A national-level screening exercise to assess tourism’s vulnerability to climate change

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1 INTRODUCTION

It is widely acknowledged that over the 21st century the global community will need to adapt to the effects of climate change\(^1\). Current climate models predict that New Zealand will experience increasing temperatures, changing frequency, intensity and distribution of rainfall events, decreased snow cover and sea level rise. Such changes will impact on key regional tourism drivers such as destination attractiveness, product content, business profitability, infrastructure planning and investment. Changes will manifest locally and will uniquely affect individual tourist destinations, communities and businesses. An ability to respond is therefore vital. Thus, the overarching goals of this research are:

- Identifying which parts of the tourism industry are most vulnerable to the effects of climate change;
- Developing key indicators which allow tourism businesses to measure, assess and track their vulnerability to climate change;
- Establishing what adaptation measures are most appropriate for minimising vulnerability to the effects of climate change; and
- Providing the tools necessary to achieving effective management, not only in terms of reducing vulnerability to climate change but also in identifying opportunities for taking advantage of a changing climate.

This background paper will outline progress to date in relating to understanding tourism’s vulnerability at a national level. Following this stage, detailed analysis on vulnerability, indicators and adaptation measures will be undertaken in three case studies.

It is important to note that our research will not address the implications of climate change policies on tourism operators. Neither will it consider the global flow-on effects of climate change impacts and policies in other parts of the world and their potential effects on tourist arrivals and their destination choices or sustainability preferences. Some of these issues are being addressed in parallel research projects, but linking outcomes from those individual projects into an overall picture of how tourism in New Zealand relates to climate change may require a dedicated future effort to integrate those diverse perspectives.

2 FRAMEWORK

Our research is based on the vulnerability framework illustrated in Figure 1. Exposure and sensitivity are important determinants of the potential impact of a climatic condition, and adaptive capacity acts as a moderator to reduce or increase vulnerability of a particular group, place or activity to those potential impacts.
Regional climate modelling currently undertaken by NIWA will help us to understand the exposure of tourism to climatic changes. Already, we understand that temperatures in New Zealand are expected to increase. The amount of increase depends strongly on the emissions scenarios, but a “mid-range” (A1B) emissions scenario suggests an increase of about 1°C by 2040, and 2°C by 2090. Likewise for this mid-range scenario there are projected changes in mean rainfall and wind patterns. These changes show a marked seasonality with the latest results suggesting increased westerlies in winter and spring, along with more rainfall in the west of the North and the South Islands and drier conditions in the east and north. Conversely, in summer and autumn, the models suggest decreased frequency of westerly conditions, with drier conditions in the west of the North Island and possible rainfall increases in Gisborne and Hawke’s Bay. Other changes are also expected include a decreased frost risk, increased incidence of high temperatures, increased frequency of extreme daily rainfalls, a possible increase in strong winds, and a decreases in average snow cover. Such climatic changes will have bio-physical consequences that in turn affect tourism operations, such as changes in flood and drought risk, seasonal water supply, demand and quality, biodiversity and biosecurity, changes in glaciers and river run-off. A rise in average sea level, which is likely to be at least 0.5m by 2100 although substantially higher increases cannot be ruled out, will affect coastal erosion and inundation.

The sensitivity of tourism to those climatic changes and their direct bio-physical consequences depends on a range of factors including: i) how tourists respond to certain climatic conditions, ii) how important weather and weather-related natural hazards are to tourism businesses for their successful operation of specific activities (e.g. scenic flights) and iii) how infrastructure or wider natural resources such as water relevant to their operation might be temporarily or permanently affected as a result of climatic events. Overlaying climate change projections with information on tourist activity gives a first indication of which areas in New Zealand tourism are most exposed to climate change and where sensitivity might be high, simply as a result of condensed tourist activity. Queenstown, for example, can expect annual temperatures to rise by about ~1°C and an increase in its annual precipitation, including an increase in heavy rainfall events. It is also one of the main destinations for winter tourism. The actual sensitivity of individual tourism operations and clusters of activities to such changes are one of the core areas of research in our study. Finally, the vulnerability of individual operations can be modified substantially by varying levels of adaptive capacity. Ski fields, for example, have already invested substantially in
snowmaking facilities and as a result have reduced their vulnerability to warming climatic conditions and reduced snow availability.

Figure 2 (A) Projected annual mean precipitation change between 1980-1999 and 2030-2049 and (B) Projected annual mean temperature change between 1980-1999 and 2030-2049. Based on an average over 12 climate models for an A1B emissions scenario.
TOURISM’S EXPOSURE AND SENSITIVITY

A review of the international literature highlights the importance of both weather and climate to tourism. Tourists base their decisions on perceived and experienced climatic conditions. Specific weather conditions affect whether tourists can participate in tourist activities, their level of satisfaction and even their safety. Climate change has the potential to exacerbate adverse conditions but also may generate more favourable climates in some places. Environmental change due to climate change, extreme events and pressure on resources (e.g. water) may pose challenges for tourist destinations in the future.

To better understand the impacts of weather and climate on tourism in New Zealand, an archive analysis was undertaken. The archive search focused on weather events that occurred during the summer tourist season of November to March (inclusive) over a fifteen year period (1995/96 – 2009/10) for which records were readily available. NIWA’s Annual Climate Summaries and Reviews of notable weather events presented in the Meteorological
Society of New Zealand Newsletters were used to identify significant weather and climate events. The Met Soc Newsletter reports were particularly useful as the focus was on weather events that impacted on people, rather than those that reached a particular magnitude. A “Meteorology in the media” section provided additional information on key weather events which impacted on tourists. These, along with searches of the Newstext Plus electronic data base\(^1\) revealed a significant number of weather events that are already occurring (independent of climate change) and are relevant to tourism. These are categorised below first as weather events and their impacts on tourists, and second in respect of aspects of the tourist experience impacted by weather events.

### 3.1 Weather events

- **Heavy rain** – flooding of roads, railways, buildings, campgrounds, slips leading to road closures, bridges washed away, damage to walking tracks, river, lake and coastline (in unison with high tides etc) flooding, flash floods, cancellation of commercial activities
- **Strong wind** – road closures, danger from falling trees and debris, slips, high seas close coastal roads, disruption to water (Cook Strait ferry crossing, scenic boat trips) and air transport (scheduled and scenic flights), power outages, cancellation of commercial activities, danger for high vehicles such as campervans
- **Fog** – transport disruptions, commercial activity cancellations
- **Drought and hot spells** – closure of recreation areas, damage to road and rail infrastructure, road closures (e.g. Molesworth Road), fire risks, algae bloom in rivers, lakes and at beaches, reduced air quality from dust and smoke, water shortages, low lake and river levels (less scenic, cancellation of activities), increases in wasps/mosquitoes, fire bans
- **Unseasonal weather** – roads closed by snow (e.g. Milford Road), trap trampers and outdoor recreationists, rescue attempts difficult

Often several of these weather events can occur in unison (e.g. heavy rain and wind) and severe weather events may be very localised. There are also isolated freak weather events that impact on tourists e.g. ‘trampers struck by falling trees’, tornado and lightening strikes, and so on. With a focus in New Zealand on outdoor activities which are reliant on natural resources, tourists are quite vulnerable to weather conditions, while time constraints mean that many international tourists have little scope to change their plans because of weather they encounter. In the case of outdoor activities, media attention is often focused on how prepared international tourists are for New Zealand weather conditions. In New Zealand severe weather events are often very short-lived and for international tourists it is often more a case of good luck than good management as to whether they are affected by extreme weather. For domestic tourists, forecast weather and longer term weather patterns may have more of an impact on their travel plans and holiday experiences. The archive research suggests that weather can impact on all aspects of the tourist experience.

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\(^1\) Using specific dates, places and events and more generic searches using combinations of weather and tourism terms (tourism, tourist, tourist operator, weather, storm, wind, road closure and so on).
3.2 Aspects of tourist experience

- **Transport** – all types of transport and associated infrastructure may be affected by weather events – cruise ships stuck in port, airports closed and flights delayed, ferry crossings cancelled or delayed, roads closed, rail services disrupted, tunnels and bridges closed.
- **Activities** – both commercial and independent activities can be affected – cancellation of scenic flights and boat cruises, both low and high water levels can affect jet boat, rafting and other water based operations, some commercial activities vulnerable to high winds (sky diving, boat trips, bungy jumps etc), impacts on enjoyment of experiences and on tourist safety for independent activities, cancellation of activities can disrupt tourist flows, also some positives when extreme weather adds excitement to activities.
- **Special events** – cancellation of sporting events, concerts and outdoor shows, festivals as a result of extreme weather.
- **Accommodation** – flooding can cause evacuations, camping areas in particular often threatened by flooding and coastal campgrounds threatened by erosion, popularity of some types of accommodation linked to type of weather – e.g. hostels with camping areas more popular in fine weather periods, accommodation prices may rise because of increased operating costs.
- **Wider impacts** – wider impacts on infrastructure that tourism providers must pay for, insurance costs can rise, costs to the taxpayer for infrastructure repairs and rescues, food costs can rise, activity providers sometimes need to provide more equipment for tourist safety and enjoyment.

3.3 What tourist destinations are most affected by climatic events?

The weather events reported occur all over New Zealand and it is difficult to judge which have the most significant impacts. Many destinations offer alternative activities for bad weather and report changes in the types of commercial activities (and to a lesser extent accommodation types) that benefit and lose economically as a result of weather extremes. Adverse weather may also bring a complex set of impacts on tourists as happened when a heavy rain and thunderstorm warning was issued for the Taranaki region in late December 2000. A weather system of prolonged north-westerlies which brought ‘foul sticky weather’ to Taranaki had resulted in the cancellation of a Shell Cup cricket match and the annual Festival of Lights, and 39 Air New Zealand flights had been cancelled since Christmas Eve. Other regions in which tourists are frequently affected by adverse weather include Northland, the Coromandel Peninsula, the West Coast of the South Island and Fiordland – all areas where outdoor attractions and activities prevail. Tourists undertaking outdoor activities independently (i.e. not with commercial companies) have been ‘caught’ by the weather, sometimes with fatal consequences, in all areas with parts of Fiordland and Mt Taranaki being especially hazardous. The weather seldom disrupts water-based commercial activities in Fiordland, but airborne activities are more vulnerable. Land and air-based activities at the glaciers in south Westland are often weather affected.
4 UNDERSTANDING TOURISTS’ RESPONSES TO CLIMATE CHANGE

Part of tourism’s vulnerability to climate change depends on how tourists respond to adverse climatic conditions. If specific climatic events or changes are likely to severely affect tourist arrivals, satisfaction or safety, this would increase tourism’s vulnerability substantially. If, however, it appears that tourists are relatively unaffected by the scale of anticipated changes in weather and climate conditions, then the focus of this research can shift to the supply side, i.e. tourism businesses and destinations. Our research so far is based on:

1. Analysis of International Visitor Survey date with respects to tourists’ highlights, disappointments and recommendations
2. A specifically designed tourist survey
3. Further analysis of historic events and how tourists responded to them (archive).

The analysis thus far indicates that:

- Tourists potentially quite like the changeable nature of New Zealand’s weather although they face some planning challenges associated with unpredictable weather;
- Extreme events are a problem, especially when they lead to the cancellation of activities or transport problems;
- Some destinations, and the activities they offer, are more vulnerable than others to weather impacts;
- There are some safety issues associated with lack of understanding about New Zealand weather conditions; and
- Some types of tourists appear more vulnerable to weather impacts than others.

Overall the research to date on tourists’ perceptions of and responses to expected and experienced weather conditions indicates that the focus should be on extreme events. This means that the analysis of current weather to better understand climate variability is very useful with respects to future changes towards increased variability and a greater likelihood of extreme events. Improved adaptation to variability will be beneficial even under present conditions and without climate change, but will be even more beneficial if climatic changes manifest as predicted. This does not imply that longer-term gradual changes in weather and climate conditions could not also have significant implications on tourism operations (e.g. through affecting natural resources, infrastructure services and costs for service delivery by tourism businesses), but such longer-term changes are not directly perceived by tourists as impacting on their experience.

5 WEATHER AND CLIMATE INFORMATION AS ADAPTATION RESPONSE

The tourist survey and the archive analysis suggested that short term weather information and to a lesser extent average climate and weather information are important for both tourists and for tourism destinations. The newspaper archive analysis, in particular, highlighted a number of ways in which weather information was important for tourism destination promotion, and a considerable amount of attention is given to accuracy of weather information and the ways in which it is disseminated to the public:

- The accuracy of daily temperature highs and regional or destination specific sunshine hours are particularly contentious;
o Forecasting of bad weather – such as continual rain in the west – creates image problems for western regions and, in the far north, long term forecasts of more cyclones than usual over a summer season impacts on visitor numbers;
o Regional forecasts and weather data presented on television are not considered destination specific enough e.g. they give one forecast for the West Coast of the South Island, an area that stretches as far as Wellington to Auckland;
o Newspaper weather forecasts do not provide enough tourist specific information such as tide times, river levels, water temperatures, and so on.

As a result of these findings the archive review was extended to examine the weather information provided on RTO and other tourism websites, including some popular travel blogs and tourism activity company websites. This analysis indicated that:

o The weather information provided on RTO websites was generally poor (often providing little more than average annual or seasonal data) and was often difficult to locate on websites
o The weather material on guidebook websites was sometimes inaccurate
o While Tourism New Zealand provides comprehensive climate data there is no mention of either the prevailing wind direction or the strength of the wind in New Zealand
o The weather most often appears in the FAQ section of tourism company websites and usually concerns rain. Some companies ‘sell’ wet weather as an experience bonus (e.g. for rafting) and yet show photographs with sunshine in their gallery pictures
o There is a considerable amount of weather information and weather questions posted on travel blogs much of it relating to opportunities for participating in independent outdoor activities
o Travel blogs also record some tourists’ disappointment with the weather they have encountered, especially when it has disrupted the operation of planned commercial activities or influenced tourists’ enjoyment of these

Overall, this analysis suggests that better weather information could enhance visitor satisfaction and also safety. There is a real opportunity, especially for regional Tourism Organisations, to provide better service in this area.

6 ASSESSMENT OF CLIMATE SENSITIVITY AND ADAPTIVE CAPACITY OF SPECIFIC INDUSTRIES

A growing body of opinion suggests businesses do not engage with climate change, research on climate changes, etc., as these considerations are seen to be outside their time and business management horizons. To counter this failure by business to engage with the issues, we (and others) argue that any such research needs to approach businesses in a way that makes it relevant to them todayvi. For this reason we propose using existing climate variability and tourism business adaptation to this as a base surrogate for climate change research in the same spacevii. To this end we propose exploring two areas:

1. Impact of climate variability on tourism businesses: We first want to know the relationship between tourism business and the natural environment, i.e., how much
do they rely on it? We then want to know the seasonal patterns of business-environment links because seasonality and NZ climate variability, are closely related. What we then want to know is which parts/elements of the climate most influence tourism businesses, and the extent of that influence. Once we have determined these factors then we need to know how often 'events', e.g., extreme periods of wet, dry or very windy weather) need to occur to influence, positively or negatively, such businesses, and the nature of those effects, e.g., very positive effect, no great effect, highly detrimental effect? What would happen to businesses if the frequency of negative seasons were to double or triple, or if positive seasons were to double or triple? We can use this information to build a picture of current impacts and use this in association with change forecasts to consider what might happen under climate change scenarios.

2. **Current adaptations to climate variability**: Given the above, we then want to explore how tourism businesses adapt to the positive and negative climate variability events. We will assess how businesses currently adapt to low, moderate or high impact +ve or -ve events, i.e., what strategies they employ in such circumstances. Then we want to know the effect of such strategies on tourism businesses, economically. Following that will be an investigation of what such strategies would mean socially, environmentally and culturally - these are possibly more difficult to fill out, but that is fine and is context dependent. Again we expect the sum of these adaptation strategy evaluations, in association with climate change predictions, to inform us on the likely nature of potential adaptation strategies and their probable effectiveness over the four forms of well-being defined above.

3. **Time horizons and external constraints on adaptation options**: The ability of businesses to adapt to further changes in climate variability and extremes requires that those in a position to make adaptation decisions are in fact able to do so. Effective decisions require access to relevant information, and an ability to recognise and overcome external constraints. For example, snow making may be an effective adaptation option for some time, but requires additional water storage and management of increased spring water run-off. Regional regulations and competition for water could thus constrain such choices. In addition, some adaptation measures may require greater lead-time or periods over which they operate to be cost-effective. Our research will therefore aim to address such constraints and the role of different planning horizons to assess the viability of adaptation options over the next several decades.

7 **STEPS FROM HERE**

The information presented above will serve as background information to three stakeholder workshops. One workshop will be held in Wellington to receive feedback from national level stakeholders. Two more workshops will be held at a regional level, ideally in those regions where we will undertake more detailed case study research.

The Wellington workshop will seek feedback on the overall framework developed for this study and its key focus areas, as well as the selection of case studies for more detailed evaluation of vulnerability. Factors that we wish to discuss with workshop participants in selecting case studies include:
1. Level of climatic change in their area and their likely exposure to it;
2. Their importance to tourism (volume and economic value);
3. Their market mix (i.e. do they have more or less climate-sensitive tourists);
4. The sensitivity of their particular industry to climate variability and change;
5. Maori perspectives
6. Their adaptation potential and constraints

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