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# TOURISM AND CLIMATE CHANGE: SOCIOECONOMIC IMPLICATIONS, MITIGATION AND ADAPTATION MEASURES

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**Abstract**

The relationship between tourism and changing climate has been discussed and studied for a relatively long time in tourism research. Over the past 15 years, more focused studies have begun to appear, and especially recently, the issue of adaptation and mitigation has been emphasized as an urgent research need in tourism and climate change studies. This paper is based on the review of selected articles which discuss the several forms of tourism and climate change and provide recommendations for mitigation and adaptation measures. This review paper assesses the impacts of climate change on the popular forms of tourism such as; mountain tourism, wildlife tourism, adventure tourism, sun/sand tourism; last chance tourism, and describes the extent of tourism vulnerabilities and their implications. The paper concludes that the appropriate adaptation and mitigation measures have to be followed to minimize the risk of climate change while trying to save all forms of tourism. The initiative of this article is to present an overview of the existing literature on the relationship between tourism and climate change in order to establish the current state of corporate and institutional responses within the tourism industry and to set out an agenda for future research. The currency of the review is evident given the recent surge in popular discussion on climate change and its effects on tourism, and the appearance of a broad and disparate array of studies on this topic.

Keywords: tourism; climate change; mitigation; adaptation, socioeconomic

## Introduction

The goal of this review article is to present a comprehensive review of different forms of tourism and their socioeconomic implications in reference to the impacts of climate change. Based on past experiences and best practices, the paper also examines some of the feasible measures that can be adopted to mitigate the climate change effects on tourism. Illustrative examples and references are used to support the arguments.

The tourism industry is a major contributor to global economic development, especially as an employer in developing economies and regions where tourism commonly represents the main source of national income (Bigano et al., 2007; Hall & Higham, 2005). However, tourism is clearly and closely dependent on, and susceptible to, climatic conditions (Giles & Perry, 1998; Agnew & Viner, 2001; Gössling & Hall, 2006). The World Travel Organization has been forecasting about future growth in the global tourism industry, but in spite of this, the tourism industry is experiencing uncertainty, stress and crisis (Bourdeau, 2009). Even the Intergovernmental Panel for Climate Change (IPCC) has not acknowledged the significance of the impact and threat of climate change to the tourism industry, merely briefly mentioning that mountain ecosystems are affected by the changing climate (Warrick et al., 1996). Global climate change has attracted much scientific and public attention in recent years, as a result of fears that human economic activities are leading to an uncontrolled increase in greenhouse gases (GHGs) emissions and concentration in the Earth's atmosphere leading to a global rise in the earth's temperature due to the radioactive properties of these gases (Lama & Devkota, 2009). As mentioned in the IPCC report, global warming is expected to continue, with a projected increase in the range of 1.4 ºC to 5.8ºC by 2100 in comparison to 1990's documentation (IPCC, 2007). As a result of increasing temperature, the changing climate may have a wide range of effects on environmental resources that are vital to tourists, such as snow conditions; wildlife productivity and biodiversity; water quality and levels etc. (Lama & Devkota, 2009). Similarly, along with such climatic changes situations, the probability of epidemic upsurge might intensify in the acceleration of infectious diseases, pollutions, droughts, tropical cyclones, bushfires, and insect and water-borne pests. The occurrences of such consequences at the tourism destinations discourage potential visitors towards those ends. Climate change is already having visible and generally adverse impacts

on the key environmental resources (Danovaro, Dell'Anno, & Pusceddu, 2004); it is evident that several forms of tourism are already seen affected by climate change to varying degrees.

The implications of climate change on mountain tourism can be seen, by the examples of snow cover loss, receding glaciers, melting permafrost and more extreme events like avalanches and landslides. Furthermore, climate change will shift mountain flora and fauna. Second order impacts will occur in mountain agriculture, mountain hydropower and, of course, mountain tourism. Similarly, the loss of biodiversity is one of the most significant aspects of global environmental change, given the extent to which it underpins the global economy and human welfare (Martens & Rotmans, 2005).

Wildlife tourism which is recognized as an eco and animal friendly tourism is usually understood as watching wild animals in their natural habitats. Wildlife tourism is an important part of the tourism industry in many African and South American countries including Australia, India, Canada, Indonesia, Bangladesh, Malaysia and Maldives among many (Curtin, 2010). Wildlife tourism has experienced a dramatic growth in recent years worldwide and is closely aligned to the notion of eco-tourism and sustainable-tourism.

The concept of sustainable tourism/ ecotourism emerged after the adoption of sustainable development through the World Commission on Environment and Development in 1987. These forms of tourism got popular in the tourism system due to its catchphrase of committing long term well-being of host communities for their socioeconomic progress, conservation and preservation of natural resources and cultural heritages (Chan & Bhatta, 2013). Sometimes, ecotourism and sustainable tourism are used interchangeably but they have distinct meanings. Ecotourism has been acknowledged as a form of nature tourism which describes the link between tourism and ecological and socioeconomic principles of sustainability (UNWTO, 2008). It is viewed as a promising tool to provide environmental, socio-economic and cultural benefits (Matthews, 2002). A Mexican architect and conservationist, Hector Ceballos-Lascurain, who is known as one of the first writers to use the term "ecotourism" defined it as: "traveling to relatively undisturbed or uncontaminated natural area with the specific objective of studying, admiring, and enjoying the scenery and its wild plants and animals, as well as any existing cultural manifestations (both past and present) found in these areas" (Ceballos-Lascurain, 1987, p.14). Similarly, the concept of sustainable tourism became popular as market liberalization and commercial globalization

could not become successful in providing the actual socioeconomic benefits to the host communities and bringing positive changes on the quality of their lives (Chan & Bhatta, 2013). The World Tourism Organization (WTO) in 1988 declared that sustainable tourism is "envisaged as leading to management of all resources in such a way that economic, social and aesthetic needs can be fulfilled while maintaining cultural integrity, essential ecological processes, biological diversity and life support systems." However, the definition of sustainable tourism is vague and is therefore still open to various interpretations. Many developing countries, including Nepal those are following the idea of maximizing tourists' visitation for more revenue generation and economic benefits will not be able to fulfill the goal of benefiting local or indigenous communities unless they consider these segment of people as a key partner in tourism development process. In nut shell, the concept of ecotourism or sustainable tourism argues that the earlier practices and efforts of tourism development theories failed to address the recognition of environmental and cultural sustainability as well as the importance of involving local communities in development process (Telfer, 2002; Telfer & Sharpley, 2008).

Adventure tourism is also one of the popular forms of tourism in modern world and can be defined as "a leisure activity that takes place in an unusual, exotic, remote, or wilderness destination and tends to be associated with high levels of involvement and activity by the participants, most of it outdoors" (Price & Driscoll, 2010, p.3). Adventure tourism which has high reliance on natural resources and adventurous trips to extreme environments such as polar, marine, mountain, tropical is experiencing the effects of climate change well before many mainstream tourism businesses and as a result is facing policy and business development changes sooner (Ospina, 2006).

Sun/sand tourism is also another form of tourism which provides recreational opportunities for tourists such as swimming in the sea, sun tanning in the beach, reading under umbrellas in beaches, engaging in a water sports and visiting attractions. However, unfortunately, the current trends in sea level rise and its future predictions do not show an optimistic future for sun/sand tourism. The sea level rise due to GHGs is predicted to be approximately 0.5m by the year 2100 compared to an increased rise of 10cm to 25cm in the previous century (Warrick, et al., 1996).

Threatened and endangered species at vulnerable locations which have uncertain life or existence are also in peril and are thus being the issue of major concern in the tourism industry. Last chance tourism refers to a form of tourism which is understood as a travel to destinations impacted by climate change. Such tourism has become increasingly popular in recent years because people are more interested and curious to see polar bears in the arctic, and giant pandas in the Asian mountains. Particularly, the Polar north and south as well as tropical low-lying island nations and destinations in which adverse effects can 'already' be witnessed are associated with the last chance tourism notion (Huebner, 2009).

## Responding to Climate Change

There is a widespread agreement regarding the two basic measures needed to combat climate change in the tourism sector: adaptation and mitigation (Bode et al., 2003; Barnett; 2005; UNWTO, 2008). Whereas adaptation involves responses on the part of corporations, institutions and governments by taking advantages of the benefits of climate change for tourism and looking for solutions to minimize impacts, mitigation refers to undertaking actions in order to minimize the contribution of tourism activities to global warming (Chapman, 2007). The UNWTO notes that both policy-makers and business managers from tourism industry must get actively involved in all aspects of mitigation and adaptation plans, policies, strategies and decision making.

### *Mitigation*

A discussion of mitigation measures to cope up with climate change must include technological and socioeconomic changes and substitutions that can be employed to attain a reduction in GHG emissions (Hall & Williams, 2008). Indeed, air transport is the largest transport-related polluter in tourism industry. Moreover, the environmental damage of aviation is larger because greenhouse gases are released directly into the upper atmosphere, which increases their negative effects (Chapman, 2007; UNWTO, 2008). There are several mitigation measures considered to limit the contribution of air transport to greenhouse gas emissions and a number of studies consider the beneficial effects of the inclusion of air transport in emission trade systems (Chapman, 2007; Scheelhaase & Grimme, 2007; Mendes & Santos, 2008). Further mitigation strategies suggest replacing air transport with other

modes of mobility, such as intercity rail travel instead of short haul flights (Chapman, 2007). Aviation will also benefit from improvements in technology and changes in operational procedures. Some examples include changes in the design of aircraft to reduce fuel consumption, the use of alternative fuels, modification in the operational procedures for landing and taking off, etc. (Chapman, 2007). Since a single type of measure is not sufficient for the target of sustainable aviation, a combination of technological, behavioral and management changes are necessary (Chapman, 2007). Other mitigation strategies are eco-taxes or carbon credits. For example, Brouwer et al. (2008) views that the air passengers should accept air tax, highlighting factors such as passengers' knowledge and awareness of the impacts of flying on the environment and the contribution of air transport to the problem. Tol (2007) examined how eco-tax might affect emissions and the impact of the tax on tourists flow. The study concluded that the willingness to invest in climate change mitigation and to pay for its consequences was higher than it was generally assumed. This is due to the recognition of responsibility for climate change and its effects on the quality of life of future generations (Brouwer et al., 2008). However, it has been noticed that there are some important difference in terms of the context of research and the tourist cultures among the Europeans, North Americans and Asians. Europeans were found to be more aware and willing to pay, whereas North Americans and Asians were understood to be less informed and less willing to act (Brouwer et al., 2008). Other relevant conclusions refer to small effect of the carbon tax, especially in the case of medium distance flights which could produce a positive effect on air mobility within the same region, such as the European Union (Gössling & Hall, 2006; Tol, 2007).

Beyond air transport, some authors have attempted to consider other sources of tourism-related greenhouse gas emissions. A crucial factor in the success of these strategies is the capacity for companies to innovate and adopt renewable energies and incorporate new energy saving technologies (Lee, 2000). Bode et al. (2003) and Becken (2005) suggest for the use of practical alternative energies such as solar panels, low energy lighting bulbs, room keys to operate lights, light sensors and lessons on alternative energy education for tourists and employees in tourism businesses. Although the above mentioned mitigation strategies are significant in reducing GHGs, most of the literature on tourism and climate change has focused on suggestions for adaptation (Becken, 2005).

***Adaptation***

Tourism industry is dynamic and flexible enough to implement adaptive capacity measures to deal with climate change (UNWTO, UNEP & WMO, 2007). There is an urgent need for the tourism industry to adapt to the global climate change, as tourism is sensitive to climatic conditions. However, adaptation activities have to be carefully planned and considered as they require multidimensional approaches (Phillips & Jones, 2006). Much of the focus of tourism research and climate change is paying attention towards the measures that have to be undertaken to adapt to the new scenarios. Nevertheless, compared to other economic sectors, there is a general agreement that the tourism industry is approximately five to seven years back in reference to research updates on climate change (Adger et al., 2005). Becken (2005) mentioned that the wider climate change debate mainly focused on mitigating the scarce research specifically dealing with tourism and climate change and that was largely concentrated on the vulnerability of tourism and adaptation to climate change.

There are significant differences in the adaptation measures that are undertaken in tourism industry; such as in its various subsectors, activities and destinations. For example, in the case of sun/sand tourism and the protection of the coastline, research suggests that institutions, more so than private tourism companies play a key role in adaptation measures (Phillips & Jones, 2006). As Adger et al. (2005, p.3) state "a broad distinction can be drawn between actions that often involves creating policies or regulations to build adaptive capacity and action that implement operational adaptation decisions. The latter will often be constrained and influenced by a higher-level adaptation framework."

In the case of adventure tourism where skiing or other snow sports are the core industry, further measures should be considered such as diversification, contracting insurance policies (Scott et al., 2003), and new marketing strategies aimed at attracting new segments and retaining existing clients, which could emphasize the opportunities that climate change offers to creative advantage in this sector (Scott et al., 2007; Hill et al., 2010). Snowmaking has been considered the most widespread climate adaptation method used by the ski industry. Cloud seeding is also known as popular technology for weather modification that is used to produce additional precipitation, mainly for agricultural purposes (Horrocks, 2001). Some ski areas in North America (Telluride, Durango, Vail, and Beaver Creek) and Australia have also employed this technology in an attempt to generate additional snowfall (Scott & McBoyle,

2007). Adventure travel companies are also beginning to adapt to climate change impacts in order to sustain their business and their experiences provide useful lessons for other tourism businesses. Similarly, last chance tourism is highly exciting because it challenges beliefs and pre-conceptions about the impacts and causes of climate change held not only by visitors to the destinations, but by consumer and supply side of destinations affected by the devastating consequences of climate change worldwide (Huebner, 2009). Similarly, last chance tourism market trend is already being observed in some areas of Alaska, including Kenai Fjords National Park, where the chief ranger has described climate change as one of the new major themes for the park. Scott, Freitas & Matzarakis (2009) write that 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.

According to the IPCC (2007a) the Asia-Pacific region will account for 47% of global carbon emissions by 2030, and will simultaneously face temperature increases, sea-level rise and a higher frequency and magnitude of weather extremes (Li, Su & Hall, 2012). Asian tourism industry is a key player in the regional response to climate change because of its rapid growth rate and is also especially vulnerable to climate change, since many tourism businesses and destinations are extremely dependent on natural resources such as coral reefs, forests, alpine areas and beaches (United Nations World Tourism Organization [UNWTO], 2012). The Asia Pacific was estimated to account for 23% of international tourist arrivals (233 million) in 2012 with a growth rate of 6.8% (Kester, 2013; UNWTO, 2013), and (UNWTO, 2012) announced that this region is predicted to achieve a 30% global market share by 2030. This region for example, is predicted to have the highest rate of accommodation emissions growth, increasing from 29% of all accommodation emissions in 2005 to 40% in 2035 (The World Economic Forum [WEF], 2009). In many cases, tourism businesses and destinations demonstrate a relative lack of adaptive capacity. Heat wave events are likely to increase in frequency and duration region-wide and become more intense in some areas, such as East Asia, Central and West Asia (IPCC, 2012). There is also an increasing trend of stronger tropical typhoon or hurricane in East Asia, South Asia, and Southeast Asia, and high precipitation events in all sub-regions. Regional sea level rise and vulnerable coastal lowlands of Asia are highly hazardous to environmental change (IPCC, 2007). Economically important Asian tourism industry is especially vulnerable to climate

change and extreme weather events in particular because many local tourism businesses are directly or indirectly depended on natural tourism resources and demonstrate a substantial lack of adaptive capacity (Cruz et al., 2007; Simpson et al., 2008; ADB, 2012). Asian ski tourism, beach tourism, and eco-tourism have been identified in IPCC reports as being especially vulnerable to climate change (Cruz et al., 2007). Temperature increases are likely to lead to increased glacier and permafrost melt in the Himalayas, north-western part of China and many parts of Asia, South Asia and South East Asia with potential consequences for water availability and for tourism development in the long-term (ADB, 2012). There is also a high risk of melting of mountain permafrost which might invite natural hazards for mountain communities and tourism infrastructures.

Nepal, like other GHG non-emitting countries is extremely vulnerable to climate change although its emission level is only 0.025% of global greenhouse gas (GHG) emissions, which is the lowest in the world measuring (Dhungel, 2009). Nepal is accounted as one of the most vulnerable developing countries because of its geographic characteristics, poor physical infrastructure and the low level of social development (Agrawala et al., 2003). Temperature observations in Nepal over the last twenty-five years show an increasing trend at the rate of 0.06 ºC per year (MoEST, 2008). However, the warming is found to be more significant in the higher altitude ranges of Nepal than in the Terai or Siwalik regions. Studies show declining trend in the number of annual rainy days in Nepal during the last four decades (Practical Action, 2010). A study conducted by Dahal, Manandhar & Sharma (2015) in the Terai districts of Nepal also discovered the loss of wildlife population and their upward shifting due to the rise in temperature, realization of changes in climate among the respondents in recent years, several instances of increasing droughts and decreasing water resources, and the problems of the introduction of different types of invasive weeds in the agriculture fields. Variation in climatic situation will have direct and indirect impacts on Nepalese tourism. Climatic effects on high mountains are very specific; climate change is likely to intensity the level of natural hazards by creating dramatic consequences for tourism destinations. Therefore, the tourism scholars have rectified this situation to a certain extent by demonstrating how the industry has become vulnerable to climate change and drawing attention to the need for adaptation and mitigation strategies. Several collaborative efforts among tourism stakeholders, resident communities and governments are necessary to build

up the adaptation and mitigation strategies at local, regional and national levels in regards to the institutional development and diversification of opportunities.

Adaptation and mitigation strategies in the tourism sector must occur at several levels, starting with private entrepreneurs to residential communities and governmental and non-governmental entities at local, state and national levels (Nepal, 2011). Adaptation strategies such as initiating dialogue between tourism operators, tourism business representatives, research bodies, climate change coordination units, local authorities, municipalities and non-governmental entities can be structured by setting up a task force committee to coordinate adaptation efforts (UNWTO, UNEP & WMO, 2008).

**The Validity of the Research & Methods Used**

Most of the articles cited above have used theoretical underpinnings of tourism, climate change and adaptation policy. They have analyzed the interactions between tourism and climate change using several assessment and methodological approaches to gain an understanding of the relationship between the two and provide insights for future works. Some of the studies have used multiple cases studies throughout different tourism regions such as Alpine Europe and small island countries, and identified measures for mitigating climate change within the tourism sector as well as means of adaptation.

Most of the papers that this review article has cited are descriptive in nature, lacking in specific methodologies, however a few are empirically based. For example, the paper by Moreno and Becken (2008) used a five-step assessment methodology for tourism in coastal areas in Fiji that calculate the vulnerability to climate change. Each step relies on the input of both quantitative data and qualitative input. This vulnerability assessment methodology has several advantages. In the case of Fiji, the approach allowed examination of all tourism activities of interest and relation of these to the various dimensions of vulnerability in a structured way. However, the extensive application of the vulnerability assessment framework to different destinations in European countries can further allow fine tuning of the reliability of the methodology and assessing the framework's validity. Similarly, the paper by Peeters & Dubois (2010) has explored automated scenario generation as a way to define back casting scenarios that both reach the emission reduction target and retain the highest possible

economic value for the tourism sector. The use of this methodology resulted in the major implications for the sustainable development of tourism, and described how the sustainable tourism system might look in the future. The major contribution of this study and methods was its comparison of the value of different ways to approach the future of tourism. The validity of the research methodology of this study can be considered progressive in terms of its reliability and strength that are used but it has not given the directions for policies that implement the situation for sustainable development in tourism sector. So, as a suggestion for the future direction for this work, the next step would be to include policy and sector investment measures and implicate the feedback that controls the behavior of humans and corporations. Likewise, another study regarding the impact of climate change on mountain tourism conducted by Richardson and Loomis (2004) has used a contingent behavior analysis as a method to estimate the effects of changes in climate and resource variables on nature-based tourism demand. Survey responses were used to estimate the impact of climate change on park visitation and to test for the relative significance among climate scenarios and resource variables. More importantly, the contingent visitation methodology that this paper has used might be useful for park and recreation managers worldwide as they attempt to plan for possible effects of climate change on visitation and ecotourism. This study has used both direct (weather-related) and indirect (resource-related) climate scenario variables, which are found to be statistically significant determinants of contingent expected changes in visitation. The results of the contingent visitation analysis are compared with the results of a regression analysis of historic visitation and climate variation for methodological assessment so there appears the validity of the research. Based on the literature review and recommendations provided by the above mentioned articles on the impacts of climate change on tourism sector, the following section describes the scope and agenda for future research.

**Suggestive Directions for Future Work**

In order to assess the need for, and best practices to adaptation and mitigation, both global and location-specific research and evaluation activities are required to undertake specifically projecting current and future climate change impacts; assessing vulnerabilities including climate-related hazards (for effective decisions for climate risk management); evaluating resilience and adaptive capacity; and evaluating current and future adaptation and

mitigation activities; including possible new opportunities that may arise from climate change (Carter, 2007). Increasingly governments, institutions and businesses are taking a greater role in achieving the goals of sustainable development, in developing responses to mitigate and adapt to the threats and opportunities of climate change (IPCC, 2007). However, much of the works are still stayed behind because of the emergence of gap between the messages provided by the public policy makers and the actions undertaken by the tourism companies regarding the behavior of tourism and its influence for climate change (Sullivan, 2010). This proves a significant research gap in tourism and climate change literature dedicated to analyzing their impacts and associated consequences.

Hence, research regarding tourism and climate change including methodological developments, monitoring and indicator studies, empirical research, field and experimental research, predictive modeling, scenario development, economic costing, integrated assessment, quantification of the impacts of extreme weather events, modification of existing coping strategies, testing and evaluation of adaptation measures, and stakeholder participation is essential (Carter 2007). Overall, compared to other economic activities, there is a lack of research on the management of tourism and climate change, and the overriding focus of existing research is on specific tourism activities (such as sun/sand and ski tourism) and on specific regions (northern Europe, the UK and the USA). Also, the scale and realm of threats arising from climate change in other forms of tourism such as sandy beaches, adventure tourism, last chance tourism and wildlife tourism in the 21st century will require global syntheses of research and interdisciplinary approaches to design management strategies that incorporate the conservation of their key ecological attributes (Schlancher et. al., 2008).

As an outline of the agenda for future research, greater effort is required in order to clearly identify a broad range of measures for tourism companies. Most studies have not examined the totality of the impact of tourism on climate, which requires the consideration of effects at the origin, travel, and destination of tourists (Gössling & Hall, 2006). In addition, only a limited set of responses has been examined, both in terms of minimizing emissions and the impact on global warming, as well as in terms of adapting businesses to the new scenarios presented by climate change (Elsasser & Bürki, 2002). In this sense, there is a general call for a greater research focus in order to identify the entire range of measures and

to avoid the increasing focus on very narrow solutions and a limited range of destinations. In fact, efforts have already recently initiated on this front on the part of international institutions (UNWTO, 2008). Secondly, in general the majority of companies are still in a preliminary phase in terms of implementing adaptation and mitigation measures (Kolk & Pinkse, 2005; Pinkse, 2007), and tourism companies are no exception to this. Hence, the process companies experience in terms of considering and taking on adaptation and mitigation measures should receive increased attention as an emerging issue in tourism management research.

Future research in tourism planning, policy, and geography will no doubt refer to regional climate change patterns and predictions in a similar way. In the short term, however, it would seem that if we were to pick a single top priority for research, it would be the socioeconomic and environmental consequences of climate induced extreme weather events and the flow-on effects of tourism.

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