The Effects of Climate Change on Recreation and Tourism on the Prairies

A Status Report

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Executive Summary

Outdoor recreation is extremely dependent on the natural resource base and the weather. The resource base determines what kind of activities take place - for example, without water people cannot go swimming or sailing- while the weather determines when the activity will take place. Recreational choices are not only affected by the weather but also by socio-economic factors such as cultural norms, levels of disposable income, school/other holidays, the attractions present and the attractions offered elsewhere.

It is generally expected that temperatures will rise in the Prairie Provinces while there is less agreement on whether there will be more or less rain and snow. Higher temperatures, though, are expected to lead to lower water levels in the lakes and greater plant growth making swimming, fishing, sailing and water skiing less pleasurable. The season for these and other summer activities will be extended by the higher temperatures, though. The grassland ecozone is also expected to shift north. Wildlife can be expected to move with the ecozone. It is uncertain, however, how quickly this will happen. Rapid climate change could mean that many plant and animal species are unable to adapt and may become extinct in the process. Hunters and wildlife enthusiasts will more than likely follow the wildlife north or learn to hunt and view other forms of wildlife that move into the areas that they themselves usually frequent.

A longer summer does pose a threat to winter activities such as cross-country and downhill skiing, snow shoeing, skating, ice fishing, etc. Less snow cover and a shorter winter season could threaten the livelihoods of ski resort operators who have the potential to go out of business. The indirect effects of this include the loss of tourism revenues to local restaurants, hotels and other forms of amusement as well as the loss of jobs for people within the community.

Since the loss of subsidies such as the crow rate, many rural communities have been considering recreation and tourism as a means of diversifying and strengthening their economies. Without knowledge of the interaction between this sector and climate change, communities could be making an economic choice that can potentially be undermined by the weather and climate change. For this reason the author has made the following recommendations:

- Climate change scenarios need to become more locale specific,
- A deeper understanding of the economic costs of creating favourable recreation conditions is needed,
- A comparative study needs to be conducted of competing attractions in places bordering on the region and the costs of engaging in these activities,
- New management strategies need to be developed to take into account the changing resource base in its effect on vegetation, wildlife and recreational choices, and
- Resource conflicts due to competition for scarce resources such as water need to be anticipated and legislation or a process established for resolving these conflicts.

Introduction

Tourism and recreation both affect and are affected by the natural and economic environment and changes to it. Many prairie communities, being faced with changes in their economy due to the loss of subsidies and the concomitant effect on agriculture, are looking to tourism as an alternative source of income and a way to bolster their economies. This is a response to a changing economic environment but what of a changing natural environment? What are the implications of climate variability and possibly change for this economic choice? While many factors such as culture, age, level of disposable income, available leisure time, and climatic conditions play a role in people's tourism and recreational choices, the focus of this paper is the effect that changing weather and climate have on the tourism and recreation sector.

The natural resource base is a necessary part of outdoor recreation, be it water for sailing, swimming, fishing etc.; or snow for skiing, snow shoeing or tobogganing; or wildlife for viewing or hunting. Climate change and variability are expected to affect ecological zones pushing the prairie region north. As ecozones and the resource base adjust, recreational activities will adjust with them. Weather patterns (temperature, rainfall, wind, snow conditions etc.), on the other hand, influence when recreational activities take place. Hence, this paper looks at how the resource base could change in the light of climate variability and change along with a change in weather conditions, and how they will affect the mix of activities that people engage in for recreation. The socio-economic consequences of a changing mix of recreational activities are also reviewed in order to gain a holistic picture of the kind of impacts that can be expected and that the tourists in the prairie region will have to adapt to. Following this, some recommendations will be made for further research relating to this topic.

This paper is based on a literature review of articles and papers relating to climate change and recreation on the Canadian prairies. Very limited literature was found on this topic specifically. Most of the literature found related to Saskatchewan, with one paper from Alberta. For this reason, the scope of this review is fairly limited. Its usefulness, however, lies in the knowledge gaps that are revealed. These gaps that are identified form the basis for recommendations for further study.

Recreation and Tourism

Recreation and tourism can be defined in a variety of ways. The first is to make a distinction between recreation—for the purpose of this paper, the pursuit of outdoor activities by residents of the three prairie provinces or visitors—and tourism. Tourism refers to trips taken that exceed being away from home for longer than one night and that do not have work or commuting as their purpose. It often includes the pursuit of recreation. Tourism can also be categorized by who is doing the traveling. So it becomes possible to talk about domestic and international travel, which refers to people crossing the Canadian border (Wittrock et al., 1992).

Recreation can be broken down according to the season and the type of activity. Thus, Masterton et al. (in More, 1988) refer to winter season (the period between the first and last dates of snow cover of 2.5cm) and summer season (the period starting two weeks after the last date of snow cover) recreation. Outdoor recreational pursuits are then classified by the type of resource base that is required for the activity: dry-terrain (e.g., golfing, picnicking, walking, camping); water-based (e.g., sunbathing, swimming, bathing, fishing); and snow- and/or ice-based (e.g. nordic skiing, alpine skiing, snowshoeing, snowmobiling, tobogganing, ice fishing, skating). It is obvious from the above examples that outdoor recreation is extremely dependent on the resource base and on the weather. Weather will influence the way people use outdoor recreational facilities as well as their demand for outdoor experiences. It is important to realise, however, that what recreation and how much takes place is not only affected by the weather but also by socio-economic factors such as cultural norms, levels of disposable incomes, school/other holidays, the attractions present and attractions offered elsewhere. An example is the shift in people's preferences from consumptive recreation (e.g. hunting) to appreciative recreation (e.g. hiking) which increases the demand for pristine environments and parks (More, 1988; Arthur and Chorney, 1989; Wittrock et al., 1992).

Tables 1 to 3 show what recreational activities are engaged in on the prairies at present along with the climatic requirements for them.

Table 1. Climatic criteria for outdoor recreational activities[1] (Masterton in Wittrock et al., 1992).

Activity	Temp (^{0}C)	Visibility (km)	Thick Cloud Cover (tenths)	Hourly wind (km/hr)	Snow cover (mm)	Precipitation
Landscape touring	-24 to 32	>4.8	not applicable	<42.8	not applicable	nil
Skiing	-14.4	>0.8	not applicable	<25.7	25.4	nil to light
Snow-mobiling	>-21.1	>0.8	not applicable	<25.7	>25.4	nil to light
Passive Activities	>12.2	>1.6	<8	<33.8	not applicable	nil
Vigorous Activities	12.8 to 31.7	>3.2	<8	<33.8	not applicable	nil
Beaching Activities	>17.8	>1.6	<8	<25.7	not applicable	nil

[1] Where summer activities are divided into passive activities (e.g. gardening), vigorous activities (e.g. football), and beaching activities (e.g. suntanning).

Table 2. Minimum climate related requirements for summer recreation activities (More, 1988).

Water Based Activities					
	Motor Boating	**Water Skiing**	**Sailing**	**Fishing**	**Swimming/ Sunbathing**
Air Temperature (^{0}C)	15 to 35	18 to 35	10 to 35	15 to 30	15 to 30
Wind (km/h)	<50	<15	15 to 50	<15	<15
Water Temperature (^{0}C)	2 to 20	10 to 20	10 to 18	<18	15 to 20
Precipitation	nil	nil	nil	nil	nil
Lake size: • Minimum (ha) • Maximum (ha)	>80 400	>100 800	>30 to >100 800	20 to 80 400	20 to 40 800
Lake depth (m)	1.5 to 2.5	>2.0	1.5 to 2.0	0.5 to 1.0	0.5 to 2.0
Carrying Capacity	1 ha/boat	5 ha/boat	10 ha/boat	--	--
Aquatic Vegetation	Minor emergent	minor submergent	Minor submergent	Minor emergent	Nil
Dry Terrain Activities					
	Camping	**Picnicking**	**Golf**		
Air Temperature (^{0}C)	>10	10 to 25	10 to 30		
Wind (km/h)	<10	<20	<20		
Precipitation	Nil to light	Nil	Nil		

Table 3. Climatic requirements for winter recreation activities (More 1988).

Environmental Condition	**Nordic Skiing**	**Alpine Skiing**	**Snow Shoeing**	**Snowmobiling**
Snow Season	**November to April**	**November to May**	**November to April**	**November to April**
Snow depth (cm)	20 to 30 minimum 60 optimum	20 to 30 minimum 60 optimum	20 to 30 minimum 60 optimum	30 minimum 60 optimum
Snow Density (g/cm^3)	<0.6	<0.6	0.2 to 0.6	0.4 to 0.1
Air Temperature (^{0}C)	-2 to -15	5 to -20	10 to -40	10 to -30
Snow making (^{0}C)	-6 to -15	-6 to -15	Not applicable	Not applicable
Wind (km/h)	<20	<15	<45	<45
Wind Chill (watts/m^2)	700	700	1600	1400

Requirements for recreational activities may change with technological advances in clothing and equipment and with the evolution of individual recreational activities (More, 1988). These advances are examples of adaptation to weather conditions and can be expected to take place in the face of climate variability and change too.

A study conducted in Saskatchewan of the province's tourism attractions revealed that the diversity of natural resources was one of the province's most important assets. Other tourism assets listed were uncrowded, unspoiled, clean surroundings; agriculture; the north; laid-back, friendly people; history and heritage. These assets can be extended to include all three provinces due to the similarities amongst Manitoba, Saskatchewan and Alberta (Wittrock et al., 1992).

Given that the diversity of natural resources is one of the prairies' greatest recreational assets, climate change and variability could have a significant impact on them as a tourist attraction. In order to gain insight into the effect of climate change on recreation on the prairies it will be useful to know how these assets will be affected by climate variability and then how the mix of recreational activities will change as a result of changes in the resource base which supports recreation and tourism (Wittrock et al., 1992).

Impact of Climate on the Mix of Recreation Activities

Climate Change Scenarios for the Prairies

Prairie climatic conditions have always been varied and to a degree unpredictable. The prairie climate is characterized by droughts and dry spells, early and late frosts, cold spells, excessive moisture and flooding. It is a climate of extremes with minimum temperatures dropping below $-40^{0}C$ in January and rising to a maximum of between $35^{0}C$ and $40^{0}C$ in July. Annual precipitation is between 250 and 450mm, with more than two thirds occurring during summer (May to August) months. Passages of cold fronts, depressions, and numerous storms generate strong winds throughout the year. Dust storms are frequent during drought years but have also been found to occur during relatively short-lived dry conditions (Jones, 1996; Cohen et al., 1992).

Various General Circulation Models have been used to project climate change scenarios if a doubling of the concentration of carbon dioxide in the atmosphere were to occur. Most models predict that temperatures will increase for both summer and winter, and that the variability observed in the current climate will continue under climate change. There is less agreement about whether precipitation (in the form of both rain and snow) will increase or decrease but there is agreement that the availability of water will diminish due to high temperatures and evapotranspiration (More, 1988; Cohen et al., 1992; Wittrock et al., 1992; Wittrock, 1993; Jones, 1996).

These conditions are expected to have significant effects on the water resources available to inhabitants of the prairies, the vegetation and wildlife populations. What follows is a brief assessment of how these resources are expected to be affected increased climatic variability and change. A lot of this is speculation since GCMs embody inherent uncertainties due to the complexity of the system being modeled and also because the models are still not fine enough to cover changes on a micro scale in any kind of detail (Cohen et al., 1992).

Water Resources

Many of the surface waterbodies (lakes, rivers and reservoirs) in the prairies tend to be shallow and eutrophic. Water quality and quantity affect recreation directly (see Table 2). Climate variability is expected to alter lake levels and affect the salinity and flora and fauna composition of the lakes. Warmer temperatures and shallow depth will result in warmer water, which encourages algae and plant growth. Increased algae and plant growth take up large amounts of oxygen and, in the case of shallow bodies, may lead to the expiration of fish life due to a reduction in dissolved oxygen. Warmer temperatures could also mean a later freeze and an earlier melt of ice on lakes, rivers and reservoirs. Decreased run-off and shorter run-off periods are also predicted by some climate change models (More, 1988; Wittrock and Wheaton, 1992; Wittrock et al., 1992).

Vegetation

The distribution of vegetation is closely related to climate. Thus, all vegetation types, be they grasses, wild flowers, fungi or large coniferous trees, will be affected by climate change. The prairies are characterized by grassland vegetation which is drought resistant and tolerant of temperature and precipitation extremes. The prairie ecozone spanning the three provinces is bordered by the boreal forest which is less suited to temperature extremes and drought. Various climate change scenarios suggest that the climate of the boreal forest will be replaced by that of the prairie ecozone because of warmer and drier conditions. Thus, it can be expected that the prairie ecozone with its grassland species will expand northward. Which species will migrate and which species will become extinct, however, are difficult to predict since species adaptation and migration depend on a number of factors. Soil types, how they reproduce, daylength preferences and the types of predators and competition all have a bearing on this. Also, adaptation tends to occur slowly rather than quickly. Current climate change scenarios based on a doubling of the concentration of carbon dioxide in the atmosphere do not predict how quickly a doubling will take place. They are also too sparse in their application to specify regional and local changes in the kind of detail that is necessary for predicting species adaptation, migration, and extinction (Wall, 1989; Lopoukhine, 1991; Wittrock et al., 1992).

Wildlife

Wildlife is directly dependent on vegetation for food and shelter. Changes in habitats and the decreased severity of winter will result in alterations of the distribution and numbers of major big game, waterfowl, and upland game bird species. As the prairie ecozone displaces the boreal forest, species that are adapted to the prairies and aspen parkland can be expected to increase in these areas. Milder winters may also mean higher winter survival rates of species not adapted to cold and snow. The drying up of potholes that is expected to accompany rising temperatures will in all likelihood also lead to the reduced production of waterfowl. Lower lake levels could also lead to the exposure of nesting sites to predators (More, 1988; Wittrock et al., 1992).

Effect on Recreation Activities

Recreationists have a degree of flexibility in their response to these impacts. Travelling to alternative locations with favourable conditions, reducing participation when conditions are unfavourable or ceasing to participate in their usual activities at all, are all options that can be pursued. People can also undertake new activities or increase their involvement in other activities. The constraining factors will be free time and personal economic well-being (More, 1988). Putting these constraints aside, the effect of changing weather patterns and climate is looked at below.

Warmer temperatures will have a great effect on recreation and tourism. The magnitude of this effect is still to be determined, however. Warmer water and air temperatures are expected to increase swimming activity which will also stretch over a longer period of time. However, a decrease in the quantity of water and quality of the resource will reduce swimming activity. Table 2 shows that no aquatic vegetation is conducive to swimming. The expected increase in algae and plant life will inhibit swimming. It will also have a negative effect on fishing. If fish populations decrease because of a lack of dissolved oxygen, fishing may be ruled out as a recreational activity at many spots where it now takes place. Increases in air temperature will likely result in a longer season in which water based and dry terrain activities can take place. Decreased lake area and depth due to rising temperatures could result in less opportunity for sailing, boating and water skiing, however. This is especially true if boat docks become stranded above the water line and new docks have to be built. Decreased run-off and shorter run-off periods in the spring and early summer will also influence the quality of white water rafting and kayaking. While the summer season may be extended and provide more opportunities for outdoor recreational activity, it is uncertain whether this extended season will be taken advantage of. People's recreational choices are not only influenced by the weather but also by the amount of leisure time that they have available to them. So, the bulk of recreational activity may continue to take place at the same peak times as it does now: around the school holidays (More, 1988; Arthur and Chorney, 1989; Wittrock et al., 1992).

An extended summer season does not bode well for activities such as skating, ice fishing, and lake snowmobiling, though. The season for these activities is expected to be shortened substantially since at least 15cm of ice is necessary to support the weight of an adult. (More, 1988; Wittrock et al., 1992). Other winter activities such as cross-country and downhill skiing are also expected to be affected. A study in Quebec (Lamothe et al., 1988) revealed that the downhill ski season can be expected to be shortened by 50 to 70 percent as a result of climate change. More (1988) and Wittrock et al., (1992) express the same concern for the prairie provinces, although they have not quantified by how much the season can be expected to be shortened. If snow storms come later in the Fall, there may be insufficient snow for both types of skiing during the Christmas holiday season (peak ski season). There may also be insufficient water, money and time (before this period) to make snow which will meet the requirements (see Table 1) for the sport. Making snow for cross-country skiing is also impractical because of the large area that has to be covered. Higher temperatures could draw more people to skiing venues when the conditions are suitable (More, 1988; Wittrock et al., 1992).

Golfing, picnicking and camping opportunities will all increase because of the warmer and longer summers. Irrigation and the costs thereof can be expected to increase for golf courses, camping and picnic grounds maintenance as a result of low rainfall and high evapotranspiration rates.

Scenarios of vegetation change and resulting movement of wildlife indicate a higher survival rate for species that enjoy warmer winters. Many of the prairie species will move north. Wildlife enthusiasts and bird watchers can look forward to more sitings of winter survivors and they may travel north in order to view wildlife which they usually view in the south now. Hunting activities can be expected to shift north along with the wildlife population. This may have implications for out of province hunters who will have to travel longer distances in order to hunt. They may be unwilling to do so, especially if the costs become prohibitive. The species hunted are also likely to change as hunters adjust to new species in their habitual hunting grounds. As the demographics of the region alter hunting patterns will more than likely alter too. More rural people than urban people tend to hunt. If agriculture in the south becomes less viable because of climate change, there will be fewer farmers and hence fewer hunters (More, 1988; Wittrock, 1992).

Socio-Economic and Environmental Consequences of a Change in the Mix of Activities

Tourism and outdoor recreation benefit the economies of many communities. Now, with the loss of subsidies such as the crow rate, more and more communities are looking toward the recreation and tourism industry as a way of diversifying their economies. As the climate and the mix of recreational activities changes these economies can be expected to be affected. If communities do not have access to information on the relationship between recreation and the possible effects of climate change, they could be making decisions to diversify their economies in an unsustainable way.

Unfortunately, very little analysis has been done on how, and the degree to which, economies will be affected by the impacts of climate change on recreation and tourism. Speculation is that for those activities that cost recreation managers little in capital development or operating expenses, the economic impact of shifting recreation patterns will be negligible. Activities involving facilities that are costly to construct and maintain are expected to incur the greatest economic repercussions. Downhill and cross-country skiing are examples of such activities. A study in Alberta (More, 1988) found that consumers will invest large amounts of time and money in these activities. However, they expect to have a satisfying experience. If conditions are sub-optimal and the activity becomes costly then they are likely to alter their recreation habits. Making snow is costly and resorts will have to recoup this cost through revenues. If attendance drops it is likely that many ski resort operators could go out of business. The indirect effects of this include loss of tourism revenues to local restaurants, hotels and other forms of amusement as well as the loss of jobs for people within the community (More, 1988).

Tourism and recreation activities do not take place in a vacuum and as such interact with many other sectors. The most obvious on the prairies being agriculture. As has already been mentioned, many of the outdoor recreation activities on the prairies are dependent on the availability of water in large quantities. As the prairie region gets drier and experiences more drought conditions recreational water users will be competing with farmers and industry for that water source. This holds the potential for conflicts among users for limited supplies of good quality water. Other resource conflicts that can arise are between recreationists and the forestry, mining and commercial fishing industries (Wittrock and Wheaton, 1992; Wittrock et al., 1992).

Environmentally speaking, the migration of recreational activities northward along with the ecozone could lead to pressure on vulnerable wilderness areas. Longer, warmer summers may lead to greater visitation to parks which could result in degradation, over development and over use. Fewer hunters in the south could also mean overpopulation of big game species which would require new management techniques (More, 1988; Witttrock et al., 1992).

Recommendations to Enhance Adaptation

In order for the tourism and recreation sector to adapt to climate change, more information is necessary on all aspects. Very little research has been done to date on what this sector can expect on the prairies. Current general circulation models are not fine enough to reflect possible changes at specific locations in the prairies. Scenarios still refer to general locations within the region. As scenarios become more specific to locales within the region changes in recreational activities can be anticipated and the necessary contingency plans made.

A deeper understanding of the economic costs is also required. So far very little has been done to determine what the costs will be of creating favourable conditions for swimming, golfing, winter skiing, etc. Since there is limited understanding of how consumers will respond to changing weather, conditions, and costs, it is difficult to know whether these costs can be justified. Hence, a study needs to be conducted on how consumers will adjust their recreational choices as well.

No mention has been made of competing attractions outside the prairie provinces and how people will respond to these if the conditions necessary for recreation on the prairies change. This is because the author was unable to find written material relating to this topic. To gain a realistic view of what can be expected to happen in the tourism and recreation sector as a whole it will be necessary to look at competing attractions elsewhere and their capacity to draw recreationists from the prairie provinces and elsewhere.

It is thought that the ecozone will shift northward as a result of climate change. More research is needed on this so that shifts in demographics, vegetation and wildlife populations can be better anticipated. As various users - both people and wildlife - begin to compete for increasingly scarce resources (especially water) new management strategies will need to be developed that take this into account. Resource conflicts need to be anticipated and legislation or a process established for resolving these conflicts.

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