Chapter 10

Implications of Climate Change for Tourism Demand

The influence of climate change on tourism demand patterns will be shaped by the response of tourists to the complexity of the impacts on destinations as discussed in Chapter 9. Climate, the natural environment, and personal safety are three primary factors in destination choice, and global climate change is anticipated to have significant impacts on all three of these factors. Climate is also a principal driver of seasonality in demand, which has been described as one of the most problematic features of the tourism industry. Climate change will alter seasonal tourism demand by creating, deteriorating or improving climatic conditions at destinations and in source markets. As indicated, tourists have the largest adaptive capacity in the tourism sector, because of their ability to respond to climate change impacts by substituting the place, timing and type of holiday; even at very short notice. Tourists are expected to adapt to the impacts of climate change by ‘voting with their feet,’ with potentially profound implications for patterns of tourism demand at the local and regional scale. Currently there is a very wide choice of destinations and travel experiences on offer and climate factors will play an increasing role in the travel decisions of tourists.

Understanding and anticipating the potential geographic and seasonal shifts in tourism demand is of keen interest to the tourism industry and is the subject of this Chapter. Because the impacts of climate change on destinations and tourism demand are so closely interlinked, and to facilitate cross-connections with Chapter 9, this Chapter is similarly structured to examine the potential influence of four major types of climate change impacts on tourism demand:

- direct impacts of a changed climate;
- indirect impacts of environmental change;
- mitigation policy and tourist mobility; and
- societal change (economic growth and social-political stability).

Illustrative examples of projected changes in tourism demand are drawn from around the world, including mountain, islands and coastal areas, and natural-cultural heritage areas.

10.1 Consumer Response to a Changing Climate

A number of lines of evidence demonstrate the intrinsic importance of weather and climate for tourist decision making and the vacation experience. Weather and climate are of universal importance in defining destination attractiveness and a central motivator in the selection of a holiday destination and the timing of holiday travel. Warmer temperatures and greater sunshine have been found to influence travel patterns (proportion of domestic and international holidays) and tourism expenditures in some temperate nations. There is also evidence that the weather conditions experienced at the destination have important influence on overall holiday satisfaction. As climate is an important resource sought after by tourists, projected changes in the distribution of climate resources are anticipated to have important consequences for tourism demand.
10.1.1 Changes in Global Demand Patterns

Simulation models have been used to explore the potential impact of climate change, in conjunction with population growth and per capita income and other variables included in the IPCC SRES scenarios, on aggregate international tourism demand, and generate scenarios of the potential geographic redistribution of tourist departures and arrivals. These models are necessarily highly simplified and have important limitations (see Box 19). \[533, 534, 535\] The general geographic patterns of projected changes in tourism flows are summarized below in Tables 10.1 and 10.2.

Anticipated impacts include a gradual shift in preferred destinations to higher latitudes and to higher elevations in mountainous areas. Tourists from temperate nations that currently dominate international travel (e.g., Northern Europe) are expected to spend more holidays in their home country or nearby, adapting their travel patterns to take advantage of new climatic opportunities closer to home. This shift in travel patterns would have three important implications: proportionally more demand for temperate nations, proportionally less demand for warmer nations which are now highly frequented by tourists from temperate regions, and a net reduction on the total number of international tourists. In warmer countries, the reverse would occur, as these nations would attract less tourists from temperate regions and would have increased outbound travel.

Table 10.1 Ranking of countries with highest and lowest proportional change in tourist arrivals with climate change in 2025 *

<table>
<thead>
<tr>
<th>Highest proportional increase in arrivals</th>
<th>Lowest proportional increase in arrivals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canada</td>
<td>Mauritania</td>
</tr>
<tr>
<td>Russian Federation</td>
<td>Mali</td>
</tr>
<tr>
<td>Mongolia</td>
<td>Bahrain</td>
</tr>
<tr>
<td>Iceland</td>
<td>Qatar</td>
</tr>
<tr>
<td>Finland</td>
<td>Senegal</td>
</tr>
<tr>
<td>Zimbabwe</td>
<td>Kuwait</td>
</tr>
<tr>
<td>Norway</td>
<td>Niger</td>
</tr>
<tr>
<td>Zambia</td>
<td>United Arab Emirates</td>
</tr>
<tr>
<td>Sweden</td>
<td>Gambia</td>
</tr>
<tr>
<td>Republic of Korea</td>
<td>Chad</td>
</tr>
</tbody>
</table>

* Data for 1995 arrivals and departures for the 207 nations included in the study were derived from World Resources Database 2000–2001. World Resources Institute, Washington, DC. These data are not necessarily consistent with UNWTO data used in this report (Chapter 9 and 11). Population and economic growth scenario data are taken from the 17 region IMAGE 2.2 model implementation of the SRES scenarios. The climate change scenarios for the IPCC SRES emission scenarios were derived with the FUND (Tol 1999) and COSMIC (Schlesinger and Williams, 1998) models, and represent the average-minimum-maximum of 14 GCMs.

Source: Hamilton, J. M. et al. (2005b)

The macro-economic effects of these broad changes in geographic patterns were assessed with a general equilibrium model. A net negative macro-economic impact have been found for three regions: the ‘European Union’; the ‘Energy Exporting nations’ group, which include many Arab nations; and the ‘Rest of the World’ category of nations, which includes the Caribbean. China and India were expected to be largely unaffected, though with slightly positive changes in tourist numbers. Net gains were projected for North America, Australasia, Japan, Eastern Europe and the former Soviet Union. The aggregate global economic impact of a climate change-induced change in tourism demand was concluded to be quite small in 2010, but by 2050 could become a non-negligible loss under higher emission scenarios. \[536\]
### Table 10.2 Regional changes in international departures and arrivals in 2050

<table>
<thead>
<tr>
<th>Region</th>
<th>Arrivals</th>
<th>Departures</th>
<th>Macro-economic impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>USA</td>
<td>Decline (-)</td>
<td>Decline (+)</td>
<td>Increase (+)</td>
</tr>
<tr>
<td>EU</td>
<td>Decline (-)</td>
<td>Decline (+)</td>
<td>Decline (-)</td>
</tr>
<tr>
<td>EEFSU</td>
<td>Increase (+)</td>
<td>Decline (+)</td>
<td>Increase (+)</td>
</tr>
<tr>
<td>JPN</td>
<td>Decline (-)</td>
<td>Decline (+)</td>
<td>Increase (+)</td>
</tr>
<tr>
<td>RoA1</td>
<td>Increase (+)</td>
<td>Decline (+)</td>
<td>Increase (+)</td>
</tr>
<tr>
<td>EEex</td>
<td>Decline (-)</td>
<td>Increase (-)</td>
<td>Decline (-)</td>
</tr>
<tr>
<td>CHIND</td>
<td>Decline (-)</td>
<td>Decline (+)</td>
<td>Increase (+)</td>
</tr>
<tr>
<td>RoW</td>
<td>Decline (-)</td>
<td>Increase (-)</td>
<td>Decline (-)</td>
</tr>
</tbody>
</table>


Source: Berrittella, M. et al. (2006)

These aggregated results mask many sub-regional changes, such as the anticipated redistribution of tourists from southern to middle-northern Europe and from southern to middle-northern North America, as well as the potential restructuring of tourism seasons, such as a strengthening of current shoulder seasons in the Mediterranean or other regions where peak summer months might be considered uncomfortably hot by a majority of tourists in the future (see Box 17).

### Box 17 Will the Mediterranean be too hot for tourism? Sorting out the science from the science siction

A number of media stories have foretold the major threat that increased future summer temperatures poses for tourism in the Mediterranean. Indeed some stated that “The likelihood [is] that Mediterranean summers may be too hot for tourists after 2020” and that “[…] by 2030, the traditional British package holiday to a Mediterranean beach resort may be consigned to the ‘scrap-heap of history.’”

Little is known about what tourists perceive to be ‘too hot’ for any particular tourism destination. The limited information on what tourists define as optimal temperatures for beach holidays however indicates that the daily maximum temperatures in many Mediterranean destinations are currently near the optimal range in July and August (Figure 10.1). Under the lower range of warming scenarios for 2071–2100 (+3°C) warming, average daily maximum temperatures at four of the destinations in Figure 10.1 would only exceed the optimal perceived temperature for a beach holiday by about 1–2°C, which is unlikely to significantly deter visitation. It is possible however, that media coverage of extreme heat waves may have a greater impact on perceptions of climate suitability for tourism in the Mediterranean (see Box 17).

At the higher end (+6°C) there is a notable departure between the perceived optimal temperatures for a beach holiday and the projected maximum summer temperatures at all five destinations in Figure 10.1. Importantly, no such summer warming scenarios are projected until the later decades of the century and only under high emission scenarios. Furthermore, the projected number of weeks with heat waves (temperatures of over 35°C) increased by one or two through mid-century. Whether this increase is sufficient to alter tourist perceptions of the Mediterranean is uncertain. Improved summer climate conditions in major source markets for Mediterranean tourism (i.e., Northern Europe) may have a greater impact on travel patterns than climatic changes at Mediterranean destinations.

by mid-century. A more imminent climate change threat to tourism in parts of the Mediterranean is likely to be a diminishing water supply and increasing risk of forest fires.

**Figure 10.1 Average July-August daily maximum temperatures and preferred beach holiday temperatures**

<table>
<thead>
<tr>
<th>Location</th>
<th>1961-1990</th>
<th>2071-2100 (range of 10 RCMs with A2 scenario)</th>
<th>Optimal temperature for beach holiday</th>
</tr>
</thead>
<tbody>
<tr>
<td>Athens</td>
<td>25° C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Barcelona</td>
<td>30° C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Iraklion</td>
<td>35° C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nice</td>
<td>25° C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Venice</td>
<td>25° C</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Box 18 The impacts of the 2003 summer heat wave on tourism in France**

During the first two weeks of August 2003, France was struck by the most severe heat wave since 1873. The heat wave was not only exceptional by its temperatures (15% of meteorological stations recorded temperatures exceeding 40° C), but also by its length. It was associated to serious, though not exceptional drought, in spring and the beginning of summer (causing forest fires) and to a lack of wind towards its end. The best known impact was the rise in mortality (nearly 15,000 deaths) 550, but it also had consequences for economic activities including tourism.

Shifts in destinations were noted; some of which have been documented by tourism statistics. The hotels on the northern and northwestern shores benefited from additional customers, while the opposite occurred in the Mediterranean and the southwest. The central mountains accommodated holiday makers leaving the southern shores – camping sites with shade and swimming pools were most favoured. Attractions such as caves also benefited from increased visitation. The heat was also detrimental to urban tourism. There were some modifications in consumption habits across the whole population: more light meals, more mineral water (+18%), more soft drinks (+13%), more ice creams (+14%) and less clothing sold. 551

There were impacts on environmental resources that were detrimental to tourism: access was denied to forests (risk of fire) or to some mountain sites, some streams dried and the quality of recreational water deteriorated; fishing was forbidden over large parts of the country, so was canoeing and sometimes bathing. Restrictions on the use of water were severe (irrigation of lawns, swimming pools, etc.). Other vulnerabilities were discovered in the transportation and accommodation sectors. The number of trains arriving on time dropped from 87% to 77% often because their cooling systems broke down. The refrigerating systems at one quarter of the food trade (restaurants and markets) enterprises proved insufficient to cope with such heat. A very significant portion of accommodation proved uncomfortable, whereas the increased need for space cooling was confronted by difficulties in the production of electricity and by breakdowns in the network due to excessive heat. 552 Though no catastrophic failures in the power grid occurred, the situation was considered very critical and it would certainly have been worse if more tourist accommodation had been equipped with space cooling.
If institutional holiday flexibility were to increase in the future (e.g., moving to a year-round school schedule with interspersed holidays), the overall impact of climate change may reduce demand seasonality by evening out visitation levels across a larger number of months. Europeans, for instance, would be able to extend their demand over a longer period, with holidays in spring and autumn concentrating on the Mediterranean region and that in the summer months concentrating on the more northerly regions. If the institutional context for holidays remains largely the same as today, the geographic redistribution of tourism is likely to be intensified, because the temporal redistribution of tourists is restricted. Destinations would become uncomfortably hot in the peak summer travel season could experience decreased visitation, with little or no compensation in the shoulder seasons. The countries that would experience better summer conditions, on the other hand, could benefit from large increases in visitation, without being able to shift some of this additional demand to the shoulder seasons which are also climatically improved for tourism. 553

Box 19 The challenges and uncertainties of long-range global scale demand modelling

Statistics-based models (used to explain or predict travel flows) express the behaviour of tourists as a function of a given set of variables, such as ‘average temperatures at destination’, ‘travel costs’, etc. While these models can be indicative of travel behaviour, they may also have large error margins, as there are potentially many aspects that can influence holiday decision-making, while models usually account for only a few. Such models also forced to generalize to a great extent, as databases may not always differentiate between different climate zones in one country, business- and leisure-travellers, or travel motives (say a beach holiday, urban sightseeing-shopping trip, ecotourism holiday to see polar bears, or visiting friends- and relatives) which may require different climatic conditions or be less influenced by climate-related variables. Moreover, there are scientific uncertainties regarding the role of perceptions in decision-making (i.e., to which extent a change in a given parameter like temperature will really result in travel behaviour adaptation). Some of these aspects are discussed in more detail below.

Data on tourism demand: According to the UNWTO/United Nations Recommendations on Tourism Statistics, ‘Tourism’ is defined as “[…] the activities of persons travelling to and staying in places outside their usual environment for not more than one consecutive year for leisure, business and other purposes not related to the exercise of an activity remunerated from within the place visited.” The use of this broad concept makes it possible to identify tourism between countries as well as tourism within a country. ‘Tourism’ refers to all activities of visitors, including both ‘tourists (overnight visitors)’ and ‘same-day visitors’. UNWTO collects, on a regular basis, data on several indicators of tourism demand including: international visitors arrivals (including overnight visitors, i.e tourist, same-day visitors and cruise passengers), as well as number of guests and overnights stays in accommodation units both for inbound and domestic tourism. Nonetheless, despite the considerable progress made in recent decades, international tourism statistics are often not uniform, because definitions and methods of data collection tend to differ.

Temperature and weather information: Temperature is often assumed to be the most important weather parameter in the analysis of tourism flows, because outside a certain temperature range, weather perceptions become unfavourable and problems of discomfort arise. While it is not to question that temperature is a very important weather parameter, there is evidence that other weather parameters are also important, sometimes equally as important as temperature, including wind, rain or hours of sunshine. 554 These parameters are not necessarily correlated to temperature which thus cannot be considered as a satisfactory proxy. It is also uncertain of when temperatures are perceived as being ‘too hot’ by the majority of tourists. The representation of climate within such models is admittedly crude; often using the temperatures of capital cities to represent entire nations (i.e., Washington, DC represents Florida and California) or annual average temperatures, so that no shift in seasonal visits can be accounted for.

Weather extremes: Many weather parameters are predicted to change slowly over time. However, while such averages can be measured and incorporated into models, it is less straightforward to assess the consequences of weather extremes, such as heat- and cold waves, prolonged periods of
rain or drought. Experiences with such phenomena in Europe in recent years suggest that extremes can have a substantial influence on travel patterns.

**Terrorism, war, epidemics, natural disasters, environmental change:** All of these could have impacts on travel behaviour. Immediately after the terrorism attacks of 11 September 2001, many tourist reservations were cancelled and international tourism was diminished for months to follow. The second Iraq war is an example of military conflicts impacting on tourism demand. SARS, as an example of an epidemic, had substantial influence on tourist flows in Asia and Canada in 2003, and the tsunami hitting South Asia in December 2004 cost hundreds of thousands of human lives, and has had devastating consequences for tourism destinations involved, at least in the short-term. Environmental change leading to altered landscapes, changes in biodiversity, the spread of diseases (Malaria, Lyme-disease, etc.), or organisms perceived as disturbing (ticks, mosquitoes, algae, various insects) are also likely to influence the perception of destinations (Chapter 9). For example, Iceland is projected to be one of the biggest tourism ‘winners’ as a result of a changed climate (Table 10.1), but this cold water island has seen substantial tourism growth because the combination of glaciers and volcanoes makes this island so attractive. If the glaciers diminish substantially or disappear, the attractiveness of the landscape and this destination may be irrevocably altered, while projected warming will hardly make Iceland the new Majorca.

**Weather anomalies:** Heat- and cold waves could have a considerable and unpredictable influence on tourism in the future. The summer of 2007 showed largely varying weather patterns deviating substantially from previously observed long-term averages. This included, for instance, prolonged periods of drought in Southern Europe, and periods of intense rainfalls and flooding in Central and Northern Europe. Swedish media reported on tourists being stuck in their rented summerhouses, as heavy rainfall made it impossible to leave houses. In Seychelles, prolonged periods of rainfall in the supposedly driest month (July) impacted on tourist’s satisfaction. Diving conditions deteriorated, as visibility in coastal waters was reduced to a few metres.

**Costs of transport:** Mobility is a precondition for tourism and worldwide. According to UNWTO’s data some 45% of all international tourist arrivals are now by air. Air travel consumes large amounts of fuel, and is thus partially dependent on the availability of oil resources as well as on rather stable world market prices for fuel. Oil prices are currently high and are anticipated by many experts to generally increase in the years and decades ahead as so called ‘cheap’ oil supplies are conservatively expected to peak within the next 40 years and post-Kyoto Protocol policies on GHG emissions may also indirectly increase oil prices.

### 10.1.2 Changes in Regional-local Demand Patterns

The possible response of tourists to changing climate conditions and the implications for demand has also been assessed for a range of specific tourism sub-sectors at the regional and local scale.

**Visitation to national parks**

Illustrative of the expanded opportunities associated with an improved and expanded warm-weather tourism season in temperate regions is projected nature-based tourism in Canada’s system of national parks. Tourism in many of the parks in Canada and the northern USA is constrained by winter conditions, except where skiing operations exist. Assuming that other socio-economic factors that influence park visitation (e.g., desire to interact with nature, travel costs, amenity requirements) remain relatively constant, Canada’s national parks are anticipated to have higher visitation under a warmer climate. Assuming little change in visitation patterns, with an extended warm weather tourism season, total annual visits to the national parks analyzed were projected to increase by approximately 6 to 8% over the next thirty years. Annual visits by mid-century could increase between 9 and 29%. With further warming by the end of the century, the number of people visiting these parks is projected to increase 10
to 41%. Of course, demographic change (population increase) or socio-economic change (increased or decreased desire to interact with nature, travel costs to parks or other alternate holiday destinations for both domestic and international tourists) would also influence visitation patterns in the decades ahead. The interaction of these factors remains an important area of analysis to better understand how tourism demand may evolve under climate change.

Although visitation to Canada’s national parks is projected to increase system-wide under climate change, there are important regional and seasonal differences in the projected magnitude of increase. Parks on the Atlantic Ocean (Prince Edward Island and Cape Breton Highlands) were projected to experience the largest increases, with visitation levels potentially doubling in late century under the warmest climate change scenarios. Most of the parks are projected to experience the largest increases in visitation during the spring (April to June) and fall (September to November) shoulder seasons, with minimal increase during the traditional peak months of July and August Banff National Park, for instance, is projected to experience average spring increases in visitation of 19% and average fall increases of 16% under the warmest climate change scenario compared to an average increase of only 5% during July and August (Figure 10.2). Changes in the seasonal timing of increases in visitation will influence a range of management issues, including user-fee collection, environmental operations and staffing needs.

The projected increase in visitation (an additional 1 to 4 million visitors annually by mid-century) would generate substantial growth in park revenues and the economies of nearby communities. Increased visitation could also exacerbate visitor-related ecological pressures and crowding issues at popular park attractions in high visitation parks. Under a changed climate, more intensive visitor management strategies may be required to support sustainable tourism in these parks and prevent the degradation of visitor experience.

**Figure 10.2 Change in average monthly visitation to Banff National Park (Canada) in mid-century**

![Graph showing changes in visitation](source: Scott, D. and Jones, B. (2005))

**Climate change implications for golf tourism**

The golf industry is economically one of the largest recreation sectors in the world and an increasingly important tourism sector. Golf is projected to be highly influenced by climate change because it will alter the length of the operating season, influence seasonal and total golf demand, require increased turf management (i.e., irrigation, turf grass selection and turf disease and pest management), and threatens some of the world’s historic coastal courses through sea level rise and erosion.
Climate change has been identified as an important issue by leading golf organizations around the world. Drawing on the input of over 250 golf industry stakeholders, the Golf Course Advisory Panel at the Royal and Ancient Golf Course of St. Andrews (Scotland) identified climate change as one of six strategic issues facing the golf industry over the next twenty years. More recently, the World Rules and Golf Development Committee of the Royal and Ancient Golf Club of St. Andrews stated, “Every national governing body and golf facility should be finding out more about climate change predictions for their region, and starting to anticipate the effects on golf.”

Currently there remains limited information on the potential impacts of climate change on the golf industry. A survey of golf course managers in the UK found that 69% believed their course is facing serious threat from erosion and/or flooding in the next 50 years. In Canada, climate change was projected to have a positive impact on the length of the golf season and on overall golf demand. In two important golf holiday destination areas, the golf season was projected to lengthen considerably by mid-century: 25 to 86 days longer north of Toronto (Great Lakes Region) and 28 to 56 days longer in the Province of Prince Edward Island (Atlantic Coast). Assuming that other socio-economic factors that influence golf demand (e.g., social popularity of golf, travel costs and playing fees, demographics, golf course supply) remain relatively constant, by mid-century, annual rounds played in these two locations were projected to increase by 27% to 61% and by 48% to 74% respectively (Figure 10.3). As illustrated in the pattern of daily rounds played in Figure 10.3, much of this growth was expected in the shoulder seasons. Assuming little change in other factors that affect demand patterns, changes in the season length and increased annual demand, these two locations are likely representative of the types of changes that can be expected throughout central and eastern Canada as well as major golf markets in northern US states in the New England and Mid-West regions. Longer golf seasons in these regions would alter competitive relationships between major golf destinations in the south, diminishing the ‘push factor’ to winter golf tourism destinations in the southern United States (e.g., Myrtle Beach, Palm Springs, Phoenix and Las Vegas). Golf has the potential to offer greater possibilities for proximity leisure in the future, which may be important in a era of higher travel costs for sports tourism.

Figure 10.3 Climate change impacts on golf demand in Canada (annual and seasonal increases) (a)

(a) The analysis was conducted with two global climate models (NCAR-PCM – from the National Center for Atmospheric Research in the USA and CCSRNIES from Japanese Centre for Climate Research Studies) each run with different GHG emission scenarios (B2 – lower emissions and A1 – higher emissions), so as to represent the full range of climate futures in each of the study areas.

Climate change would also pose challenges for the operation of golf courses, particularly under the warmest climate change scenario. As the climate warms, there will be increased demand for irrigation to keep turf grass in optimal playing condition. This increased demand for water is likely to create or
intensify water allocation conflicts in tourism regions with limited water resources, such as the southwest US, Mediterranean, Australia. Indeed, the golf industry in Las Vegas has already opposed planned water restrictions, arguing that 3 in 10 tourists to the city spend time golfing and that the restrictions would impact the entire tourism economy. Aspects of pest and disease management could also be impacted by projected changes in the climate, posing challenges to the maintenance of playing conditions. Insect pests that currently have only one life cycle in some regions could begin to have two life cycles under warmer conditions. Similarly, turf grass diseases and pests currently limited to southern latitudes could also expand northward and require management interventions, although there are other pests whose burden could diminish in some regions (e.g., fusarium patch, snow scald, red thread, typhula blight).

**Figure 10.4 Climate change might favour some regions for golf tourism development, and constrain others**

“The golf industry’s significant sensitivity to weather will make it one of the first to feel the impacts of increasing weather uncertainty due to climate change. As a result, we anticipate the industry to be impacted in the near-term as the old paradigm of business and financial planning around predictable and cyclical weather patterns may be disrupted by an increasingly volatile climate. [...] certain geographic markets are already facing these challenges [...]”

WeatherBill Inc. (2007)

**Winter sports**

As identified in Chapter 9, winter sports tourists are faced with the prospect of less natural snowfall and shorter, more variable ski seasons in the future. A critical question for the future of the ski industry and closely associated tourism operators is how tourists might respond to these changed conditions and what will happen to overall demand in the tourism marketplace. Insight into these questions comes from several nations.

Marketplace surveys with skiers have been conducted in Australia and Switzerland to determine how skiers would change their skiing patterns if climate change conditions were realized (described as poor snow conditions existing over five years). In Australia, 25% of respondents indicated they would continue to ski as often in Australia, while 31% said they would ski less often, but still in Australia. An even greater portion of skiers would be lost to the Australian ski industry, with 38% of respondents indicating they would substitute destinations and ski overseas (mainly in New Zealand and Canada) and a further 6% would quit skiing altogether. With 44% of the ski market potentially lost and 31% skiing less often, the implications of climate change for Australia’s ski industry appear ominous. Whether the remaining skiing demand would be sufficient to sustain the ski industry in Australia remains an important uncertainty. A similar investigation with Swiss skiers found that 58% would ski with the same frequency (30% at the same resort and 28% at a more snow reliable resort at higher elevation).
Almost one-third (32%) of respondents indicated they would ski less often and 4% would stop skiing altogether. No similar surveys have been conducted in other European nations, so it is uncertain whether these results can be generalized to the European ski market.

An assessment of the national ski industry in Japan (61 ski areas) estimated that reduced snowfall at ski areas resulting from a 3° C warming scenario would reduce overall skier visits by 30%. Ski areas in southern regions were considered the most vulnerable, with skier visits falling by 50%. Conversely, the impact of climate change on skier demand was projected to be negligible in some northern high altitude ski areas.

In eastern North America, a climate change analogue approach has been used to understand the potential response of the ski tourism marketplace to future climate change. The winter of 2001–2002 was the record warm winter throughout much of the region and approximated the normal temperatures expected in mid-century under a mid-range warming scenario (approximately +4.5° C). Skier visits during this record warm winter were consistently lower than in the previous climatically normal winter of 2000–2001: –11% in the Northeast ski region of the US, –7% in Ontario, and –10% in Quebec. Although this finding is not surprising considering the ski season was approximately 20 days shorter in the record warm winter, what is somewhat surprising is how small the reduction in skier visits was during this climate change analogue season. It was observed that utilization levels at ski areas increased, as many skiers in the region adapted by skiing more frequently than in a normal year (i.e., skiing every weekend, instead of every two weeks). Notably, skier visits declined the least at larger ski areas, suggesting that skiers may have adapted by selecting ski areas that generally have greater snow-making capacities and diversified tourism products. It is uncertain whether this same pattern of adaptation would occur if consecutive years of poor snow conditions occurred. Future analogue events may provide insight into this question.

10.2 Demand Implications of Climate-induced Environmental Change

It is important to emphasize that it is the holistic impact of climate change on tourism environments that tourists will respond to, not just changes in climatic conditions. Tourism demand at the regional scale will also be affected by the range of environmental impacts brought about by global climate change. Environmental change is a particular risk for destinations where nature-based tourism is a primary tourism segment and ecosystems are highly sensitive to climatic change. This Section focuses on two such destination types: coral reefs and alpine landscapes.

Coral reefs

Recent coral bleaching events and the imperilled future for many coral reefs under climate change are a cause for concern for diving and other related tourism. Unfortunately, there is limited information about how tourists responded to the severe coral bleaching that occurred in many reef systems around the world in 1998.

A case study from El Nido, Philippines does provide some insight into the response of different tourist market segments to coral bleaching and degraded reef environments. In El Nido and nearby islands, severe coral bleaching in 1998 led to 30–50% coral mortality and a typhoon that same year (also linked to El Niño) caused further damage to local reefs. Whether divers or not, most tourists (95%) coming to El Nido have at least some interest in the local marine environment. However, general awareness of coral bleaching among tourists was found to be low (44%). The bleaching event did not impact budget tourist arrivals, but fewer budget tourists went diving during their stay. The impact at resorts, some of which cater to the high-end dive market, was much worse. The annual economic losses were estimated to be US$ 6–7.4 million over the next ten years, concurrent with coral recovery timeframe. If however there is no significant coral recovery or a bleaching event reoccurs, the economic losses increased to between US$ 15–27 million.
Another study\textsuperscript{577} found that there may be large differences between dive destinations. In this case study of Mauritius, it was found that the state of coral reefs was largely irrelevant to dive tourists and snorkellers, as long as a certain threshold level was not exceeded. This threshold level was defined by visibility, abundance and variety of species, the occurrence of algae or physically damaged corals, and was not exceeded in the case study, despite the fact that considerable damage had already occurred. However, this will probably depend upon the type of divers attracted by a destination. Experienced divers making conscience decisions for certain dive sites can be assumed to be more critical about climate change related damage of coral reefs than holiday divers partaking in diving as sideline activities.

In other coastal locations, the impact of climate change was also projected to adversely affect tourist preferences for these destinations. In Bonaire and Barbados, more than 75\% of tourists were unwilling to return for the same holiday price in the event that coral bleaching or reduced beach area occurred as a result of climate change.\textsuperscript{578}

Although the climatic conditions for tourism in northern Germany are projected to improve,\textsuperscript{579} a survey of tourists found that when presented with scenarios that described potential impacts of climate change on the coastal areas and marine life on the German coasts of the North and Baltic Seas, respondents were less likely to intend to spend their main vacation at these destinations.\textsuperscript{580}

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{image.png}
\caption{Coral bleaching in the Great Barrier Reef} 
\end{figure}

\textbf{Box 20  Coral bleaching and Great Barrier Reef tourism}

The Great Barrier Reef has experienced several mass coral bleaching events in the past decade (1998, 2002, 2006). During the 1998 global mass bleaching event about 50\% of Great Barrier reefs suffered bleaching; 87\% of inshore reefs and 28\% of mid-shelf and offshore reefs. Overall, about 5\% of reefs were severely damaged by this bleaching event.\textsuperscript{581} The Great Barrier Reef suffered the largest mass bleaching event on record in 2002, when 60\% of reefs were bleached.\textsuperscript{582} The response of tourists to these bleaching events remains unknown and an important area for future market research. A survey of tourists in Cairns (North Queensland, Australia) asked if they would visit the region if they knew that there had been a recent bleaching event – 29\% were uncertain and 35\% indicated they would not.\textsuperscript{583}
Increases in surface water temperatures are projected to occur more frequently in the future under climate change scenarios. Coral bleaching events are likely to increase in frequency and severity and are therefore thought to be one of the most serious long-term threats to the Great Barrier Reef and its massive tourism industry. The increasing threat of coral bleaching under projected climate change scenarios triggered the Great Barrier Reef Marine Park Authority to prepare a Coral Bleaching Response Plan \(^584\), with the objectives to:

- improve ability to predict bleaching risk;
- provide early warnings of major coral bleaching events; measure the spatial extent of bleaching;
- assess the ecological impacts of bleaching;
- involve the community in monitoring the health of the Reef;
- communicate and raise awareness about bleaching; and
- evaluate the implications of bleaching events for management policy and strategies.

### Alpine landscapes

The perceived quality of the alpine environment is an important attraction for tourism in mountain regions and there have been repeated warnings about the potential negative effects of environmental change to reduce the attractiveness of the mountain landscapes to the extent that tourism may be adversely impacted. \(^585\), \(^586\), \(^587\) The limited knowledge of how tourists might respond to changes in sensitive mountain landscapes comes from the Rocky Mountain region of North America.

When presented with hypothetical scenarios of how the landscape might be affected by climate change over the next 30–50 years, the responses of tourists in three national parks (Rocky Mountain National Park – USA, Glacier-Waterton Lakes International Peace Park – USA and Canada, and Banff National Park – Canada) were remarkably consistent. When asked how the specified changes in the mountain environments would have affected their intention to visit that park, the majority of visitors indicated that they would not change their visitation patterns. In Rocky Mountain National Park, visitor response to the environmental changes resulted in a 10 to 14% increase in annual visitation under scenarios of moderate warming, while the ‘extreme heat’ scenario would cause a 9% decline in visitation. \(^588\) The environmental change scenarios constructed for the early and mid-decades of the 21st century were also found to have minimal influence on the intention to visit Glacier-Waterton International Peace Park or Banff National Park, with almost all visitors still intending to visit the parks and 10% indicated they would visit them more often, presumably due to improved climatic conditions. \(^589\), \(^590\) There is also the potential that media coverage of melting glaciers might motivate more people to visit these parks over the next 20–30 years to personally see or show children the glaciers before they disappear and in order to witness the impacts of climate change on the landscape. This market trend is already being observed in some areas of Alaska, including Kenai Fjords National Park, where the chief range has described climate change as one of the new major themes for the park. \(^591\) If such an increase in visitation is realized, it would require adaptation to accommodate larger numbers of visitors and provide new public education about the changes in natural heritage that are occurring.

In the studies that attempted to look at the potential impacts of greater environmental change, an important threshold was reached for many visitors to Glacier-Waterton International Peace Park and Banff National Park in scenarios that might occur by the end of the 21st century. A substantial number of tourists (19% in Glacier-Waterton and 31% in Banff) indicated they would not intend to visit the parks if the specified environmental changes occurred. The projected loss of glaciers in the region was noted as a significant heritage loss and the most important reason cited for not intending to visit the park in the future. Another 36–38% of tourists indicated they would plan to visit less often. Visitors most
likely to be negatively affected by climate-induced environmental change were long-haul tourists and
ecotourists, motivated by the opportunity to view pristine mountain landscapes and wildlife. As such,
the impact of environmental change was more pronounced in Banff National Park, which has a much
greater number of international tourists. If realized, such impacts would require these destinations to
adapt to very different impacts of climate change.

Of course the findings from the aforementioned North American studies cannot be generalized to
other mountain regions, and similar research on visitor responses to environmental change needs to be
conducted in mountain regions around the world, particularly in developing nations where tourism is a
vital component of local or regional economies.

It seems, overall, that despite concerns that climate-induced environmental change may adversely
impact the aesthetics and hazards in mountain tourism destinations, \textsuperscript{592, 593, 594} the temporal scale
of these changes are such that, with the exception of a few high profile tourism attractions (e.g., well
known glaciers or snow capped peaks like Mt. Kilimanjaro) or some key tourist market segments (e.g.,
expert mountaineers), the eventual impact on visitation to mountain parks and mountain destinations
more broadly may actually be minor as the frame of reference of mountain landscapes evolves in
future generations of tourists. The perception of some contemporary visitors that the landscape would
be degraded from a former state if the specified environmental changes occurred, may not be shared
by a visitor born in the 2040s who has no experience with the former condition. It therefore remains
uncertain if the stated behavioural intentions of contemporary visitors would translate similarly to visitors
a generation from now, who may have never experienced the attributes that current visitors used to
define the quality of these mountain landscapes for their tourism experience. Arguably the 20th century
offers some historical analogues for visitor perceptions of changing mountain landscapes. For example,
the ice caves in Glacier National Park, the US portion of Waterton-Glacier International Peace Park, were
an important tourist attraction in the 1930s, but melted decades ago so that contemporary tourists have
no experience with these ice caves or any perception that the park landscape is less attractive than that
of a previous more pristine state. More generally, glaciers have been melting and vegetation responding
to warmer temperatures throughout the European Alps and North American Rocky Mountains over
the last half of the 20th century and these environmental changes have had no known impact on
visitation levels to these regions. Contemporary visitors still value these mountain landscapes and the
recreation opportunities they provide, even though they are different than in previous decades. \textsuperscript{595} This
interpretation is of course debateable, as others might argue that landscape values and preferences are
relatively stable between contiguous generations.

\textbf{Box 21 The importance of tourist perceptions of climate impacts}

The perceptions of future impacts of climate change are likely to play the central role in the
decision-making of tourists and tourism investors alike, as perceptions of climate conditions or
environmental changes are just as important to consumer choices as the actual conditions.
Perceptions of climate change impacts in a region are often heavily influenced by the nature of
media coverage. For example, market surveys found that media coverage of the three hurricanes
that hit parts of Florida in August and September 2004 had created an impression that the entire
state was heavily damaged. Reservation cancellations went up sharply and one in four tourists
were less likely to plan to visit Florida between July and September in the following years. \textsuperscript{596}
Tourists were unable to distinguish between areas that had been damaged and those that were
unaffected by the hurricanes. The drought and resulting wildfires in the state of Colorado (USA)
in 2002 provides a similar example of perceptions based on media coverage being as damaging
for tourism as actual impacts of the climate event. Media coverage of major fires in some parts of
the state and a misstatement by a senior government official who said that “it felt like the whole
state was on fire” had a significant impact on summer tourism, with visitor numbers 40\% lower
in some areas of state, even well away from fire affected areas. \textsuperscript{597} In both Florida and Colorado,
the state governments and tourism industry spent millions of dollars on marketing campaigns to
inform consumers that the climate impacts were isolated. Similar effects have been observed as a
result of wildfires in Portugal, Spain and France in recent years.
The impact of extreme events such as storms, drought and wildfires on tourist perceptions of a destination are likely to be short-lived and thus the recovery period relatively quick. Other climate change impacts are likely to be more enduring in the minds of consumers and may over time widely alter the perceived attractiveness of a destination. The expansion of geographical areas susceptible to the transmission of vector-borne diseases, such as malaria and dengue, to popular tourism destinations where these diseases are not now prevalent is one such example. How would travellers respond if required to take malaria medication to go to the Azores, South Africa, Cuba or Mexico in the future? Traveller response to media coverage of regional outbreaks and perceived changes in disease risk could have important implications for travel patterns and remains an important area for further research. Similarly, in the absence of credible information and recurrent exposure to messages that the Mediterranean is or will soon become too hot for comfortable holidays may eventually lead some consumers to accept this notion, especially if it is combined with education campaigns on the increased risk of skin cancer. While the effectiveness of public relations and marketing campaigns to avoid or correct consumer misperceptions about climate impacts is uncertain, this is likely to be an indispensable adaptation strategy for the tourism industry and governments alike.

10.3 Demand Implications of Mitigation Policies and Tourism Mobility

National or international mitigation policies – that are policies that seek to reduce greenhouse gas emissions – have an impact on tourist behaviour in two ways. First, policies, especially market-based instruments, will lead to an increase in the costs of travel. Second, policies can foster environmental attitudes that lead tourists to change their travel patterns.

Tourism transport providers and especially the airline industry seek to improve their fuel efficiency to reduce their costs and offer more competitive prices. At the same time climate change initiatives such as carbon trading are likely to increase transport costs and this may well outweigh economic savings achieved through efficiency gains. 599 Recognition should also be given to the manner in which various transport sectors are approaching mitigation, either through their own initiative or via mandatory participation in incentive-based systems. Notwithstanding regional and unilateral efforts, such as the proposed inclusion of aviation in the EU ETS, which would require certain emission targets for all aircraft operating within and to the EU to be met, industry groups such as ICAO and IATA have called for more global measures that would act outside of incentive-based mitigation schemes. 600

A number of studies have analysed the price sensitivity of air passengers, and the results vary considerably. 601 Overall, it appears that leisure travellers are more price sensitive than business traveller), and short-haul travellers are more sensitive to price increases than those on long-haul trips. The reason for this is that there are more choices and possibilities for substitution for shorter trips compared with long ones. 602 Also, tourists who can afford long-distance holidays are likely to be wealthier than average. Research also found that tourists are more likely to adjust their behaviour (i.e., travel less by air) in response to higher prices in the longer term rather than immediately. This means that an increase in airfares may not have an immediate effect (i.e., tourists cannot change their plans quickly), but over time tourists may learn to avoid the pricier option of air travel and become more savvy in alternative transport options (e.g., trains).

The perception of transport, and in particular air travel, in relation to its carbon footprint is possibly more important than tourists’ responses to price changes. Recently, there has been substantial media coverage on this topic, for example:

- ‘What is the Real Price of Cheap Air Travel?’, The Observer, 29 January 2006
- ‘It’s a Sin to Fly, Says Church’, The Sunday Times, 23 July 2006
- ‘Flugreisen als Klima-Killer’, Abendblatt, 6 July 2004
The growing awareness of the potential environmental impacts of air travel is reflected in a number of opinion polls. A British survey found that the proportion of respondents that believed ‘air travel harms the environment’ increased from 62% in 2002 to 70% in 2006. The same survey found that 64% agreed that that ‘the price of a plane ticket should reflect the environmental damage that flying causes, even if this make air travel a bit more expensive.’ However, support dropped to 47% when the inclusion of environmental damage ‘makes air travel much more expensive’ (33% disagreed). The British Social Attitudes Survey from 2003 to 2005 also found consistently low support (15–18%) for unlimited air travel if it harms the environment. Notably support for unrestricted air travel increased to 78% if ‘damage to the environment was limited’.

Public opinion polls have also identified varied ‘willingness to pay’ to offset the environmental consequences of air travel. The aforementioned British survey found 69% would be willing to pay some additional charge to reflect environmental costs, with 52% stating a willingness to pay an extra 20%. In a recent survey of Canadian travellers, 76% reported that they would pay C$ 10 or more for every C$ 1,000 spent on airfares to offset carbon emissions when travelling by air, while 18% would be willing to pay C$ 40 or more. Similarly, TripAdvisor, the world’s largest travel community, recently surveyed more than 1,000 (largely eco-) travellers worldwide: 24% of respondents said that air travel should be avoided to help preserve the environment; 38% of travellers surveyed were willing to pay more to take an eco-friendly flight and 26% were willing to pay a premium of up to 10%. Only 3% of travellers surveyed, however, have actually purchased carbon credits. These uncertainties about the ‘willingness to pay’ to offset greenhouse gas emissions from travel are important and reveal the need for further market research to understand the real potential for mitigation through off-setting and the impact of other forms of mitigation policies on future air travel.

The growing media and consumer awareness of the environmental impacts of air travel and in some cases a willingness to pay to offset or reduce impacts are a signal that customer behaviour may be about to change, and the tourism industry and tourism ministries need to begin to put in place measures to reflect this concern and take actions to help shaping the tourism market to reduce climate change impacts from which the sector suffers itself, and to lead by example.

One way of reducing the footprint of a destination is for tourists to travel less and stay longer when travelling, an option that has been featured by the tourism and travel media. For example Mark Ellingham, the founder of Rough Guides, and Tony Wheeler, who created Lonely Planet, encourage tourists to ‘fly less and stay longer’ and donate money to carbon-offsetting schemes. They urge their readers to: “ […] join to discourage ‘casual flying’”. This may mean that tourist destinations have to revisit their tourism forecasts, marketing strategies and targeted markets in the light of these new trends. It remains to be seen at this point in time if tourists’ attitudes translate into actual changes in behaviour, for example reducing the number of flights or the widespread use of carbon offsetting schemes.

Long-haul destinations are particularly concerned about impacts on tourism demand. The Australian government and Australian Tourism Export Council, for example, have expressed concern that ‘growing guilt over the impact of jet flights on global warming’ could adversely impact the nation’s tourism economy. Similar concerns about the impact of ‘anti-travel’ sentiments in Europe and the costs of carbon taxes or other mitigation policies have been expressed in other Asian and Caribbean long-haul destinations as well. Tourism destinations are currently seeking to position themselves and address growing concerns over air travel. The New Zealand tourism minister said at the 2007 tourism trade show: “We must develop a sustainable tourism proposition so compelling all our visitors continue to feel good about travelling here.”
Organization, while supporting initiatives to achieved reductions in GHG emissions that would reduce the negative impacts on the climate system, propose that “[...] every effort must be made to ensure that future consumer movements and government action in the EU to address climate change [...] do not deter potential European travellers from taking vacations in the Caribbean”, as this could jeopardize the sustainable livelihood of a large proportion of the region’s population. 615

Box 22 Cutting down GHG emissions means reshaping demand: a ‘factor four’ scenario for France 616

The scenario shows that under a constraint of complying with a 75% reduction of GHG emissions nationwide by 2050, maintaining widespread access to holidays and to some extent to long-haul leisure travel are feasible. The scenario accepts a small increase in individual distance travelled per year (12% to 2050), added to the growth in the number of trips resulting from increased population. This choice reflects the positive values related to tourism (contacts between people, economic development, etc.), which are preserved in the scenario. Nonetheless, a reduction of the environmental impacts and a compliance with other dimensions of sustainable development (equity of access to holidays for the less wealthy) imply that such results can only be reached through a considerable redistribution of mobility between the types of trips, transport modes and categories of tourists. For example, overseas travel by air is globally maintained almost at the same volume as in 2000 in this scenario, whereas it would grow at a fast pace in a ‘business-as-usual’ scenario. Another difference is that long-haul trips are more fairly shared: one intercontinental trip a year for 10% of households in 2000 is replaced in 2050 by one intercontinental trip every seven years for 70% of households. The scenario accepts a fall of 20% in the mean distance of trips as long distance mobility diminishes. This is largely a consequence of the level at which intercontinental mobility is maintained, and related to the assumption that exoticism will remain more attractive than traditional European resorts. An increase in outings compensates for the fall in long distance mobility. Leisure near the home is another manner to compensate and this type of mobility doubles by 2050.

In summary, the two main factors in this scenario are a change in tourism/leisure behaviour and habits, and a change in the modal share. Compared to 2000, when train and bus had only 14% of the market shares (in pkm), these two transport modes represent 51% in 2050. Aviation is limited to 19% (pkm) under this scenario to achieve the necessary GHG emission reductions.

10.4 Demand Implications of Climate-induced Societal Change

The economic scenarios of the Stern Review 617 have not been systematically interpreted for the tourism sector, and interpretation of the socio-economic scenarios that are the basis of the IPCC SRES scenarios has also been limited. 618 Although, these are useful resources for tourism, considering the obvious affects of climate change impacts on the economy. When the long-range IPCC SRES scenarios for global population and GDP are considered (Table 10.3), the importance of interpreting the socio-economic scenarios associated with these alternative development pathways in any future long-range tourism forecast like Tourism 2020 Vision 619 is unmistakable. Stabilisation scenarios (see Chapter 8) offer another field of research which is largely unexplored. Setting emission goals for GHG such as reducing by a factor 3 or 4 emissions from tourism in developed countries by 2050 and examining the means to reach them (see Box 22), inevitably leads to drastic changes in demand and tourism patterns since progress in technology and management currently appear likely to be insufficient.

Tourism depends on economic prosperity and socio-political stability. Following the conclusions of the Stern Review on the Economics of Climate Change 620, in the long-term the negative impact of climate change on global economic growth would reduce the discretionary wealth available to consumers for tourism. Tourists are averse to political instability and social unrest 621, 622 and the negative tourism
Implications of Climate Change for Tourism Demand

Demand repercussions for the climate change security hotspots of Sub-Saharan Africa, Southern Africa, Caribbean, Southeast Asia, and Bangladesh-India-Pakistan are very evident. 623

**Table 10.3 Socio-economic characteristics of IPCC SRES scenarios (2000)**

<table>
<thead>
<tr>
<th>1990 Baseline</th>
<th>2100 A1fi</th>
<th>2100 A2</th>
<th>2100 B1</th>
<th>2100 B2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Global population (in billions)</td>
<td>5.3</td>
<td>7.1</td>
<td>15.1</td>
<td>7.0</td>
</tr>
<tr>
<td>Global GDP (in trillions US$)</td>
<td>23.0</td>
<td>525.0</td>
<td>243.0</td>
<td>328.0</td>
</tr>
<tr>
<td>Income ratio between developed and developing nations</td>
<td>16.1</td>
<td>1.5</td>
<td>4.2</td>
<td>1.8</td>
</tr>
</tbody>
</table>

* A description of these socio-economic futures is provided in Box 2 in Chapter 8 and additional details, including regional breakdowns of each indicator, can be obtained in the SRES report from the IPCC.

Source: IPCC (2000)

10.5 Conclusion

With their capacity to adapt to the effects of climate change by substituting the place, timing and type of holidays in their travel decision, tourists will play a pivotal role in the eventual impacts of climate change on the tourism industry and destinations. The evidence available suggests that the geographic and seasonal redistribution of tourism demand resulting from changes in climate may be very large for individual destinations and countries by late-century. The direct affect of climate change might be significant enough to alter major intra-regional tourism flows where climate is of paramount importance, including Northern Europe to the Mediterranean, North America to the Caribbean, and to a lesser extent Northeast Asia to Southeast Asia. However, the net effect of a change in climate on tourism demand at the global scale may be limited, as there is no evidence to suggest that a change in climate will directly lead to a significant reduction of the global volume of tourism. Similarly, the indirect impacts of global climate change, including environmental change and social change, are anticipated to have an important impact on tourism demand for specific destinations, but not affect it at the regional or global level, unless, as some economic analyses indicate 624, global economic growth were to be adversely affected by climatic change.

Information on tourist climate preferences and key thresholds (i.e., ‘what is too hot for a beach holiday’) and tourist perceptions of the environmental impacts of global climate change at destinations (i.e., perceptions of coral bleaching, diminished or lost glaciers, degraded coastlines, reduced biodiversity or wildlife prevalence) remain important knowledge gaps that need to be addressed if potential long-range shifts in tourism demand are to be more accurately projected. There is also limited understanding of how climate change impacts will interact with other longer term social and market trends influencing tourism demand, including: aging populations in industrialized countries, increasing travel safety and health concerns, increased environmental and cultural awareness, advances in information and transportation technology, as well as shifts toward shorter and more frequent holidays.