Introduction

Sustainable tourism is one of the fundamental focus areas in the realisation of the global agenda for sustainable development as outlined in Sustainable Development Goals 8, target 8.9 and 12, target 12b (United Nations, 2015). Subsequently, the United Nations (UN) flagged 2017 as the International Year of Sustainable Tourism for Development. The main aim of the UN was that of promoting a change in policies, business practices and consumer behaviour towards a more sustainable tourism sector. Notwithstanding the foregoing, climate change poses a threat to natural capital, the impetus for nature-based tourism. The Intergovernmental Panel for Climate Change (IPCC, 2014a) accentuates that the evidence of climate change is most pronounced in natural systems. Tourism thus is closely related to the environment and climate itself (Uchegbu & Kanu, 2013). Climate change brings with it challenges associated with temperature increases, sea-level rise and changes in precipitation all of which have a bearing on the natural capital pivotal for tourism.

Projections for an increase in temperature under medium scenarios revealed that some parts of Africa will exceed 2°C towards the end of the century compared to the late 20th century mean annual temperature (United Nations Environment Programme (UNEP) & African Ministerial Conference on Environment (AMCEN), n.d.). Warmer temperatures are a potential source of a rapid shift in ecosystem ranges leading to loss of biodiversity, accelerated woody plant encroachment resulting in limited grazing options. On the other hand, sea-level rise along the Indian and Atlantic oceans is expected to be around 80 cm above 2,000 by 2,100 under the 4°C scenarios (and 40 cm above 2,000 by 2,100 in a below−2°C scenario) putting coastal cities of Mozambique, Tanzania, Cameroon, Egypt, Senegal and Morocco at risk of flooding (UNEP & AMCEN, n.d.). Changing precipitation, melting snow and ice as well as shrinking of glaciers alter hydrological systems, thereby affecting the quality and quantity of water resources (IPCC, 2014a). Consequently, the geographic ranges, seasonal activities, migration patterns and abundance of many terrestrial, freshwater and marine species have shifted (IPCC, 2014a). Climate change also results in increased frequency of extreme weather events characterised by droughts heat waves, floods, cyclones and wildfires the consequences of which have revealed the vulnerability and exposure of some ecosystems...
Tourism and climate change in Africa

Tourism and climate change in Africa (IPCC, 2014a). Warming makes heat waves longer, stronger and more frequent; droughts more intense by drying out and heating up land that is suffering from reduced precipitation; puts more water vapour in the atmosphere making wet areas of the world wetter and deluges become more intense and more frequent; raises sea levels making devastating storm surges more likely (Romm, 2018). The consequences include extreme summertime temperatures; loss of biodiversity and natural attractions; disruption of food production and water supply; as well as damage to infrastructure (IPCC, 2014a).

Since climate change is actually the change in mean and variability of climatic properties that persists for an extended period of time (IPCC, 2014); response measures may tend to be reactive than proactive. Responses may also be delayed by the continuing uncertainty about the severity and timing of climate change impacts (see IPCC, 2014a). Timely response measures are however imperative given that some impacts if left unchecked may cause severe, pervasive and irreversible harm to unique and threatened species globally and regionally (see IPCC, 2014a). The two response measures comprise efforts geared towards reducing sources of GhG emissions or enhancing sinks and reservoirs (collectively known as mitigation) as well as those aimed at moderating or avoiding harm or exploiting beneficial opportunities with respect to expected climate and its effects (commonly referred to as adaptations) (IPCC, 2014b; Mayer, 2018; United Nations, 1992). Arguments have been made in favour of adaptation especially for developing countries such as those in the African continent. Some of the reasons advanced are that developing countries are the most affected by climate change whereas they contribute the least to global emission and the least able to afford adaptation efforts (see Scott et al., 2012).

Climate change is likely to continue for centuries to come in the process of changing human and animal life patterns (Uchegbu & Kanu, 2013). This makes tourism led economies especially vulnerable and ultimately their sustainability is questionable unless appropriate and timely action is taken by all tourism stakeholders. This chapter therefore reviews the tourism–climate change nexus as it applies to the African continent. The objectives of the review are to determine the following: the focus of tourism–climate change nexus research in Africa; major tourism destinations that have been or in danger of being affected; and existing climate policy responses by various relevant stakeholders.

Geographical distribution of Africa’s nature-based tourism attractions and related climate change impacts

Tourism is geographical in nature in that it occurs in places and involves movement and activities across space (Lew et al., 2008). African countries have now become major tourism growth areas (Uchegbu & Kanu, 2013). In the early 2000s, Southern Africa received the most international tourists followed by East Africa, while North Africa’s tourism had not evolved into a major economic growth engine compared to other parts of Africa owing to cultural and religious ideologies which view tourism in a bad light (Lew et al., 2008). In recent years, however, international tourism trends highlight a strong recovery of the industry in North Africa especially in Tunisia and Morocco (United Nations World Tourism Organisation (UNWTO), 2018). In sub-Saharan Africa, good performance was realised from Kenya, Cote d’Ivoire, Mauritius and Zimbabwe while South Africa, the sub-region’s top destination was reported to have had a slow growth in 2017 (UNWTO, 2018).

Climate change affects the various geographical areas which form the basis for nature-based tourism and hence the effects are already being felt in coastal zones, wildlife areas and freshwater ecosystems resulting in changes in the ecosystems and natural resources needed to sustain the tourism economy.
Coastal zones and freshwater ecosystems

With current predictions of climate change and sea-level rise, beaches that have become synonymous with tourism are under significant threat of erosion worldwide (Uchegbu & Kanu, 2013). This is also exacerbated by the fact that coral reefs, a source of white sand that prevents beach erosion, are inundated by bleaching, also resulting from climate change (see Ahmed & Hefny, 2007; Wielgus et al., 2010). Rising sea levels, from melting of polar ice caps and frequency of storms cause beach erosion and places like Barbeach in Lagos Nigeria have been affected (Uchegbu & Kanu, 2013). Impacts include beach erosion, saline intrusion, flash floods, landslides and coral reef bleaching (Uchegbu & Kanu, 2013). Coral reefs are highly sensitive to climate change since they can only withstand a narrow temperature range (Ahmed & Hefny, 2007). The coastal town of Mombasa, Kenya for example is already being affected by extreme climatic events such as floods, droughts and strong winds (Awuor et al., 2008). Some of the best beach tourist destinations are found in Kenya, Malawi, Mozambique, Madagascar, Tanzania, South Africa, Egypt, Seychelles, Mauritius, Namibia, Gabon, Ghana, Sao Tome and Principe, Sierra Leone, Senegal, Cape Verde, Morocco and Tunisia.

In terms of freshwater ecosystems, prominent wetlands on the African continent situated between 15°N and 20°S include the Okavango Delta of Botswana, the Sudd in the Upper Nile, Lake Victoria basin and Lake Chad basin, and the floodplains and deltas of the Congo, Niger and Zambezi rivers; riverine systems of the Nile, Niger, Zaire and Zambezi; Rift valley lakes comprising of Victoria, Tanganyika, Nyasa, Turkana, Mweru and Albert (Kabii, n.d.). East Africa is garlanded with the Great Lakes of Africa emanating from the Great Rift Valley. According to CNN Travel (2018a), the most amazing places to visit in Africa include Victoria Falls of Zambia and Zimbabwe, Wonder of the Nile (includes a cruise down the Egyptian Nile), Flamingos Kenya (Lake Nakuru National Park), Zambia’s Lower Zambezi, Fish River Canyon of Namibia and Lake Malawi. On-going climate change has resulted in freshwater species (among others), shifting their geographic ranges, seasonal activities, migration patterns, abundances and species interactions (IPCC, 2014a).

Vegetation, wildlife, protected areas and mountainous places

The rate at which climate change occurs impedes the natural ability of living organisms to adapt to the changes hence some species are threatened by extinction (Nakaya, 2017). Vegetation and animals prevalent in a particular place are influenced by the climate (humidity, precipitation, temperature) and the geomorphology thereof (Lew et al., 2008). Hence the bio-geographical distribution of natural vegetation is such that: Irish green vegetation such as that found in tropical rain forests prevails in high humidity and high-temperature areas; while low humidity and high temperatures are associated with arid, desert vegetation; the lowest temperature regions, on the other hand, are adorned with spruce coniferous trees and tundra type of grass; finally in between the three extremes lies a mixture of evergreen trees, deciduous trees and grasslands (Lew et al., 2008). Global warming has resulted in a decline in vegetation causing wildlife to migrate to areas that still have water (Uchegbu & Kanu, 2013).

East Africa is popular for safari tourism which involves viewing big game in the wild with Kenya being the most visited country in this part of Africa (Lew et al., 2008). Most of Africa’s wildlife is found in protected areas which many African countries have adopted for in-situ conservation which is becoming more challenging with the advent of climate change resulting in species range dynamics due to possible range shifts (Monzón et al., 2011; Pettorelli
et al., 2012; Tanner-McAllister et al., 2017). CNN Travel (2018b) regard the Serengeti National Park of Tanzania, Kidepo Valley National Park of Uganda, Hwange National Park of Zimbabwe, Samburu National Reserve in Kenya, Botswana’s Kalahari Desert, Zambia’s South Luangwa National Park and Kafue National Park, Etosha National Park of Namibia and the Kruger National Park of South Africa as eight of the best safari destinations in Africa.

Mountain tourism is also important in Africa. In east Africa for example, there is the mountain region of Kenya, Tanzania, Uganda, Rwanda, Burundi and the Democratic Republic of Congo. These mountains are closely linked to the East African Rift system and offer tourist attractions of Kilimanjaro National Park, moorland zone of the Aberdares, the Kenya section of Mount Elgon; Virunga Mountains comprising of the Kigezi Gorilla Game Reserve on the slopes of Mounts Muhavura and Mgahinga on the Ugandan side while the Volcanoes National Park and the Virunga National Park are found on the Rwanda and Congo portions of the Virunga Mountains (Kalinga & Baker, 2018). In southern Africa, the highest mountain range is the Drakensburg, a primary tourist destination in South Africa (Linde & Grab, 2008). Mountain areas are sensitive to climate change which manifests itself in the form of decrease in snow cover, shrinking of glaciers, melting permafrost and increased frequency of extreme events such as landslides; ultimately economic activities such tourism are affected (Bürki et al., 2003; Uchegbu & Kanu, 2013). For example, winter sport activities have also been affected by climate change due to a decrease in snow cover and shrinking of glaciers, which has resulted in altered winter sport seasons and landscape aesthetics (Uchegbu & Kanu, 2013). This has happened in places like Tiffendell, the highest mountain peak in the Cape and a ski resort in South Africa and, Mount Kilimanjaro in Tanzania (Lew et al., 2008; Uchegbu & Kanu, 2013).

Responses: climate change adaptation and mitigation

In order for the tourism sector to survive the vagaries of climate change there is need for appropriate mechanisms aimed at minimising the impacts on the tourism sector or the contribution of the sector to emissions that result in climate change. “Africa is the continent where rapidly changing climate will deviate from “normal” earlier than across any other continent, making adaptation a matter of utmost urgency” (UNEP & AMCEN, n.d., p.V). Adaptation measures are influenced by the type of tourism subsector, activities offered and the destination in question (Hernandez & Ryan, 2011). The measures may be technical, e.g. artificial snow making, access to early warning equipment; managerial, e.g. product and market diversification, impact management plans; policy, e.g. regulatory compliance, building design standards; research, e.g. assessment of business and tourism knowledge gaps; education, e.g. water and energy conservation training for clients and employees; and behavioural, e.g. greenhouse emissions offset programs, good practice in-house (Hernandez & Ryan, 2011; Simpson et al., 2008). However, adaptation costs of African countries are expected to rise under different scenarios. For example, projections predict that costs could rise to USD50 billion per year (less than 1%of GDP) by 2050 under the below 2°C scenario while it could double by 2,100 in the case of a 4°C warming which would amount to 6% of African GDP (UNEP & AMCEN, n.d). Therefore, limiting the rate and magnitude of climate change is one way of reducing the overall risks of climate change impacts and by so doing, reducing the required scale of adaptation (IPCC, 2014b).

Strategies that may be assumed by the tourism sector for climate change mitigation include government economic policies aimed at raising the price of greenhouse gas emissions or subsidising the price of carbon-free energy sources, e.g. carbon tax or cap and trade
system, inclusion of air transport in emission trade systems; increasing the use of clean energy or reducing the emissions of GHGs, e.g. fuel economy standards, design aircrafts that with low fuel consumption levels, alternative fuels; modification of operational procedures for landing and take-off; technological (research-based) policies aimed at lowering the cost and improving the performance of low-carbon sources, e.g. LED lighting, solar panels, room keys to operate lights, light sensors, promoting energy consciousness and energy saving behaviour on the part of the tourist and tourism industry employees (Becken 2005; Chapman, 2007; Hernandez & Ryan, 2011; Mendes & Santos, 2008; Romm, 2018; Scheelhaase & Grimme, 2007).

As illustrated earlier, adaptation and mitigation measures overlap and therefore always advisable to adopt both categories of climate change response measures. Scholars have however observed that the capacity of the continent to cope with the challenges posed by climate change is still wanting as domestic resources and current international funding are not sufficient (Kunreuther et al., 2014; Ojekunle et al., 2013; Scott et al., 2012; UNEP & AMCEN, n.d).

Review protocol: methods

The purpose of the review was to determine and synthesise information available in relation to nature-based tourism and climate change nexus in Africa. The systematic literature review method was applied to answer the following questions: what is the focus of tourism–climate change nexus research in Africa; which major tourism destinations have been affected; what climate policy responses exist and what are the gaps? The procedure followed in conducting the narrative review was adapted after Xiao and Watson (2017) and entailed literature search where electronic databases were the main point of reference particularly Google Scholar and Science Direct and Google while recommendations by colleagues were also taken into consideration. The inclusion criteria were based on academic research published in international journals and specifically addressed issues of tourism climate change nexus based on the research questions of the study. The papers were therefore screened based on keywords such as climate change, tourism, impacts, policy and Africa. The keywords informed data extraction which were synthesised and reported with particular reference to the research questions. Ultimately, there were 81 documentary records identified 81; following screening, 8 were removed since there were no full texts; from the 73 that remained, 39 were excluded (24 did not adequately address issues pertaining to the African continent; 11 touched on economic sectors in general and information pertaining to the tourism sector was tacit; 3 addressed climatic issues but not climate change per se; 1 was a review hence excluded to avoid duplication); leaving 35 that met the criterion for assessment.

Findings

The review resulted in 14 papers dealing with perceptions, views, understanding, awareness, knowledge and attitudes of various stakeholders towards climate change–tourism nexus, 12 papers on impacts of climate change on tourism destinations, nine papers dealing with policy responses by tourism stakeholders towards climate change, four on knowledge inquiry and methodological issues surrounding research in tourism–climate change nexus and one paper investigating the vulnerability of a tourism destination. Some of the papers fell in more than one category (see Table 6.1).
## Table 6.1 Research focus on tourism climate change-nexus in Africa

<table>
<thead>
<tr>
<th>Paper</th>
<th>Description</th>
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<tbody>
<tr>
<td><strong>Vulnerability, threats</strong></td>
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</tr>
<tr>
<td>1 Hambira (2011)</td>
<td>To determine the extent to which the tourism sector in Botswana is vulnerable to climate change.</td>
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<tr>
<td><strong>Impacts</strong></td>
<td></td>
</tr>
<tr>
<td>1 Dube and Nhamo (2018a)</td>
<td>An examination of the evidence and potential implications of climate variability and change on tourism in the Zambian town of Livingstone.</td>
</tr>
<tr>
<td>2 Ahmed and Hefny (2007)</td>
<td>A determination of the impact of climate change on the Sinai (Egypt) environment and the need to take measures to meet the expected changes in order to maintain tourism industry in Sinai?</td>
</tr>
<tr>
<td>3 Steyn and Spencer (2012)</td>
<td>A focus on the relationship between climate and tourism, the likely effects of climate change on tourism in general, and highlights the projected impacts on South Africa. The planning implications of the expected impacts are also highlighted.</td>
</tr>
<tr>
<td>4 Sagoe-Addy and Addo (2013)</td>
<td>An assessment of the potential impact of enhanced sea-level rise for different IPCC scenarios on tourism facilities along Ghana’s Accra coast.</td>
</tr>
<tr>
<td>5 Köberl et al. (2016)</td>
<td>This paper assesses the potential impacts of climate change on tourism demand in the case study regions Cap Bon, Tunisia (of Sardinia, Italy).</td>
</tr>
<tr>
<td>6 Darkoh et al. (2014)</td>
<td>An investigation of the trends and impacts of climate change as well as coping and adaptation strategies in Malawi, Botswana and Kenya.</td>
</tr>
<tr>
<td>9 Njoroge (2015c)</td>
<td>Consolidation of information on climate change impacts and vulnerability of Kenya’s tourism industry to climate change. The paper further discusses the implication of climate change on the role of tourism in contributing to Millennium Development Goals.</td>
</tr>
<tr>
<td>10 Shaaban and Ramzy (2010)</td>
<td>An examination of the views of Egyptian policymakers and tourism managers on potential climate change impacts on Egypt’s tourism industry, and their policies and action plans in response to such impacts.</td>
</tr>
<tr>
<td>11 Fitchett et al. (2016a)</td>
<td>An exploration of climate change threats and perceptions of these threats within the tourist sector in South Africa’s coastal towns of St Francis and Cape St Francis.</td>
</tr>
<tr>
<td>12 Hambira (2017)</td>
<td>A determination of Botswana tourism operators and policymakers’ perceptions and responses to the tourism-climate change nexus. Results touch on impacts of climate change as perceived by the policymakers and tourism operators.</td>
</tr>
</tbody>
</table>

| **Perceptions, views, understanding, awareness, knowledge, attitudes** | |
| 2 Gössling et al. (2006) | Perceptions of climate change by tourists visiting the island of Zanzibar in Tanzania. |
| 3 Fitchett et al. (2016a) | An exploration of climate change threats and perceptions of these threats within the tourist sector in South Africa’s coastal towns of St Francis and Cape St Francis. |

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<tr>
<th>Paper</th>
<th>Description</th>
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<tbody>
<tr>
<td>6 Saarinen et al. (2013)</td>
<td>A determination of the perceptions and ultimately the preparedness of tourism businesses with regard to the impending climate change impacts their operations in Maun and Tshabong, Botswana.</td>
</tr>
<tr>
<td>7 Hambira et al. (2013)</td>
<td>A determination of how the perceptions of the tourism operators have influenced their preparedness and responses to the impending climate change in Maun, Botswana.</td>
</tr>
<tr>
<td>8 Saarinen et al. (2012)</td>
<td>A determination of how the perceptions of the tourism operators have influenced their preparedness and responses to the impending climate change in Kgalagadi South District.</td>
</tr>
<tr>
<td>10 Shaaban and Ramzy (2010)</td>
<td>An examination of the views of Egyptian policymakers and tourism managers on potential climate change impacts on Egypt’s tourism industry, and their policies and action plans in response to such impacts.</td>
</tr>
<tr>
<td>11 Njoroge (2015a)</td>
<td>A determination of tourism stakeholders’ past account of environmental hazards and among other things perceptions of potential impacts of climate change in the coastal tourism region of Mombasa, Kenya.</td>
</tr>
<tr>
<td>12 Dube et al. (2018)</td>
<td>An examination of the understanding, perceptions, knowledge and attitude of the tourism industry’s main stakeholders, the tourists, in light of the future of the tourism industry, in the context of climate.</td>
</tr>
<tr>
<td>13 Peck and Hedding (2014)</td>
<td>An exploration of the attitudes of domestic tourists in South Africa towards the introduction of a carbon tax, together with their knowledge and perceptions of climate change.</td>
</tr>
<tr>
<td>14 Hoogendoorn et al. (2016)</td>
<td>An exploration of the perceptions of tourists and tourist accommodation establishment operators regarding climate change threats to tourism for the towns of St Francis Bay and Cape St Francis.</td>
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**Knowledge inquiry and knowledge production**

<table>
<thead>
<tr>
<th>Paper</th>
<th>Description</th>
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<tbody>
<tr>
<td>1 Pandy (2017)</td>
<td>An examination of key debates in the nexus of tourism and climate change in order to identify research imperatives including for African scholars.</td>
</tr>
<tr>
<td>2 Fitchett et al. (2016b)</td>
<td>A determination of a viable approach of applying TCI for locations in which no sunshine hour data is available.</td>
</tr>
<tr>
<td>3 Rogerson (2016)</td>
<td>An examination of issues around climate change impacts for South Africa’s tourism sector and in particular implications for local economic development.</td>
</tr>
<tr>
<td>4 Steyn and Spencer (2012)</td>
<td>A model proposal for the development of adaptive strategies based on existing impacts of climate change on tourism in Western Cape, South Africa and actions that can be taken to mitigate and adapt to the impacts of climate change.</td>
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**Policy responses**

<table>
<thead>
<tr>
<th>Paper</th>
<th>Description</th>
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<tbody>
<tr>
<td>1 Hambira et al. (2013)</td>
<td>A determination of the adaptation strategies that Botswana tourism operators have, or are planning to put in place, in order to cope with or benefit from climate change.</td>
</tr>
<tr>
<td>2 Gössling and Schumacher (2010)</td>
<td>An analysis of energy usage and emission levels in the Seychelles’ tourism sector. Ways to reduce the emission levels with the aim of making the island state a carbon neutral destination were also explored.</td>
</tr>
</tbody>
</table>
Tourism-climate change nexus research in Africa

Vulnerabilities and threats

The literature search unveiled one paper that attempted to investigate the vulnerability of a tourism destination. A screening of the Okavango Delta’s vulnerability to climate change revealed that the delta was indeed vulnerable (Hambira, 2011). The study determined the extent to which the delta was vulnerable to climate change by screening changes in climatic variables; the physical environment and ecosystems; threats to livelihoods and socioeconomic issues; as well as weaknesses in governance structures.

Impacts

The research considered impacts in terms of observed evidence but mostly potential impacts on tourism destination. The impacts considered were about the sector in general, landscapes in which specific attractions were found, the economy of countries in relation to the contribution of tourism, tourism infrastructure, as well as tourism demand and management. The impacts were mostly expected from climate change drivers such as increased rainfall, extreme weather events, change in seasons and sea-level rise. Expected impacts from increased temperatures on the tourism industry comprise of reduced tourist comfort (Dube & Nhamo, 2018a, 2018b); climate-induced gains and losses, e.g. increased energy demand in summer and reduced energy costs in summer (Dube & Nhamo, 2018a; Küberl et al., 2016); reduced quality of tourism activities such as scenic flights/helicopter rides (Dube & Nhamo,
2018b; Hambira, 2017) and dive tourism (Shaaban & Ramzy, 2010). In terms of impacts from rising sea levels, the result showed that it would culminate in bleaching of coral reefs and salt intrusion (Ahmed & Hefny, 2007); and submergence of beaches and associated tourism infrastructure (Darkoh et al., 2014; Fitchett et al., 2016a; Njoroge, 2015c; Sagoe-Addy & Addo, 2013; Shaaban & Ramzy, 2010). Another interesting impact is that operators who are blind to industry perceptions and consequently fail to meet their needs are expected to lose clients to more responsive competitors (Marshall et al., 2011). On the other hand, change in seasons and water flows as a result of climate change is expected to alter tourism peak and off seasons (Dube & Nhamo, 2018a). Extreme weather events are expected to increase in frequency and intensity due to climate change and the expected impacts on tourism include redistribution of tourism resources geographically and seasonally (Steyn & Spencer, 2012). Specific impacts on tourism activities, destinations and tourist attractions are detailed in the next main section of this chapter.

**Perceptions and awareness of climate change impact on tourism**

Studies under this category covered issues pertaining to various tourism stakeholders’ perceptions (including attitudes and views) and awareness (including knowledge and understanding) of thermal conditions of tourism destinations as well as climate change impacts on destinations, business operations and the economy in general.

Based on the perceptions of beach holidaymakers, Becker (1998) developed a Beach Comfort Map of South Africa describing the maximum, minimum and average number of beach days per month and the probability of beach days and thus providing critical information on the thermal conditions of selected beach holiday resorts. People desiring to visit Cape Town in January for example can expect an average probability of more than 70% beach days while a winter holiday in Durban holds a 50% chance for beach days. Another study on thermal conditions was by Gössling et al. (2006) who investigated tourist’s travel motives influenced by a mixture of climate-related considerations, incommensurate and convenience motives. The study revealed that a set of parameters comprising temperature, rainfall, humidity and storms affect comfort perceptions as opposed to temperature as a single parameter.

Regarding perceptions on climate change impact on destinations and business operations, Shaaban and Ramzy (2010) noted that many industry managers and policymakers shared views to the effect that damage to coastal tourism facilities was very likely due to sea-level rise. The managers however did not see this having an impact on the volume of tourists but rather on tourism patterns. Other disjunct views were found between tourists and tourist accommodation establishment representatives in St Francis Bay and Cape St Francis. The former were more concerned about the risk of flooding, sea-level rise and degeneration of beaches while the latter were more concerned with day-to-day changes in weather and subsequently the comfort of their guests (Hoogendoorn et al., 2016). Still in the adjacent coastal towns of St Francis Bay and Cape St Francis in the Eastern Cape province of South Africa, Fitchett et al. (2016a) further probed climate change perceptions of proprietors of accommodation establishments. Climate change was a cause for concern for 42 of the 53 respondents especially representatives of establishments located close to the coast and more than half of them believed that it would negatively affect the towns themselves due to their experiences with extreme weather events which damages infrastructure and compromised access to some tourism establishments. A low-level concern for the sea-level rise was noted, save for its immediacy and extent. Fitchett et al. (2016a) further posit that the government
was perceived to be responsible for the provision of adaptation mechanisms hence they were not yet investing in infrastructural changes to address flooding induced by sea-level rise. Only small-scale adaptations to address the threats had been instituted but mainly focused on climatic suitability.

In terms of awareness and knowledge of climate change as pertains to the tourism sector, Dillimono and Dickinson (2015) targeted tourists who declared awareness of climate change. The results showed a rudimentary knowledge of the topic related to experience or observation such as seasonal changes. There were misconceptions about the causes of climate change with some answers pointing to ozone depletion which was also in some instances used interchangeably with climate change. The climate change concept was also confused with other environmental issues like earthquakes. The tourists did not see any linkages between their travel and climate change and were not willing to change their travel behaviours to reduce their carbon footprint. On the other hand, Marshall et al. (2011) reveal that climate change has an impact on the perceptions and choices of dive tourists as most of them were of the view that the coral reefs in the Egyptian Red Sea were already declining. The industry was not aware of the changes in the tourists’ awareness and attitudes towards climate change.

Saarinen et al. (2013) and Hambira et al. (2013) noted in their research that even though the tourism operators in northern Botswana were aware of the general impacts of climate change, the majority of them did not perceive any critical impacts on their operations and the industry in general. This could explain why they barely had any adaptation measures in place. Most operators had observed changes in the physical environment, livelihoods and weather patterns that they linked to climate change. Consequently, operators rendering nature-based outdoor activities deemed their activities vulnerable to climate change as this would lead to loss of quality of attractions and consequently decline in tourist numbers. However, the operators holding this line of thought said they had not experienced any significant impacts on their activities as a result but anticipated the negative effects in the future. In many instances, there were no adaptation measures in place except for air conditioners which are not for climate change per se. Some mitigation efforts were also evident in some establishments, i.e. energy and water saving mechanisms. The lack of proactive stance could be attributed to lack of information and limited awareness on climate change–tourism nexus. Still in Northern Botswana, Dube et al. (2018) reported that the tourists were aware of the general causes of climate change and the implications of their actions on climate change. However, this awareness has not translated into meaningful actions to reduce their carbon footprint. They perceived water flow as well as flora and fauna of the Okavango Delta to have been altered by climate change. Similarly, Saarinen et al. (2012) showed how Tshabong operators in South Western Botswana, alluded to the fact that they were aware of climate change and that it has had effects on their physical environment but has not had an effect on their businesses and the activities they offer. Hence the operators were likely to react to climate change in terms of adaptation as opposed to being proactive due to the slowness of the climate change process and the uncertainties surrounding the nature of the impacts. Hambira and Saarinen (2015) focused on Botswana’s policymakers and revealed that even though some were well aware of climate change and its possible impacts on the tourism industry, the following factors are likely to impede effective policy development: uncertainties surrounding climate change, information gaps, inadequate data and poor public awareness, challenges posed by poor coordination and indeed data capture and harmonisation by concerned institutions.
In Mombasa Kenya, Njoroge (2015a) highlighted that the tourism operator’s general awareness and understanding of climate change were good even though there was no precise understanding of the scientific basis and few understood the implications of climate change. On the other hand, scientists, researchers, government officials and tourism-related officials were found well informed about climate change. Based on the claims of an alarmist report that Mombasa would sink due to climate change, the operators were not sure or confident about how their business operations would be affected should that materialise. In another study, Peck and Hedding (2014) posited that domestic tourists interviewed at OR Tambo International Airport in South Africa were said to have a good basic understanding of climate change but lacked in-depth knowledge on the natural causes of climate change and greenhouse gases. Many acknowledged aviation to be a major contributor to climate change and indicated they would consider paying a voluntary carbon tax but due to the concept of attitude-behaviour gap, the number of those who agree would in the end be much less. That is, even though the tourists agreed that they were part of the problem, they did not see themselves as part of the solution.

**Knowledge inquiry and methodological issues**

Some of the research uncovered the prevailing state of affairs regarding suitable methods and frameworks to employ when studying the nature and extent of climate variability and change as it applies to the tourism sector. Fitchett et al. (2016b) for example provided solutions to data challenges in the calculation of the Tourism Climate Index (TCI) scores in South Africa. While Pandy (2017) unravelled research imperatives in the tourism-climate change nexus including research conducted by African scholars and the research imperatives are: tourism enterprises’ capacity to adapt to climate change; adaptive pathways need more attention compared to mitigation research whereas adaptation should be seen as complementary to mitigation issues; perceptions of key tourism industry stakeholders were pertinent in determining the extent to which they recognise the implications of climate change for their industry and the level of interests in particular mitigation actions. Rogerson (2016), on the other hand, examined issues around climate change impacts for South Africa’s tourism sector and in particular implications for local economic development

**Policy responses**

In view of the impending effects of climate change on Africa, research has been conducted on what various tourism stakeholders have done in terms of adaptation strategies, adaptation needs, mitigation responses including how to reduce emission levels from energy use in tourism facilities, emerging policies in relation to the aviation sector, greening of hotels and response strategies to environmental hazards in relation to coastal tourism. The adaptation measures were aimed at coping with increased temperatures (see Dube & Nhamo, 2018a; Hambira et al., 2013); increased frequency of droughts (see Mbaiwa & Mmopelwa, 2009; Saarinen et al., 2012); flooding (Mbaiwa & Mmopelwa, 2009; Njoroge, 2015a); unfavourable weather conditions (Hoogendoorn et al., 2016); extreme weather events (Dube & Nhamo, 2018a); changes in tourism peak and off seasons (Dube & Nhamo, 2018a); as well as inadequate awareness of the tourism-climate change nexus (Shaaban & Ramzy, 2010).

On the other hand, mitigation measures were aimed at addressing environmental and carbon footprint (Hoogendoorn and Fitchett, 2018; Gössling & Schumacher, 2010;
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Hoogendoorn et al., 2016; Rogerson and Sims, 2012) and the impact thereof on tourism industry in developing countries (Gössling et al., 2008). Detailed policy responses are presented after this next section.

**Endangered tourism destinations and associated climate change impacts**

This section addresses the question of the major tourism destinations that have been affected by climate change. The destinations in question were identified from the reviewed papers which had a focus on the impacts component of the tourism-climate change nexus. Reasonable evidence is key in determining whether climate change is a concern in a particular place. Some of the affected places and attractions include the tourist town of Livingstone in Zambia, the Sinai environment and the red sea region in Egypt, the coastal towns of South Africa, Kenya and Ghana, and renowned wetlands of Botswana and Zimbabwe.

In Zambia, a study by Dube and Nhamo (2018a), examined the evidence and potential implications of climate variability and change on tourism in the Zambian town of Livingstone and found statistically significant evidence of climate change for annual temperature. The high temperatures are expected to have the following challenges on tourism activities in the tourist town of Livingstone: reduced tourist comfort; increased air conditioning energy demand in summer while on a positive note energy costs would go down in winter; increased insurance premiums due to extreme weather events such as droughts, extreme rainfall and fires; changes in seasons and water flow at the waterfalls might affect the tourism peak and off seasons. Similarly, in Tunisia, subject to various uncertainties and limitations, there is a potential for climate-induced revenue gains in the shoulder seasons while climate-induced losses are expected in the summer months due to increased heat stress (Köberl et al., 2016).

In Egypt, the fauna and flora, coral reefs, wetlands, avifauna and the general landscape of Sinai are expected to be affected by climate change and Ahmed and Hefny (2007) outline the following expected impacts: bleaching of coral reefs, alteration of the velocity of lakes due to reduction of Nile flow given the rate of precipitation patterns on the Ethiopian and equatorial lakes such as Lake Victoria, as well as salt water intrusion emanating from sea-level rise among other factors. The consequent reduction in tourism revenue would result in a significant impact on the country’s balance of payments and economic performance. Still in Egypt, Marshall et al. (2011) maintain that while climate change impacts on coral reefs may not be apparent, it is already impacting the perceptions and choices of dive tourists whereas the industry is not aware of this development. Consequently, their clients’ climate and environmental interests are not taken into account in business operations hence they risk losing this cohort of clients to more responsive competitors. Marshall et al. (2011) further posit that the fact that the industry in the Red Sea region is unaware of current dive tourists’ perceptions surrounding climate change and coral reef condition makes the region’s tourism industry vulnerable to climate change. This leads to what the authors term ‘awareness and attitudinal impacts’ and they further opine that dive tourists who participated in the study were well educated and aware of environmental as well as climate change issues as pertains to coral reefs. Shaaban and Ramzy (2010), on the other hand, postulate that according to Egypt’s policymakers, several types of tourism dominating the international tourism market in Egypt, are expected to be affected by climate change as follows:
recreational or beach tourism in the Sinai Peninsula and the red sea coastal zone are likely to be affected by sea-level rise due to their relatively low elevation thus posing a threat to existing tourism investments; while dive tourism prominent in the red sea coral reefs is expected to be affected by high temperatures.

In South Africa, Steyn and Spencer (2012) advance that the impacts on tourism are expected to be severe manifesting in extreme weather conditions, prolonged droughts as well as a rise in temperatures and sea levels leading to a redistribution of tourism resources geographically and seasonally. For example, sea-level rise is a concern for coastal towns of St Francis and Cape St Francis since accommodation facilities in the said towns are situated in the coastline’s low-level elevations (Fitchett et al., 2016a). Threats include flooding of the establishments and damage to local infrastructure which impedes access to tourists. The Digital Elevation Model sea-level rise projections suggest that by 2050, there will be a considerable reduction of the beach area with extensive coastal squeeze (especially Sea Vista Area of St Francis Bay). On the other hand, projections for the year 2100 suggest a complete inundation of the beach affecting the primary tourist town and heighten flood risk for the 11 beach front accommodation establishments.

Similarly, in Ghana’s coast of Accra, Sagoe-Addy and Addo (2013) posit that 31% of the tourist facilities cannot physically withstand the event of sea-level rise hazard. According to the study, physical analysis of the vulnerability of accommodation facilities showed that 50% of the facilities are highly vulnerable to sea-level rise. The study’s field results revealed that over 50% of tourism facilities represented had no measures and plans for protections and or mitigation/adaptation. While Kenya’s coastal town of Mombasa is already experiencing extreme weather events particularly floods, droughts and strong winds (Awuor et al., 2008; Njoroge, 2015a). Darkoh et al. (2014) purport that a rise in sea level is likely to lead to the submergence of the town leading to loss of biodiversity and tourist attractions.

With regard to Botswana, tourism facilities located in the middle of the Okavango Delta were deemed most vulnerable to flooding and in the event of high floods, this would result in permanent flooding of the area, and consequently, turnover will be affected due to cancellation of bookings (Mbaiwa and Mmopelwa, 2009). The vulnerability of the delta to climate change was also reiterated by Hambira (2011) as alluded to in the earlier section. Hence Darkoh et al. (2014) identified the tourism sector as one of Botswana’s economic arms which has been affected by climate change and variability.

Another famous wetland endangered by climate change is the Victoria Falls shared by Zimbabwe and Zambia. Dube and Nharno (2018b) provided evidence of climate variability and extreme rainfall patterns with a stronger leaning towards drought years, shift in seasons and winter warming resulting in shorter peak discharge periods. The study further postulates that temperatures increased by 1.4°C between 1976 and 2016 and the paper purports that this would negatively affect flora and fauna, and tourists’ comfort. Other expected negative impacts include increased demand for cooling systems, thereby contributing to carbon emissions leading to more global warming, and increase in fire frequency for the area which can disturb the ecology of the area. Dube and Nharno further postulate that, generally, there has been a warming of winter months with the month of June witnessing a 1°C temperature increase between 1976 and 2016. Helicopter operations were already affected since high temperatures mean that the aircrafts take longer to climb to regulatory levels hence consuming more fuel. On a positive note, increased rainfall could result in increased runoff and river discharge over a short period which would be a desirable turn of events for tourism as high river discharge enhances the aesthetic value of the falls.
Climate change policy responses in the tourism context

The results presented in this section are from the reviewed cohort of papers that were deemed to answer the question pertaining to climate policy responses that exist in Africa’s tourism-climate change nexus. The climate policy actions were in response to the following climatic effects on tourism activities: increased temperatures, frequent droughts, coral bleaching, flooding, poor climatic conditions, extreme weather events. The responses covered both adaptation and mitigation measures.

Adaptations geared towards increased temperatures include alteration of activity times (Hambira et al., 2013) and the adoption of climate-friendly facilities (Dube & Nhamo, 2018a). In response to increased drought occurrences, tourism operators in Botswana planned to provide water holes for animals (Mbaiwa & Mmopelwa, 2009; Saarinen et al., 2012). For impacts that reduced the quality of attractions such as coral bleaching, diversification of the tourism product was the way to go. For example, in the Red Sea area in Egypt, companies that are predominantly dive operators have diversified their offerings ranging from bird watching, lessons on astronomy and indigenous foods, culture and music (Marshall et al., 2011). To address flooding, responses ranged from moving guests to alternative rooms or locations (Mbaiwa & Mmopelewa, 2009); improvement of drainage systems by hoteliers in Mombasa Kenya, while the resultant cancelation if bookings were compensated by local walk-ins, day trippers and conference makers (Njoroge, 2015a). In the event of poor climatic conditions, tourists engaged in alternative activities that are not weather dependent while beach tourism operators in South Africa’s coastal towns provide board games and satellite televisions for their guests (Hoogendoorn et al., 2016). On the other hand, extreme weather events would require revision of pricing models due to increased insurance premiums while changes in tourism peak and off seasons in Livingstone, Zambia would call for business realignments (Dube & Nhamo, 2018a). Shaaban and Ramzy (2010) identified increasing public awareness as the most appropriate policy response to the impacts of climate change on tourism in Egypt and the country has prepared a national action plan on climate change to coordinate its efforts.

In terms of mitigation measures, the climate actions identified during the review include greening of accommodation establishments, that is, implementation of measures for reduced energy and water consumption and minimisation of the hotel’s environmental footprint (Hoogendoorn et al., 2016; Rogerson & Sims, 2012). The studies revealed that various hotels in South Africa were at different levels of implementing green initiatives driven mainly by costs, the voluntary nature of the policy in the country and international tourists who opted to stay in green or environmentally friendly establishments. Examples outlined in the studies included a change from high energy demand electric appliances such as stoves to gas powered appliances, heat pumps to reduce energy costs of boilers, renewable energy and smart technologies for all energy inputs, outputs and consumption; and with respect to water conservation, water saving shower heads were installed and grey water used where possible. With regard to carbon-neutral tourism policies, Gössling and Schumacher (2010) found no correlation between income and willingness to pay indicating that even though the Seychelles for instance is an upscale destination, wealthy travellers will not necessarily want to pay more for their travel in order to offset their emissions. The study however highlights that, in the bid to maintain viable economies, it may be wise for small tropical islands to proactively adopt carbon neutral policies, a path which may not be sustainable in the long run should more large economies join efforts to offset emissions resulting in increased costs for carbon reductions or offsets. Furthermore,
 according to the study, impact of climate policies on developing countries such as Madagascar and Seychelles, for example emission trading schemes, may affect ticket prices, e.g. for price elasticities close to −1 and in the event that tourist’s price perceptions would focus on the cost of airfares, demand may decline by up to 6% for the Seychelles. The negative growth rates indicate that developing countries depend on international tourism which involves long haul trips.

Discussion and conclusions

Tourism in Africa is mainly nature-based making the chances of escaping the challenges of climate change very limited. It is thus imperative that research on all facets of climate change including the vulnerability of the tourism sector, the impacts thereof on the sector and appropriate response measures to guard the industry be accelerated. Based on this review, not much academic research has been done to inform affected stakeholders on what to expect and what to do to avoid the anticipated negative impacts or to take advantage of the positive ones.

The review showed that only one paper, Hambira (2011) made an attempt to investigate the vulnerability of the tourism sector to climate change. There is therefore limited literature and research that has been carried out on the vulnerability of the tourism sector to climate change. It is however important to determine how vulnerable the tourism sector is to climate change in order to prevent or minimise the loss of value of tourist attractions. In terms of impacts of climate change on the tourism sector, the review has indicated that even though the studies have shown evidence of the drivers of climate change such as increased temperatures and precipitations, few of them have shown the actual impacts of these on tourism operations. Therefore most of the papers alluded to expected impacts from the drivers of climate change as opposed to the effect that these drivers have had on tourism-related activities. This may be because climate change is a long-term phenomenon whose impacts may also manifest in the long term (Hambira, 2017).

Without adequate information on the extent of vulnerability of tourism attractions to climate change as well as impacts thereof, efforts to put in place appropriate response measures would be futile. Research and provision of relevant information set a platform for appropriate adaptation or mitigation strategies to be devised in order to minimise or eliminate impending climate impacts on the tourism industry. This would ensure sustainable tourism practices in Africa. The papers reviewed for this chapter either made some recommendations on suitable response strategies depending on the destination under study or revealed the strategies currently in use or planned at various tourism destinations and facilities. The strategies were either aimed at reducing emissions associated with the tourism industry or adaptation and coping strategies that the industry could apply to its operations in order to contend with the effects of climate change. Climate adaptation plans require that both the likely positive and negative impacts be considered (Marshall et al., 2011).

Adaptation by all tourism stakeholders especially tourism operators, tourists or policymakers is key in sustaining the tourism industry against the vagaries of climate change. Research in Africa has shown however that response leans towards reactionary rather than precautionary measures of climate change since often operators do not have adaptation plans in place or planned. This may be exacerbated by the fact that the impacts of climate change are long term and uncertainties surrounding impact predictions make the determination of adaptation needs difficult. Not only should nature-based tourism be protected from climate change, the sector’s contribution to emissions should also be considered and
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dealt with in relation to the reduction of carbon footprint in facilities and aviation. Given the environmental hazards associated with climate change that have a bearing on tourism in terms of possible flooding events, heat stress, disease outbreaks, it is important for relevant stakeholders to have appropriate plans to deal with the emergencies associated with extreme events resulting from climate change. Considering that climate change has no borders, a sub-regional approach to the tourism-climate change issues could strengthen country efforts.

References


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