the character and recreational potential of shoreline ecosystems. Some of the greatest impacts of lake level changes will occur along the margins of the Great Lakes where wetlands constitute important waterfowl habitat and a source of recreation for many people.

Point Pelee National Park (Figure 1) and Presqu'ile Provincial Park (Figure 2) were selected as study sites. Both contain large areas of marsh which are of considerable significance for wildlife and recreation. However, they also constitute two different types of wetland systems with the potential to respond differently to changes in water level. Point Pelee is a closed, protected marsh which is separated from the lake by natural barrier beaches. In contrast, the marsh of Presqu'ile is an open wetland system. In both cases the marshes are not influenced to any great degree by run-off from the mainland and water levels in Lake Ontario are a primary determinant of the vegetational composition and functioning of the marsh.

3.2 Impacts

Water levels in Lake Ontario are expected to drop 30 to 83 cm as a result of mean annual temperature increases in the neighbourhood of 4 to 6 °C. Precipitation may increase but increased evaporation is expected to more than offset this. In naturally confined marshes such as Pelee, lowered lake levels will cause the marsh to revert to marsh meadow and eventually succeed to dry land. Because of the protective sand spits, the marsh will be prevented from moving lakewards and vegetation will tend to shift from hydric to mesic conditions. Some plant species may change growth form to accommodate drier conditions but vegetation will change dramatically as species intolerant of drying die and are replaced by species emerging from buried seeds. The trees which mark the landward edge of the marsh may advance due to a lowering of the flood line.

Wetland species diversity will decline and the suitability of the marshes as a habitat for recreationally and commercially valued species, such as migrating waterfowl and muskrats, will be reduced. Sport fishing may also be affected by the reduced quality of shoreline marshes

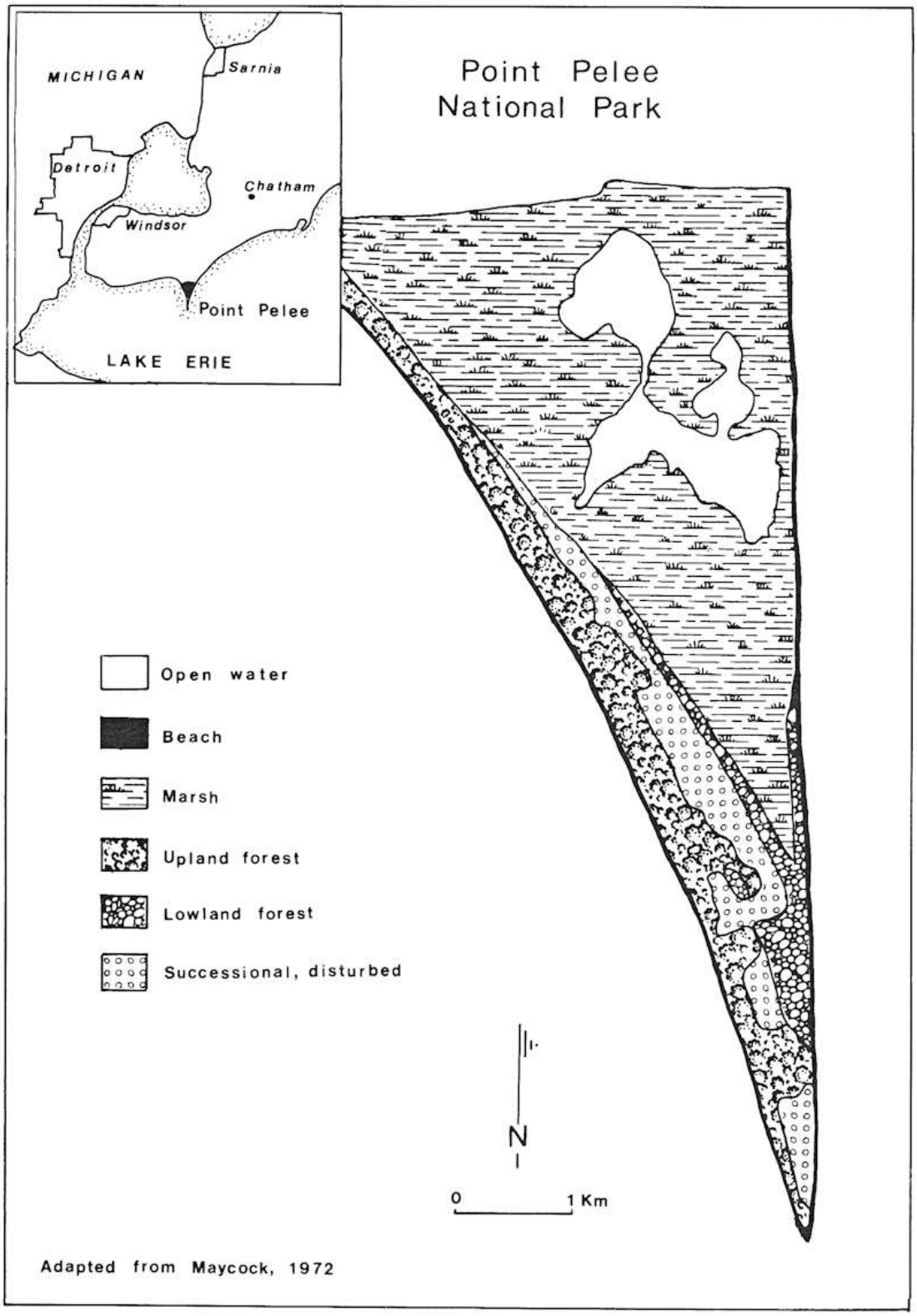


Figure 1. Point Pelee National Park.

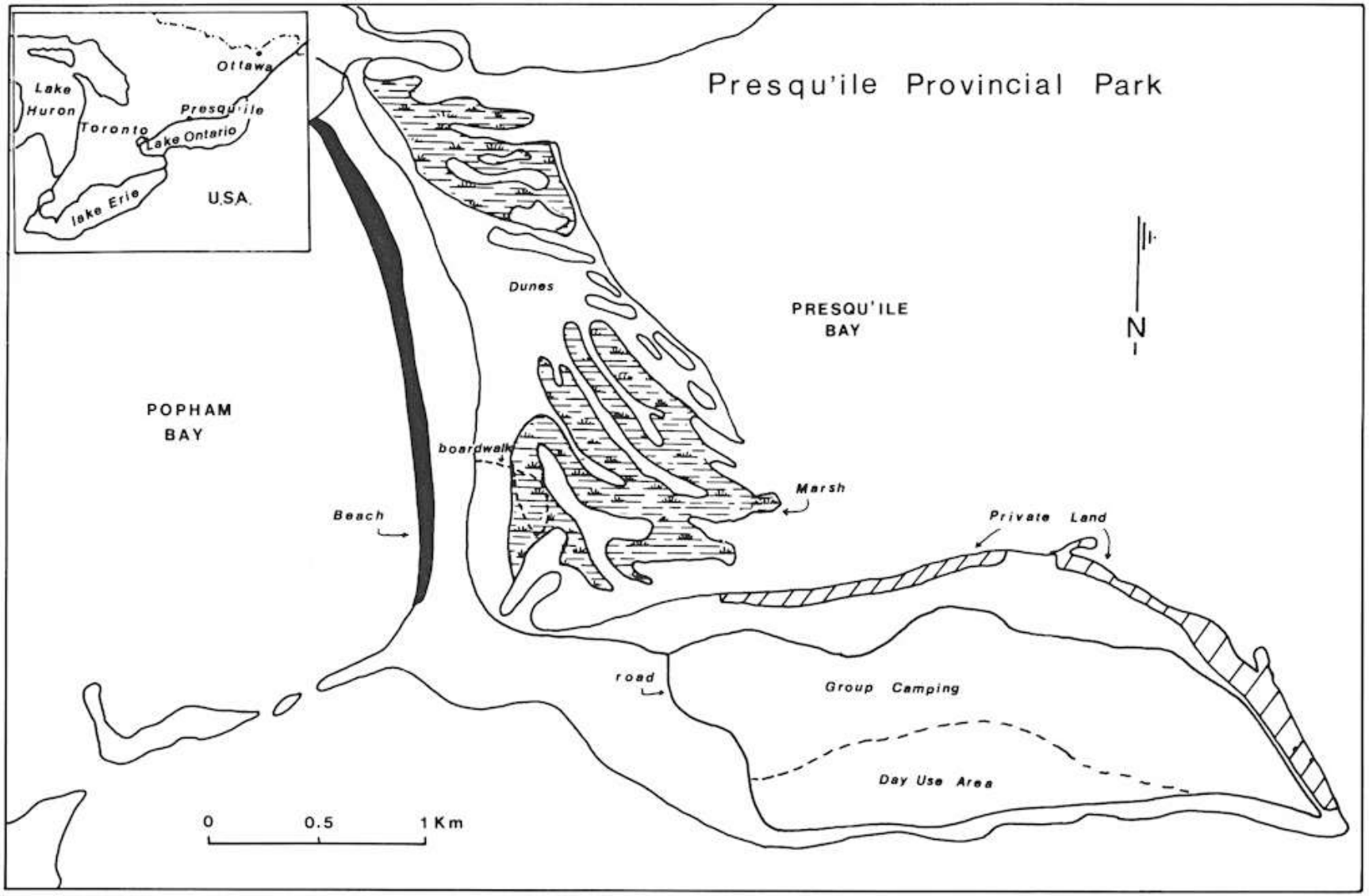


Figure 2. Presqu'ile Provincial Park

where fish feed and spawn. Other non-consumptive activities, such as canoeing and ice skating, will also decline due to the lack of open water. In time, the marsh may lose its wetland character and, under extreme conditions, the waterfowl migration route may change resulting in the collapse of hunting and, more importantly, birdwatching.

In open shoreline marshes such as Presqu'ile, the effects of lowered lake levels are unlikely to be as severe. Instead of a draining of the marsh and a trend towards dry land, there will probably be a shift in the vegetation in a lakeward direction. The extent of this shift depends upon the magnitude of the lake level change, the slope of the bottom profile and the suitability of the substrate. Some new shoreline areas may actually develop wetland characteristics.

3.3 Conclusions

Point Pelee is a closed marsh and a decline in water levels may lead to a drying out of the marsh with an associated loss of ecological diversity and a consequent decline in the recreational interest of the area. On the other hand, Presqu'ile is an open marsh and it may be able to migrate with changing water levels leaving its ecological interest largely intact. It is evident that the impacts of climatic change on shoreline ecosystems will vary considerably with the physiography of the littoral.

4. DOWNHILL SKIING

4.1 Introduction

Many recreational activities are seasonal and there are strict climatic requirements for them to be possible or enjoyed. If follows that anything which alters the length of the seasons is likely to have repercussions for participation in outdoor recreation and for the businesses which cater to recreationists. Downhill skiing is one such activity.

Two areas of Ontario were selected for detailed study. The South Georgian Bay area was selected as a southern ski area and the Lakehead was chosen from northern Ontario. Together these two areas constitute the major downhill ski areas in the province. For each of the two areas the following three procedures were carried out:

1. snow cover periods suitable for skiing were determined for present day conditions as well as for conditions suggested by Scenarios A and B using a method suggested by Crowe et al. (1977);

2. data on current skier visits and expenditures were used in conjunction with estimated future season lengths to calculate changes in the number of skier visits and the economic consequences of the climate scenarios;

3. sensitivity analyses were conducted to determine the likely impacts of various small changes in temperature and precipitation combinations.

4.2 Results

Changes in the average monthly values for precipitation and temperature for the months of November to April inclusive, the winter season, are displayed in Tables 1 and 2. Both scenarios suggest that winter temperatures will increase while precipitation totals will vary from normal to 115 per cent of normal, depending on location. Even if precipitation increases, because of the rise in temperatures, snowfall will be reduced.

Using the procedure developed by Crowe *et al.* (1977), snow cover suitability percentiles were calculated for both study areas for present day conditions and for future climates as suggested by the scenarios. The results of these calculations are presented in Figures 3 and 4. The diagrams display the ski seasons divided into two major categories:

1. the "reliable snow cover season" (hereafter called the reliable season) in which there is a 75 per cent or greater probability of there being suitable snow cover for skiing;

2. the "marginally reliable or better snow cover season" (hereafter called the marginally reliable season) in which there is a probability of between 50 and 74 per cent of there being snow cover suitable for skiing.

For the Lakehead under Scenario A, the present marginally reliable season will be reduced from 131 days to 91 days, a reduction of 30.5 per cent. The present reliable season will be shortened from 111 days to 72 days, a reduction of 34.5 per cent. Further reductions in both the reliable and marginally reliable seasons occur under Scenario B. Although the reductions in the ski seasons are large, the key Christmas break when 20 per cent of the year's business is done, and the university/college mid-February break, still fall within the reliable skiing season. The elimination of skiing in March, when 20 per cent of skier visits currently occur, is the major loss and will give rise to a reduction of skier expenditures annually at the resorts under Scenario A of $1.9 million in 1985 dollars. However, it may not be necessary to endure all of this loss because of the possibility of an enhanced ability to draw upon the southern Ontario market.

The South Georgian Bay region, which is climatically marginal for skiing at present, does not fare as well as the Lakehead. The present day marginally reliable ski season of 70 days will be reduced to 40 days under Scenario A and will disappear altogether under Scenario B. There will be no reliable ski season under either Scenario A or B. It is questionable if skiers will continue to be attracted to an area with, at most, a 40 day marginally reliable ski season that excludes the Christmas and tertiary education mid-February break. The calculations associated with both scenarios suggest the virtual elimination of the ski industry in the South Georgian Bay area with a loss to the resorts in 1985 dollars of $36.55 million per annum in skier spending and a reduction of $12.8 million per annum in the retail trade of Collingwood. This is in addition to the millions of dollars invested in infrastructure by the ski industry.

Table 1: Changes in Average Monthly Values for Precipitation and Temperature Suggested by Scenarios for Lakehead and South Georgian Bay Areas.

SCENARIO A

	Lakehead			South Georgian Bay Area		
	Change in Temp.		Change in Precip.	Change in Temp.		Change in Precip.
	(°F)	(°C)	(%)	(°F)	(°C)	(%)
Nov.	+8.1	4.9	115.5	+9.0	5.4	99.5
Dec.	+3.6	2.2	101.1	+3.8	2.3	89.3
Jan.	+5.8	3.5	93.8	+3.6	2.2	103.6
Feb.	+6.7	4.0	85.9	+8.6	5.2	153.6
Mar.	+8.5	5.1	102.3	+7.6	4.6	98.5
Apr.	+3.4	2.0	100.3	+2.2	1.3	108.2
Average	+6.0	3.6	99.8	+5.8	3.5	108.8

Table 2: Changes in Average Monthly Values for Precipitation and Temperature Suggested by Scenarios for Lakehead and South Georgian Bay Areas.

SCENARIO B

	Lakehead			South Georgian Bay Area		
	Change in Temp.		Change in Precip.	Change in Temp.		Change in Precip.
	(°F)	(°C)	(%)	(°F)	(°C)	(%)
Nov.	+9.5	5.7	114.3	+9.7	5.8	98.3
Dec.	+10.4	6.2	117.3	+10.4	6.2	109.0
Jan.	+10.3	6.2	116.0	+10.4	6.2	110.0
Feb.	+10.3	6.2	114.6	+9.9	5.9	112.7
Mar.	+9.5	5.7	111.9	+9.3	5.5	112.2
Apr.	+8.3	5.0	111.0	+7.9	4.7	111.7
Average	+9.7	5.8	114.2	+9.6	5.7	109.0

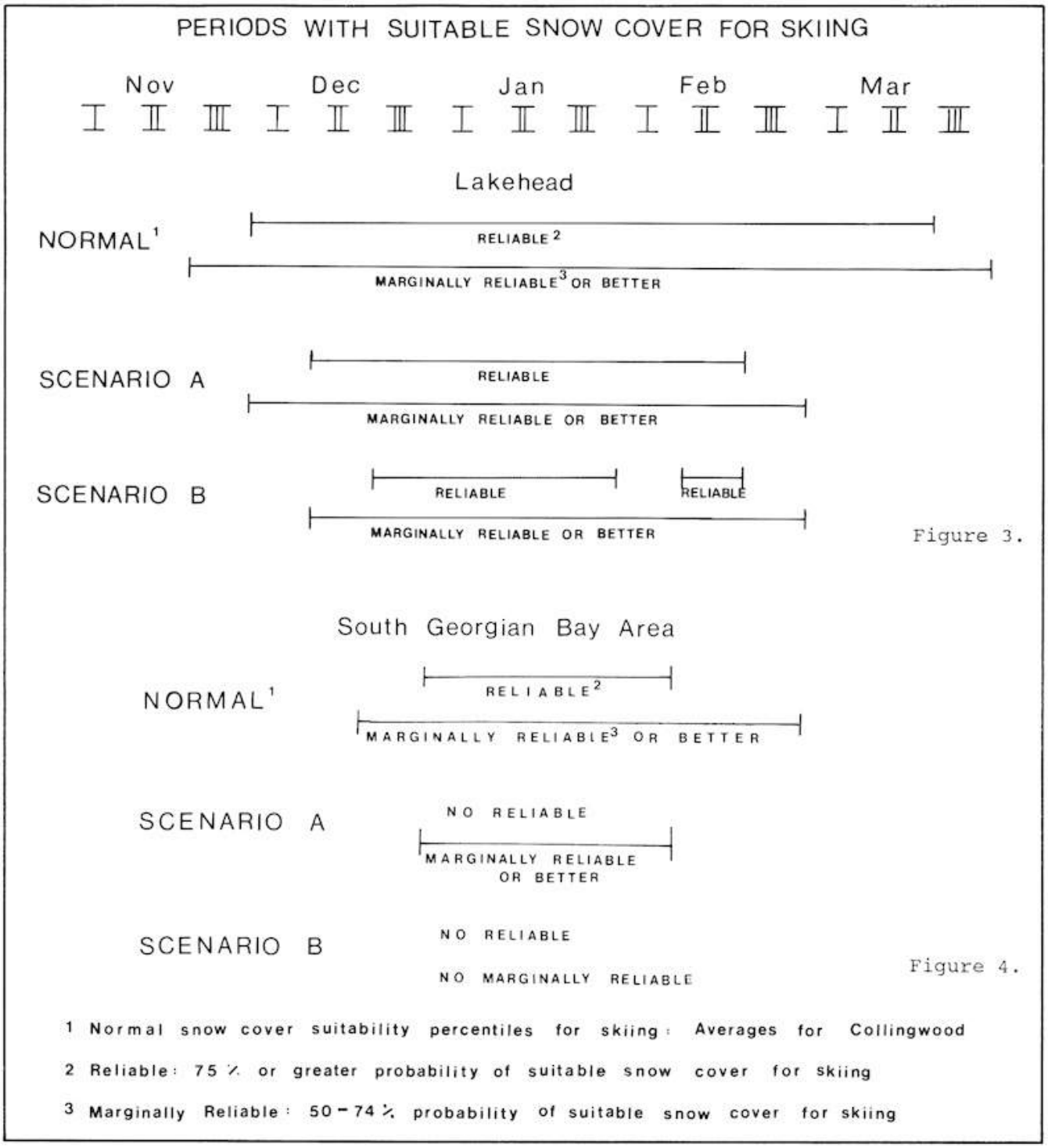


Figure 3.

Figure 4.

Figs 3-4: Periods with Suitable Snow Cover for Skiing: Lakehead, South Georgian Bay

The conclusions, particularly with respect to the South Georgian Bay area, may appear to be extreme. However, an analysis of climatic variability indicates that this is not the case and average conditions as indicated by the scenarios are experienced occasionally under the present climatic regime. Furthermore, it is not necessary for climatic change to be as great as that suggested in the scenarios for there to be a marked decrease in the length of the ski season in the South Georgian Bay area.

4.3 Conclusions

The analyses suggest that, under both Scenario A and B, the ski areas in the south will be more adversely affected than those in the north. Unsuitable conditions occur in present-day, mild winters such as 1979 to 1980 and they will occur at temperature values lower than those indicated in the scenarios. Two observations are in order. Lakehead resorts may be able to take advantage of the reduced skiing opportunities in southern Ontario by catering to residents of the south. Diversification of activities is suggested as a management response, for the summer season will be lengthened and in this way it may be possible to defray winter losses through summer gains.

5. CAMPING

5.1 Introduction

Camping is both a recreational activity and a means to participate in many other forms of outdoor recreation. As such one might expect there to be a relationship between participation in camping and participation in other summer recreational activities, such as hiking. For this reason, camping is likely to be a good indicator of participation in summer outdoor recreations.

It is possible that the warming and drying trends suggested by the scenarios will lengthen the period of the year which is conducive to camping. Much as was done in the preceding section on skiing, it is possible to employ temperature satisfaction criteria developed by Crowe *et al.* (1977) to calculate a lengthened camping season based upon user satisfaction. Once the lengthened season is established, the economic implications of the increased potential can be assessed. However, camping is influenced by many other factors in addition to climate and weather, and participation in camping exhibits considerable peaking on both a seasonal and a weekly basis. For the purposes of this study it is assumed that any elongated season will provide the campgrounds with the same amount of activity in the additional weeks as is present at the margins of the current normal season.

5.2 Study Sites and Research Procedures

Camping opportunities are provided both by the public and private sectors but, because of data availability, the analyses are confined to camping in provincial parks. Eight parks were selected for analysis (Figure 5). No claim is made that they are representative of Ontario: rather they constitute parks of a diversity of sizes and types from a variety of locations scattered across the province. Temperature frequencies were divided into three groups representing the 0, 50 and 100 per cent satisfaction percentiles found in Crowe *et al.* (1977).

The data were divided into 10-day periods and 18 °C was taken as the lower limit for 100 per cent satisfaction (the lower limit for reliable camping); 11°C was taken as the temperature at which 50 per cent satisfaction occurs (11°C to 18°C was termed the marginally reliable season); and below 11°C it was assumed that conditions would be unsuitable for camping. Note that the temperatures being considered here are the average daily maximum temperatures. Satisfaction percentiles were calculated for each 10-day period from April to October, excluding July and August. Many of the parks are at peak capacity during July and August so that a warming trend will not cause more people to visit the parks at these times. It seemed to be more appropriate to concentrate attention on the shoulder seasons.

5.3 Changes in Camping Seasons

The data have been simplified and are presented in graphical form in Figure 6. It is evident that there are considerable regional differences in season length with parks in the south generally experiencing a longer season climatically (although not necessarily administratively) than those further north. In all cases the reliable camping season is extended under both scenarios, sometimes by as much as 40 days. The marginally reliable seasons always occur earlier in the spring and later in the fall.

Differences in the length of extended seasons, from no change in the fall in Fitzroy under Scenario A to a considerably extended fall season at Pinery and Fitzroy under Scenario B, indicate the magnitude of climatic change on a regional basis. There does not appear to be a clear north-south or east-west pattern. However, Scenario B permits the greatest extension of the season in all cases.

5.4 Economic Implications

Information on numbers of campers, their length of stay and expenditures incurred within 40 kilometers of the parks was obtained from the statistical summary of the Ontario provincial parks (Ministry of Natural Resources 1984). The average expenditure per camper per night was calculated for each park and multiplied by the number of camper-nights to give total camper expenditures within 40 kilometers of each park.

The impact of the extended seasons of the scenarios was found by calculating the number of 10-day periods suitable for camping (with the marginally reliable periods receiving a weighting of two-thirds that of reliable periods) for normal and scenario conditions. If the number of 10-day periods in the normal camping season is divided into total camper expenditures then we can find the expenditure per 10-day period at present. If it is assumed that expenditures per capita will remain the same, then total camper expenditures for Scenario A and B are gained by multiplying this figure by the number of weighted 10-day periods. The results of these calculations are presented in Table 3.

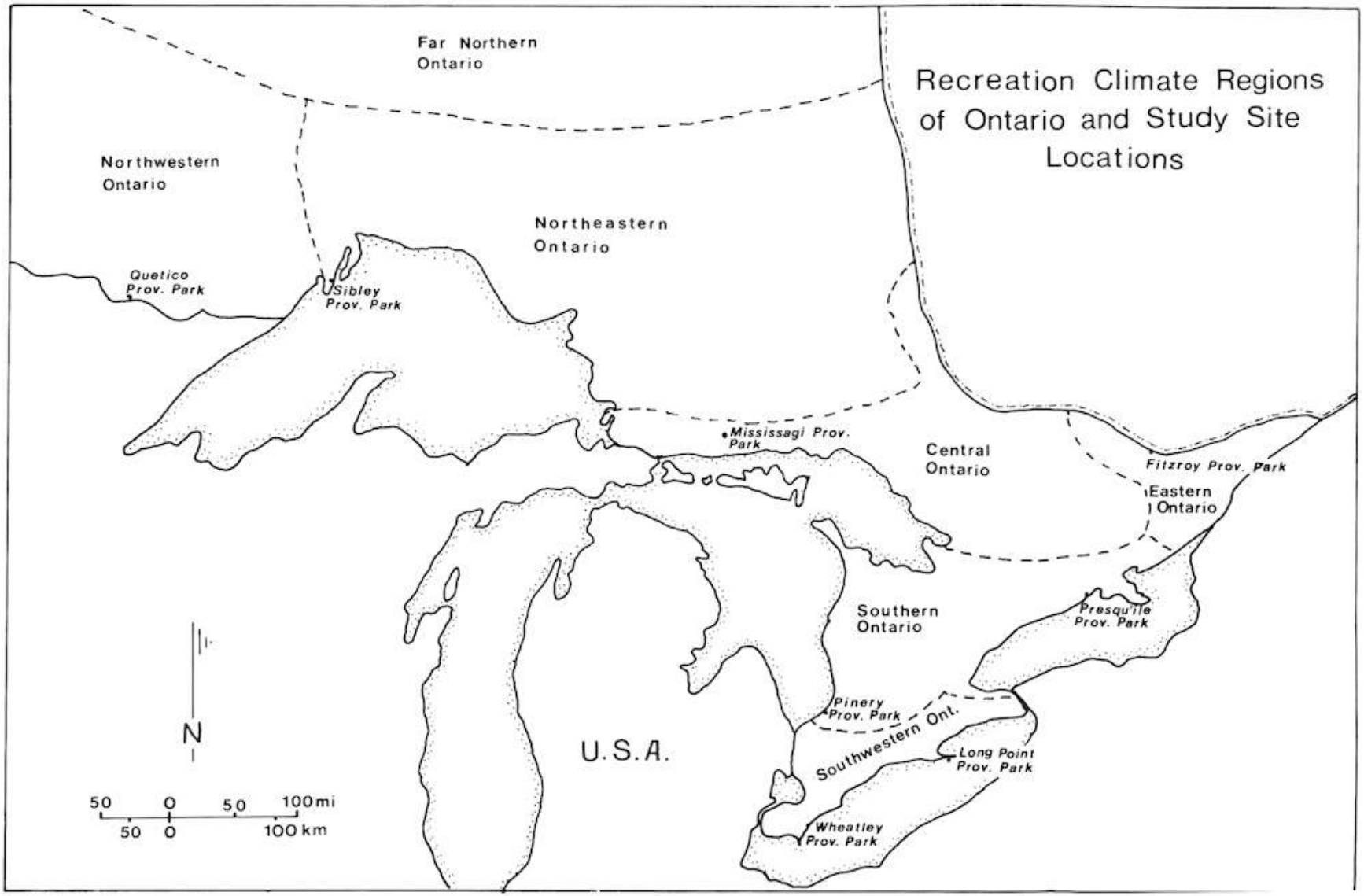


Figure 5. Study Site Locations

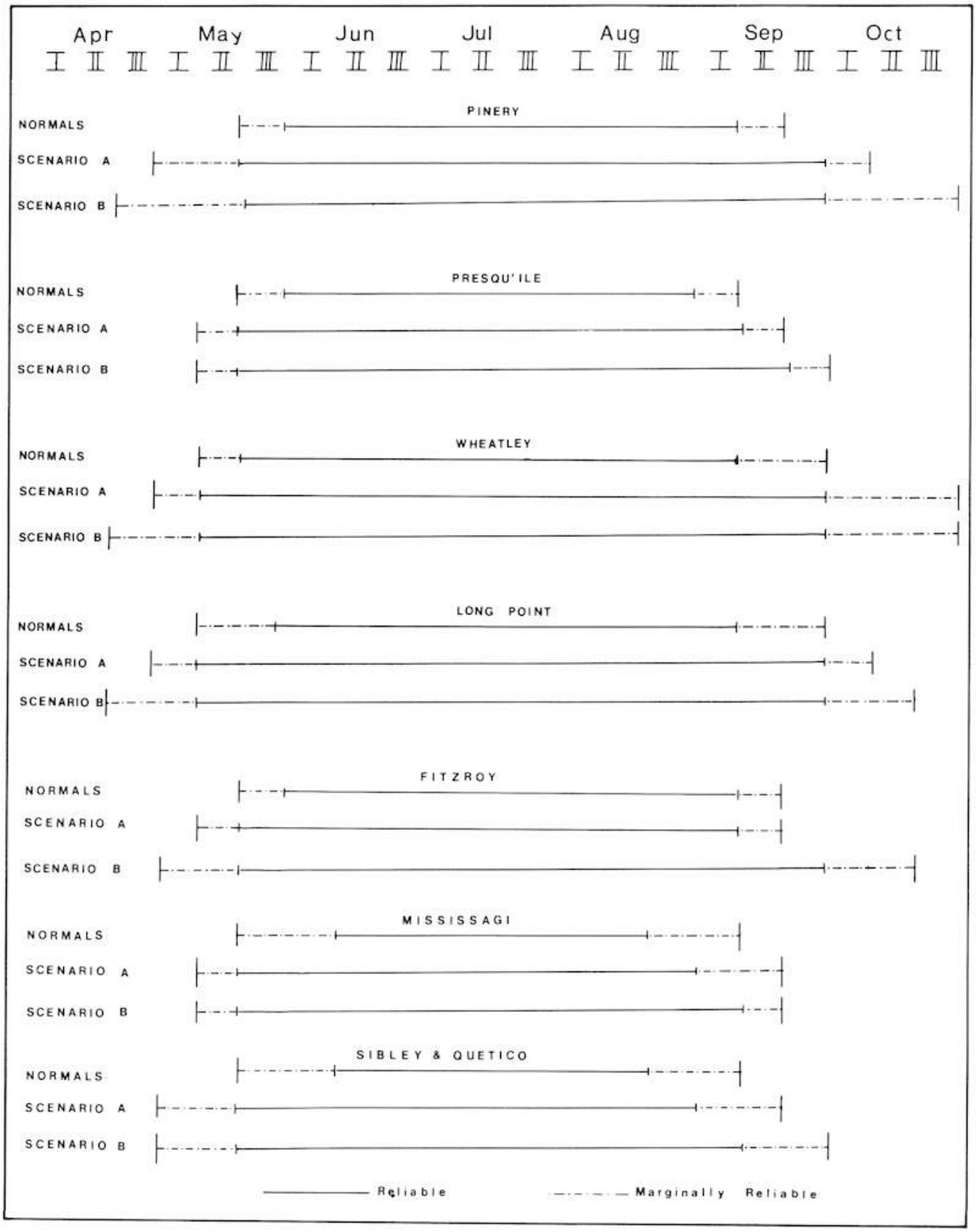


Figure 6. Reliable and Marginally Reliable Camping Seasons: Normal; Scenario A, Scenario B.

Under Scenario A conditions, expenditures increase from a low of 9 per cent at Fitzroy to 31 per cent at Sibley and Quetico. The magnitude of increases depends upon park size, the number of visitors, and opportunities to spend money in the surrounding region, as well as climatic variables. Thus, for example, Pinery Provincial Park has the largest number of camp-sites, camper-nights and the greatest volume of expenditures so that the implications of an extended season are relatively large.

5.5 Conclusions

Both Scenario A and Scenario B suggest that there may be a potential for camping seasons to be extended. Should campers take advantage of this there would be positive economic implications which vary in magnitude in different parts of the province. However, these economic benefits may accrue at the risk of increased environmental deterioration as the parks experience more users for longer periods of time.

6. SUMMARY

This report has examined some of the implications of climatic change for tourism and recreation in Ontario. A case study approach has been adopted in which selected recreational resources, and a winter and summer activity, have been the focus of attention. Where possible, economic estimates of the magnitude of impacts have been made.

The study of the wetlands of two parks indicates that, in addition to the magnitude of climatic change, the physiography of the shoreline is a major factor influencing the response of wetlands to water level modifications induced by climatic change. In some cases there may be a reduction in species diversity and recreational attraction as water levels recede, but in others the marsh may be able to migrate with the water levels.

The studies show that the implications of climatic change will be mixed. The climatic changes of the scenarios will place increased stress on businesses catering to winter activities, particulary in southern Ontario, as operating seasons will be reduced. The downhill ski season in the South Georgian Bay region could be eliminated unless technological measures are able to overcome the climatic difficulties. The climatic data suggest that investments in winter activities should be undertaken with caution and it is in the interest of winter recreational complexes and the communities in which they are located, to diversify their activities.

Summer activities are likely to have extended seasons and the viability of summer recreational enterprises may increase with associated positive benefits to neighbouring local economies; at least there will be the potential to extend summer business into what at present are shoulder seasons if institutional arrangements permit. However, this potential varies spatially. It may also place increased pressure on the resource base. This will require careful management.

Table 3: *Camper Expenditures.*

Park	Present Numberof Camper Nights	Average Expenditure per Camper Night (s)	Present Total Expenditure ($)	% Increase In Total Expenditure Under Scenario A	% Increase In Total Expenditure Under Scenario B
Sibley	25,999	10.63	276,369.37	31	41
Long Point	72,675	4.68	340,119.00	21	32
Quetico (Dawson Trail)	8,804	9.15	80,556.60	31	41
Finery	274,015	7.82	2,142,797.30	26	44
Fitzroy	37,507	13.52	507,094.64	9	42
Presqu'ile	92,737	7.46	691,818.02	19	29
Mississagi	10,507	8.62	90,570.34	24	28
Wheatley	38,121	7.44	283,620.24	23	28

7. REFERENCES

1. Crowe, R.B.I., W. Baker and G. McKay. 1977. The Tourist and Outdoor Recreation Climate of Ontario. Atmospheric Environment Service, Downsview (3 vols).

2. Ministry of Natural Resources. 1984. Ontario Provincial Park Statistics. Toronto.