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PERCEPTIONS AROUND CLIMATE CHANGE IMPACTS ON NATURAL RESOURCES AND TOURISM SUSTAINABILITY IN PROTECTED AREAS; A CASE STUDY OF MAASAI MARA NATIONAL RESERVE, KENYA

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ABSTRACT:

Kenya' tourism industry is predominantly based on nature and founded on protected areas (PAs) model. However, climatic changes through unstable temperature as well as rainfall patterns have the potential to cause declines in wildlife populations in these PAs. Climate change poses exceptional social, cultural as well as environmental challenges. In Kenya's Maasai Mara National Reserve (MMNR), a combined number of factors including climate change, human population pressure on wildlife dispersal areas including human wildlife conflict has resulted in catastrophic declines in wildlife populations. The study investigated MMNR host community perceptions oaround climate change impacts of on natural resources and sustainability of tourism. This is because regional knowledge gaps exist in research on climate change impacts on tourism. Exploratory research design was adopted. This research used quantitative data and hence exploratory approach was considered suitable. Simple random sampling was adopted to sample 399 heads of households who filled the questionnaires. Using SPSS V.23, descriptive as well as inferential statistics was adopted to analyze quantitative data. The relationship between the variables was determined using linear regression. The study findings indicate a positive as well as significant relationship on the two variables of natural resources and tourism sustainability as evidenced by the values (β=0.393 and p=0.000). Also, the coefficient of determination (R squared) shows 39.5% variation in sustainability of tourism can be attributed to climate change as indicated in Table 3. The study findings raises the need for strategic initiatives and considerations for developing alternative wildlife based tourism products in the advent of declines in wildlife populations as a result of erratic rainfall and temperature patterns.

Keywords: *Host Perceptions, Climate Change, Wildlife, Tourism Sustainability*

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INTRODUCTION

The study aimed to investigate MMNR host community perceptions around climate change impacts on wildlife as well as sustainability of tourism. This is because of insufficient research on the ramifications of climatic changes on the tourism industry. For instance, the Intergovernmental Panel on Climate Change (IPCC, 2007) assessment reports indicated the impacts of climate change on the tourism sector are poorly understood in Africa (Scott et al., 2016). While substantial progress has been made in studying the effects of climate change in different areas, climate change impacts on tourism remains under explored (Becken, 2019).

It is vital that the consequences of variations in climate change on wildlife and vegetation as well as social, economic and environmental sustainability be known and determined in order to inform the planning, development and management of the tourism industry in Kenya. Findings from the study have the potential to inform National and County Government strategic plans and legal frameworks including guidelines and operating procedures with regards to climate change impacts. Also, findings from this study have the potential to offer data for future tourist investments. Lastly, tourism stakeholders will be better positioned to anticipate what is likely to occur, and develop appropriate plans to mitigate potential negative effects while maximizing positive effects of climate change.

LITERATURE REVIEW

Climate Change Tourism

Climate change is defined by Cater et al., (2015) as alteration in the long-term average weather experienced globally. Increasing temperatures result in events such as heavy precipitation, droughts and sea level rise that have become frequent and intense because of climate change (Semenza and Kristie, 2019). Variations in the frequency of precipitation and severe temperatures pose considerable risk to tourists and their travel experience (De Urioste-Stone et al., 2016). These variations in climate and weather conditions have the potential to render nature-based tourism sites less attractive to tourists (Dube & Nhamo, 2020). Elsewhere, climate change impacts have been observed in high altitude areas of Asia and the Himalayas as the glacier covering decreases (Murtaza and Romshoo, 2016). In other countries such as Taiwan, its National Parks have experienced tourist's declines due to irregularities in precipitation (Liu, 2016). Iran is also affected by high temperatures that cause severe heat waves which caused declines in tourist inflow (Yazdanpanah et al., 2016). Islands are diminishing in other locations such as Vann Island in India's Mannar Gulf that reduced to 84% of its original size and is anticipated to be entirely submerged by 2022 as the sea level increases (Jayaprakash et al., 2016).

In Africa, forests such as the ones located in North Africa are major tourist sites for tourism activities like hiking, bird watching, nature walks. Climate change has significantly affected these forests with regards to increased extreme events such as forest fires and precipitation changes (Me'dail, 2017). This raises concerns about the potential of forests including wildlife to support tourism-related activities in the future.

Dube et al., (2018) raises tourist's worries about the effects of climate change on tourist's resorts including natural resources such as wildlife that is a tourist's attraction and that tourists could be forced to alter their future travel patterns as well as travel destination choice. Mushawemhuka et al., (2018) also argues climate change through excess heat has the potential to cause increased demand for air conditioning in accommodation establishments. Additionally, catastrophic weather occurrences in form of droughts, heat waves and flooding have been on the increase in South Africa (Dube, and Nhamo, 2019). Other studies have emphasized that such extreme events would certainly undermine tourism activities (Dube and Nhamo, 2019; Van Wilgen et al., 2016). Kilungu et al., (2017) notes that, migration patterns of wildlife has been disrupted in Tanzania's Serengeti National Park due to climate change impacts causing dramatic wildlife losses with the potential of

altering tourism seasonality. This is a cause for alarm for wildlife tourism dependent countries such as Kenya. Additionally, Muchoki (2018) asserts that climate change impacts in MMNR are not only confined to wildlife but also droughts and floods which impact overall tourism. For instance, during periods of extreme rainfall, flood waters destroy tourism infrastructure and amenities and in some cases rendering game drive roads impassable. Muchoki (2018) further asserts that during rainy seasons, accommodation facilities including tented camps in MMNR face serious risks of flooding as some of them close down implying limited leisure opportunities for tourists.

Wildlife Tourism in Kenya

Kenya is characterized by outstanding network of Protected Areas (PAs) as shown in figure 1.2 as well as natural habitats, distinctive natural traits and ecosystems that support a diversity of wildlife species (GoK, 2018) upon which the tourism sector is based on. Figure II indicates wildlife distribution in Kenya. Therefore, Kenya's tourism industry is mainly based on nature and characterized by a variety of parks, reserves, sanctuaries and conservancies. Kenya has a total of 22 Parks, 28 Reserves, 5 Sanctuaries, 160 Conservancies, 234 Forest Reserves, 5 Marine Reserves, 4 Marine Parks, 6 World Heritage Sites (WHS), 66 Important Bird Areas (IBA), 6 Ramsar Sites and 6 Biosphere (GoK, 2018) as shown in figure I.

Wildlife tourism is one of the most important tourism products, comprising of a game drive, wildlife photography and wildlife viewing in protected areas among many other tourism related activities. Figure II indicates wildlife population distribution in Kenya that is vital for the tourism industry. Findings from a research according to Sanghi et al., (2017) assert that tourism based on wildlife encounters is profoundly integrated into the local economy of Kenya that stimulates a great number of employment opportunities and socio-cultural benefits.

However, wildlife and wildlife habitats continue to face unprecedented chronic and new challenges for example climate change (GoK, 2018). Aduma et al., (2018) argues that extreme temperature occurrences are projected to be frequent as well as severe resulting to biodiversity declines and impacts on mobility as well as survival for large herbivores because of global land surface warming. Climate change impacts and risks on Kenya's tourism resources as well as infrastructure are shown in Box 1.0.

An analysis by Ogutu et al., (2016) focusing on the status and trends of wildlife population in Kenya during the period 1977–2016 point out a disturbing loss of wildlife of 68.1% on average annually. Wildlife population declined by 48.7% in the years 1977–1980 and by a further 20% between 1994–1997 as well as 2011–2013. Ogutu et al., (2016)

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CLIMATE RISKS

- Rising temperatures
- Uncertain changes in rainfall patterns
- Rising sea levels and stronger storm surges
- Greater risk of extreme weather events (droughts, floods and landslides)
- Melting glaciers
- Ocean acidification

KEY SOURCES OF VULNERABILITY

- High levels of multi-dimensional poverty, particularly in the ASALs
- Gender inequality
- Environmental degradation, including loss of forest cover
- High reliance of the national economy and local livelihoods on rain-fed agriculture
- High level of water scarcity and mismanagement of water resources
- Insecure land tenure and land fragmentation
- Population growth and migration to urban areas
- Heavy disease burden and limited access to quality health care, particularly in rural and remote areas

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Box 1.0. Climate Change Impacts and risks on Kenya's tourism resources
Source: GoK (2018-2022)

Elsewhere, Damania et al., (2019) also notes that Kenya's wildlife has declined in various parts of the country and catastrophic declines have been observed especially for the ungulates species and predators. More importantly, three major counties namely Narok, Kajiado and Taita Taveta that depend primarily on wildlife tourism lost approximately 70% of its wildlife, for Narok with Kajiado 60% and Taita Taveta 40% between the period 1977-2016 (Damania et al., 2019).

The declining wildlife population has the potential to negatively impact tourism sustainability in Kenya. It's not clearly known how the decline in wildlife numbers will influence the tourism industry that is heavily reliant on wildlife that this study seeks to ascertain. It is highly likely that the sustainability of the tourism industry could be rendered unsustainable as social, economic and cultural benefits of tourism are lost as a result of reduced visitation to protected areas experiencing declines in wildlife populations. Therefore, climate change exerts a negative influence on wildlife resources that is vital for tourism (Scott, 2019) especially in Kenya. In such a phenomenon, future viability of the tourism industry remains uncertain.
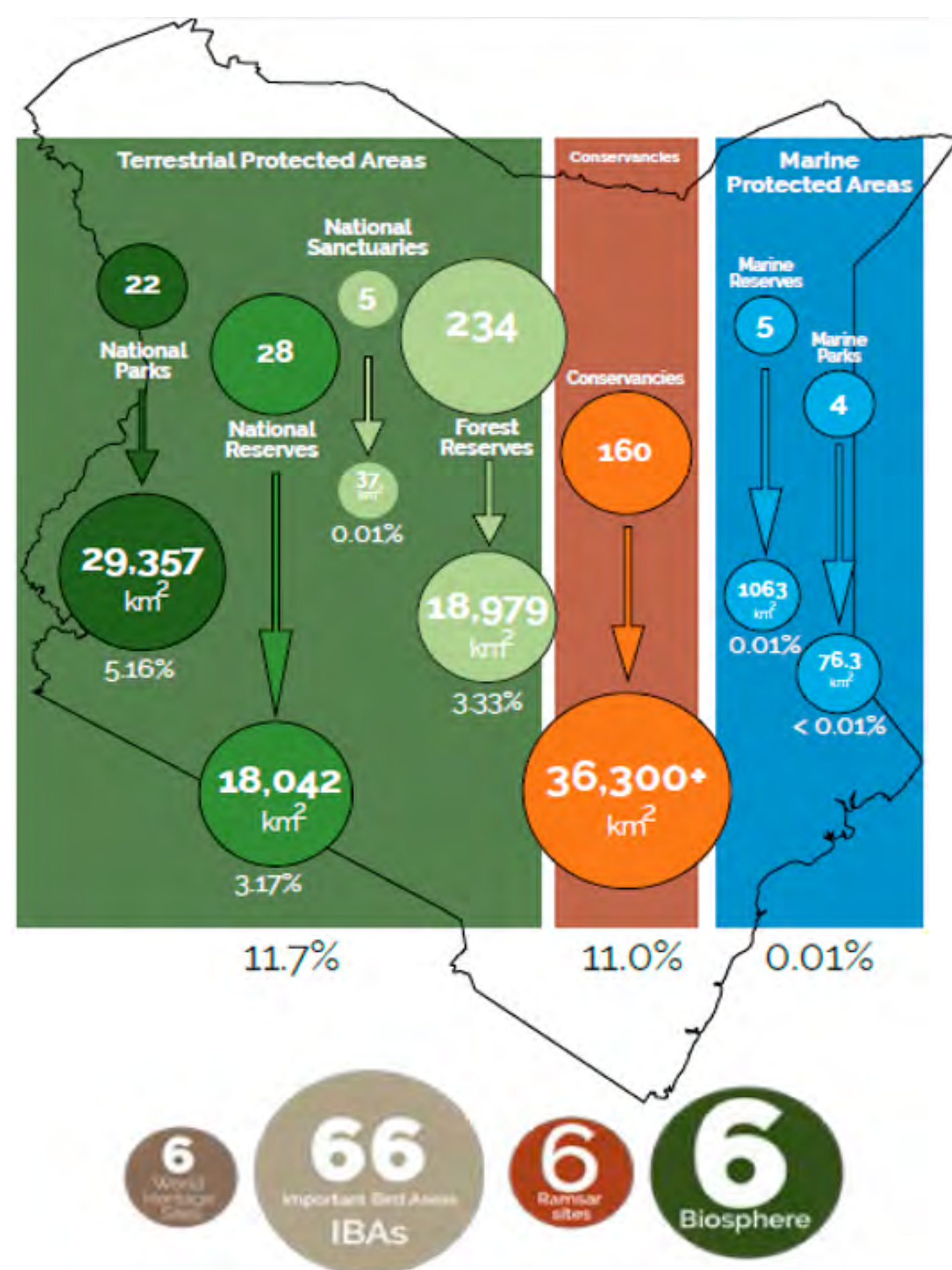

Figure 1. Map of Kenya showing Natural resources vital for tourism industry
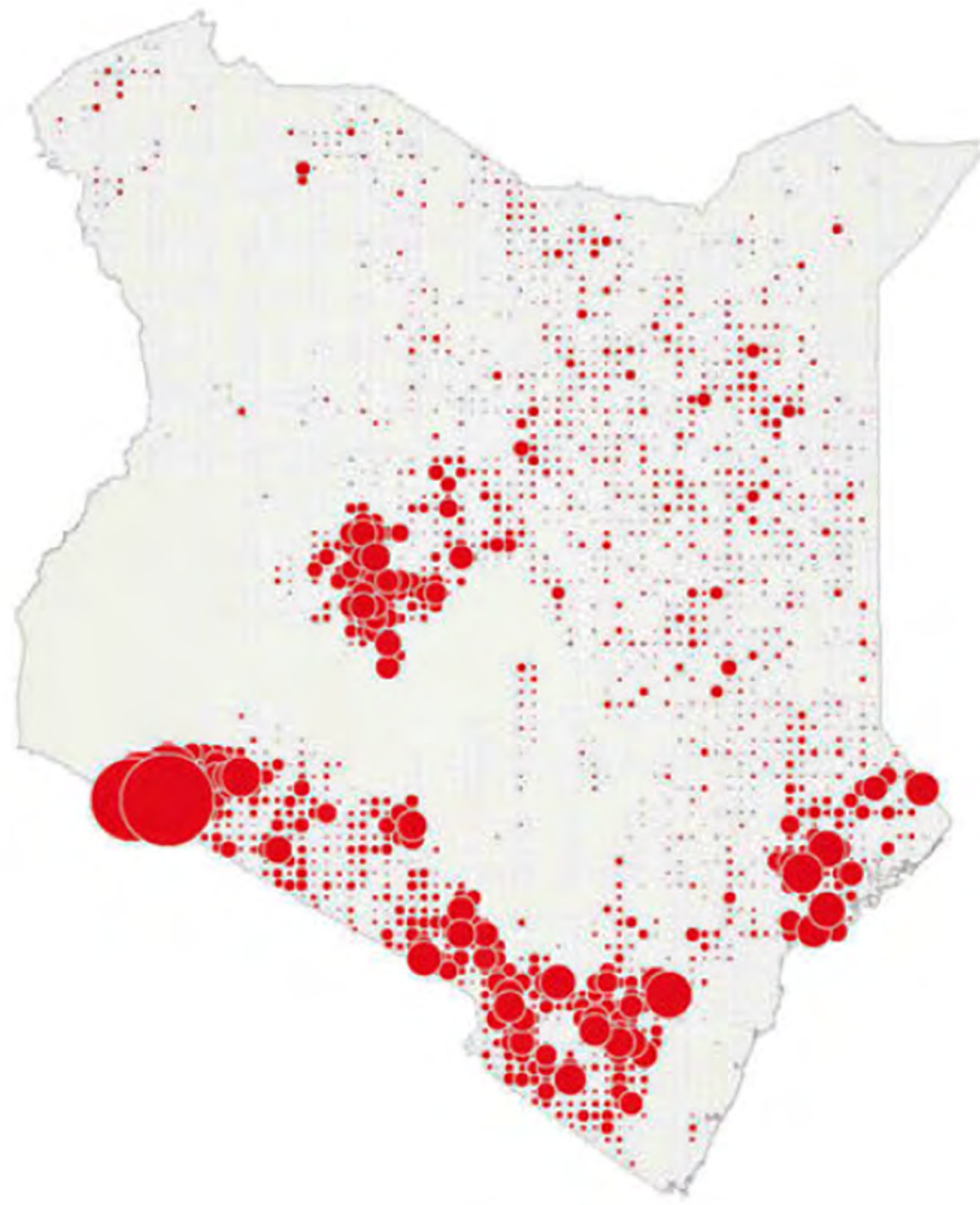*Source: GoK (2018)*

Figure 2. Wildlife population distribution in Kenya
Source: Ogutu et al., (2016)

KEY
- KBA with Official Protection
- KBA with no Official Protection
- National Parks
- National Reserves
- National Marine Parks/Reserves
- Lakes and rivers
- City/Town
- Mountain
- Range/Hills

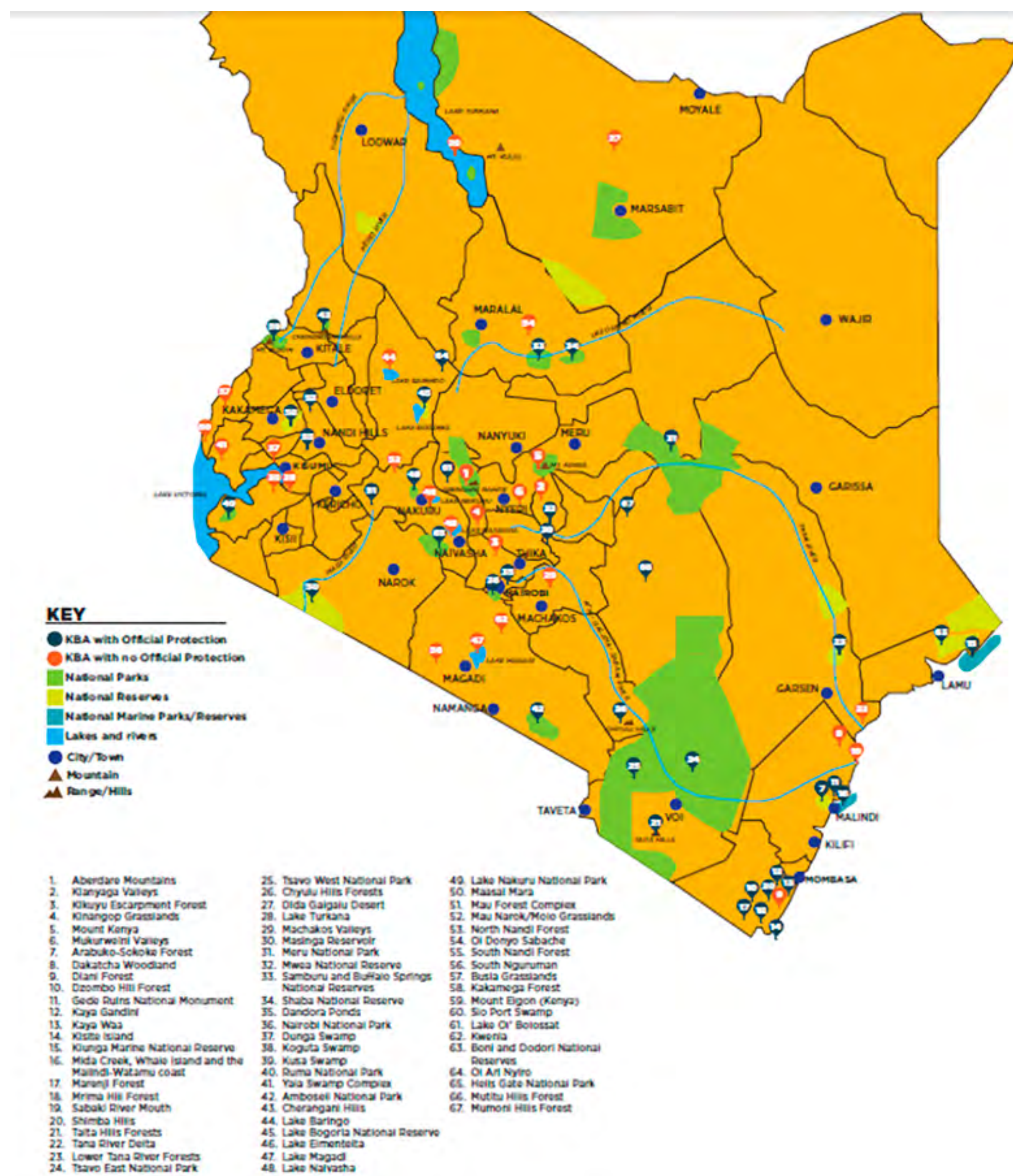|		
1. Aberdare Mountains	25. Tsavo West National Park	49. Lake Nakuru National Park
2. Kianyaga Valleys	26. Chyulu Hills Forests	50. Maasai Mara
3. Kikuyu Escarpment Forest	27. Olda Gaigalu Desert	51. Mau Forest Complex
4. Kinangop Grasslands	28. Lake Turkana	52. Mau Narok/Molo Grasslands
5. Mount Kenya	29. Machakos Valleys	53. North Nandi Forest
6. Mukurweini Valleys	30. Masinga Reservoir	54. Ol Donyo Sabache
7. Arabuko-Sokoke Forest	31. Meru National Park	55. South Nandi Forest
8. Dakatcha Woodland	32. Mwea National Reserve	56. South Nguruman
9. Diani Forest	33. Samburu and Buffalo Springs	57. Busia Grasslands
10. Dzombo Hill Forest	National Reserves	58. Kakamega Forest
11. Gede Ruins National Monument	34. Shaba National Reserve	59. Mount Elgon (Kenya)
12. Kaya Gandini	35. Dandora Ponds	60. Sio Port Swamp
13. Kaya Waa	36. Nairobi National Park	61. Lake Ol' Bolossat
14. Kisite Island	37. Dunga Swamp	62. Kwenia
15. Kiunga Marine National Reserve	38. Koguta Swamp	63. Boni and Dodori National
16. Mida Creek, Whale Island and the	39. Kusa Swamp	Reserves
Malindi-Watamu coast	40. Ruma National Park	64. Ol Ari Nyiro
17. Marenji Forest	41. Yala Swamp Complex	65. Hells Gate National Park
18. Mrima Hill Forest	42. Amboseli National Park	66. Mutitu Hills Forest
19. Sabaki River Mouth	43. Cherangani Hills	67. Mumoni Hills Forest
20. Shimba Hills	44. Lake Baringo	
21. Taita Hills Forests	45. Lake Bogoria National Reserve	
22. Tana River Delta	46. Lake Elmenteita	
23. Lower Tana River Forests	47. Lake Magadi	
24. Tsavo East National Park	48. Lake Naivasha	

Figure 3. Map of Protected Areas in Kenya
Source: Biodiversity Areas Status & Trends (2017)

Climate Change and Tourism Sustainability

Sustainable tourism strives to reduce negative impacts associated with tourism development on the environment as well as host communities including the economy and encourage mutual beneficial exchanges that result in an environmentally friendly, ethical and economically equitable industry (Pan et al., 2018). Economic, social and environmental aspects of tourism should be well balanced in order to establish tourism sustainability while fulfilling the needs of tourists and tourism stakeholders (Pan et al., 2018). Additionally, offer opportunities for future development of tourism that fosters environmental integrity as well as responsible consumption and production (Pan et al., 2018).

Climatic changes can completely derail sustainable tourism initiatives. These changes pose the greatest risks to attain tourism sustainability (Scott and Becken, 2010). Social, economic and environmental ramifications of climatic changes on the tourism industry are expected to be of high degree into the future (Gonzales, 2016). Figure IV demonstrates the concept of sustainable tourism composed of environmental, economic, social and cultural aspects identified by (Pan et al., 2018)

Viner and Agnew (1999) assert that protected areas are founded on wildlife species where climate factors are crucial for wildlife survival. Additionally, climate change impacts characterized by prolonged droughts and floods have the potential to reduce wildlife populations. This could mean a reduction of viability of recreational activities such as wildlife safaris implying reduced social, economic and environmental benefits for tourism stakeholders and consequently reduced tourism sustainability.

Figure 4. Aspects required for achieving sustainable tourism
Source: Adopted from Pan et al., (2018)

Scott (2021) further asserts that sustainable tourism cannot be attained if climate change impacts is not addressed amicably through global reduction of CO_2 levels in the atmosphere. Furthermore, the tourism industry will not be sustainable only if and when it reduces its CO_2 emissions according to Conference of Parties targets of the Paris agreements (Scott, 2021). However, countries such as Kenya and many other African countries contribute significantly low amount of CO_2 precisely less that 4% to the global emissions. Ironically, these African countries are being heavily impacted by the impacts of climate change through frequent and severe droughts as well as floods. It is imperative that African countries ought to be given urgent attention not in terms of CO_2 emission reduction targets, but a paradigm shift on enhancing adaptation as well as mitigation initiatives on climate change impacts.

RESEARCH METHODOLOGY

MMNR is known internationally as one of the Seven Wonders of the World (MMNR Management Plan, 2009-2019). MMNR is a part of a bigger complex protected area comprising of the Ngorongoro Conservation Area, Serengeti National Park and various game reserves, which cumulatively account for 25,000 km² supporting a complex wildlife ecosystem (MMNR Management Plan, 2009-2019).

Explanatory design forms the first step of research when the universe of study is unknown (Cooper & Schindler, 2008). The design looks for causes and reasons, and identifies the reasons for occurrences and attempts to explain why things happen or why things happen the way they do (Small *et al.*, 2011). Explanatory research design was appropriate as the study focused to identify a cause-effect relationship allowing use of inferential statistical analysis to organize, describe and summarize data collected.

The target population of the study was 316, 681 respondents comprising of 169, 220 households in Narok County (GoK, 2018). Yamane (1967) formula for calculation of sample size was adopted and a sample size of 399 community members was arrived at. Narok County where MMNR is located was stratified according to sub-counties, where each of these categories formed a stratum. The household was stratified into four stratums representing the four Sub-counties namely; Transmara West, Narok North, Narok South and Transmara East. MMNR is located in Narok South with a total of six wards. 399 heads of household from the six wards were selected through simple random sampling to fill the structured questionnaires that captured the variables of the study (Climate change, Natural Resources and Tourism Sustainability) forming primary data as indicated in Tables 1, 2 and 3.

Published articles from reputable journals in relation to the study objectives were collected and formed the secondary data. The impacts of climate change on tourism sustainability in MMNR were determined by use of Pearson product moment of correlation. The research hypothesis was tested by multiple regression analysis.

RESULTS AND DISCUSSIONS

Community member's views on climate change

The community members neighboring MMNR indicated their views about climate change on a five-point Likert Scale. This approach enabled construction of multiple items that constituted Likert Scales. The communities were asked to score on statements explaining the climate change variable. The descriptive analysis used included frequencies, percent, means and standard deviation. Table 1 represents mean and standard deviation (descriptive statisctics).

Two hundred and ninety-five questionnaires were administered to local community members addressing climate change, natural resources and tourism sustainability variables. Based on the results, one can conclude that most of the respondents 232 (78.6%) agree that the rainfall patterns have changed, with 15.9% not decided and 5.4% did not agree ($M=4.02$; $SD=0.83$). Additionally, majority 243 (82.4%) of the host community agreed that Mara river water flow level has changed, with 12.9% undecided and 4.7% did not agree, ($M=4.25$; $SD=0.87$). Additionally, majority of the host community 181 (61.4%) agreed that climate change adaptation & mitigation strategies exist, with 27.8% not decided and 10.9% did not agree ($M=3.65$; $SD=0.90$).

Furthermore, findings indicated that most of the of the host community members 203 (68.8%) agreed that temperatures have risen than before, with 19% not decided and 12.2% did not agree ($M=3.68$; $SD=0.86$). Furthermore, majority of the host community members 120 (40.7%) were undecided that drought is rampant, with 37.9% disagreed and 21.4% agreed ($M=2.77$; $SD=0.79$). Similarly, the results point out that most of the respondents 161 (54.6%) disagreed that floods scenarios were common, with 38% not decided and 7.4% agreed

(*M=2.43; SD=0.79*). The results suggest that majority of the respondents 177 (60%) were undecided that the rainfall experienced is high, with 20% disagreed and 20% agreed (*M=3.03; SD=0.74*).

The study findings reveal that MMNR community perception about climate change can be summed as; rainfall patterns have changed overtime, river Mara water flow level has changed climate change adaptation & mitigation strategies exist and the temperatures have risen than before. However, the host community members did not find rampant droughts, flooding scenarios as common and that the rainfall experienced was not high.

The above findings agree with previous studies for example, (Gundula et al., 2016) asserting that divergent temporal changes of rainfall patterns have been observed for the Serengeti-Mara ecosystem and other parts of East Africa. While the IPCC reports high possibility for increases in rainfall patterns in the East Africa region, Niang et al., (2014) finds evidence of decreased wet season rainfall in recent decades in the same region (Lyon and DeWitt, 2012).

Nonetheless, General Climate Models (GCE) for East Africa indicates an increase in short rains (October-December) by 5-20% between 2020 and 2030 and 25-50% between the period 2050-2070 (Otieno et al., 2017). It is therefore definite that rainfall variations in the Mara have caused changes in River Mara water levels during rain and drought seasons. The result is a significant influence on wildlife population dynamics as explained earlier. It is highly likely that visitor numbers could decline with intense rainfall variations due to inaccessibility of tourism attractions for example the case in Nigeria (Dillimono & Dickinson, 2015) thus impacting negatively on sustainability of the tourism industry.

Table 1. Community member's views on climate change*

Statement	SA		A		N		D		SD		Mean	SD
	F	%	F	%	F	%	F	%	F	%		
Drought is rampant	2	.7	61	20.7	120	40.7	91	30.8	21	7.1	**2.77**	**0.88**
Floods are common	1	.3	21	7.1	112	38.0	130	44.1	31	10.5	**2.43**	**0.79**
Temperatures have risen	36	12.2	167	56.6	56	19.0	34	11.5	2	.7	**3.68**	**0.86**
The rainfall is high	12	4.1	47	15.9	177	60.0	57	19.3	2	.7	**3.03**	**0.74**
Rainfall patterns changed	85	28.8	147	49.8	47	15.9	15	5.1	1	.3	**4.02**	**0.83**
Mara river water flow level has changed	141	47.8	102	34.6	38	12.9	13	4.4	1	.3	**4.25**	**0.87**
Climate change adaptation & mitigation strategies exist	46	15.6	135	45.8	82	27.8	28	9.5	4	1.4	**3.65**	**0.90**
Mean											3.41	.4

* SA-Strongly Agree, A-Agree, N-Neutral, D-Disagree, SD-Strongly Disagree

Source; Author (2019)

Community members' views on tourism sustainability

Tourism sustainability was measured using the social, economic and environmental sustainability constructs. The respondents' response on tourism sustainability was measured on a five-point Likert Scale where the community members indicated their views on tourism sustainability.

Based on the results presented in Table 2, most of the respondents 241 (81.7%) agreed that presented there are sustainable tourism practices in MMNR, with 12.9% did not decided and 5.5% disagreed (*M=4.04; SD=0.87*). Also, majority 236 (80%) of the host community agreed that MMNR conducts conservation education among their staff & tourists, with 11.5% did not agree and 8.5% agreed (*M=4.03; SD=0.93*). Additionally, most of the respondents 247(83.8%) agreed that Wildlife and Vegetation conservation programs exist in MMNR, with 8.5% undecided and 7.8% did not agree (*M=4.06; SD=0.88*). Furthermore, most of the host

community members agreed that reuse, recycling & reducing practices are carried out in MMNR (*M=4.00; SD=0.95*).

Most of the host community members 228 (77.3%) agreed that there exists a rich Maasai culture & heritage in the Mara with 14.9% did not decide and 7.8% disagreed (*M=3.98; SD=0.97*). Furthermore, most of the host community members 144 (82.7%) agreed that tourism unites the Maasai community and encourage people to work together and support each other in MMNR with 10.5% did not decide and 6.7% disagreed (*M=4.02; SD=0.87*). Further, most of the host community members 239 (81%) agreed that host communities within the Mara have the have the potential for wealth creation via tourism with 11.9% undecided and 7.1% disagreed (*M=4.01; SD=0.88*). Moreover, majority of the respondents 238 (80.7%) agreed that there exists improved tourist facilities in the MMNR because of tourism with 10.2% undecided and 9.1% undecided (*M=4.01; SD=0.88*).

The results indicate that most of the host community members 127 (86.1%) agreed that there are environmental protection guidelines, with 6.8% undecided and 7.1% disagreed (*M=4.24; SD=0.95*). Also, most of the host community members 135 (81%) agreed that there is a rise of social amenities within MMNR with 13.6% did not agree and 5.5% disagreed (*M=4.13; SD=0.89*). Additionally, most of the host community members 130 (78.9%) agreed that there are preservation & conservation initiatives for the Maasai culture with 78.9% did not decide and 5.4% disagreed. Furthermore, most of the host community members 257 (87.1%) agreed that there is increased urban development, with 11.2% undecided and 9.5% disagreed (*M=4.11; SD=0.91*).

Additionally, most of the host community members 115 (82%) agreed to the statement that tourism fosters the development of public amenities and facilities, with 11.3% undecided and 6.8% disagreed (*M=4.32; SD=1.92*). Additionally, majority of the respondents 129 (76.6%) agreed that there is improvement of livelihoods among local communities in MMNR with 8.8% undecided and 6.8% disagreed (*M=4.21; SD=0.91*). Further, most of the host community members 159 (99.7%) agreed to the statement that tourism triggers employment opportunities in the Mara with 6.4% undecided and 7.8% disagreed (*M=4.26; SD=0.96*). Additionally, most of the host community members 38 (44.1%) agreed that tourism diversifies the local economy 6.4% undecided and 7.8% disagreed (*M=4.09; SD=0.92*).

What is more, most of the host community members 122 (89.5%) agreed that tourism is good for the local economy because the money that tourists spend when they visit MMNR that helps stimulate the economy with 6.1% undecided and 4.5% disagreed (*M=4.37; SD=0.84*). Additionally, most of the host community members, 129 (43.7%) of the respondents were undecided that there is reduced profitability of tourism enterprises in the Mara due to flooding/drought scenarios, with 23.7% agreed and 32.5% undecided (*M=2.98; SD=0.97*).

Based on the results, climate change will adjust the travel industry operations as a result of extereme climatic events (Hamilton and Tol, 2004). Local communities in the Mara had the ability to create wealth through tourism and improve their livelihoods.

Availability of employment opportunities exist by virtue of tourism facilities and services. While there was improvement of the local economy, property prices go up disfranchising locals from making purchases.

Table 2. Community members views on tourism sustainability*

Statement	SA		A		N		D		SD		Mean	SD
	F	%	F	%	F	%	F	%	F	%		
There are sustainable tourism practices in MMNR	88	29.8	153	51.9	38	12.9	9	3.1	7	2.4	4.04	0.87
MMNR conducts conservation education among their staff & tourists	98	33.2	138	46.8	34	11.5	20	6.8	5	1.7	4.03	0.93
Wildlife/Vegetation conservation programs exist in MMNR	94	31.9	153	51.9	25	8.5	19	6.4	4	1.4	4.06	0.88
Reuse, recycling & reducing practices are carried out in MMNR	91	30.8	148	50.2	30	10.2	18	6.1	8	2.7	4.00	0.95
There are environmental protection guidelines in Maasai Mara	14	47.8	113	38.3	20	6.8	13	4.4	8	2.7	4.24	0.95
There is richness of Maasai culture & heritage in the Mara	93	31.5	135	45.8	44	14.9	13	4.4	10	3.4	3.98	0.97
There is a rise of social amenities within Maasai Mara	11	39.0	124	42.0	40	13.6	12	4.1	4	1.4	4.13	0.89
There is preservation & conservation of the Maasai culture	11	38.6	119	40.3	46	15.6	11	3.7	5	1.7	4.11	0.91
Tourism unites the community and encourage people to work together and support each other in MMNR	83	28.1	161	54.6	31	10.5	14	4.7	6	2.0	4.02	0.87
Tourism promotes the development of public facilities in Mara	14	47.8	101	34.2	33	11.2	17	5.8	3	1.0	4.32	1.92
Tourism brings people of different backgrounds and cultures into the community in MMNR	72	24.4	154	52.2	38	12.9	26	8.8	5	1.7	3.89	0.93
There is reduced profitability of tourism enterprises in Mara due to flooding/drought scenarios	28	9.5	42	14.2	129	43.7	88	29.8	8	2.7	2.98	0.97
Host communities within the Mara have the ability to create wealth thorough tourism	85	28.8	154	52.2	35	11.9	16	5.4	5	1.7	4.01	0.88
There are better recreational facilities in the MMNR because of tourism	95	32.2	143	48.5	30	10.2	19	6.4	8	2.7	4.01	0.96
There is improvement of livelihood among local communities in MMNR	13	45.1	116	39.3	26	8.8	16	5.4	4	1.4	4.21	0.91
There is increased employment opportunities in the Mara	14	50.5	145	49.2	19	6.4	17	5.8	6	2.0	4.26	0.96
There is improvement in the local economy strength in MMNR	10	34.6	28	9.5	13	4.4	-	-	7	2.4	4.09	0.91
Increase in prices and property values makes it difficult for sections of people to live in the Mara	70	23.7	156	52.9	49	16.6	14	4.7	6	2.0	3.92	0.88
There is increased urban development within the reserve	91	30.8	166	56.3	23	7.8	10	3.4	5	1.7	4.11	0.82
Tourism is good for the economy because the money that visitors spent when they visit Mara helps stimulate the economy	15	53.2	107	36.3	18	6.1	9	3.1	4	1.4	4.37	0.84
Mean											**4.04**	**.576**

*SA-Strongly Agree, A-Agree, N-Neutral, D-Disagree, SD-Strongly Disagree, SD-Standard Deviation

The regression model shown in Table 3 shows climate change as a predictor was significant (F=190.95, p value =0.000) shows that there is a significant relationship between climate change and tourism sustainability in MMNR.

Table 3. Climate change and tourism sustainability ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	38.528	1	38.528	190.950	.000[b]
	Residual	59.118	293	.202		
	Total	97.646	294			

a. Dependent Variable: Sustainability

b. Predictors: (Constant), Climate

Therefore, one can conclude that there is a significant relationship between tourism sustainability and climate change in MMNR.

CONCLUSIONS

The results indicate a positive as well as a significant relationship between climate change and tourism sustainability in MMNR. Stable rainfall and temperature patterns guarantee availability of vegetation that wildlife population thrives and consequently tourism activities. This is supported by Mushawemhuka (2018) emphasizing that climate determines the best season for nature based tourism because it is a function of tourists comfort outdoors and the climatic impacts on the flora and fauna which they hope to see. Also, weather is an important factor determining the suitability for tourists to visit tourist attractions and their enjoyment of the experience (Dube and Nhamo, 2019). Therefore, climate change has the potential to reduce the long-term viability of tourism (Hoogendoorn et al., 2018).

Extreme weather events associated with flooding and droughts negatively impact the tourism industry and its sustainability. For example, increase in temperatures in Victoria Falls negatively impacted the aviation sector as some smaller aircrafts were grounded due to high temperatures (Dube & Nhamo, 2020). They further assert that high temperatures will definitely affect tourist arrivals. Rogerson (2016) also emphasizes that continued climatic changes of a location characterized by flooding, storms and sea level rise can cause tourism destinations to become unsuitable for tourism.

Declines in wildlife numbers caused by a combination of factors including climatic factors have the potential to result in declines of tourism activities including revenue in the reserve. Also, extreme weather events inhibit accessibility of the reserve and damage tourism facilities and infrastructure. Despite the fact that sustainable tourism aims at ensuring socio-economic wellbeing of host communities, the aforementioned phenomenon will render communities dependent on tourism income vulnerable to socio-economic disparity. As Rogerson (2016) points out climate change threats on the tourism sector are most likely with regards to socio-economic development in middle income countries in Africa.

The study findings indicate that there exist attempts to conduct sustainable tourism practices in MMNR. However, climate change is one of the most serious threats to tourism sustainability and is likely to have the greatest long-term impact (Scott et al., 2019). The impacts caused by changing weather patterns through rainfall and temperature results to a large scale and irreversible changes to plant and wildlife communities and the scenic values they provide consequently affecting sustainability of tourism. Tourism attractions experiencing declines in wildlife populations as well as aesthetics are highly likely not be visited by tourists. Such tourism attractions will likely be unable to sustain tourism activities. Therefore, climate change has the potential to reduce the sustainability of tourism (Hoogendoorn and Fitchett, 2018).

Biodiversity loss due to prolonged drought and rapid rainfall patterns will have a negative effect on tourism destinations attractiveness and operations including tourism activities that are dependent on weather conditions. This will have a negative influence on tourism sustainability. Also, extreme weather events inhibit accessibility of the reserve and damage tourism facilities and infrastructure. Despite the fact that sustainable tourism aims at ensuring socio-economic wellbeing of host communities, the aforementioned phenomenon will render communities dependent on tourism income vulnerable to socio-economic disparity. As Rogerson (2016) points out climate change threats on the tourism sector are most likely with regards to socio-economic development in middle income countries in Africa. Climate change is one of the most serious threats to tourism sustainability and is likely to have the greatest long-term impact. The impacts caused by changing weather patterns through rainfall and temperature results to a large scale and irreversible changes to plant and animal communities and the scenic values they provide consequently affecting sustainability of tourism.

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