IMPACT OF CLIMATE ON RECREATION AND TOURISM IN MICHIGAN

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ABSTRACT

Outdoor recreation and tourism (ORT) together constitute one of the three largest industries in Michigan, and the provision of ORT opportunities to the traveling public represents a vital source of income and jobs within the state. Many of the activities provided depend heavily upon appropriate climatic, and associated environmental, conditions. However, many of these conditions are projected to change, possibly quite substantially, in future decades. The purpose of the study discussed here is to develop a web-based tool that will enable stakeholders in Michigan's ORT industries to examine the potential impacts of a range of futures (climatic, technological, socioeconomic, and demographic) on the financial viability of their businesses, so as to improve future planning and enable more informed decision-making. Construction of such a tool first requires development of valid statistical models of historical relationships between ORT activity, climatic conditions, and other factors likely to influence ORT use or participation, and it is this topic that forms the basis of the present contribution. Models of participation in downhill skiing and in general ORT activity (as measured by tourist traffic) are presented; a model of camping activity remains under construction. Upon development of valid representations of historical ORT activity, these models will be integrated with a suite of climate change scenarios and a web-based interface that will allow users to access both historical and projected data. ORT stakeholders will then be able to convert projected levels of activity at their site under a range of future climatic conditions into financially meaningful figures, thereby allowing them to consider multiple future scenarios and, thus, make more informed planning and management decisions.

KEYWORDS: *Outdoor recreation and tourism (ORT), Climate, Michigan*

INTRODUCTION

Outdoor recreation and tourism (ORT) are vital elements of Michigan’s economy and society. In 2001, Michigan welcomed 67 million leisure visitors, who spent over US$10.8 billion. The state accounts for 3.4% of leisure trips in the United States, placing it seventh in the nation in terms of leisure travel activity (1). Mid-Westerners are avid outdoor lovers, and there are more registered boaters and more daily fee and municipal golf courses in Michigan than in any other state in the union. Other activities engaged in at above national average levels include hunting, ice fishing, snowmobiling, and skiing, all of which exhibit heavy dependence on weather/climatic conditions and the environmental conditions created by them (snow and ice depth, vegetation patterns, lake levels, etc.).

The current climate in the Great Lakes region consists of warm summers, cold winters, and substantial year-round precipitation. The Great Lakes themselves have a significant impact on local and regional weather conditions. Areas leeward of the lakes experience intense lake-effect storms; such storms currently contribute up to 50% of annual snowfall in these areas (2). Climate in the region may be warmer and wetter in the future, according to the Great Lakes Regional Assessment (3), part of the US Global Change Research Program’s National Assessment. Output from the Canadian (CGCM1) and Hadley (HadCM2) general circulation models (GCMs) suggests increases of between 1-2ºC in minimum summer temperature, and between 0-1ºC in maximum summer temperatures, by 2025-2034, with more warming in the western part of the region than the east. Increases in summer precipitation of 15-25% are also projected. Expected changes in 2025-2034 winter conditions include increases in minimum temperature of between 4-6ºC according to CGCM1, and 0.5-2.5ºC according to HadCM2, and in maximum temperature of between 2-3ºC (CGCM1) and 0.5-2.5ºC (HadCM2). While the CGCM1 scenario suggests winter precipitation levels similar to present day levels, the HadCM2 prediction is slightly lower. Projections for 2090-2099 suggest even more substantial increases in summer and winter temperatures, with an increase of approximately 20% in winter precipitation according to both the CGCM1 and HadCM2 models.

The direction and magnitude of predicted climate change in the Great Lakes region offers both threats and opportunities for outdoor recreation and tourism. While shorter, less severe winters may be damaging for winter activities such as ice fishing and skiing, longer summers may bode well for golfing, boating, fishing, camping, etc. To date, however, impacts of both current and future climate on ORT in the region remain under-investigated, especially from the perspective of those most likely to be directly affected by such change: ORT participants and providers. For providers, the economic ramifications of climate variability and change are particularly pertinent, yet little research has addressed the financial viability of this industry in the face of changing conditions, climatic and otherwise.

The study, described below, attempts to redress this shortcoming through construction of a series of models that will enable ORT stakeholders in Michigan to evaluate the effects of weather and climate on their business or activity from the perspective of its financial viability. The primary objective of the study is to develop and monitor the use of a web-based tool that will enable stakeholders in Michigan's ORT industries to examine the potential impacts of a range of futures (climatic, technological, socioeconomic, and demographic) on the viability of their business, so as to aid their planning activities and enable more informed decision-making. Secondary objectives include: (i) the fostering of increased interaction and collaboration between researchers, policy makers, and ORT industry members in Michigan; (ii) increased knowledge regarding decision-making in the face of uncertainty such as that surrounding the issue of climate variability and change; and, (iii) improved understanding of the impacts (economic, environmental, and others) of climate change and variability in the Great Lakes region.

METHODS

In recognition of the likely differential impacts of climate change on the various sectors of Michigan's ORT industry, most particularly depending upon their season of offering, the study focuses on two distinct outdoor recreation activities – downhill skiing (a popular winter activity) and camping (a popular summer activity) – in addition to the industry as a whole (on a year-round basis, as measured by traffic volume on major tourist routes). Figure 1 illustrates the five major stages envisaged for each of the three analyses (skiing, camping, and general industry), the first three of which, focusing on the development of valid statistical models of historical relationships between ORT activity, climatic conditions, and other factors likely to influence ORT use or participation, form the basis of this paper.

Location of industry stakeholders and identification of their information needs has been a crucial first stage in each of the three activity analyses (of skiing, camping, and the industry as a whole). Methods have included the convening of special advisory committees, composed of key players in Michigan's ORT sector, as well as the involvement of the project team in numerous industry events and meetings where the project has been introduced and assistance solicited. These preliminary contacts have enabled identification of industry collaborators for each of the three activities: those government agencies, industry organizations, and private businesses willing to share with the project team the historical use/participation data needed to construct the statistical models of past conditions which will then be integrated with various climate change scenarios. In this paper, results from two of the three sets of analyses (of skiing and the industry as a whole) are presented. Collaborators to date for these two areas have been various individual ski resorts, and the Michigan Department of Transportation (MDOT), respectively. Use/participation was measured on a daily basis in both cases, by lift tickets sold for skiing, and by traffic counts (as a general proxy of overall tourism activity).

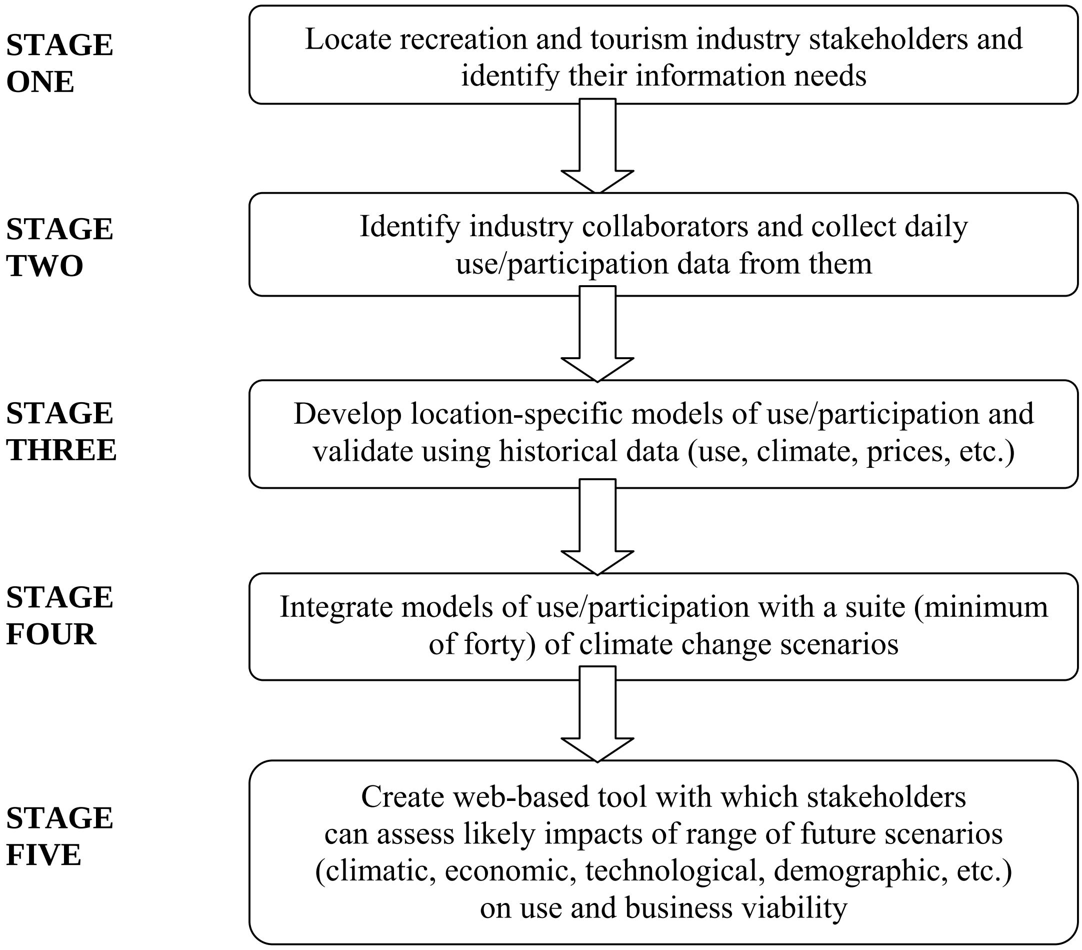

Figure 1: Project stages

Collection of these data has enabled construction of a series of site-specific regression models designed to account for as much of the daily variation in lift ticket sales and general tourism traffic (the dependent variables) as possible, based on inclusion of a series of independent variables relating to as many potentially influential factors as are measurable and able to be entered into such analyses (climate, prices, other economic and social conditions, etc.). Upon development of statistically valid representations of historical patterns, these models will then be integrated with a suite of climate change scenarios so as to enable assessment of the potential impacts of projected change. Individual users will then be able to convert projected levels of use/participation into financially meaningful terms, thereby allowing them to make more informed planning and management decisions.

RESULTS

Construction of valid models of historic patterns that explain as much variation in use/participation as is possible is essential before they can be integrated with future climate scenarios, and it is upon this task, for the skiing, and general tourism sectors, that these results focus.

Table 1: Multiple regression results, spring traffic volume (log of daily traffic count, 1991-2000)

predictors	*unstandardized coefficients* *b*	*std. error*	*standardized coefficients* *beta*	*t*	*sig.*
(constant)	-80.418	14.989		-5.365	0.000
max. temperature	0.017	0.001	0.318	19.470	0.000
precipitation	-0.003	0.001	-0.030	-1.890	0.059
gas price	0.275	0.098	0.046	2.797	0.005
CCI	-0.001	0.001	-0.040	-0.804	0.422
Friday or Sunday	0.800	0.017	0.791	48.380	0.000
Saturday	0.309	0.021	0.236	14.471	0.000
public holiday	1.145	0.078	0.234	14.761	0.000
year	0.044	0.008	0.291	5.839	0.000

$R^2 = 0.81$

Table 2: Multiple regression results, fall traffic volume (log of daily traffic count, 1991-2000)

predictors	*unstandardized coefficients* *b*	*std. error*	*standardized coefficients* *beta*	*t*	*sig.*
(constant)	-100.772	18.288		-5.510	0.000
max. temperature	0.015	0.001	0.264	15.046	0.000
precipitation	-0.003	0.001	-0.047	-2.675	0.008
gas price	-0.120	0.123	-0.019	-0.980	0.328
CCI	-0.002	0.001	-0.154	-2.600	0.010
Friday or Sunday	0.854	0.019	0.826	45.633	0.000
Saturday	0.303	0.024	0.228	12.610	0.000
public holiday	0.916	0.064	0.253	14.382	0.000
year	0.055	0.009	0.354	5.919	0.000

$R^2 = 0.79$

Tables 1 and 2 illustrate results of regression analysis of daily traffic flow as measured at an MDOT recording station on a major route (US 27) to the north-western portion of Michigan's lower peninsula. The route experiences little daily commuter traffic, and the recording device differentiates between motorcycles, cars, pickups, minivans, and large trucks and trailers (by number of axles). Thus, a good proportion of non-tourist industrial traffic can be excluded from the count. The majority of the remaining traffic consists of travelers accessing the many outdoor recreation opportunities offered in the area. To account for differences in tourist traffic throughout the year, separate models have been constructed for each season. Tables 1 and 2 represent spring (March-May) and fall (September-November), respectively. Table 3 shows regression results for ski lift ticket sales at a popular ski resort in the north-western part of the lower peninsula.

Table 3: Multiple regression results, ski resort (log of daily lift tickets sold, 1996-2002)

predictors	*unstandardized coefficients*		*standardized coefficients*	*t*	*sig.*
	b	*std. error*	*beta*		
(Constant)	3.790	0.230		16.513	0.000
CCI	0.001	0.002	0.022	0.795	0.427
min. temperature	-0.055	0.012	-0.310	-4.720	0.000
min. temperature square	-0.001	0.000	-0.185	-2.910	0.004
snow depth	0.002	0.000	0.165	5.839	0.000
public holiday	1.478	0.123	0.314	11.974	0.000
slope	0.210	0.069	0.084	3.035	0.002
weekend	1.111	0.061	0.463	18.086	0.000
peak season	0.858	0.070	0.328	12.333	0.000

$R^2 = 0.55$

DISCUSSION

Results suggest that there are statistically significant relationships between weather conditions and both general tourist traffic (maximum temperature and precipitation) and ski participation (minimum temperature and snow depth). Spring and fall traffic levels experience statistically significant increases with rising daily maximum temperature, and decreases with increasing daily precipitation, as expected. Lift ticket sales increase as snow depth rises, and also increase as daily minimum temperature drops, though in a non-linear, decreasing fashion. In all three regressions, however, temporal factors appear to have the most substantial impacts on traffic and lift ticket sales. Spring and fall traffic increases significantly on weekends, with Fridays and Sundays (the most typical days of arrival and departure) showing even more substantial activity than Saturdays. Significant increases in traffic are also suggested on public holidays. Similarly, ski activity increases significantly on weekends, public holidays, and in the industry-defined peak season (January and February). The relationships between tourist traffic, ski activity and economic conditions, as measured by gas prices and the Consumer Confidence Index (CCI), are less clear, since neither appears significant on a consistent basis.

The overall explanatory power exhibited by the models is substantially better for the traffic models than the ski model (R^2 equals 0.81 for spring traffic and 0.79 for fall traffic, but only 0.55 for skiing), which suggests that the ski model in particular requires significant improvement before it can be integrated with any scenarios of future climate change. One variable under consideration for incorporation in the ski model is weather conditions in major markets (to enable testing of the hypothesis that conditions at the skier's point of origin may influence their propensity to participate).

ACKNOWLEDGEMENTS

The work presented results from U.S. Environmental Protection Agency funding for the project, "*Improving the Utility of Regional Climate Change Information from a Stakeholder Perspective,"* submitted by Sousounis, P.J., Andresen, J.A., Black, J.R., Holecek, D., and Winkler, J.A.

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