Opportunities from Satellite Observation Systems in Climate Risk Mitigation: The Case of Tourism and Hospitality Industry in Lake Nakuru National Park, Kenya

Article *in* International Journal of Science and Research (IJSR) · September 2014

CITATIONS
0

READS
814

4 authors, including:

Julius M Huho
Garissa University, Kenya
31 PUBLICATIONS **204** CITATIONS

SEE PROFILE

Margaret Mungai
Karatina University
1 PUBLICATION **0** CITATIONS

SEE PROFILE

International Journal of Science and Research (IJSR)
ISSN (Online): 2319-7064
Impact Factor (2012): 3.358

Opportunities from Satellite Observation Systems in Climate Risk Mitigation: The Case of Tourism and Hospitality Industry in Lake Nakuru National Park, Kenya

Julius M. Huho[1], Margaret Mungai[2], Teresa Kinuthia[3], Rose C. Kosonei[4]

[1, 2, 3]Department of Tourism and Hospitality Management, Karatina University
P.O. BOX 1957, Karatina, Kenya

[4]Department of Environmental Science, Maseno University

Abstract: ***One of the key findings in the Fourth Assessment Report (AR4) is that millions of people globally will be exposed to increased water stress due to climate change. With over three quarters of Africa falling under arid and semi-arid climate, the continent is prone to the vagaries of climate change. Like other African countries, climate related disasters pose threat to the economy of Kenya, which largely depend on agriculture, tourism and hospitality sectors. Droughts and floods make regular news in the country causing devastating effects which are sometimes irreversible, at least in the short-term, causing destitution among the natives and huge losses to government agencies. In a continent where rainfall performance plays a critical role in most of economic sectors, monitoring of drought hazards is important in coping with climate vagaries and adopting the most appropriate mitigation measures. This paper focuses on the effects of climate shocks on tourism and hospitality sector in Nakuru County in Kenya. It utilizes satellite images, in addition to rainfall data, for drought assessment and monitoring. Normalized Difference Vegetation Index (NDVI) and land cover images have been used to establish and map the geographical extent and severity of droughts and the availability of pasture and browse for wildlife. Changes in water levels in Lakes Nakuru have been well documented. The study benefits the tourism destination managers, tour operators and hoteliers on the best locational sites for tourism and hospitality enterprises not only to ensure maximum revenue but also facilitate satisfying experiences to the visitors during climate related catastrophes. In addition, the findings inform government agencies which areas require rapid responses and plan contingency measures a head of time.***

Keywords: Droughts; Floods NDVI; Satellite images; Tourism and Hospitality sector

1. Introduction

Tourism is one of largest and the fastest growing economic sectors globally playing a major role in the growth of global economy (GoK, 2013).It accounts for up to 9% of the global Gross Domestic Product (GDP), 8.8% of the jobs, 5.8% of the exports and 4.5% of the investment (Christie et al., 2013). With a positive growth, global projection indicates that by 2022, the global average growth rate will increase by up to 4% accounting for 10% of the GDP. As a result, one in every 10 jobs will be from tourism industry (World Travel and Tourism Council (WTTC), 2012). Tourism also generates jobs in diverse areas including those with harsh environment and thus typically difficult to generate employment (World Bank, 2010). In South Africa, a total of 513, 000 jobs (3.9% of total employment) emanated from Travel and Tourism sector in 2011. In addition, tourism acts as a catalyst for investments in other sector triggering economic diversification. Overall, tourism expenditures can turn over up to 7 to 11 times in an economy (source). For instance, a strong relationship co-exists between tourism and hospitality industry.

The proportion of tourist arrival in Africa is fairly minimal at 4.8% of all tourist arrivals in the world (African Studies Centre (ASC), 2008).The number of tourists varies from one part of the continent to the other with about 33.3% visiting Maghreb countries, 33.4% visiting Southern Africa, 25% visiting East Africa and 8.3% going to the rest of the continent, but mainly West Africa (ASC, 2008). Fortunately, there has been a gradual increase in the number of tourist visiting Africa at a rate of 7.2%. For instance, in sub-Saharan Africa (SSA) the sub-sector attracted about 33.8 million visitors in 2012 up from 6.7 million in 1990 (Christie et al., 2013). Tourism remains the fastest developing enterprise in Africa providing the continent's major investment opportunities (African Studies Centre (ASC), 2008). Christie et al. (2013) observes that tourist and travel industry accounts for 5% (one in every 20 jobs) of all employments in Africa. It is viewed as the key drivers for economic take off in SSA. In 2012, it directly contributed to 2.8% of the regions GDP. Taking into account the total contribution i.e. direct, indirect and induced, tourism accounted for up to 7.3% of the GDP and projections indicate that about 3.8 million jobs will be created by tourism industry in SSA over the next 10 years.

Climate is an important influence on the tourism sector as it is one of the environmental factors that determine the choice of a holiday destination. However with changing climate, tourism and hospitality industry has been largely affected. For instance, while sea life, which attracts tourists in the

Maldives and the Pacific Islands, have been destroyed by rising sea levels and sea acidification, melting of snow due to increasing temperature has negatively impacted skiing in ski resorts (Viner and Agnew, 1999). Such effects can be easily monitored using satellite observation systems for early detection and planning of mitigation measures.

1.1 Tourism in Kenya

Tourism is third largest foreign exchange earner in Kenya after tea and horticulture. The sub sector employs about 12% of the total wage and accounts for 13.7%of the GDP. Unfortunately, the subsector faces a myriad of challenges ranging from natural calamities such as climate-related disasters to anthropogenic threats such as terrorism. Despite the challenges, Kenya continues to be a popular holiday destination in East Africa. The diverse tourist attractions and favorable climate in Kenya attract more visitors. Such attractions include: wildlife, mountain scenery, coastal beaches and coral reefs, geyser, lakes, grasslands, marine Park and ancient Swahili cities. The most prominent is wildlife tourism. International tourism accounts for up to 70% of the country's total tourism while domestic tourism accounts for 30% (Kenya Tourism Federation, 2010). Over the years, the number of tourists and revenue from tourism and hospitality sector has been increasing(Figure 1).Between 2001 and 2005 for instance, the number rose from 1 million in 2001 to 1.62 million in 2005 with an overall growth rate of 9.8% (GoK, 2006). By 2004, Kenya ranked 5th in international tourist destination in Africa. A total of 1.36 million international tourists visited Kenya accounting for 4.1% of the market share in Africa (GoK, 2006).Income accrued from the sub-sector rose steadily from KShs. 65.4 billion in 2007 to 62.46 billion in 2009, 73.78 billion in 2010 and 97.9 billion in 2011 (GoK, 2013).Tourism, unlike agriculture and manufacturing, is a service industry where the product is consumed at the spot of production and therefore largely affected by the prevailing environmental conditions. According to World Bank (2010), the number of visitor in Kenya game parks and reserves fluctuate from year to year and within the year depending on several factors such as animal movements, climate variations, political instability and global financial crisis. It is against this background that this study sought to examine the effects the changing climate, particularly droughts and floods, on tourism and hospitality sector in Nakuru County.

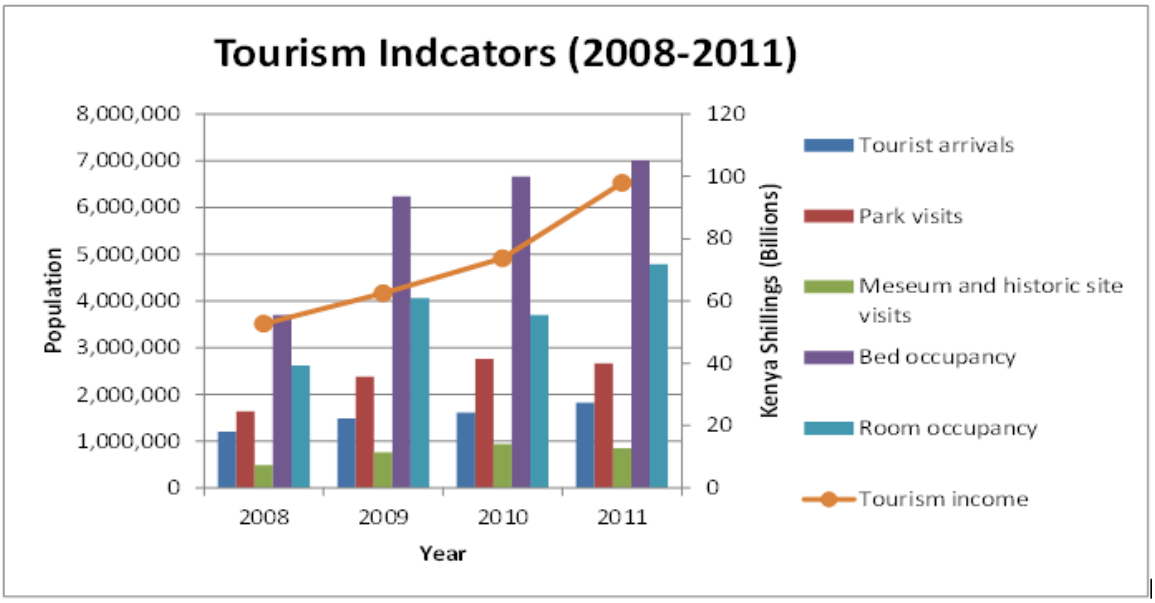


Figure 1: Trends in tourism indicators in Kenya (Source: Kenya National Bureau of Statistics, KNBS, 2012)

2. Study Area and Methodology

Data for the study was collected from Nakuru sub-county which has an area of 7,496.5 square kilometers, a population of about 1,603,325 and 409,836 households. The Population density is 213.9 persons per square kilometer. The County is divided into four sub-counties namely: Molo, Nakuru, Subukia and Naivasha (Figure 2). It enjoys good climate with predictable weather patterns. Temperatures range between 10°C and 20°C while annual rainfall ranges between 700mm and 1200mm with an annual mean of about 950mm. The climate is not only suitable for agriculture but also for tourism activities. However, about 43% of the population lives below the poverty line.

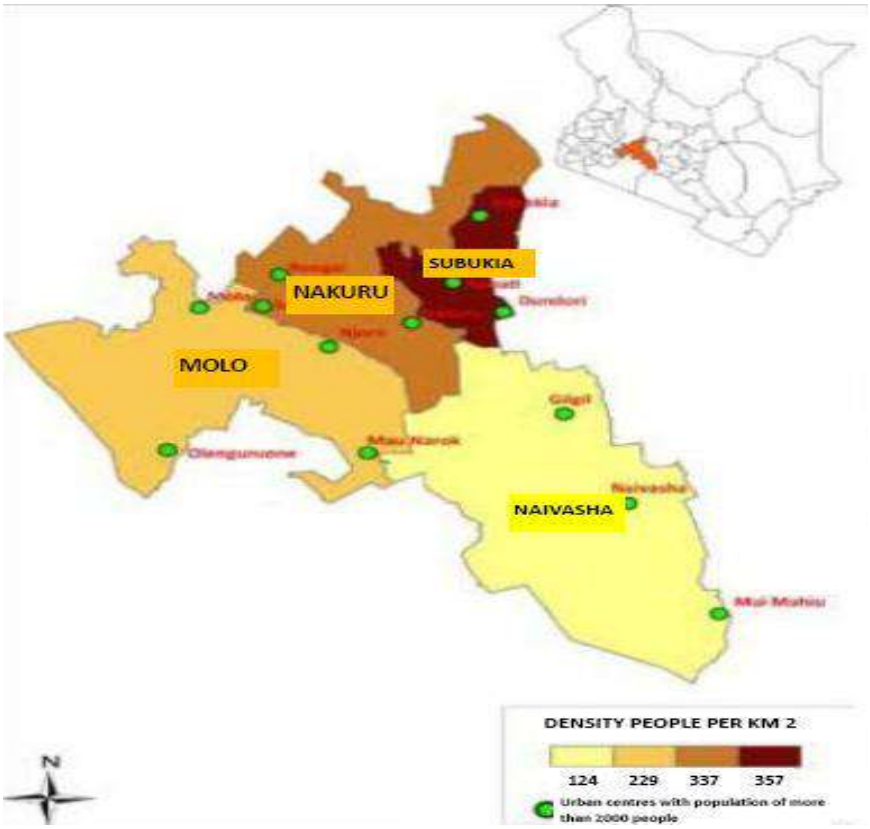


Figure 2: Location and size of Nakuru County

Tourism plays a critical role in the economy of the county with some local governments in the county earning up to 70% of their revenues from the sub-sector. The main tourist attractions in the County include Lake Nakuru National Park, Menengai Crater, Hell's Gate Park, Lake Naivasha, Lake Elementaita, Hyrax Hill Anthropological Site and Longonot Crater. The County is famous for Flamingoes at Lake Nakuru, which also host a large number of animal and bird species. In Nakuru County, just like in other parts of Kenya, wildlife is found in both protected areas and open fields that are privately or communally owned.

Rainfall data for a period of 48 years (1964 – 2011) was obtained from Kenya Meteorological Department for Nakuru station.From rainfall data, normal, drought and wet years were computed. Weather was considered to be normal when annual rainfall fell between Mean + 2/3 standard deviation ($M+^2/_3\delta$) and Mean- 2/3 standard deviation ($M - ^2/_3\delta$). With an annual mean of 954.9 mm and a standard deviation of 209.8mm, this translated to 1094.8mm and 815.0mm for upper and lower limits respectively. Thus, droughts occurred when annual rainfall was below 815.0 mm while wet years occurred when annual rainfall was above 1094.8mm. Rainfall amounts between 815.0 mm and 1094.8mm was considered as normal.

In Kenya where tourism is largely wildlife based, changes in vegetation cover and water resources are critical in a sustainable tourism sector and thus requires frequent monitoring. The study used satellite observation system to monitor vegetation cover and water resources in Nakuru County. Landsat satellite imageries were used. Table 1 shows specifications for Landsat images used

Table 1: Landsat Image Specifications

Date Acquired	*Satellite*	*Sensor*
01/07/1984	Landsat 5 -	TM
28/01/1986	Landsat 5 -	TM
22/05/1999	Landsat 7 -	ETM
15/03/2000	Landsat 7 -	ETM
03/04/2001	Landsat 7 -	ETM
01/02/2002	Landsat 7 -	ETM

Normalized Difference Vegetation Index (NDVI) was used to analyze the greenness of the biomass in the county at large and Lake Nakuru National Park (LNNP) in particular. NDVI is the ratio of two wavelengths, red and near-Infrared (NIR) and by examining their difference in wavelength absorption and reflection, the health of the vegetation is determined.The index values range from 1.o to +1. Healthy vegetation yields an NDVI closer to +1 while sparse vegetation has an index of close to 0.2. Computation of NDVI values and images was done using Erdas Imagine v 2011. The study adoptedthe following classification of NDVI (http://simwright.com/downloads/SimWright_NDVI.pdf):

Table 2: NDVI Classifications

NDVI values	*Land cover type*
0.3 to 0.8	Dense vegetation
0.2 to 0.3	shrub and grassland
0.1 to 0.2	Soils
0.0 to 0.1	Bare rocks and sand
0.0 to negative values	Free standing water

For water resources, the study used Lakes Nakuru. Landsat images of the lakes were used to delineate their sizes over

different periods. ArcGis 10.1 software was used in estimating their sizes in square kilometers.

3. Results and Discussion

3.1 Rainfall Characteristics

Rainfall is the key parameter influencing social and economic activities of Nakuru County. As a sub-sector of the economy, tourism is equally influenced by rainfall characteristics. Wildlife tourism predominate the sub-sector in the County. The condition of the parks, which is dependent on rainfall performance, therefore plays a critical role in the concentration and visibility of wild animals and eventually the number of tourists visiting the parks. However, rainfall characteristics vary from season-to-season and from year-to-year (Figure 3). In general, rainfall in Nakuru County is less variable with a coefficient of 0.21. Between 1964 and 2011, for instance, 44% of the years had annual rainfall variations within normal rainfall range of between 815.0 and 1094.8mm. However, the county occasionally experiences years of above and below normal rainfall causing floods and droughts. There were about 13 very wet years (27%) and 14 drought years (29%) between 1964 and 2011 (Figure 3).

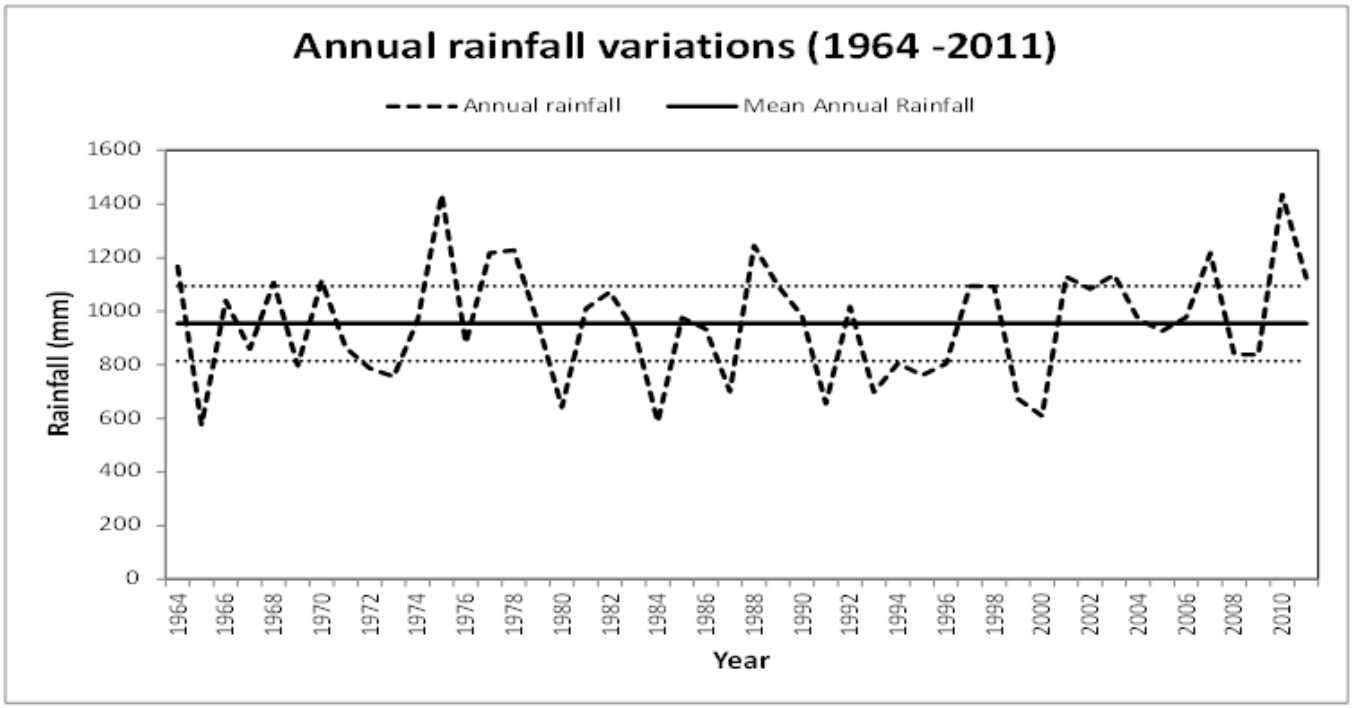


Figure 3: Annual rainfall variations for Nakuru County between 1964 and 2011

The year 1975 and 2010 were the wettest each recording annual rainfall of 1435mm, i.e. 50.2% above the long term mean. The years 1988, 1978, 1977 and 2007 were second, third, fourth and fifth wettest years respectively. 1965 was the driest year with an annual rainfall total of 575.2mm i.e. 39.8% below the long term mean. In order of drought severity, other dry years occurred in 1984, 1980, 2000, 1991 and 1999.

Analysis of annual rainfall in the county revealed a gradual increase in annual rainfall amount (Figure 4). Rainfall was characterized by increased intensity and decreasing number of rain days, an indicator of climate change (Figures 5 a, b, c and d). The number of rain days with 1mm of rain and above decreased from an average of 131 in 1970s to 119 in 2000s with the intensity increasing from 7.7 to 8.2mm during the same period. Similarly, the number of rain days with 5mm of rain and above decreased from an average of 63 in 1970s to 54 in 2000s with the intensity increasing from 16.3 to 18.1mm during the same period.

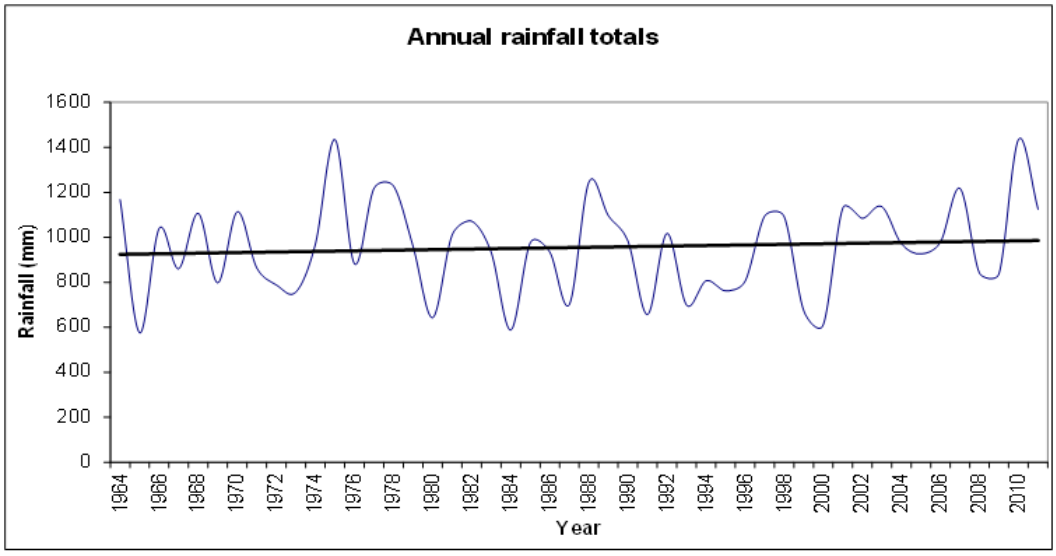
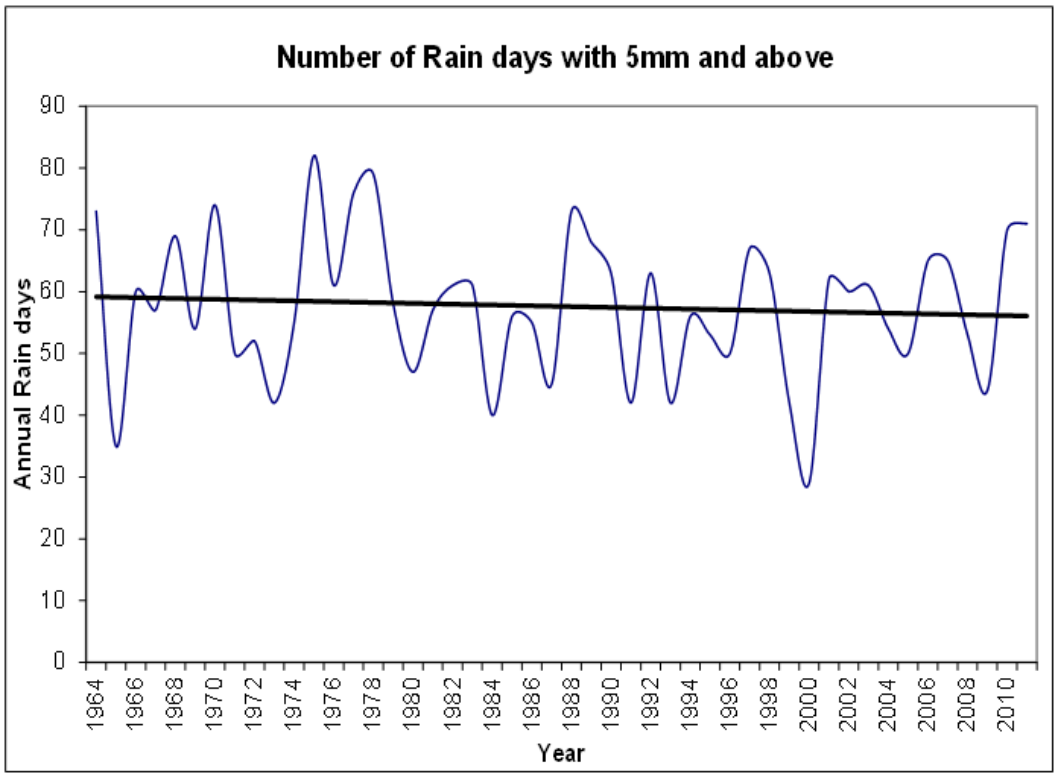
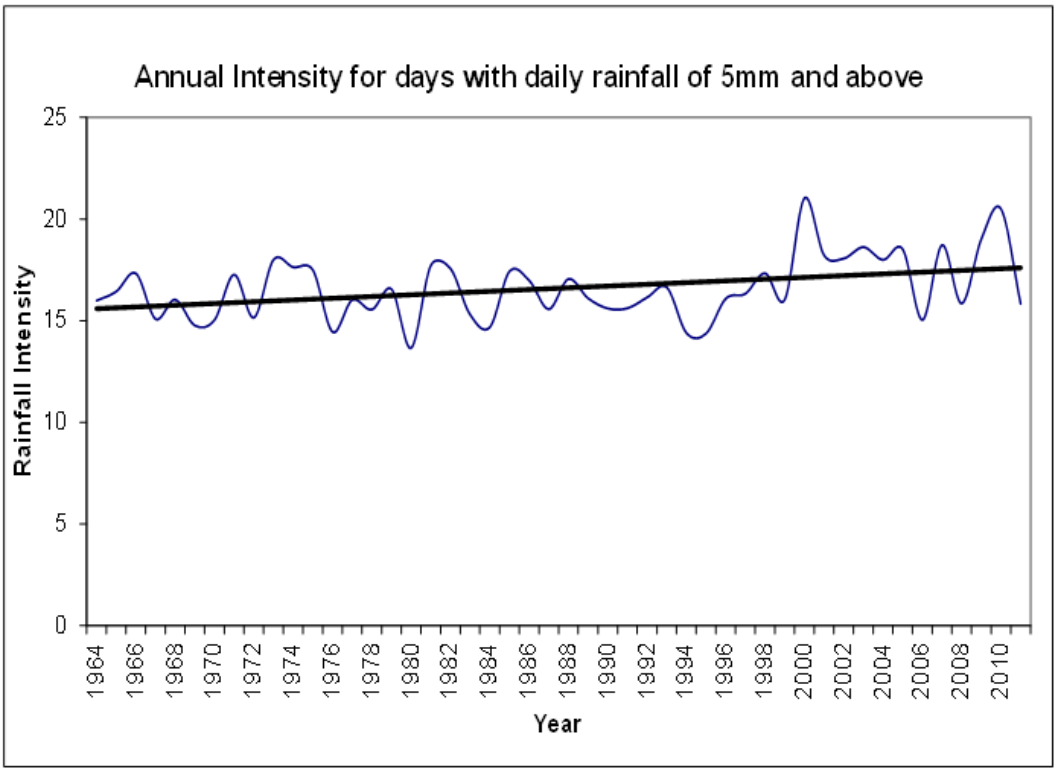
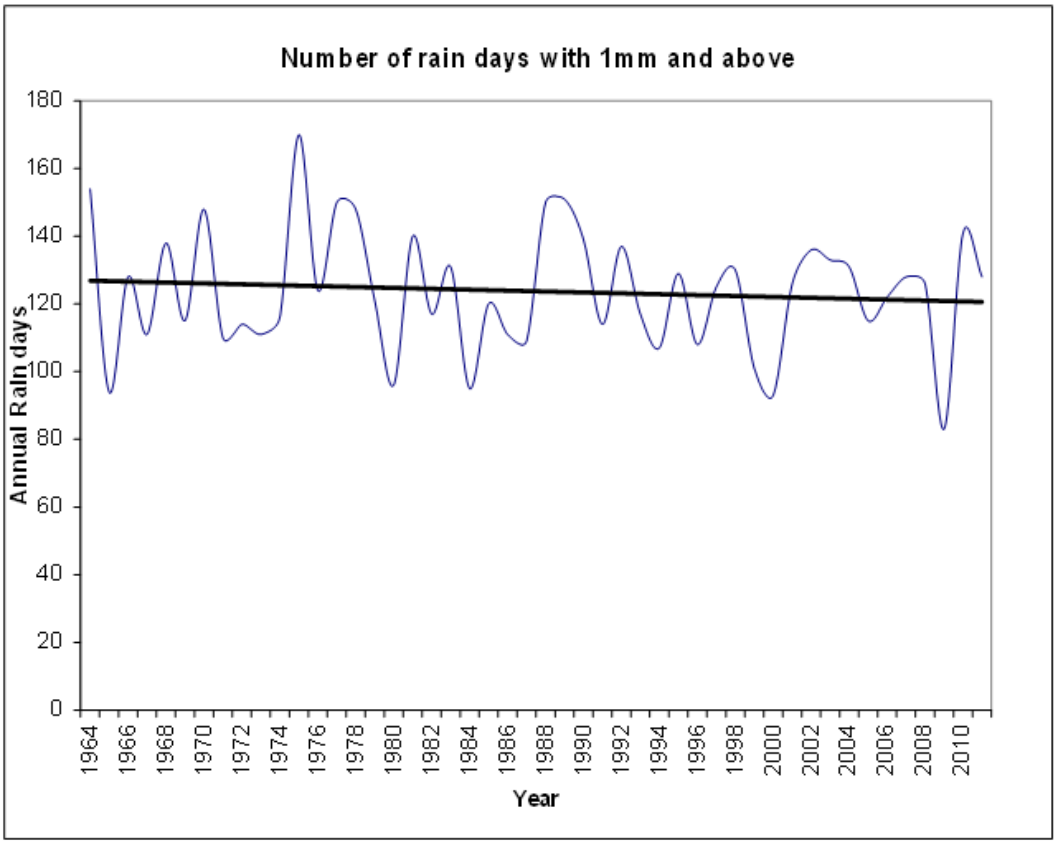


Figure 4: Annual rainfall trend for Nakuru County between 1964 and 2011







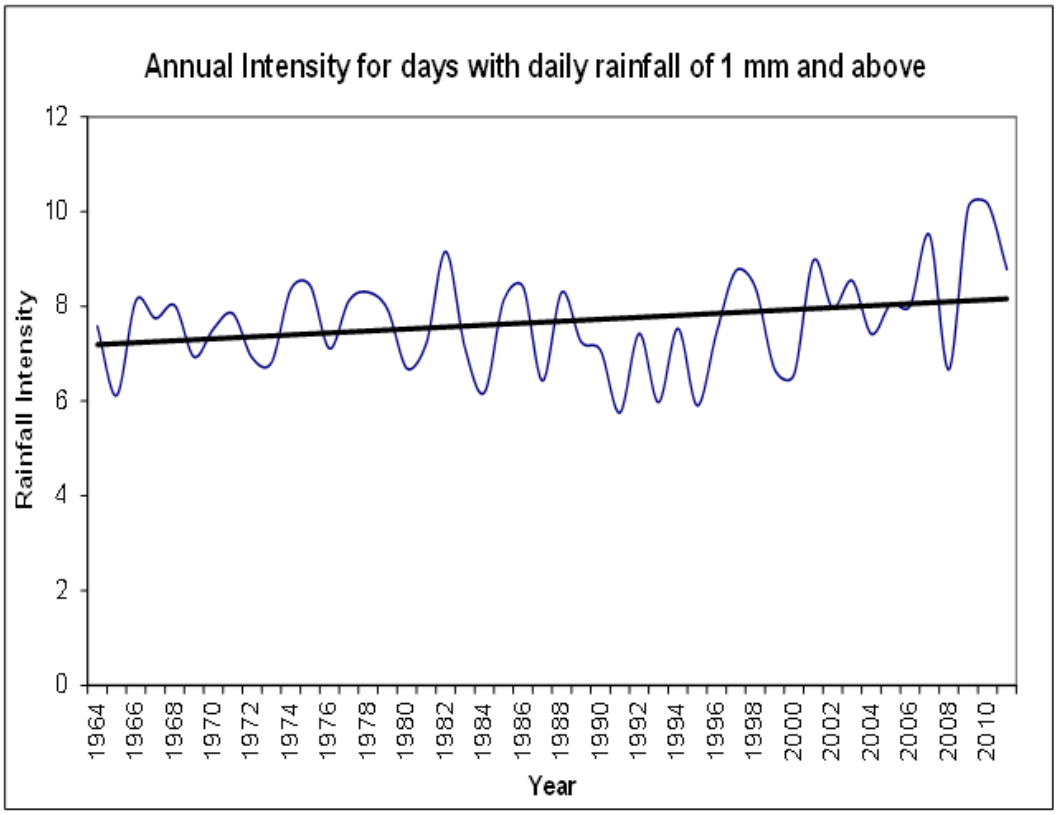


Figure 5: (a) number of rain days with 5mm of rain and above (b) Rainfall intensity for days with daily rainfall of 5mm and above (c) number of rain days with 1mm of rain and above (d) Rainfall intensity for days with daily rainfall of 1mm and above

3.2 Effect of Climate Variability on Tourism and Hospitality Sub-Sector

The proximity of LNNP from Nakuru town (4 km) makes it the second most visited park after Nairobi National park in Kenya. Tourism is largely wildlife based and therefore depends on the concentration and visibility of wild animals. Table 3 shows the effects of floods and droughts on tourism and hospitality sector.

Table 3: Major effects of floods and droughts on tourism and hospitality sector in Lake Nakuru National Park from1993 - 2013

Year	*Rainfall characteristics*	*Major effects on tourism and hospitality activities*
2013	Floods	•Highest water levels since 1960s •Over 22.9 km^2 of Lake Nakuru flooded – decreased salinity and silting caused flamingoes to migrate to Small Lake (Naivasha) and Lake Bogoria •Several campsites, tented camps and lodges have submerged •10 rhinos relocated to Samburu Ranch in Laikipia due to scarcity of graze caused by floods
2012	Floods	•Water levels rose by 2m - submerged sections of acacia forest and reduced the salinity of the water making the aquatic habitat unsuitable for flamingoes.
2011	Normal	- Easy accessibility to the park
2010	Floods	•Reduced numbers of tourists due to destroyed road networks •Flooding of Lake Nakuru lodge led to the closure of the facility affecting hospitality sector.
2008-09	Prolonged drought	•Relocation of huge herbivores to the Nairobi park due to acute shortage of pasture •Park under wildfire
2000	Drought	•Lake level decreased caused increased water salinity leading to the migration of flamingoes
1995	Drought	•More flamingos' mortality following the 1993-94 droughts. Gradual disappearance of Arthrospirafusiformis – feed for lesser flamingoes
1994	Drought	•Continued drying of the lake affecting the population of flamingoes.
1993	Drought	•Over 20,000 lesser flamingos died.

Availability of graze and water for wild animals determined the pattern of animal distribution in the park which in turn influenced the number of tourists visiting the park. High concentration of wildlife attracts more tourists *vis a vis* low concentration. Normal rainfall favored fair distribution of graze and water for wildlife triggering high concentration of animals in easily accessible areas (Plate 1). East (1999) observes that favorable habitats enhance high concentration of waterbucks with the population densities reaching a height of more than 10 per square kilometer in LNNP.

Plate 1: Concentration of buffaloes due to the availability of graze

Low concentration of animals was common during drought period as animals scattered in search for graze and water. Visibility of animals was reduced during the dry periods, as animals grazed in bushy areas where pasture was still palatable and as they shielded themselves from the scorching sun. Other effects of droughts on tourism included loss of wild animals due to starvation and fire out breaks (Plate 2a &b). For instance, the 2008/ 2009 led to fire outbreak in 2009 destroying habitats. To mitigate the effects of this drought, KWS relocated ten rhinos among other huge herbivores to the Nairobi Park (Africa Conservation Foundation, 2009).

Plate 2: (a) Animal carcass (b) rangers putting off fire in LNNP during 2008/2009 drought

Above normal rainfall rendered the park inaccessible due to flooded and destroyed roads (Plate 3). In 2013 the Lake level rose rendering the park inaccessible using the normal main circuit, the administrative block was flooded and most of the herbivores had been forced to higher grounds. This necessitated creation of alternative path ways for tourists and relocation of administration offices. The lake level was highest since 1960. Due to flooded grazing field, the relatively reduced pasture at the park was not sufficient for white rhinos' population forcing Kenya Wildlife Service (KWS) to relocate them to a new conservancy in Northern Kenya.

According to KWS (2011) the 2010 floods made some parts of LNNP inaccessible the destruction of a number of the Park bridges and roads reducing the number of tourists visiting the Park. The problem of accessibility due to heavy downpour is usually short lived and the situation improved suddenly with reduction in rainfall. For instance, despite massive destruction of park roads during the 2010 floods, reduction in rainfall in 2011 allowed easy accessibility of the park by tourists. The main circuit from the main gate around the lake shore through baboon cliff, Muya's causeway, Lake Nakuru Lodge, Sarova Lion Hill Lodge, Wildlife Clubs of Kenya and Lanet gate remained safe for driving.

Plate 3: Flooded and destroyed access roads in LNNP

Lake Nakuru which is located between latitudes 0°19' and 0°24' S and longitude 36°04' and 36°07 E covers an area of about 45 – 50km^2. It occupies about 27% of the Lake Nakuru National Park (http://whc.unesco.org/en/tentativelists/1344/). Analysis of satellite imageries revealed that the size of Lake Nakuru varied from year to year depending on rainfall performance of a particular year and the weather conditions of the preceding year(s) (Plate 6). For instance, despite the 1984 severe drought the size of the Lake was 42.16 km^2, approximately 84% of the entire Lake. This can be attributed to the preceding consecutive years of normal rains in 1981, 1982 and 1983. After the drought, the lake size dropped by 12% by 1986. The normal rains of 1985 (2.2% above the long term mean) did little to revive the size of the lake. During the 2000 extreme drought, the lake size reduced by 12.2% compared to its size in 1999 (from 41.97 km^2 in 1999 to 37.44km^2 in 2000). This remarkable decline was attributed to the occurrence of drought in 1999 which was followed by the severe drought of 2000. Rainfall amounts in 1999 and 2000 were -29.4 and -36.1 below the long term mean respectively. Figure 7 shows variations in lake sizes for selected years. As lake receded during droughts, more foot paths emerged as tourists moved closer to the shores (Plate 8).

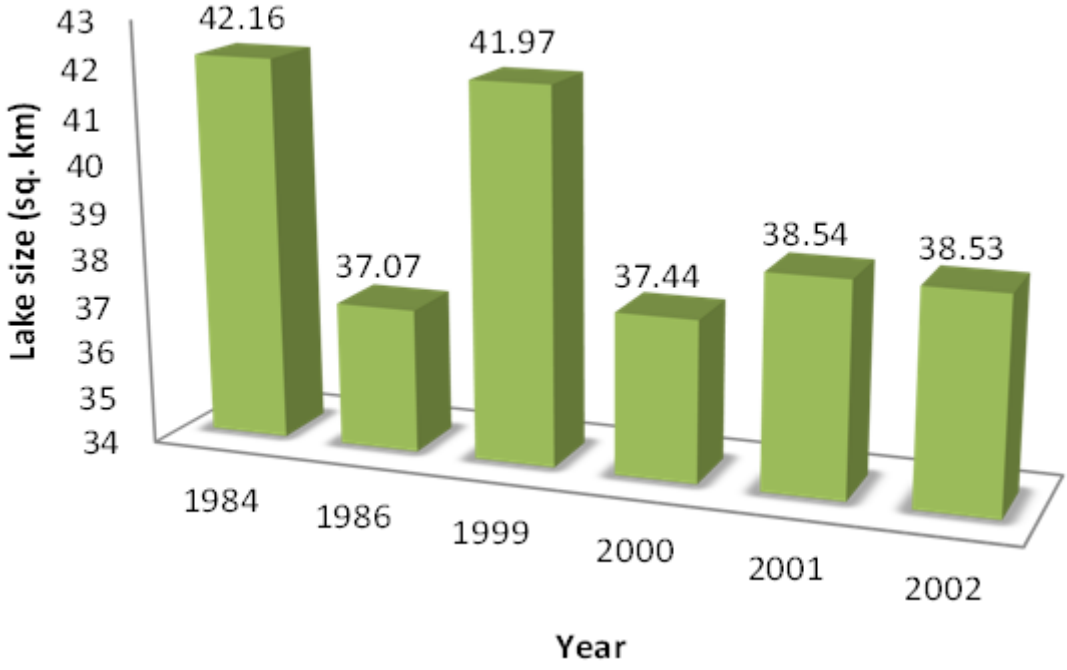


Figure 6: Graphical presentation of variations in size of Lake Nakuru for selected years

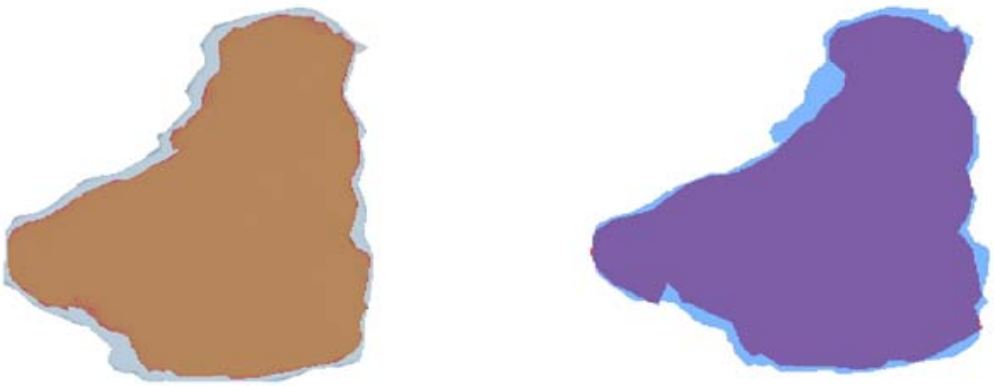


Figure 7: Changes in the sizes of Lake Nakuru during drought and wet years

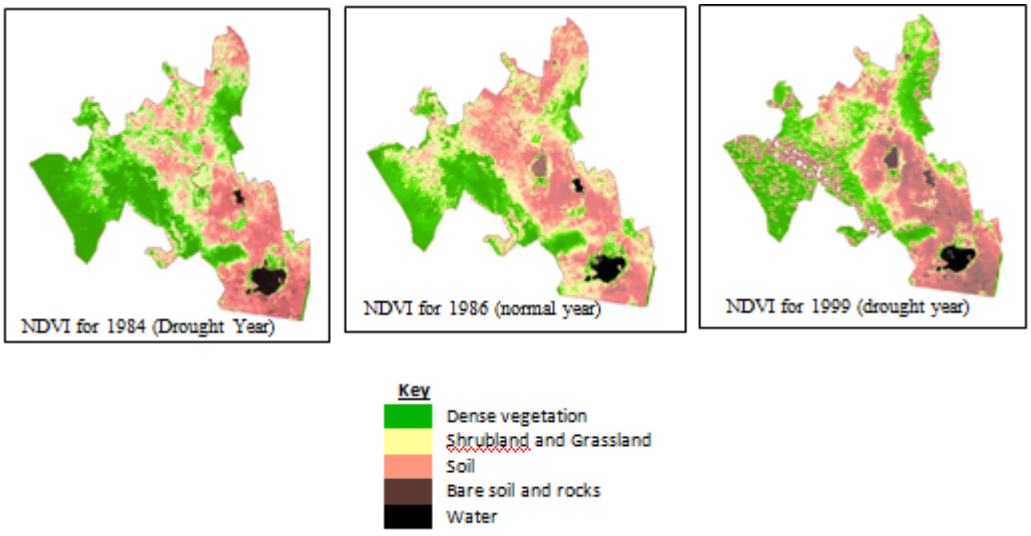
Figure 8: More foot paths to reach the waters of receding Lake Nakuru during the 2000 drought

Decrease in lake levels during droughts increases lake water salinity while increase during floods reduces the salinity of lakes Nakuru and Elementaita. Salinity levels affect the growth of the green algae (undesirable blue algae Microcystis sp., Anabaena sp) which is the main source of food for the lesser flamingoes. On average about 162 tons of algae is consumed daily by the flamingos. Very high or low salinity levels do not favour growth of the green algae leading to shortage of food for the flamingoes. Thus, the amount of food supplies as well as the number of flamingoes, especially for the lesser flamingoes (*Phoeniconaias minor*), fluctuates greatly from year-to-year dependent on rainfall performance. Massive flamingo mortalities and migration occur during droughts. For instance, Odada, et al. (2006) observes that during the 1993 drought, over 20,000 flamingoes died in Lake Nakuru. The prolonged drought that extended to 1996 led to decrease in lake levels. By 1994, the lake showed signs of drying and by 1995; the population of *Arthrospirafusiformis* (which is a source of food for flamingoes) started decreasing. The migration of flamingoes to Lakes Bogoria in Baringo County and SimbiNyaima in Homabay County during the 2000 drought was partly attributed to shortage of food for the flamingoes due changing salinity levels in Lakes Nakuru and Elementaita. Decrease in salinity and increased saltation following the 2013 floods caused migration of flamingoes to Small Lake in Naivasha and Lake Bogoria (Onywele, et. al., 2013).

3.3 Use of satellite observation systems in mitigating climate risk in LNNP

Key to wildlife tourism in Nakuru County is the availability of pasture and water for wild animals. The study utilized Landsat satellite images for various years to monitor availability of pasture. NDVI for selected years, with different rainfall characteristics, was used to show variations in vegetation cover in Nakuru County (Figure 9).

Analysis of satellite images gave an indication of the environmental conditions of Nakuru County. During drought years, water levels and vegetation cover are largely affected. However, the effects were not immediate, particularly on the vegetation. For instance, despite the year 1984 having the second severest drought after 1965, the level of greenness was average. This can be attributed to the fact that the past three years (1981-83), the county had experienced normal rainfall conditions.



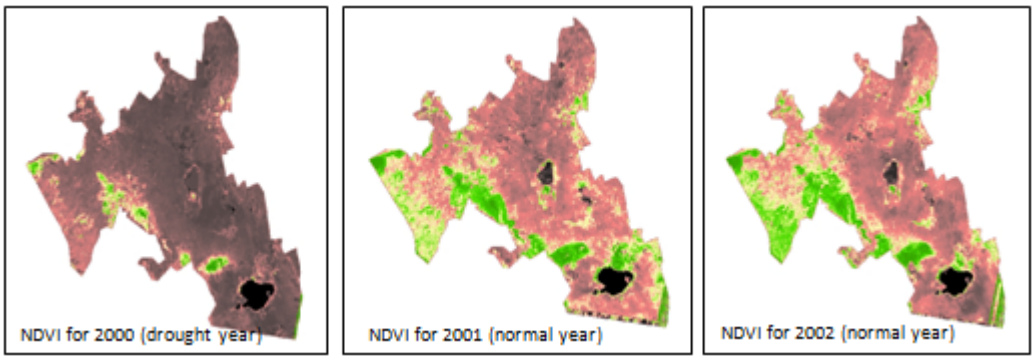


Figure 9: NDVI images for selected years in Nakuru County

As different parts of the park were affected differently by droughts, four consecutive years with different rainfall characteristics were analyzed. These were 1999 (drought), 2000 (drought), 2001 (normal rainfall) and 2002 (normal rainfall). From the NDVI images areas that were worst hit by droughts and that took long for pasture to recover after drought a drought event were identified (Figure 10).

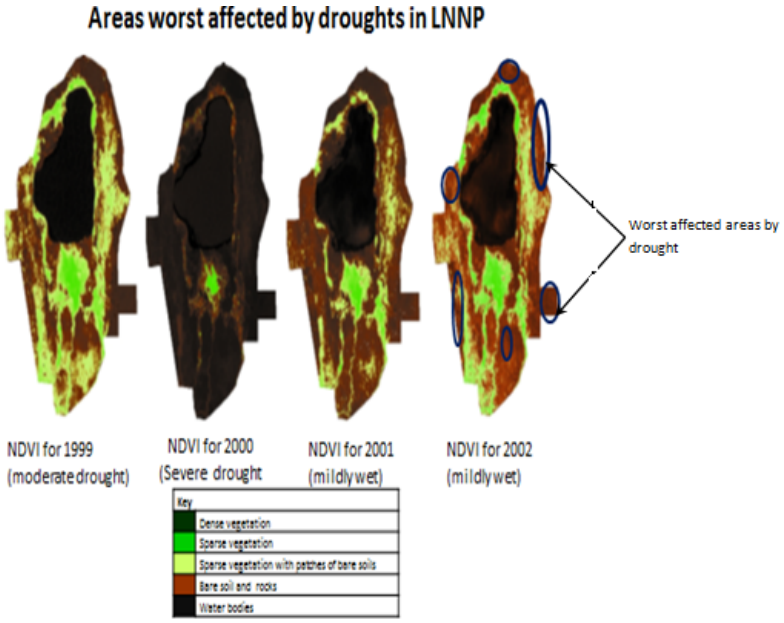


Figure 10: Worst affected areas by drought

4. Conclusion and Recommendations

Climate variability is one of the major threats affecting LNNP resources affecting both tourism and hospitality sector. Loss of animals due to droughts and floods has led to declining number of tourists visiting the park and the associated economy. The study recommends the use of satellite-based information in analyzing threats to park resources. The knowledge of the spatial distribution of park resources is critical not only in planning to contingency measures but also guiding the tourists on areas that large concentration of animals can be found based on pasture availability during droughts and soon after the drought. For instance, the provision of water and feed for wildlife during the 2000 drought by the government to would have benefited from such information. In addition, the information can also give an idea to the government and other stakeholders in tourism and hospitality sectors on sections of the park where more emphasis need to be put in developing of tourism and hospitality products.

Reference

[1] Africa Conservation Foundation (2009) Kenya: Wild animals not spared by drought. Available online at: http://www.africanconservation.org/in-focus/item/kenya-wild-animals-not-spared-by-drought-2

[2] ASC (2008) Tourism in Africa. Information sheet 3. Available online at: http://www.ascleiden.nl/pdf/infosheet3engels.pdf

[3] Christie, I., Fernandes, E., Messerli, H. and Twining-Ward, L. (2013) Tourism in Africa: Harnessing

tourism for growth and improved livelihoods. World Bank report
[4] East, R. (1999) African antelope database 1998; IUCN/SSC Antelope Specialist Group.IUCN, Gland, Switzerland and Cambridge.
[5] Gereta, E.J., Wolanski, E. and Chiombola, E.A.T. (2003) Assessment of the environmental, social and economic impacts on the Serengeti ecosystem of the developments in the Mara river catchment in Kenya
[6] GoK (2006) Statistical analysis of tourism trends: Globally and locally. Available online at: http://www.tourism.go.ke/ministry.nsf/doc/tourism_trends_oct2006_revised.pdf (Accessed: 9/2/14).
[7] GoK (2013) National tourism strategy 2013-2018. Department of Tourism: Ministry of East Africa, Commerce and Tourism
[8] http://simwright.com/downloads/SimWright_NDVI.pdf. Normalized Difference Vegetation Index (NDVI): Analysis for Forestry and Crop Management. Downloaded on 08 July 2014.
[9] Kenya Tourism Federation (2010) Exploring the potential of domestic tourism. Kenya Tourism Federation Newsletter Issue 6, 23rdAugust 2010
[10] KNBS (2012) Kenya: Facts and figures 2012. Available online at:
[11] KWS (2011) Flooding subsides, all roads passable in Lake Nakuru National Park. Available online at: http://www.kws.org/info/news/2011/06_12_2011_flooding.html
[12] Odada E. O., Raini, J. and Ndetei, R. (2006) Lake Nakuru: Experience and Lessons Learned Brief. http://www.worldlakes.org/uploads/18_Lake_Nakuru_27February2006.pdf
[13] Onywere, S. M., Shisanya, C. A., Obando, J. A., Ndubi, A. O., Masiga, D., Irura, Z., Mariita, N. and Maragia, H. O. (2013) Geospatial Extent of 2011-2013 Flooding from the Eastern African Rift Valley Lakes in Kenya and its Implication on the Ecosystems. Available online at: http://www.ku.ac.ke/schools/environmental/images/stories/research/Geospatial_Extent_2011-2013.pdf
[14] World Bank (2010) Kenya's Tourism: Polishing the Jewel. World Bank May 2010.
[15] WTTC (2012) Travel and tourism: economic impact 2012, South Africa. Available online at: http://www.wttc.org/site_media/uploads/downloads/south_africa2012.pdf (Accessed: 9/2/14).
[16] This Kenyan (2013): Lake Nakuru Park under Water! Available online at: http://omongepaul.wordpress.com/2013/10/10/lake-nakuru-park-under-water/
[17] Viner, D. and Agnew, A. (1999) Climate change and its impacts on tourism. Report Prepared for WWF-UK July 1999

Author Profile

Dr. Julius M. Huho is a senior lecturer and a researcher in the Department of Geography in Karatina University Kenya. He has taught in Kenya University for the last 13 years with specialty in climatology, GIS and Remote Sensing. Currently, he is the Head of Department of Tourism and Hospitality Management, Karatina University.

Ms. Margaret Mungai is a Lecturer and a researcher in the department of Tourism and Hospitality Management, Karatina University, Kenya. She has a specialty in tourism management and has published widely. She is currently undertaking her doctoral studies in tourism management

Ms. Teresa Kinuthia is also a lecturer and a researcher in the department of Tourism and Hospitality Management, Karatina University, Kenya. Her specialization is in hospitality. She is an experienced lecturer with over 15 years of teaching hospitality courses both at intermediate and tertiary institutions. She is currently undertaking her doctoral studies in hospitality.

Ms. Rose Kosonei is a Master of Science in Environmental Science student at Maseno University, Kenya. Using GIS and Remote Sensing techniques, Ms. Kosonei is investigating the effects of drought on vegetation cover and water resources in the masters. Currently she is working as an Environmental Impact Assessment expert in Kenya