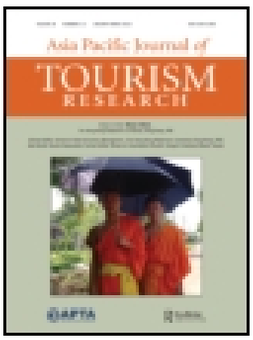

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Climate Change and Tourism: An Overview

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This paper presents an overview of the relationship between tourism and global climate change. On the one hand, the tourism industry may be one of the greatest economic victims of climate change. Yet, on the other hand, the broader tourism sector is also a significant contributor to greenhouse gas emissions. This study traces the evolution of academic interest in tourism and climate change. Growth in this area has tracked growth in interest in climate change in general, with tourism-related papers representing consistently about 0.5% of the published research on climate change.

Key words: climate change, tourism, tourist, consumer

Introduction

It is beyond reasonable scientific doubt that the world's climate is changing and that the change is largely due to anthropogenic sources (Intergovernmental Panel on Climate Change [IPCC], 2007). While there remains a small group of sceptics who dispute anthropogenic causes (see Gladstones, 2011; Plimer, 2009), there is broad consensus among the scientific community about the causes and likely impacts. A vast body of rigorous scientific research supports these claims (McMullen, 2009). What is uncertain is the speed at which change will occur and the extent of that change. The IPCC (2011) predicts that extreme weather conditions will become more acute unless global action is taken to mitigate greenhouse emissions and that global temperatures could rise from between 1.1°C and 6.4°C by 2100. The ultimate level of temperature increase will be determined by the amount of greenhouse gasses (GHGs) that are emitted into the atmosphere in coming decades.

Tourism is not immune to the observed and likely future impacts of climate change. It is

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both a significant source of GHG emissions and also, potentially, a significant victim of changing climate. However, the impacts will be variable, depending on the location of the destination and its readiness and ability to cope with changes. There will be winners and losers (Berrittella, Bigano, Roson, & Tol, 2006). The aim of this paper is to introduce the reader to climate change and tourism by reviewing some of the core literature on the subject. The paper commences with a brief review of the extent to which the atmosphere is warming followed by a review of the evolution of scientific interest in climate change. The paper concludes with a discussion of the position of tourism as a victim, winner or loser in relation to climate change.

Climate Change

There is strong scientific evidence that human action is a key driver in the current warming of the atmosphere and that this process will exert a significant impact on humanity in future decades (IPCC, 2007; Stern, 2006). The IPCC states explicitly that "warming of the climate system is unequivocal (IPCC, 2007, p. 30)" and that "most of the observed increase in global average temperatures since the mid-twentieth century is *very likely* due to the observed increase in anthropogenic GHG concentrations (IPCC, 2007, p. 39)". The current phase of climate change appears to be a direct result of economic growth (Sathaye & Andrasko, 2007) in the period commencing with the Industrial Revolution. Current climate change is a direct result of increasing emissions of GHGs, including carbon dioxide (CO_2), methane (CH_3), Ozone (O_4), sulphur hexafluoride (SF_6) and nitrous oxide (N_2O). The single greatest contributor is the burning of fossil fuels (coal, oil, and gas). Agricultural activities (IPCC, 2007) are also a major contributor as is deforestation. Slash and burn deforestation, for example, is common in many parts of the world and contributes directly to CO_2 emissions, while the reduction in forest cover reduces the earth's ability to absorb CO_2.

Atmospheric levels of CO_2 have risen from 280 ppm (parts per million) at the beginning of the Industrial Age in the nineteenth century to 390 ppm in October 2011 (WMO, 2011). Moreover, between 1990 and 2010, there was a 29% increase in radiative forcing – the warming effect on our climate system – from GHGs (WMO, 2011). If the current trend in emissions' growth continues, CO_2 levels could reach 1,000 ppm by 2100, leading to a possible increase in global temperatures by 5°C or more (IPCC, 2007). While part of the recent increase in atmospheric CO_2 is the result of the rapid economic growth of India, Brazil, China and other emerging economies, the developed world continues to produce the greatest amounts of CO_2 *per capita*. In 2008, the five largest emitters of CO_2 were China (32.3%), USA (18.1%), the combined EU (14.4%), India (5.8%) and Russia (5.7%) (UNEP, 2011). The *Guardian* newspaper published an "An atlas of pollution: the world in carbon dioxide emissions" that summarizes the latest data on emissions by economy (Guardian, 2011). It can be downloaded from http://image.guardian.co.uk/sys-files/Guardian/documents/2011/02/10/CarbonWeb.pdf.

Global action to combat climate change has been slow and formally commenced with the Kyoto Protocol initially adopted in December 1997. Under the protocol, 37 developed countries and the European Community agreed to reduce four GHGs (CO_2, CH_3, N_2O and SF_6) and two types of gasses (hydro-

fluorocarbons and perfluorocarbons) by 5.2% on average for the period 2008–2012 relative to base year emissions in 1990. Developing counties including China and India were exempt from emission reduction. The USA did not ratify the Protocol, greatly reducing its effectiveness. Despite the Kyoto Protocol, global emissions have continued to increase. One of the reasons international agreement has been slow is that politicians in many countries have found it difficult to show leadership in combating climate change based on the fear that binding targets for greenhouse emission will hamper domestic growth. As a consequence many have employed a "blame game" strategy calling on other countries to act first before they act. Fortunately, the most recent attempt (the seventeenth session of the Conference of the Parties to the United National Framework Convention on Climate Change (UNFCCC) held in Durban, South Africa in late 2011) has had some success, with an agreement that a legally binding deal comprising all counties be prepared by 2015 to take effect in 2020.

A wide range of ecological, social and economic impacts are beginning to be observed and unless mitigation is able to successfully arrest or at least slow the rise in global temperatures in the near future, significant economic and ecological costs will ensue (IPCC, 2007; Stern, 2006). Observed and likely future impacts have been discussed widely by global organizations (IPCC, 2007; UNEP, 2011; UNFCCC, 2007), government agencies (DCCEE, 2011; EC, 2011; EPA, 2011; HKO, 2011) conservation groups (NC, 2011) and the popular press (Biello, 2007) and need not be reviewed here in detail. As the climate changes, no area of the world will be spared. Thermal expansion of the oceans and melting ice caps will contribute to rising ocean levels and the flooding of low-lying areas and islands. They may also reduce the water supplies to many areas that rely on mountain runoff as their main source of water. More severe droughts are expected at middle latitudes. Changes in ocean circulation patterns will affect temperature and rainfall, affecting food production. Increased malnutrition and disease are likely as well as increased mortality from extreme weather events including increasing heat waves in summer. Furthermore, we can expect even greater rates of species extinction as well as widespread loss of biodiversity (Pittock, 2005).

Evolution of Scientific Interest in Climate Change

There is a rapidly growing corpus of refereed publications that consider an almost bewildering range of climate-associated issues ranging in scale from the micro to the macro. The most influential publications to date have been the reports published by the IPCC in 1990, 1995, 2001 and 2007 with a fifth report due in 2014. The IPCC reports synthesize the scientific and related literature to bring together in one publication a balanced view of the current state of knowledge about climate change. The fourth IPCC Report (2007) cited over 6,000 peer-reviewed publications and was itself reviewed by 625 expert reviewers.

The evolution of research about climate change can be illustrated by using the "Scopus" database. The Scopus database contains over 46 million records, including almost five million conference papers and journal articles within 19,000 titles published by 5,000 international publishing houses (Scopus, 2011). The comprehensive data base includes 25 million records dating from 1996 and over 21 million records prior to that. Interest in climate change grew slowly

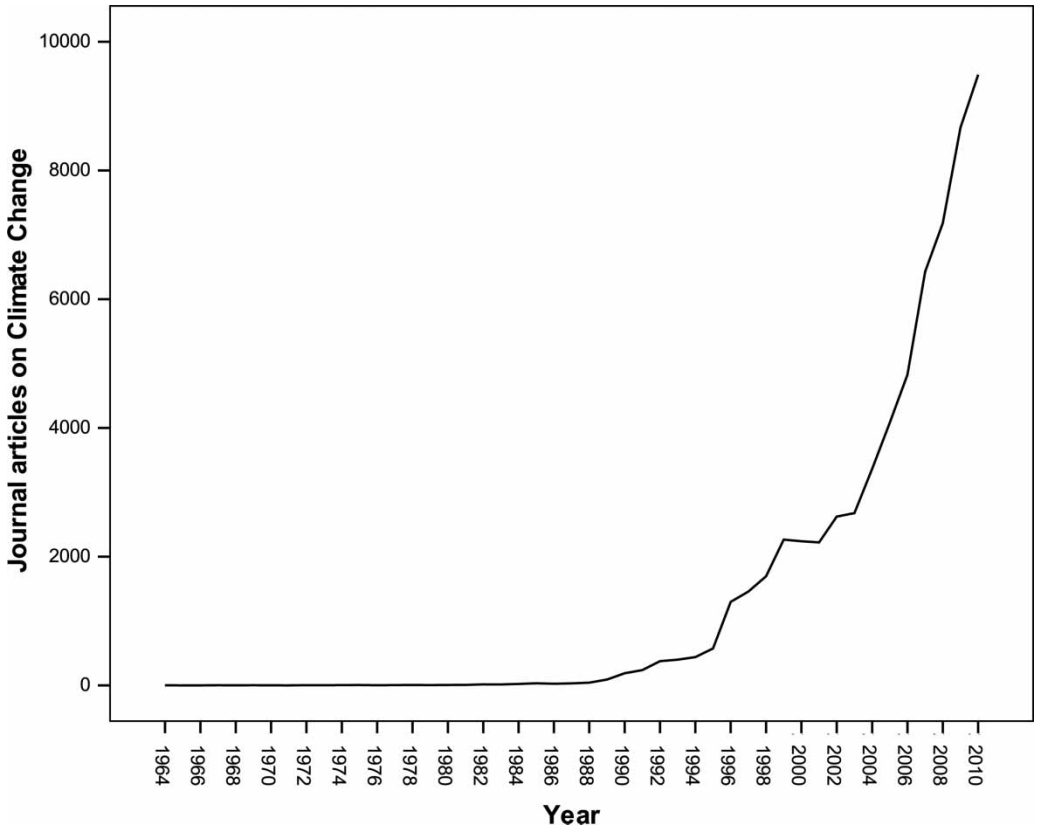

Figure 1 Number of Journal Articles on Climate Change Per Year
Source: Scopus.com

through the 1970s and early 1980s (Figure 1). Fewer than 10 papers a year were published in the 1970s, while, typically, between 15 and 30 papers a year were published in the early to mid-1980s. However, interest in the topic grew strongly in the early 1990s, with the number of journal articles jumping from 90 in 1989 to 573 in 1995. A geometric rise in published research has been noted since then, with more than 9,700 academic journal articles published in 2010.

The earliest published academic study on the link between anthropogenic CO_2 emissions and climate change was written by Svante Arrhenius in 1896 (Arrhenius, 1896). Later, Lockyer (1910) wondered if the climate of India was changing, but could not answer the question definitively due to a lack of longitudinal data. Newspaper stories also appear to have discussed this issue as early as 1937 (McDermott, 2009). Modern interest in climate change began in 1970 when Benton (1970, p. 899) concluded, prophetically

> Climate varies naturally, for reasons which are only poorly understood. Superimposed on natural climatic change are variations due to man, primarily

as a result of the increase of carbon dioxide and particulate pollution. At present, the natural causes of climatic change are probably more important than the effects of man-made gaseous and particulate pollution. However, the balance is changing as industrialization, urbanization, and transportation continue to grow at an accelerating rate. Some years from now, man will control his climate, inadvertently or advertently. Before that day arrives, it is essential that scientists understand thoroughly the dynamics of climate.

First generation papers were remarkably prescient in their identification of both the causes and potential consequences of climate change, even though the authors were working within an information vacuum due to limited data sets and the modest climate models available at the time. As such, early research tended to raise the issue and signal a warning for the future. Matthews (1973) reported on the findings of a "Study of Man's Impact on Climate" conducted in 1971 involving 30 scientists from 14 countries. The study sought to develop a consensus concerning the present and future scale of human activities that may affect the global temperature and concluded that human activity was having an impact but that many knowledge gaps existed that needed to be filled. Rotty (1973), analysing data from the Mauna Loa Observatory in Hawaii, concluded that while atmospheric CO_2 concentrations were at the time not at levels to cause great alarm, continued heavy dependence on fossil fuels would lead to observable climate changes in the next few decades. Landsberg and Machta (1974) also commented about the increased risk of noticeable climate change in the early parts of the twenty-first century due to the combinations of the greenhouse effect, global population increase and industrialization. Kunen (1976) felt that warming trends noted in the Southern hemisphere may indicate the onset of a CO_2-induced greenhouse effect. Bolin (1977) was more cautious when he suggested that the need to study the extent the climate of the earth is being influenced by energy production obviously represents an important aspect of the total environmental problem. Broecker (1975, p. 190) was more blunt when he wrote "it is possible that we are on the brink of a several-decades-long period of rapid warming".

The level of interest, sophistication of research methods, methodological accuracy and breadth of coverage has grown steadily since then, culminating in the production of various reports by the IPCC (2007), and its various supporting documents, a compendium of more than 400 scientific research studies (McMullen, 2009) and various national and stakeholder studies on climate change, including tourism (UNWTO-UNEP-WMO, 2008).

The Tourism Industry and Climate Change

The tourism industry is in the unique and unenviable position of being simultaneously a major contributor of GHGs and a significant victim of changing climate. Research on the relationship between tourism and climate lagged significantly behind that of other studies on climate change. Again, the Scopus database identifies 440 journal articles on this topic. As shown in Figure 2, the body of literature has grown exponentially in the past few years, from a handful of papers published up to the mid-2000s to more than 100 papers a year at present. The first appeared as a "viewpoint" commentary in the journal *Land Use Policy* only in 1990 (Smith, 1990). Giles and Perry (1998) have the honour of being the first to publish a paper on climate change in a tourism-specific

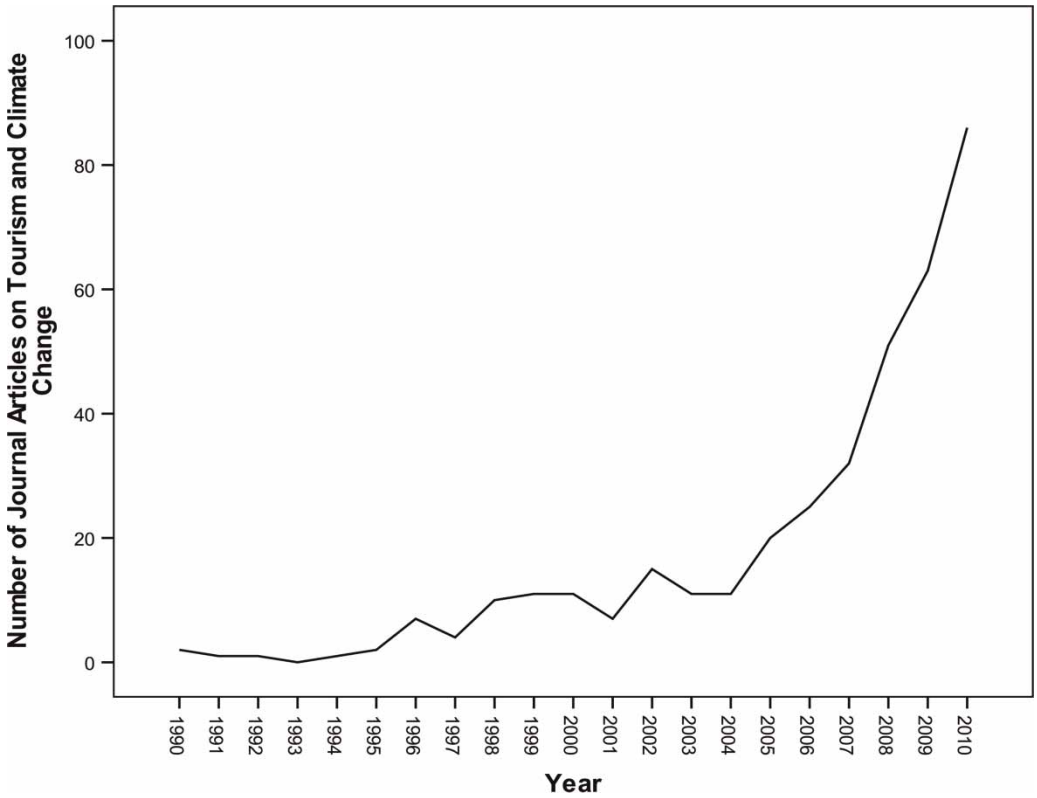

Figure 2 Published Journal Articles on Tourism and Climate Change
Source: Scopus.com

journal, with Harrison, Winterbottom, and Sheppard (1999) being the second authors to do so. It should also be noted that Wall (1998) was the first recognized tourism academic to write on this topic, publishing a paper on the potential impact of climate change on wetland tourism in the journal *Climate Change*, focusing primarily on the ability of tourists and businesses to adapt to the effects of climate change.

Interestingly, the share of tourism-related papers has been consistent over the last 20 years, representing about 0.5% of all works published on climate change. Fewer than 20 papers were published prior to 1998, all in non-tourism-specific journals and covered such topics as snow cover, coral reef damage and ecosystem damage in tourism areas. Some 76 journal articles were published between 1998 and 2004, with all but seven appearing in non-tourism-specific titles, though, with most of them focusing on how ecosystem change or ecological degradation may affect tourism. Since then, about 350 journal articles have been published in more than 160 journals, with about 85 appearing in tourism and/or hospitality titles. The *Journal of Sustainable Tourism* has published the largest number of works with 27 papers.

Variable Impacts on Tourism: Tourism as Victim, Winner or Loser

It is obvious that as a weather-dependent industry, tourism will be affected by climate change. Scott et al. (2008) in their report commissioned by the UN's World Tourism Organization classified the range of climate change impacts on tourism into the five categories of direct and indirect impacts of climate, possible changes to tourist mobility, destination vulnerability and social impacts.

Early research tended to focus on tourism as a potential victim of climate change, although it was recognized that impacts would be uneven, potentially benefiting some destinations. This "Victim, Winner, Loser" theme has continued to dominate much of the research agenda to the present. For example, the abstract to Smith (1990) sets the tone for much research to follow when he wrote:

> [in] a higher CO_2 world, the overall volume of tourism, the pattern of outdoor pursuits, the degree of customer satisfaction and even the levels of safety in some environments are all likely to change… winter sport and beach holiday facilities will be directly threatened by global warming and sea level rise. Enhanced temperatures in the mid-latitudes may well reduce the relative attraction of some Mediterranean and longer-haul destinations, especially if areas like the Caribbean become more prone to hurricanes.

His paper also raised a number of other critical issues, including the lack of interest shown by the tourism industry in exploring its atmospheric sensitivity and little real awareness of the social, economic and managerial challenges posed by climate change. He discussed not only impacts in destination areas, but also the importance of the originating market's climate, showing a direct link between a wet and cold summer in England and an increase in travel to Portugal in the subsequent winter. He suggests that warmer weather within the originating region may also convince more people to take domestic holidays. The impact of climate change on tourist satisfaction also features in this paper, where he suggests that tourists will become more discriminating as they become aware of the impact of climate on the quality of recreational experiences.

Studies focusing on the theme of tourism as victim expanded on these topics. Low-lying touristic islands may become inundated (Maddison, 2001), while demand during the summer peak season in places such as Spain, France, Italy, Greece and Turkey may fall as temperatures exceed comfortable levels (Amelung, Nicholls, & Viner, 2007). Coral-reef-dependent destinations will also come under pressure as coral bleaching reduces their appeal (Hoegh-Guldberg, 1999). Williams, Bolitho, and Fox (2003) have warned that the biodiversity of rainforests will also suffer as temperatures increase. Extremes in weather may also affect the appeal of certain Australian destinations due to hotter weather, more intense rainfall, but less precipitation overall, a greater risk of fire and a greater risk of severe cyclones (TourismReview, 2009). Golfing destinations that rely on plentiful water supplies may be affected by a decline in rainfall (UNWTO-UNEP-WMO, 2008). Cultural heritage sites in Italy have been damaged by landslides due to floodwaters, and the Chan Chan Archaeological zone in Peru has been affected by intense precipitation (Lollino & Audisio, 2006).

The ski industry is particularly at risk (Abegg, Agarwal, & deMontfalcon, 2007; Elsasser & Buerki, 2002), especially low-altitude resorts. In the European Alps, for

example, areas covered by naturally occurring snow could decline by between 61% and 91% (depending on the climate model used) (UNWTO-UNEP-WMO, 2008). As a result, Elsasser and Buerki (2002) suggest that only 44% of existing Swiss ski resorts will remain viable within a few decades. Both Bicknell and McManus (2006) and Pickering (2011) came to a similar conclusion when studying the skiing sector. Bicknell and McManus (2006) believe Australia's is the "canary in the coalmine" as far as skiing goes, for it will be affected first by climate change. Pickering (2011) observed that the number of visitor-days to low-altitude resorts fell by as much as 86% at the lowest altitude, cross country skiing resorts, while total visitor-days increased at higher-altitude resorts, even though the actual number of visitors fell. In particular, falling revenue and visitor numbers may reduce incomes to the extent that the costs of offsetting declining snowfalls with snowmaking will no longer be commercially viable.

After studying various climate scenarios in the Caribbean, Moore (2010) concluded that extreme weather events could affect the hotel infrastructures as well as tourist attractions, while on the demand-side a change in climatic features could lead to a shift in visitor patterns. In particular, the study determined that in a worst-case scenario, tourist arrivals could fall by about 1% per year, costing the region about US$118 million to US$146 million in lost revenue per annum. Arrivals to Bermuda, Jamaica and Trinidad and Tobago could fall by about 5% per annum due to the effects of climate change.

Unpredictable weather further makes trip planning difficult and may lower visitor satisfaction. If weather conditions change or become volatile, tourists may either shift to other destinations or simply stay home (Pack, 2004; Perry, 2006). The advent of social media and on-line booking agencies has reduced the travel planning window. In the future, tourists may rely more on last-minute bookings, once they are more certain that the weather in their preferred destination is appealing.

The impacts of a changing climate will be felt unevenly, leading Scott, McBoyle, Minogue, and Mills (2006) to suggest there would be winners and losers in the skiing sector as some resorts cease to operate and demand is shifted to those that are more climate-resilient. Rebetez (2011) further found a significant correlation between the number of nights spent in mountain resorts in the summer and hot temperatures at lower elevations. The study concluded that warmer temperatures may extend the summer season. In a similar manner, Amelung et al. (2007) also predicted that some Mediterranean destinations may see shifts in their peak seasons from summer to current shoulder season. Giles and Perry (1998) noted that an unusually hot summer of 1995 led to a revival of many British seaside resorts and a subsequent decline in overseas travel. Harrison et al. (1999) ran a series of climate models to predict the future of tourism in Scotland and concluded that sunnier summers, coupled with no real noticeable decline in winter snowfall, led to a positive outlook. Buzinde, Manuel-Navarette, Yoo, and Morais (2010) further suggest that tourists may be more willing to accept changed conditions than previously thought. Their study of a destination suffering from severe beach erosion found that while some people were disappointed, many others were psychologically prepared for what they were going to encounter upon arrival and coped well.

Indeed, the most likely scenario is that climate change will result in a redistribution

of tourists from more to less climate-sensitive destinations (Scott, McBoyle, & Schwartzentruber, 2004), affecting destination choice (Hamilton & Lau, 2004), vacation satisfaction (Williams, Dossa, & Hunt, 1997) and destination competitiveness. Bigano, Bosello, Roson, and Tol (2008), studying the possible impacts of sea level rise and tourism flows, concluded that shifts in tourism arrivals would favour Western Europe, Japan, Korea and Canada and penalize all the other world regions, but that the overall impact on GDP will be minimal. Other studies suggest that tourists from Germany, the UK and Ireland will shift to domestic travel (Hamilton & Tol, 2007; Taylor & Ortiz, 2009), helping to revitalize many destinations. The shift to domestic travel may benefit the local industry, but could exert severe adverse economic consequences on small island nations that are economically dependent on tourism (Hamilton & Lau, 2004). The extent of redistribution may also be affected by various governmental policy and tax regimes (Becken & Hay, 2007), especially if proscriptive carbon taxes make long-distance travel less affordable.

An increasing number of studies suggest that the impact of changes depends greatly on the flexibility demonstrated by institutions and tourists to react to climate change. As such, a growing body of literature proposes various strategies to help destination regions mitigate or adapt to the predicted impacts. Scott and McBoyle (2007), for example, discuss a range of existing and potential adaption strategies for the ski sector. Snowmaking has been used since 1952 and is now an integral part of most resort operations. Improvements in technology means that snow can now be made at temperatures above 0°C. Many resorts have also introduced a range of management actions to capture and retain snow, including grass cutting in the off seasons, slope contouring, landscaping and the protection of glaciers. Other initiatives include agglomeration of the industry, more creative marketing, developing three or four season resorts, diversifying businesses and creating additional winter-based recreational facilities.

Jopp, DeLacy, and Mair (2010) developed a framework for regional destination adaptation to climate change (Figure 3) based on an

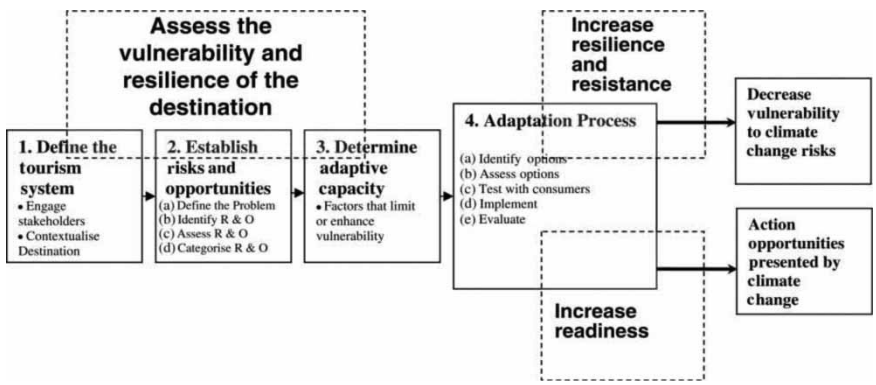

Figure 3 Framework for Regional Destination Adaptation to Climate Change
Source: Jopp et al. (2010)

analysis of existing frameworks. Their two-phase model first involves an assessment of a destination's vulnerability and resilience by defining the components of the tourism system, evaluating risks and opportunities, and then determining the adaptive capacity of the destination. The second phase focuses on increasing the destination's resilience, resistance and readiness with the goal of enhancing its ability to absorb change, reduce the number of impacts that are likely to affect tourism, and, more importantly, be ready to take advantage of opportunities that arise.

Tourism as a Contributor to Climate Change

Tourism is a double-edged sword, being both a victim of and a major contributor of GHG emissions. A growing body of research is also exploring this theme. The United Nations World Tourism Organization (Simpson, Gössling, Scott, Hall, & Gladin, 2008; UNWTO-UNEP-WMO, 2008) estimates that tourism contributed to about 5% of total global CO_2 emissions and up to 14% of all emissions when other GHGs are considered. Some members of industry, though, still appear to be sceptical of this link between tourism and climate change (Gössling et al., 2007). The contributions by sectors are summarized in Table 1.

The contribution of the aviation sector is significant, accounting for up to 40% of total emissions from the tourism industry. Moreover, airborne emissions may be between 1.9 and 5.1 times more harmful than surface-based emissions (Gossling et al., 2007). In particular, the growth of low-cost carriers has added significantly to the total emissions from aviation (Becken & Hay, 2007). Low-cost carriers have changed travel patterns, enabling people who would otherwise take land transport to short-haul distances to fly to medium- and long-haul destinations for about the same cost. The latest UNWTO tourism highlights, for example, indicate over half of international tourists (53%) flew in 2009 (UNWTO, 2010). In Europe, for example, 11% of tourist movements are by air, yet air travel contributes

Table 1 Estimated Emissions from Global Tourism

Sub-sector	Mt-CO_2	Share (%)
Air transport	515	40
Motor vehicles (cars)	420	32
Other transport	45	3
Accommodation	274	21
Other activities	48	4
Total tourism	1,302	100
Share of tourism's contribution to total global CO_2 emissions (%)	4.9	

Source: UNWTO-UNEP-WMO (2008).

46% of tourism-transport-related emissions (UNWTO-UNEP-WMO 2008). Long-haul and frequent travellers, in particular, are identified as the major driving source of CO_2 emissions in the aviation sector (Becken, 2007; Dubois & Ceron, 2006). Long-haul travel, in particular, is seen as being especially unsustainable, leading some journalists to advocate that individuals forsake it for the good of the planet (Millward, 2011).

On the surface, tourism's 5% contribution to GHG appears to be rather small. But, this figure needs to be placed in context. Figure 4 compares the GHG emissions attributable to tourism activities with those of the leading GHG contributing nations. Here, the extent of tourism's contributions becomes clearer. If it was a country, tourism would be the world's fifth leading contributor of GHG, behind only China, the USA, India and Russia, and ahead of countries like Japan, Canada and Germany. It is no wonder then that tourism has become the target of many climate change campaigners, who see it as an example of the type of discretionary activity that could be curtailed without causing undue harm to most individuals.

A number of studies have attempted to identify the carbon footprint of tourism at the national or transnational level (Dwyer, Forsyth, Spurr, & Hogue, 2010). Others have examined the typical carbon footprint of the same market visiting different destinations. For example, Sisman (2007), summarizing

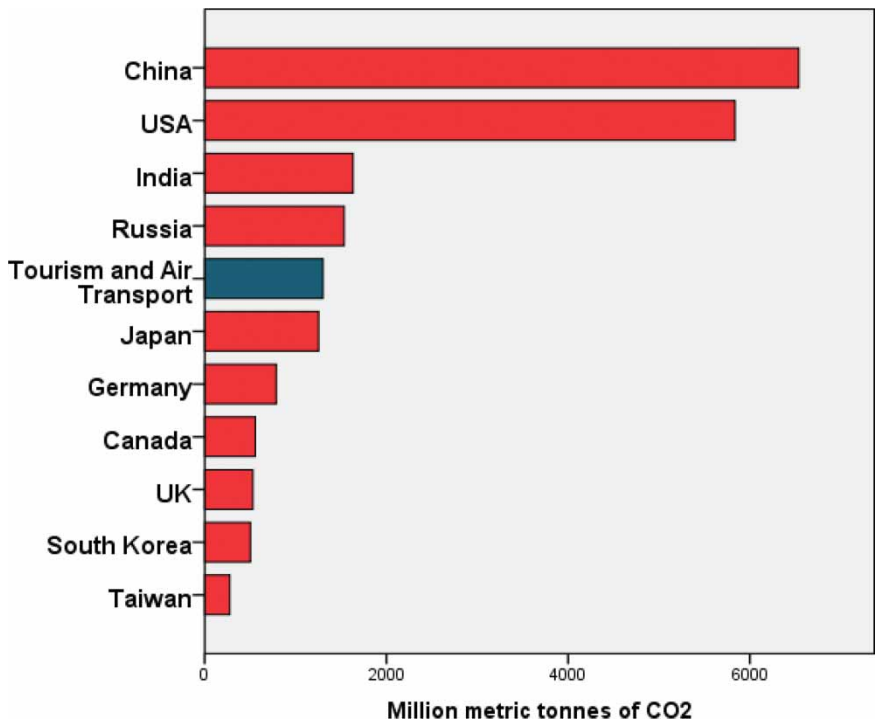

Figure 4 Tourism's Global Share of Carbon Emissions.
Source: Adapted from UNWTO-UNEP-WMO (2008)

various studies, indicated that the carbon footprint per British tourist per bed night in Majorca as 27 kg of CO_2, while it is 66 kg for Cyprus. Gössling et al. (2005) have also calculated the eco-efficiency of various source markets for different destinations. Generally, short-haul markets produce much less GHG emissions per unit of expenditure than long-haul markets. Becken (2002) further estimated that the annual CO_2 emissions attributed to air travel by Hong Kong residents travelling to New Zealand to be in excess of 65 kilotons.

Different styles of tourism exert various carbon footprints. Distance is a critical factor, as are choice of mode of transport and style of accommodation. The European Environmental Agency (2011), for example, indicates that air travel contributes an average of 130 g of CO_2 per passenger kilometre, while the typical passenger car emits 124.5 g/pkh, rail emits 46 g/pkg and coaches 34 g/pkh. Obviously, these figures are estimates and can vary significantly depending on a range of factors, including, but not exclusive of, the age and passenger load of the vehicle, class of passenger (business *vs.* economy), type of fuel used and terrain to be crossed. However, they are indicative of the fact that the two most common forms of transport, airplanes and motor vehicles, are the most polluting.

Different types of accommodation also have different carbon footprints. Full-service hotels have the largest footprints, emitting an estimated 20.6 kg of CO_2 per guest night. This figure is comparable to self-catering flats (19.0 kg), vacation homes and guest houses (15.9 and 14.3 kg, respectively), but far exceeds the estimated carbon footprints of campsites (7.9 kg) and pensions/bed and breakfasts (4.0 kg) (UNWTO-UNEP-WMO, 2008).

Interestingly, the tourist's complicity in climate change has received relatively little attention among academics. Fortunately, this situation is changing. Unless and until the tourist also seeks to travel in a more sustainable manner, tourism's carbon footprint is unlikely to decline. According to most recent estimates, an average tourist trip lasts 4.15 days and causes emissions of 0.25 tCO_2 (UNWTO-UNEP-WMO, 2008). Each typical trip therefore contributes relatively little to overall global emissions; however, the cumulative effect of billions of personal trips is immense. So, are tourists willing to change their behaviour? The short answer is, not yet. A number of studies have suggested that most tourists do not consider environmental issues when planning their trips (Anonymous, 2007; Tourism Australia, 2008), do not consider climate change when making travel purchase decisions (Anable, Lane, & Kelay, 2006; Berman, 2007; Leiserowitz, 2006) and show indifference to airlines' attempts to bolster their environmental credentials through such programmes as carbon offsets (Taylor, 2009a, 2009b). Disturbingly, Becken (2007) found many tourists who were sceptical about the link between tourism and climate change.

This attitude is due in part to ignorance, part to denial and part is attributable to the belief that one's own actions play such an insignificant role that they do not need to change and that instead, others must change first. Becken (2004) notes that few tourists made the connection between causes (e.g. emissions from air travel) and effects (climate change). Dawson, Stewart, Lemelin, and Scott (2010) found that tourists participating in a polar bear viewing experience believed that climate change was negatively affecting the bear population, but they failed to realize that when they were flying to the destinations, they were actually producing CO_2 emissions. Hares, Dickinson, and Wilkes's (2010) and Cohen and Higham (2011) found that British

tourists were unwilling to alter their air travel behaviour.

McKercher, Prideaux, Cheung, and Law (2010) found that people who flew the most were the least willing to change their behaviours, while those who see it as an infrequent activity are most willing to change. The most frequent air travellers supported paying a carbon tax, even though they realized it might accomplish little. Cohen, Higham, and Cavaliere (2011) label these people as binge fliers and liken their engagement in excessive air travel to a form of addiction. Like other addicts, they sacrifice long-term outlooks for immediate gratification.

Becken (2004) explains this phenomenon based on the perceived net benefit to an individual from pursuing an action. She found that where personal benefits are seen to be large, people tend to perceive the environmental consequences of their actions as being less than when perceived benefits are lower. McKercher and Prideaux (2011) offer two alternate explanations. First, people are simply overwhelmed by the number of environmental issues they face and see tourism as a lower-order issue. When asked to list the most important ones, air transport ranked 44th and tourism came in at 56th on the list. Tourism simply is not a high enough priority to engender action. Second, tourism is the quintessential liminal experience where social normal norms can be set aside temporarily, including calls to act in an environmentally sustainable manner. The act of being a tourist symbolically frees the person from such rules.

Dubois, Peeters, Ceron, and Gossling (2010) question the ability of the tourism sector to stabilize its emissions over the long term, let alone reduce them. They illustrate the IPCC calls for a reduction in global GHG emissions of between 50% and 80% by 2050 if climate change is to be arrested. Yet, at the same time, tourism emissions are expected to grow. Their study concludes that "avoiding dangerous climate change leaves room for tourism mobility, but only if a major shift in the use of transport modes is achieved in combination with a reduction in the distances travelled, and the rapid introduction and development of new low-carbon transport technologies (Dubois et al., 2010, p. 1041)". Such a goal can only be achieved if the air transport sector stagnates or adopts new non-polluting fuel with a parallel shift towards other forms of transport such as fast rail. They are rather pessimistic about achieving emission reduction targets unless a series of stringent demand management strategies are introduced, including pricing strategies, individual emissions quotas and ultimately having societies reflect upon the ethics of tourism.

To address this issue, a number of people have suggested we change how we travel. Simpson et al. (2008) suggested that tourists need to be more aware of their choice of destinations, mode of transport and consider joining carbon offset programmes. They also suggested that tourist should travel less often, fly less frequently, choose nearby destinations more frequently and choose environmentally certified businesses. Dickinson, Lumsdon, and Robbins (2011) suggest a move to slower forms of travel. These solutions are fine in principle, but will be difficult to implement as they go against current tourism behaviour. The trend towards short break holidays will continue to increase as hard financial times affect us all. Residents of mature markets who have travelled a lot may be willing to modify their travel behaviours, but it is unlikely that tourists from emerging markets (e.g. the rise in tourism from mainland China) will do so. Instead, their appetite

to see the world as quickly as possible is high, and will continue to grow.

Conclusions

This paper provides an overview of the relationship between tourism and climate change. Its purpose is not to argue against tourism, but to place tourism within a broader climate change context. The tourism sector faces some critical challenges if it is to reduce its carbon footprint, not least of which is the expected continued growth in global tourism for the foreseeable future.

It is apparent that tourism researchers are beginning to pay serious attention to the issue of climate change and the implications that it has for the shape of the tourism industry in the future. It is also apparent that there remain a number of gaps in knowledge and in the ability of tourism researchers to draw on the scientific literature in a meaningful way to provide a more robust foundation for the future study of climate change. Ultimately, the tourism industry will need to comply with new regulations and policies that are likely to be enacted by governments in the future as they seek to deal with climate change. It is apparent that there is a need for researchers to continue to work in this area looking at a range of important issues including the impact of climate change on the industry, the impact of policy, ecological issues and how they will affect the tourism experience, how tourists will react to the impact of climate change and adaptation.

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