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Climate Change and Tourism in Tanzania: Identifying the Gaps

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Abstract
Tourism plays a significant role in Tanzania's socio-economic development but climate change is likely affecting natural resources relevant for the sector. This paper identifies knowledge gaps regarding the impact of climate change on tourism in Tanzania through a review of literature. Findings show that the literature is rich in explaining the impact of climate change on natural resources base relevant for tourism. However, it is not clearly integrating knowledge on the impact of climate change on relevant natural resources and the actual impact on operations and performance of the tourism sector.

Keywords: Tanzania, Climate change, tourism attractions, water resources, Kilimanjaro

Introduction

Tourism is one among climate sensitive sectors since it is heavily dependent on natural resources which are vulnerable to climate change (such natural resources include water, wilderness including wildlife and forestry resources; beach, scenic view, and weather). Climate change is likely leading into volatility in the sector's performance in many countries across the world. Some of the metrological characteristics which have already been observed in different parts of the world and which have implications on the tourism sector include higher maximum temperatures and more hot days, more severe tropical storms with higher speed winds, more intense rains and more severe droughts (IPPC 2007, 2014). In Tanzania, climate change is a reality. A study by Luhunga et al., (2018) indicates that for the period 2011–20100 Tanzania is likely to experience an increased minimum and maximum temperature trend over the entire country. In the western parts of the country, south-western highlands and the eastern parts of Lake Nyasa, for example, maximum temperatures are projected to be greater than 3.5°C and in the range of 2 to 2.4°C. The western sides of the Lake Victoria basin and parts of North-eastern highlands are likely to experience increased minimum temperatures in the

range of 4.5 to 4.8°C. The cold season, i.e. June-July-August-September (JJAS), is likely to become warmer than the warm season that starts from October and continue to May. During this season (JJAS), the country is likely to experience an increased maximum temperature in the range of 1.7 to 4°C (Luhunga et al., 2018). The country is generally experiencing seasonality variability characterized by varying rainfall amounts, varying rainfall timing (in terms of onset, peak, and ending) as well as variations in distribution and higher temperatures (Bushesha 2018; Bushesha 2015; Kangalawe and Lyimo2013; Mjata and Bushesha, 2017). As such most parts of the country are getting drier with increased temperatures (Bushesha 2018; Liwenga et al., 2012; URT 2012; Kangalawe and Lyimo 2013). While Mjata and Bushesha (2017), as well as Liwenga et al., (2012) report frequent drought and increased temperatures in northern highlands; Mwangole et al., (2015) report similar findings for southern highlands. Increased incidents of prolonged drought and increased temperatures in north-west and central part of the country is notably reported in Kangalawe and Lyimo (2013); Lema and Majule (2009); Bushesha (2018); Katunzi et al., (2017) and Matata et al., (2018). As a result of seasonality variability, during the last 40 years Tanzania has experienced more frequent and severe flooding events particularly along coastal areas (Bushesha and Mbura, 2012); other parts of the country that have been reported to experience severe floods include central and southern parts of the country including Dodoma and Mbeya regions (URT 2012; Bushesha, 2015). Not only that, climate change has resulted into vector diseases such as malaria in former non-malaria zones such as the northern and southern highlands. Additionally, over the same period of time more than 70% of all natural disasters have been hydro-meteorological and are linked to droughts and floods (URT 2012).

There is no question that Tanzania is rich in natural resources that offers enormously in tourism. The Serengeti plains host the largest terrestrial mammal migration in the world. The Ngorongoro Crater on the other hand, is the world's largest intact volcanic caldera and home to the highest density of big game in Africa (Kimwaga, 2014). The Mikumi, Manyara and Selous, also adds on the Tanzania's richness in wildlife resources which makes an important tourist attraction in the country. Bagamoyo, Kilwa and Zanzibar are one of the important historical sites in the world particularly on the history of slave trade. Kondoa Irangi and Isimani are other such historical sites available in the country. Being the highest mountain in

Africa and caped with ice despite being in the tropics, Mount Kilimanjaro benefits hugely the tourism sector in the country.

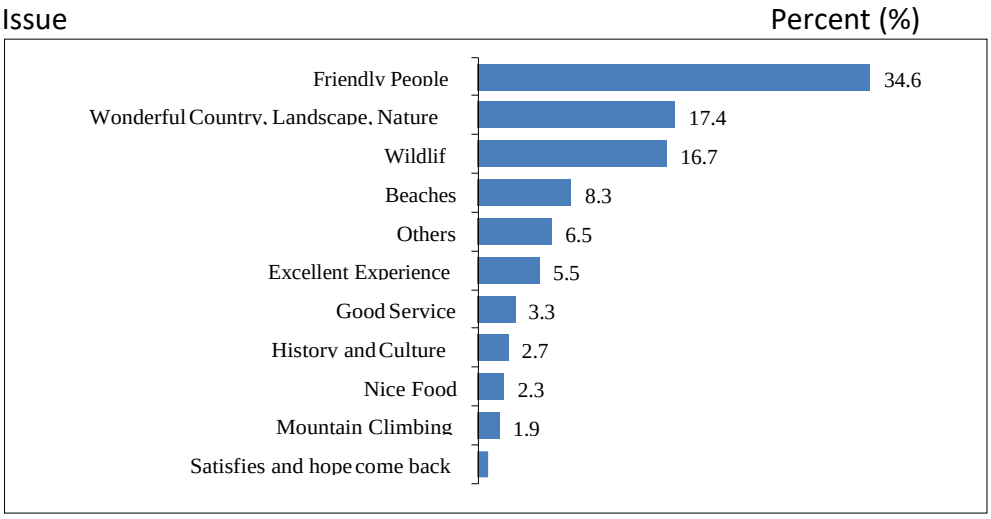
Of recent, the sector has attracted many international figures including worldly renown musicians, soccer players and designers and many others who have all visited different tourist sites with much attention on safaris. The former US president Mr. Baraka Obama and his family have reportedly commended tourist attractions in the country. Having spent five days in the country with his family, Mr. Obama promised to boost the sector in the country. The Swiss president Mr. Alain Berset is said to be visiting the country for fifteen days for the same purposes[1]. As such, tourism contributes substantially in the social and economic development in the country. According to Travel and Tourism Council (2018) in year 2017, for example, the sector's (Travel and Tourism) direct contribution to GDP was TZS4,405.7bn (USD1,975.9mn), which was an equivalency of 3.8% of total GDP; the forecast indicated a rise of such direct contribution by 9.4% in 2018. On the other hand the total sector's contribution to the national GDP in the same year 2017 was TZS10,526.7bn (USD4,721.0mn), an equivalency of 9.0% of total GDP and projections indicated a rise of such total sector's contribution to the GDP by 9.1% in 2018 (ibd). Also, while in 2017 Travel and Tourism directly supported 446,000 jobs (3.3% of total employment) and this was expected to rise by 7.1% in 2018; within the same year (2017), the total contribution of Travel and Tourism to employment, including jobs indirectly supported by the industry was 8.2% of total employment (1,092,500 jobs) and this was expected to rise by 6.6% in 2018 (ibd). The sector makes a good market for goods and services in such sectors as agriculture, industry, transport and construction. Supplies from the agricultural sector as well as the industry sector particularly handicrafts benefit the country at individual as well as at country levels; likewise transport services.[1]

However, URT (2017) indicates that levels of tourist satisfaction in the country is at stake. For example, very few tourists (0.8%) are satisfied with tourism services provided in the country and would likely come back (figure 1); this is not welcoming findings for the sector. What concerns this paper is the interrelationship between climate and tourism vs. tourism performance in the country. The different subsectors in the tourism sector are mostly climate sensitive. Safaris, world heritage sites, mountains, birds habitats and exotic beaches are all climate sensitive tourism attractions

(National Geographic 2018). Yet it is not very much known the extent to which climate change is impacting tourism operations and hence the sectors performance. The paper therefore explores the literature that explains how different climate change variables are currently affecting or likely to affect the different tourism operations and hence the sector's performance.

Understanding the existing knowledge as well as the gaps is crucial for adaptation planning which is a major focus for the Tanzanian chapter as stipulated by the Tanzania climate change strategy (see URT 2012). The discussion in this paper concentrates on the interface between tourism activities and the major climate change variables including rainfall, temperature, excessive wetter weather and severe drought. The paper first establishes the interrelationship between climate and tourism. Secondly, the paper discusses the impact of climate on tourism. Thirdly, the paper identifies existing gaps through answering the question what is yet to be known and how that is likely affecting tourism performance in the country.

Figure 1: What Impressed Visitors. 'Others' refer to such variables as specific scenery at specific sites as well as specific encounters by visitors such as unexpected sceneries and weather.



Source: URT (2017)

Theoretical Framework

This study adopted the carrying capacity theory in examining the impact of climate change on tourism. The Malthusian Theory of Population is a theory of exponential population growth and arithmetic food supply growth. Based on the law of diminishing return, Malthus believed that the rapid population increase (in his society during those years) would surpass the environmental capacity to produce food hence most people would die of hunger and other natural checks in order to maintain balance between population and food supply (Malthus, 1986). For this study, the carrying capacity theory is used to explain the idea that climate change jeopardizes the capacity of the different ecosystems to supply the necessary resources for tourism. For example, prolonged drought reduces water availability for such important tourism sub-sectors as food production, wildlife, and domestic uses and the general hospitality operations; this in turn affect tourism performance as tourists are likely to refrain from visiting the country due to lack/ expensive food, lack of satisfaction upon visiting game parks (due to wildlife loss), and poor hospitality caused partly by lack of water. Likewise climate change reduces ice cap on Mount Kilimanjaro (Minja, 2014) and accelerates deterioration of some historical sites through acceleration of weathering (Berenfeld, 2008). As a result, Mt. Kilimanjaro and the historical sites will be deprived of their capacity to attract tourists; hence forth numbers of tourists visiting the sites will be reduced and because of that the tourism sector performance is likely to be compromised.

Methodology

The Study Area

Tanzania lays between latitudes 1° 00’ and 11° 45’ south of the Equator and longitudes 29° 15’ and 41° 00’ east of the Greenwich meridian. It is bordered on the south by Mozambique, Malawi, and Zambia; on the west by Zaire, Burundi, and Rwanda; on the north by Uganda and Kenya; and on the east by the Indian Ocean[2] (Figure 2). The total area is 947,300km2 out of which land area covers 885,800km2 while water area covers 61,500km2[3] (Figure 2).

Figure2: Geographical location of Tanzania

Source: https://www.google.com (accessed 5.9.2018)

Tropical climate dominates the climate of Tanzania. However, there are variations across regions given the fact that the topography in the country varies from low land to highlands. Temperatures range between 10 and 31°C depending on topography and season in a given year (URT 2012). The country comprises many water bodies they include the Indian Ocean, lakes such as lakes Victoria, Tanganyika and Malawi. Others are lakes Manyara, Natron, Eyasi, Rukwa, and Kitangili; some of these can be observed on Figure 2. The country also has a number of national parks, including the Serengeti, Ngorongoro, Manyara, Mikumi, Gombe, Mahale and Katavi. There are also numerous game reserves in the country including Selous, Rungwa, and Uwanda. Tanzania is home to the Africa's highest point, Mount Kilimanjaro. The Serengeti National Park is believed to have the greatest concentration of migratory game animals in the world (Briggs, 2006). Agriculture, mining, tourism, financial and business services, trade, tourism, and manufacturing are the major economic sectors in the country (JETRO, 2014).

Methods

Integrative review approach

According to Callahan, (2010), literature review can stand alone as a research method that can bring light about unknowns in a given field of study usually through identifying knowledge gaps. This research work intended to identify knowledge gaps on the study topic, literature review, therefore, was considered to be the most appropriate research method for the study. The study adopted an integrative review, this is a form of research that reviews, critiques, and synthesizes representative literature on a topic in an integrated way such that new frameworks and perspectives on the topic are generated (Torraco, 2005). The body of literature includes all studies that address related or identical hypotheses. The major advantage of an integrated review approach over other approaches as systematic review is that an integrated review includes both experimental and non-experimental (quantitative and qualitative) studies where as a systematic research includes only experimental (quantitative) studies and many times only randomized controlled trials (Callahan, 2010). Although integrative review considers both 'what' is being said (content) as well as 'how' it is being said (as the case is in methodological review) yet the reviewer is not confined into taking into considerations both scenarios at a go, one can focus on either content or methods at a time (Cooper, et al., 2009). Therefore, the study adopted an integrative review approach to scrutinize of all studies related to the study topic regardless of whether they are of qualitative or quantitative nature. With a focus on 'what is being said' (content) the study hunted and reviewed all literature on the impacts of climate change on tourism. Henceforth, other review approaches as argumentative, methodological, theoretical, historical and systematic review were not of interest to this study. According to Callahan, (2010) a well-done integrative review meets the same standards as primary research in regard to clarity, rigor, and replication.

Data and Analysis

Relevant journal articles, conference papers, books and achieves were put under scrutiny in a way that insights on what is in the pool of knowledge and what is not was revealed. Internet was used to collect online journal articles and reports from different websites and libraries allowed the study to access a significant body of literature that is used in this study's analysis and hence its related conclusions. The inclusion criteria were documents that could provide insight on a discussion pertaining climate change impact

on tourism, written in English, and included either empirical and/or theoretical content. The major methodological challenge was limited access to some journals especially. Therefore, it is worth noting here that most data used in this study based on those data accessed for free. The collected articles were first read to determine their core contents. Then the contents were analysed thematically where main themes and subthemes were determined. Through this approach the study managed to map out main themes that are currently available in the existing literature; that way the study was able to identify issues that are yet to be addressed in the existing body of knowledge.

Findings and Discussion

The Interface between Climate and Tourism

To better understand the interface between climate and tourism the paper is first contextualizing different terms and concepts which in later sections will form a base for the discussion. Bushesha (2011) noted that peoples' perception of concepts pertaining climate influences their responses on impacts that may be brought by climate change. As such, it is considered important for studies to conceptualize different terms and concepts whenever a discussion in the area of climate change is being undertaken. Glantz (2003) also made an observation that the term 'climate' is too often used interchangeably with the term 'weather' (Glantz, 2003: 17) while the two are scientifically defined differently. This section, therefore, conceptualizes such terms and concepts as climate, weather, climate change, climate variability, climate fluctuation, and extreme weather events as they are opposed to seasonality.

The term **'**climate' is scientifically defined as "the average meteorological condition over a specified time (Glantz, 2003: 17) "usually at least thirty years. The term 'weather' on the other hand is defined as "a condition of the atmosphere at a particular place and time measured in terms of wind, temperature, humidity, atmospheric pressure, cloudiness and precipitation" (Ibid). Using the two terms interchangeably makes wrong communication to the intended audience; this may have serious impact in planning for climate change adaptation, resilience and mitigation.

The concept "climate change" is also differently defined by different people/sources. Alley *et al.,* (2007) define climate change as any change in climate over time, either due to natural variability or as a result of human

activity. Slater et al., (2007) define climate change as a process of global warming, in part attributable to the 'greenhouse gases' generated by human activity. While Slater et al., (2007) consider human actions inseparable in defining climate change, Alley et al., (2007) suggest that climate change may or may not necessarily be caused by human actions. That means climate change may happen even without a hand of man. The United Nations Framework Convention on Climate Change (UNFCCC) defines climate change as a change of climate that is attributed directly or indirectly to human activities that alters the composition of the global atmosphere which is in addition to natural climate variability observed over comparable time periods (Alley et al., 2007). This paper views climate change as any change in climate - being natural, human induced or both. In describing climate change, however, there are a number of terms that need to be defined or used consistently since they influence human activities in specific ways; these include variability, fluctuation, deep climate change, extreme meteorological events and seasonality.

Climate variability refers to changes in climate on seasonal and inter-annual time period bases (Glantz, 2003). This manifests itself in such ways as succession of years of either deficiency or surplus (rainfall). Climate fluctuation refers to changes in climate on decadal time scales (Ibid). Climate change is a change in the statistical distribution of weather patterns when that change lasts for an extended period of time (i.e. more than a decade to millions of years). However, where there are shifts in the global climate system that have not been witnessed for one or more centuries or even millennia the situation is referred to as deep climate change (Ibid). For Glantz, describing time frame is important in defining the concept climate change. Extreme metrological events - refers to such events as droughts, floods, frosts and severe storms (Ibid). Seasonality refers to the natural flow of the seasons; it is therefore the opposite of the first four, i.e. variability, fluctuation, change and extreme metrological events. Therefore perceptions or experiences of climate change may be a function of one or more of the four key terms above.

The interface between climate and tourism is complex in the sense that the two influence each other. Consumer patterns in the tourism industry, for example, have a role in either aggravating or mitigating climate change. Tourists' choice of foods, for example, heavily influences the carbon-intensity of meals served. Food now accounts for approximately one third

of emissions caused by households in industrialized countries, and is thus an important factor in reducing energy use (WTO and UNEP 2008). Generally, locally produced food will have a considerably smaller energy footprint. Food choices among tourists that necessitate food importation may lead to a significant contribution to emission of Green House Gases (GHG) within the sector. Food imported by air is remarkably noted for its contribution to the emission of the GHGs. Contrary, using local resources, for instance by serving mostly local food instead of imported dishes; hotels would hugely cut down carbon emission from food within the sector. A good example would be tourists in Small Islands States opting to be served with local seafood vs. imported meat dishes. Likewise, tourists favouring organic food and avoiding food that is particularly harmful to the environment, such as shrimps produced in converted mangrove areas would contribute positively in cutting down GHG emission. Environmentally oriented restaurants in Europe, for example, have started to serve increasing shares of vegetables, as meat is far more carbon intense (WTO and UNEP 2008); the state of affairs on the same in African countries is yet to be established. Energy used for heating facilities such as water and warming or cooling hotel rooms is another source of GHGs emission that leads to global warming (Scott and Jones 2006). To deal with this it is more feasible using solar power especially in tropics, this have been proven to work efficiently and securely (ibid).

Climate on the other hand is an important element considered for tourism. Climate variability, for example, determines the length and quality of tourism seasons thus plays a major role in the destination choice and tourist spending (UNWTO, 2018). Tourists demand patterns and flows are influenced by weather conditions of given places. Favourable weather in the area of origin facilitates movements and travels to areas of destination while poor weather is a hindrance to such movements (Scott and Lemieux, 2009). Most air travels tend to be hampered by heavy snow for example; while extreme metrological events such as severe flooding tend to lead into destruction of infrastructure both in areas of origin and destination and that discourages tourists from travelling to such particular places but also moving from their own homes (Ibid). As a result most cancellation of tourists' bookings tend to change flow patterns of tourists. Demands of tourists also change with weather patterns; it would be strange for tourists to stick to a prior planned safari tour or outdoor leisure and recreation activities for this matter with weather change to a poor day. Changes in

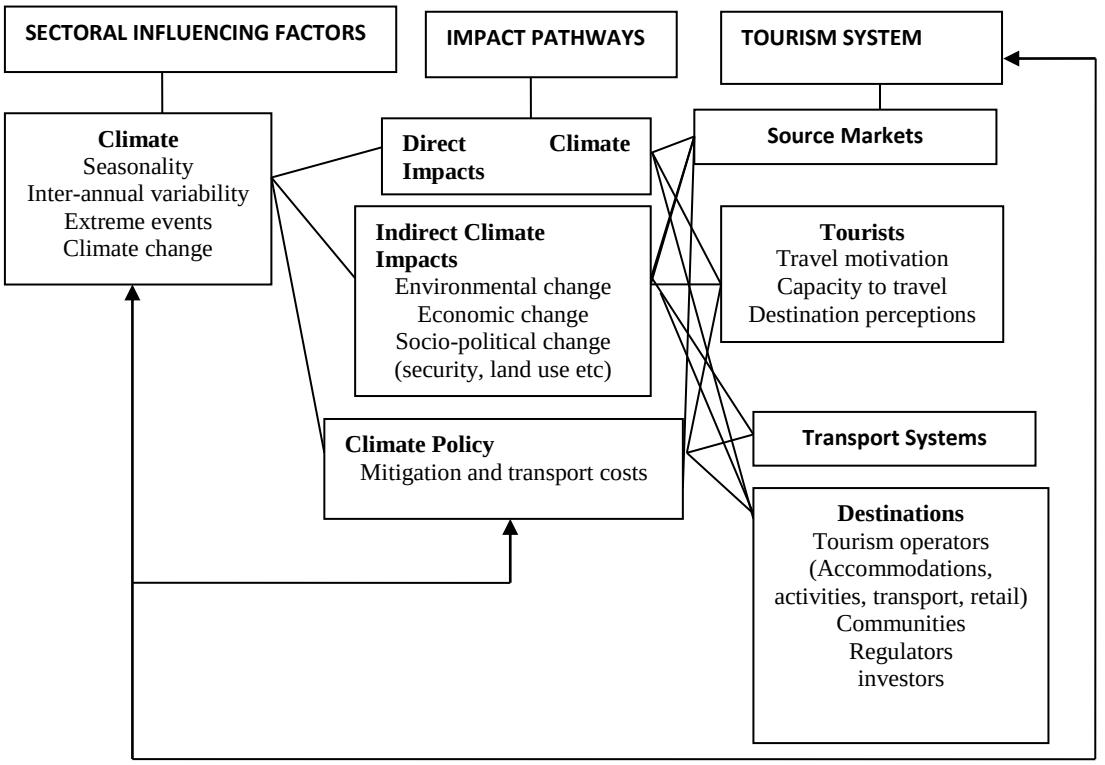
tourists flow and demand patterns consequently impacts tourism businesses and eventually locals in host communities. Such sectors as agriculture, handicrafts and construction tend to be hampered by any negative swing in the tourism sector (UNWTO 2018).

Scott and Lemieux (2009) report that tourism destinations are influenced by seasonality in demand (this is why we have high and low seasons), they are affected positively or negatively by variability (that may bring heat-waves, unseasonable cold, drought or heavy rain) (Scott and Lemieux 2009). All of the above can affect tourist comfort and safety and thereby satisfaction. Climate change can also affect products that attract tourists e.g. snow cover, coral reefs and wildlife (Moreno, 2009). Scott and Lemieux (2009) also made it clear that climate variability also impacts other sectors relevant for tourism. The water sector for example is an important sector as it supplies water in the tourism sector. Water is among the major resources that enables smooth running of key activities in the sector. Therefore when rainfall dwindles in a given season water supply and quality is likely to be at stake. The other sector is the agricultural sector, this supplies food to tourism sector which is also key for the sector's operations i.e. feeding tourists as well as employees. Any crop failure has implications to the sector (Scott and Lemieux, 2009). When temperatures go down significantly heating-cooling costs usually also shoot up, this has implications to the sector as well (ibid). With higher temperatures snowmaking requirements adds to the costs of tourism operations, same applies to insects and pest control, as well as evacuations and temporary closures (ibid).

Climate change i.e. variability, fluctuation, deep changes and extreme weather conditions and outbreak of infectious diseases, wildfires, insects and water-borne vectors such as mosquitoes (for example malaria, jellyfish and algae blooms) and extreme events such as tropical cyclones are all closely related, all of which can deter tourists from destinations (Scott and Lemieux, 2009). Therefore along with other factors as travel costs (which of course may also be impacted by extreme weather), climate dominates destination image (Anderssen and Colberg, 1973) which has great influence on destination choice among tourist. Tourists may shy ways from re-visiting given destinations due to poor weather thereby hampering the sector's performance.

Figure 3 provides a summary of the literature on the interface between climate and tourism where through seasonality, variability, extreme events and climate change climate has both direct and indirect impact on all tourism systems namely source markets (tourists supplying countries/places), tourists motivation to travel, their capacity to travel as well as the way they would perceive destination; these have influence on decision to visit given attractions. The direct and indirect impacts of climate also have influence on transport system as well as on destinations as already discussed. Seasonality, inter-annual variations and climate change also impacts policies especially through mitigation policies as well as transport policies; these also have impact on the tourism system (Figure 3).

Figure 3: The interface between climate and tourism



Source: Modified from Scott and Lemieux (2009)

The Impact of Climate Variability and Change on Tourism in Tanzania

Rainfall

Rainfall pattern variability and change has significant impact on tourism operations. Planning for most tourism operations such as safaris, bird watching, mountain climbing, beach leisure activities including sun bath, as well as outdoor sports mostly depend on weather conditions as pointed out by Scott and Lemieux (2009). An unexpected wetter weather on a day that was meant for outdoor activities, for example, may not allow maximum enjoyment on the side of tourists. However, rainfall pattern variability and change is widely acknowledge in the Tanzanian literature (Climate variability and change in Tanzania is widely acknowledge in the existing literature (See for example URT 2012; Yanda and Mubaya 2011; Hamisi 2013; Bushesha 2014; Kangalawe and Lyimo 2012; Bushesha and Mjata, 2017). Hamisi (2013) noted that rainfall in Tanzania is highly variable. He pointed the northern parts of the country particularly Kilimanjaro region to be experiencing high rainfall variability. Likewise Mkonda (2014) reported rainfall variability in Mvomero district that highly affected agriculture. Bushesha (2014) also noted rainfall variability in Kyela district which is in the southern part of Tanzania and that it highly affected rice and maize production in the district. Likewise Phillipo *et al.,* (2015) reported rainfall variability in Pawaga in Iringa region in the southern highlands that had had impact on agricultural production in the region. Rainfall variability in the country is also reported by Kangalawe and Lyimo (2012) who noted inter annual rainfall variations in western part of the country and that significantly impacted agriculture in the area.

Clearly the literature is rich in pointing out the existence of inter annual rainfall variations across the country and its impacts on such sectors as agriculture. The literature however is short in explaining the impact of such inter-annual rainfall variations on the tourism sector in the country. There is no ample literature that provides a clear account on the extent to which tourism operations have been affected by rainfall variability over time despite the fact that rainfall variability in the country is real. How does variability in rainfall (in terms of onset, amount, and ending) in different tourism attraction areas (such as the variability in the northern circuit as discussed by Bushesha and Mjata 2017; also the variability presented by Kangalawe and Lyimo 2012 in central parts of the country as well as the variability presented by Phillipo et al., 2015 for the southern zone) affect the tourism sector in terms of tourist demand, food supply, water supply?

These together with recommendation for repeat visit are some of the questions that are still not clearly answered in the existing literature. Experiences elsewhere in the world, however, indicates that rainfall variability has negative impact on tourism. In Austria for example, Falk (2014) noted that the average precipitation had significantly negative effects on tourism performance.

Scott and Lemieux (2009) also noted that seasonality and variability have impact on tourism operators including accommodation providers, tourism activities e.g. tour guiding; transport providers, food supplies; also impacts on communities, regulators and investors. As noted earlier the body of knowledge clearly demonstrates that rainfall variability affects agriculture in Tanzania, in particular, climate change results into crop failure coupled with food insecurity in the country (Ojija *et al,* 2017). At the same time agriculture is an important sector for food supplies for the tourism sector. When seasons change unexpectedly crops failure tend to be inevitable; that may disrupt food supplies in hotels which in turn may lead into tourists' dissatisfaction. To what extent has the impact of climate change on agriculture particularly inter annual rainfall variability affected food supplies in the tourism sector and its implications on revenues, number of tourists arrivals, tourists perceptions over the country, are yet other questions that have no clear answers in the existing literature. Tourism sector employs a range of population in the country; local farmers around tourist attractions as well as tour guides and porters (Gereta, 2004). How exactly such groups as those of local farmers as well as tour guides and porters are being affected by climate change in the sector is yet to be explored. A comment by a commentator online on the impacts of climate change on tourism as quoted below has a strong message regarding the fate of porters, water resources and tourism at the Mount Kilimanjaro:

> Until recently, water was easily found in streams and rivers off the glaciers, but porters now have to walk for up to an hour to find water. In the future, I think the only option will be to hire more porters to carry bottled water up the hill, which will in turn make the trip more expensive. Since Kilimanjaro is one of the more expensive mountains in the world to climb now (the permit and sleeping cost is USD$100 per night), it is easy to imagine that tourism to Kilimanjaro will also dry up in the future.[4]

Temperature

As mentioned earlier temperature in Tanzania is rising and its effects on the environment are well discussed in the existing literature (see for example Yanda and Mubaya 2011; Hamisi 2013; Bushesha 2014; Kangalawe and Lyimo 2012; and Bushesha and Mjata 2017; IPPC 2014; Minja 2014). For tourism, temperature rise affects the sector in many ways. Due to rising temperature some tourist attractions have been affected; the ice cap on Mountain Kilimanjaro which is one of the most important tourists attraction is melting (Minja 2014). The Kilimanjaro has lost 82% of its ice cap in the last 90 years (Kilungu and Amellung 2016). Primarily, tourists excitement would be to see snow covering a mountain in the tropics, most tourists came to witness such existence of snow in tropics. Snow is for the northern and southern hemisphere at most. As such tourists flourished in the country to see the wonder as presented by Reeves (2018):

> The white cap of Kilimanjaro has always been considered an integral part of the unique landscape of Tanzania which attracted thousands of tourists from all over the world to have an unforgettable experience of a Kilimanjaro climb...Climatologists have concluded that over the last decades the melting of ice on Kilimanjaro has accelerated...Now the researchers predict that in case the current trend persists, by 2033 the highest mountain will have lost its snow cap altogether (Reeves, 2018).

Connected to the above, since ice is melting in the Mount Kilimanjaro, implicitly the former intact rocks gets loose; climbing the mountain then becomes more risky as boulders may fall unexpectedly causing injury and or deaths; this also is not welcoming for tourists. How ice melting in the Kilimanjaro is so far influencing tourists perceptions of Mount Kilimanjaro as a destination as well as their decision to visit the attraction and how that has so far impacted the sector's performance is yet to be revealed. Climate change especially temperature rise has lead into spread of malaria in formerly non malaria zones. Ojije *et al.,* (2017) and Minja (2014) confirm outbreak and increased cases of malaria in the northern highlands yet the effects of such spread of malaria in Kilimanjaro on tourism are not critically delineated in the existing literature. Although (Minja 2014) demonstrates that the spread of malaria in the northern highlands is likely deterring tourists from visiting mount Kilimanjaro yet one would ask for example how many tourists cancelled plans to visit the Kilimanjaro specifically due

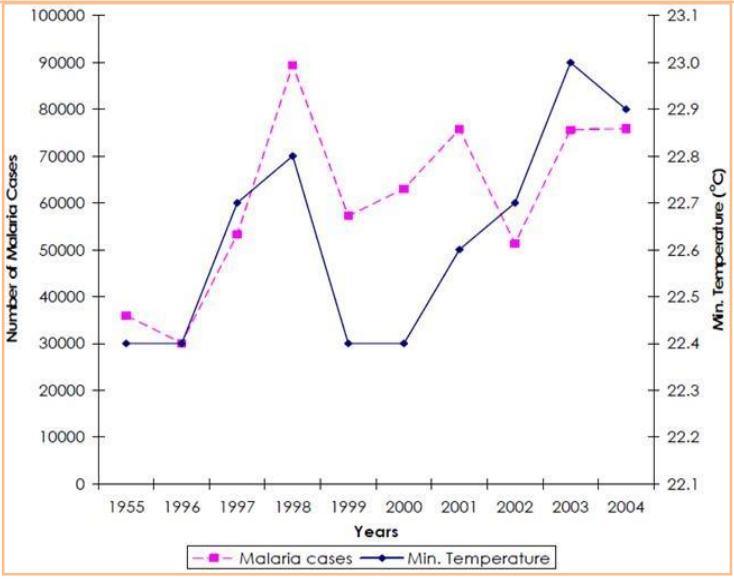
to malaria outbreak? To what extent such travel plans cancelations had affected local farmers who would otherwise supply food to those tourists? What about the hotels which had reserved rooms for the tourists-how much money did they lose and how that had affected business? How tourists travel cancellation had had knockoff effect on revenue and the general sector's performance? These are the kinds of specifics which are missing in the existing literature. In the UK in year 2010 the press made headlines following a pop star music singer and former wife to a famous England footballer Ashley Cole, Cheryl Cole fall sick from Malaria after visiting and climbing Mt Kilimanjaro. Explaining her malaria experience after recovery Ms. Cole told the Sun the following:

> For four days Derek and I had been on safari to Tanzania in June, 2010....There was no airport lounge (in Tanzania) and we sat on these plastic chairs for three hours waiting for the flight. When we finally took off I noticed three mosquito bites, two on my foot and one on my face. All of them were really painful. Five days after...when I got home I collapsed on my bed. Derek found me and took my temperature, it was 104°F. A blood test at home confirmed malaria and I was rushed in for treatment in the early hours. "This is serious, and I mean serious," the doctor said. I had the worst strain of malaria, falciparum. It was attacking my liver and new blood cells. My malaria count was rising rapidly. The parasites in my liver were doubling and I was taken to the Hospital for Tropical Diseases. I can clearly remember asking the nurse if I was dying and feeling relieved when she said: "It's a possibility." Derek slept on the floor beside me, refusing to leave. He began blaming himself, saying we'd never have gone on safari if he hadn't wanted to see a lion....[5]

Ms. Cole's case informs how spread of malaria in some of the Tanzanian tourist attractions could deter tourists from visiting the country. Two years ago, still malaria news was an issue making headlines in the UK. However, so far there is no literature that could otherwise confirm the extent to which the spread of malaria has affected number of tourists in the country (literature that could at least answer the several questions I have just paused above), this is an area that needs further research. The Tanzanian southern highlands were also formerly non malaria zone. However in 2005 Maegga et al., (2005) reported that malaria was the major public health problem in the highlands districts of Mbeya and Iringa Regions. Updates on

the status quo of malaria in the area and the state of art regarding number of tourists visiting southern highlands is required. Malaria outbreak has many implications both economically and socially. When people fall sick of malaria means they will need money and other resources for them to recover from the disease. Such people will also be off work for sometime till they fully recover and that means they will have to spend their savings since they will be less productive during the time when they will be sick. Not only that but also malaria may cause death hence no person would in any case be emotionally okay with malaria. Generally malaria is an expelling agent from people visiting any malaria prone area. Figure 4 reveals a close relationship between cases of malaria in Lushoto district (a district in the northern highlands) and temperature trends.

Figure 4: Annual malaria cases and minimum annual temperature in Lushoto district, 1995-2004



Source: Kibona, 2008 as cited by Ojija 2017

The literature on climate change also indicates that temperature rise is affecting the agricultural sector in Tanzania. Outbreak of non-common pests and diseases aggravated by temperature change is commonly reported as one of the impacts of temperature rise on the agricultural sector in the country see for example Yanda and Mubaya (2011), Lema and Majule (2010), Bushesha (2014), Minja (2014) and Liwenga et al., (2012). As mentioned earlier, hampering the agricultural sector will lead into

increasing running cost in the tourism sector which is not desirable for the sector's development. Details regarding the impacts of climate change on agriculture and hence food supplies in the tourism sector are still required. Which major crops for the tourism sector are now not available, by how much percent, and what have been the implications in terms of the sectors performance is a question to be answered.

Temperature rise leads to sea level rise, which have destroyed cultural, historical, archaeological and heritage sites along coastal areas in the country. The buildings at Kilwa, which made one of the worlds' heritage sites, are deteriorating partly due to temperature rise and rising sea levels (Figure 5). How many tourists have being shying away from the Kilwa ruins due to buildings deterioration and what that means in Tanzania's tourism development is yet to be well defined.

Figure 5: The Gereza Fort at Kilwa Kisiwani in Tanzania deteriorated partly due to climate change

Source: Berenfeld (2008)

Excessive wetter weather and flooding events

Favourable weather in both areas of origin and destinations facilitate movements and travels among tourists while poor weather is a hindrance to such movements (Moreno, et al., 2008). Experience shows that most tourists would cancel or reschedule prior travelling plans following poor weather in either origins or destinations or both (Moreno, et al., 2008). Excessive wetter weather and flooding events would cause such cancellations or reschedules of travelling plans among tourists. This is especially because excessive wetter conditions are not welcoming for most outdoor activities (Moreno, et al., 2008). Tanzania has been experiencing unpredictable seasonality, extreme dry weather and extreme wetter weather including flooding incidents; as such it is pertinent to conceptualize how that affects the tourism sector in the country. For instance, Dar es Salaam which is popular for beach tourism is one of the Tanzania's flood prone areas. A case study by Bushesha and Mbura (2015) noted the following: "between December 2006 and January 2007... heavy rains battered the city (of Dar es Salaam) triggering devastating floods". Many people were driven out of their homes, peoples' livelihoods were destroyed and many people were left without means to recover from the effects of the flooding event (Red Cross 2011). Likewise, in the year 2011 the city experienced flooding events of high intensity, duration and scale (Bushesha and Mbura 2015 citing Red Cross 2011). The 2011 floods magnitude was unprecedented and the effects were the worst ever; about 14,000 people were in dire need of humanitarian assistance (ibid). In April 2014 about 11 people were reported to have been died in Dar es Salaam because of flooding... Notwithstanding the measures taken so far, the problem of floods has alarmingly persisted in Dar es Salaam (Bushesha and Mbura, 2015:181-182).

There is, unfortunately, no literature explaining how tourism has been hampered by frequent floods in the country despite the acknowledgement that the country has been hit by flooding events more frequently partly due to climate change. Experiences around the world, however, indicate that floods are disastrous on tourism, they can affect bookings and reservations in accommodation and travel related businesses; they can also affect tourists' length of stay in destinations. In year 2002, for example, floods in Prague reduced the number of visitors by one-third with a cancellation of 30,000 reservations for national airline flights (Southon and Merwe, 2018 citing Suarez *et al.,* 2005; Kang *et al.,* 2010; Brázdil *et al.,* 2011; Filimonau *et*

al., 2011; and Maharjan, 2014). Southon and Merwe (2018) identify tourism destinations that has had already suffered due to flood related disasters to include the US state of New Orleans, Australia, Mumbai (India), Bangladesh, Malawi, Ghana, Nigeria, Botswana, Mozambique, South Africa and Zimbabwe. Jusohet *et al.,* (2012) report that in Malysia, the 2006-2007 flood had led to a destroy of the nature and cultural heritage which are key when it comes to tourists attractions; that in turn had led into a decline of tourists' influx in the country, loss of hotel revenue and occupancy, and drop in retails of city economy. Jusoh et *al.,* (2012) suggest that it is imperative to develop a tourism contingency plan that can ensure alternatives of adaptive measure are available during the post and recovery period of the flood event. This experience elsewhere in the world causes eyebrow rising in Tanzania; understanding how such flooding incidents gradually affects the tourism sector in the country would form basis for climate change adaptation plans for the sector.

Excessive wetter condition as well as flooding incidents can also destroy crops in the farms leading to shortage of food for the tourism industry. This could be true for Tanzania where floods tend to be reported in staple food producing regions in the country such as Arusha (Arusha district, Meru, Longido and Monduli districts); Zanzibar; Kilimanjaro (Same, Hai, and Mwanga districts); Tanga (Handeni and Lushoto districts); Manyara (Simanjiro, Kiteto and Babati districts); Tabora (Nzega and Kaliua districts); Pwani (Mafia and Rufiji districts); Mwanza, Morogoro, Dodoma, Mbeya, Rukwa, Mtwara, Shinyanga, and Geita.[6] How much do we know about tourists perceptions on food supply in the country and how that motivates/de-motivates them from visiting the country? This kind of questions adds on the need for the literature to deal with specifics as far as climate change impacts on tourism performance is concerned.

Tanzania is rich in game parks ranging from Serengeti, Ngorongoro, Manyara, Mikumi and all the way to Tarangire national park. According to Mathivha et al., (2017) "game parks are important recreational and nature tourism attractions. They offer visitors an unparalleled diversity of tourism opportunities, including game viewing, bush walks and exposure to culture and history" (Mathivha *et al.,* 2017:1). The impact of climate change on wildlife productivity and the general biodiversity is henceforth another concern for the tourism sector in Tanzania. While game park is an important tourist attraction, flooding results in deaths of wildlife. Spawning

grounds for fish and other wildlife habitats are often destroyed by floods; gradually, that translates into a reduced abundance of wildlife and degradation of the general biodiversity. With a reduced wildlife and degradation of the general bio-diversity, attraction takes a downhill side which makes bad news for the tourism sector. Morzillo and Alig (2011) present a detailed review of the literature pertaining effects of climate change on wildlife and wildlife habitat at a broad scale; although they intended to inform policy in the USA, still they provide key information for tourism stake holders since they draw examples from all over the world. They describe direct ecological and behavioural responses of wildlife to climate change, such as geographical range shifts by species. They confirm that habitat variation as a result of climate change is expected to affect individual species differently, based on life history, characteristics and ability to adapt to changing habitat conditions. Since Tanzanian tourism depends hugely on the wildlife and safaris, the observation by Morzillo and Alig (2011) form an important justification for scientists in the country to pay attention on the impact for climate change on tourism. Some of the questions that the literature would need to answer [from Morzillo and Alig (2011) perspective] would include the following: Which specific game species are being impacted and how? Where are such impacted games located? Are there any indicators that tourists are shying away from given game parks due to change in game species and if yes how that is affecting tourism performance in the country? Answering these questions will enrich plans for adaptation to climate change in the sector.

One of the tourists attractions that are would be impacted by excessive wetter conditions and /or floods would include the Lake Manyara wetlands where hippos, crocodiles and fish spawning grounds could be affected. Not only that but also flooding exacerbates contamination of the ecosystem with wastes from human activities including agriculture (Bushesha and Malley - upcoming). It should however be noted that currently Lake Manyara is drying up due to prolonged drought[7] as it will be presented in the next section.

Excessive wetter conditions and flooding events also affects other infrastructures relevant for tourism such as roads that tend to be damaged; busts of sewages and other water systems; destruction of electricity leading into power cuts in hotels and related facilities, as well as destruction of communication networks; all these would lead into

frustration in the tourism sector and would deter tourists from re-visiting the country and or even recommending the country for friends and relatives (Mathivha *et al.,* 2017:1). In worst case scenarios floods may also lead to destruction of different accommodation facilities, usually this would go hand in with property damage and the worst been loss of life (Mathivha *et al.,* 2017:1). In the 1990's Tanzania was battered by excessive wetter weather due to El Niño and that led to serious destruction of roads across the country. With prolonged rains maintaining roads especially roads with tourists attractions located in hinterlands such as in the national parks tend to be a serious challenge; roads that are non tarmac tend to be severely impacted during such times. Implicitly, tourism operations including safaris and many other activities tend to be at stake during excessive wetter weather. How this has impacted tourism development in Tanzania is yet to be unfold. Experiences in neighboring countries as Kenya shows that in 2006 El Niño rains left many park roads impassable for a long period of time, and that resulted in reduced tourist visits and loss of revenue (Nyamwange, 2016).

Extreme and prolonged drought

Extreme dry weather may impact the tourism sector in Tanzania in many ways. First, drought reduces water resources which are among the most import resources for the tourism sector. Water is important for feeding wildlife and maintaining stability of the bio-diversity. With water shortage wildlife is at stake and once that happens few tourists would be attracted to visit Tanzanian game parks and that has multiple implications on the general performance of the sector. Minja (2014) noted that due to frequent drought the Kilimanjaro National Park is facing forest degradation, decreased water in rivers and springs as well as wildlife and birds migration. This is supported by Gereta (2004) who noted that increased water salinity during dry seasons triggers animal migration in the Serengeti ecosystem. In the Ruaha National Park ecosystem, droughts have affected wildlife significantly through persistent dryness in the ecosystem (URT, 2012; Kangalawe 2012). Frequent incidents of prolonged drought have jeopardized the ecosystem's ability to provide the basic natural resource that supports livelihoods in the area (Kangalawe, 2012). According to Kilungu and Amellung (2016) the Serengeti National Park has lost 40% of its original area since 1910 due to frequent drought and the Mara River has lost 50% of its water flow since 1970. Lake Manyara is likely to disappear in ten years time unless drastic measures are taken; the current water depth

which is only 30 centimetres, during dry season water levels in the basin would go even less than the 30centimeters. While in the past the lake could drown an adult human, now people can cross the waters with ease Nkwame (2018).

How the reduced area of the Serengeti National Park (as an ecosystem) and the reduced water in the Mara River as well as the drying up of Lake Manyara has impacted tourism operations and the sector's general development is the key question that remains unanswered. Water is an important resource for hospitality which is one of the key parameters for tourism as already pointed out earlier. Hotels will less likely provide services of highest standards with water shortage; a range of activities from housekeeping to catering services will all be at stake during such times. With poor hotel services the sector is unlikely to attract a good number of tourists. Furthermore, most tourists would prefer friendly weather where excessive dry weather may deter some of the tourists from visiting the country. Empirical studies for this case are required to unfold prolonged drought effects on tourism performance in the country. Has scenic view degraded? Has game numbers diminished? Has water supplies diminished and if yes how that has affected tourism operations? Are tourists shying away from the attractions and what is the trend? If tourists are shying away from visiting these destinations how that has affected hotel business in related area, how that has affected the agricultural sector and particularly subsistence local farmers in the destinations surroundings, how government revenues have been affected? Answering these questions would touch some specifics on the impact of climate change on tourism in the country.

There is a limited literature explaining the detailed impact of drought on tourism in Tanzania. Lwoga and Asubisye (2018) focused on drought and production of cultural products for tourists and noted that climate change and drought in particular had led into scarcity of raw materials for making such cultural products impacting quality of such products. However, the literature is short in explaining how such production of cultural products of low quality has so far i) impacted growth in the tourism sector in the country; ii) sent negative image among tourists and how; iii) reduced recommendations for tourists from visiting the country in the next vacation; iv) reduced revenues among locals and at national level and to what extent; also, what is the likely future trend on cultural tourism given

the climate change status in the country? These are some of the unknowns that need to be unfolded. For South Africa, for example, findings by Mathivha et al., (2017) indicated that drought negatively affected tourism arrival in the country where 19.36% of the drought years corresponded to a negative change in tourist arrivals to the parks. Mathivha et al., (2017) concluded that with climate change tourism remains to be a fragile industry. Further impact of extreme drought on tourism is reported by Minja (2014) who noted that forest fires aggravated by climate change leads to the disappearance of unique flora and fauna in the Kilimanjaro national park. Agrawala et al. (2003) also argued that despite the KINAPA banning of camp fires, decreased precipitation and increased temperature has resulted into current increased forest fires compared to the few cases reported in past years. However both Minja (2014) and Agrawala et al. (2003) analysis only reveals the impact of climate change on natural resources base that is relevant for tourism; insights on how the impacted resources base in turn affects the sector's performance is still required.

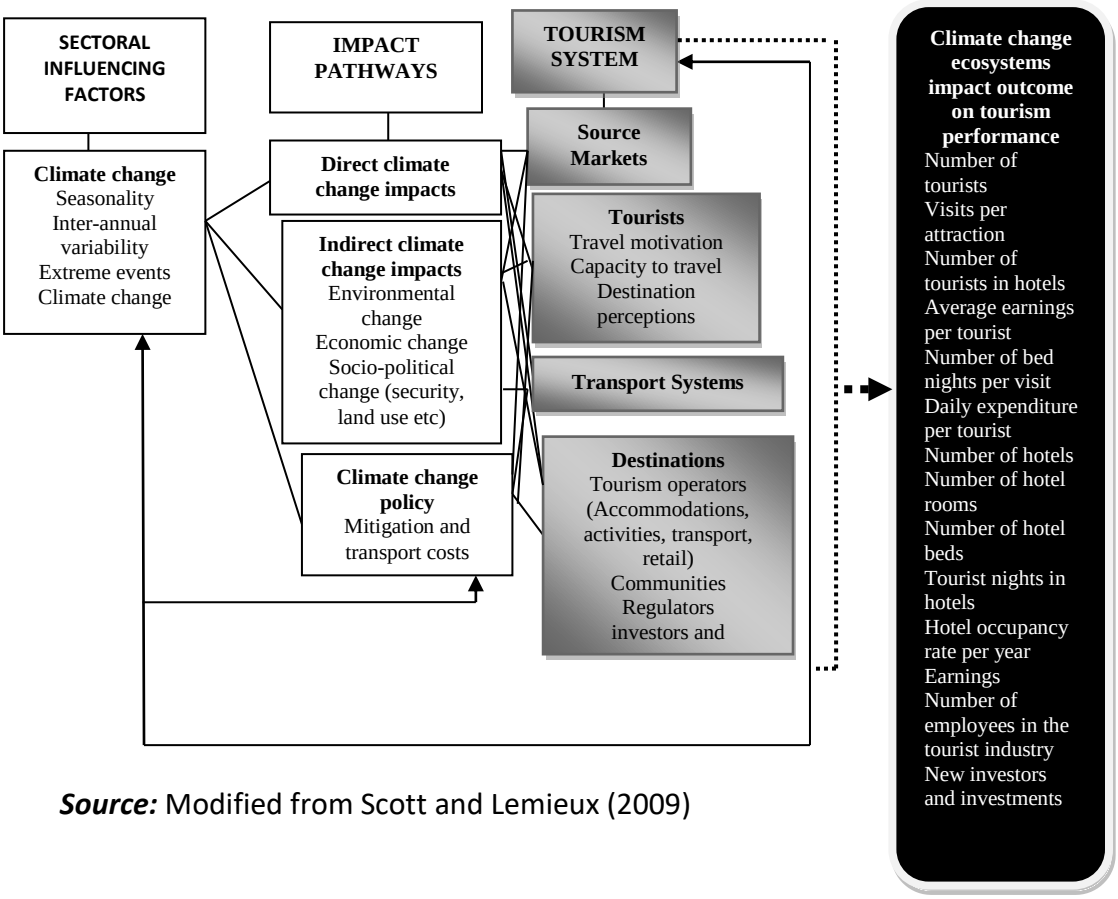
Global literature also acknowledges the impact of drought on tourism; Butler, (2002) noted that, in 2002 extreme dry climate led to wild fires in Colorado (USA) and that led to cancellation of some tourists' bookings leading to a decline of number of tourists in the state by 40%. Greece experienced a decrease of tourists by 50% in 2001, following devastating fires of summer 2000 that are partly believed to have been caused by extreme dry weather (IUCN, 2007). The 2003 heat wave in Western Europe which was exceptional by its temperatures and also its length impacted tourism differently in parts of the continent. In Spain for example beach destination lost an estimated 10% of guest nights. But visitation to inland mountain destinations increased as travellers sought comfortable climatic conditions (WMO, 2005).

The Gaps

The preceding discussion clearly indicates that there is an ample literature acknowledging the impact of climate change on the natural resource base upon which tourism depends. That climate change is affecting ecosystems relevant for tourism is no longer a question for discussion rather to what extent such effects affects supplies from the ecosystems necessary for tourism is the remaining grey area in the literature. The second knowledge gap in the existing literature can be well expressed by the question how climate change effects on supplies from different ecosystems is in turn

affecting tourism performance. Although some literature provides some account of changes in some supplies as water, yet the literature concentrates on decrease in water resources without specifically mentioning how much water is now not available for tourism as a result. Likewise for the agricultural sector; the literature is rich in explaining ways in which climate change has affected crop production in the country; but how much food is missing for the tourism sector? Which specific crops are now on higher demand in hotels? How local farmers are being impacted by crop failure which otherwise could provide for their livelihoods? For ecosystems supporting wildlife the question could be are there still enough games in terms of numbers and species that thrills tourists upon visiting the game parks? In terms of tourism sector performance, what has changed and towards which direction in terms of number of tourists especially tourists per specific attraction, number of visitors in given hotels and the implications on the hotel business; revenue, employment, new investors and investments, infrastructure development, etc and how such changes relates to the effects of climate change on ecosystems relevant for tourism - are all questions to be answered. Filling these gaps is important for practical policies development relevant for adaptation to climate change for the sector. This paper therefore extends the conceptual framework on the interface between climate and tourism earlier presented in Figure 3; the extension adds variables relevant for examining climate change ecosystem impacts outcome for the tourism sector's performance (figure 6) which are not clearly delineated in the existing body of knowledge as far as the impact of climate change on tourism in Tanzania is concerned. The implications of the impact of climate change on tourism performance on such variables as number of tourists, visits per attraction, number of tourists in hotels, average earnings per tourist, number of bed nights per visit, daily expenditure per tourist, number of hotels, number of hotel rooms, number of hotel beds, tourist nights in hotels, hotel occupancy rate per year, earnings, number of employees in the tourist industry and new investors and investments are all considered important especially for adaptation strategies development.

Figure 6: An extended conceptual framework on the interface between climate and tourism



Source: Modified from Scott and Lemieux (2009)

Pining down the influence of reduced ice cape at the Kilimanjaro Mountain, cases of malaria in formerly malaria free zones, water shortages in different ecosystems supplying in the tourism sector, forestry degradation, and wildlife deaths on levels of tourists satisfaction in different aspects of tourism services will shed light on whether climate change in the country impacts numbers of tourists visiting the country. A study that will focus at establishing reasons as to why tourists are not satisfied with given services especially those related to ecosystem services will likely come up with findings that will predict the future trend of number of tourists visiting the different tourists' attractions in the country. More importantly such a study will likely establish possible adaptation options for the sector. Clearly the literature acknowledges that with climate change, the ecosystems are changing, some are no longer supporting life same ways as they did in the

past, wildlife are dying because of floods and excessive dry weather; this understanding should pave way to studies questioning tourists perceptions of the quality of services and levels to which their expectations are being met when conducting safaris. What are the chances for the tourists to revisit same destinations and why? What challenges do tourists meet that relate to weather- is it too hot or too cool for them and how that affect their placidity? What is being done and what should be done to enhance the sector's resilience and adaptation? in which ways can the sector contribute into climate change mitigation? How climate change has affected tourism revenues and hence the GDP? These are some of the questions that future studies need to focus on.

Conclusion

The previous section identified two major knowledge gaps regarding the impact of climate change on tourism; these are presented in two questions, the first question being- to what extent climate change effects on natural resource base affects supplies from ecosystems necessary for tourism? The second question being - how such climate change effects on supplies necessarily for tourism from different ecosystems affects tourism sector's performance? The paper concludes that for Tanzania to adopt to climate change sustainably especially on the tourism sector the identified knowledge gaps need to be filled up. One of the specific objectives of the Tanzania climate change strategy is to build the capacity of Tanzania to adapt to climate change impacts; to enhance mobilization of resources; address climate change; to enhance public awareness on climate change; to strengthen information management on climate change; and to enable accessibility and utilization of the available climate change opportunities (URT 2012). Attaining these objectives need a deeper and wider understanding of the inter-linkages between climate change and the associated impacts on different sectors including the tourism sector. Some of the suggested strategic objectives that will enhance development in the tourism sector include promotion of alternative tourist attractions, restoration of the degraded tourist sites as well as enhancement of tourism infrastructure (URT 2012). However, all these can be attained only where there is much information on ways in which each subsector is being impacted by climate change. Answering the different questions paused in this paper will not only shed light on the impact of climate change on the tourism sector but will also assist in identifying new opportunities posed by climate change, opportunities that can allow developments of projects

which are economically, socially and environmentally sustainable. There is also a need to understand how the other side of the coin i.e. tourism operations aggravates climate change. Metrological information in most less developed countries including Tanzania especially forecast is mostly poor. As a result it is difficult for people to plan ahead in response to the expected weather. Being informed would help locals to get ready to harness opportunities but also to adapt to worst case scenarios. Experiences show that in such countries as those in small island states and most countries in the developing world, where tourism is a major economic activity, any significant reduction in tourist arrivals will have serious employment impacts and generate further poverty[8]; these should alert Tanzania for timely adaptation actions.

Notes

1. https://tanzania.go.tz/egov as of 01/11/2017
2. http://www.geographia.com/tanzania
3. (ibid)
4. https://www.adventurealternative.com as of 10/10/2018).
5. Jackson 2012 https://www.thesun.co.uk/archives/ as of 19/07/2018.
6. https://reliefweb.int/disaster as of 12/9/2018.
7. https://allafrica.com/
8. http://sdt.unwto.org/en/content/climate-change-tourism as of 04/10/2018

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