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ECOLOGICAL AND SOCIO-ECONOMIC IMPLICATION OF CLIMATE CHANGE AND VARIABILITY ON TOURISM IN KILIMANJARO MOUNTAIN NATIONAL PARK, TANZANIA

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Abstract

The study assessed social-economic and ecological implications of climate change and variability on tourism in Kilimanjaro National Park and adjacent communities. Specifically the study analyzed ecological and socio-economic implications of climate change and variability in Kilimanjaro National Park. Further, the study identified climate change and variability adaptation strategies in the area. Also the study examines policy implication of climate change and variability on tourism. Both purposeful and random sampling was used for villages and households selection in the area. Primary and secondary data both qualitative and quantitative were used in this study. Primary data were mainly collected using structured household questionnaire. PRA methods such as questionnaire, Focus Group Discussions (FGD), key informant, time line, drivers of change and direct field observation were used to obtain data for CC&V implication on social economic and ecological in the area. Findings revealed that climate change and variability affects socio-economic and ecological resources in diverse ways. In terms of economic implications responses to Yes were significance X^2 0.05=7.81, Df = 3. The presented calculated chi-square $X^2 = 9.214$ was larger than tabulated; therefore there was a significant statistical difference in socio-economic implications. Education, capacity building, soft loans, grants were adaptation strategies adopted. It is anticipated that the information obtained from this study will be beneficial to researchers, policy makers and conservation officers in National Parks in Tanzania to mainstream effective mitigation, coping and adaptation strategies for sustainable tourism and ecosystem management.

Keywords: Climate Change, Tourism, Ecological, Implication.

1.0 Introduction

Africa, including Tanzania is mentioned as being highly vulnerable to climate change impact with less adaptive capacity due to poverty *inter alia* (IPCC, 2001). According to Hastenrath (2001); Bradley *et al.*, (2004), the global impact of climate change and variability on higher altitude regions may be amplified and will have an influence on the regions, their resources and surrounding environment. In Kilimanjaro, Kibo glacier which attracts thousands of tourists is vulnerable and the projection shows that it will diminish by the mid-21st century (Molg *etal*; 2003). This condition is likely to aggravate the situation increasing vulnerability to adjacent communities' livelihoods and associated sectors of economy (URT, 2007).

Temperature increases and the decline in rainfall for example, will cause ecological stresses that could impair the functioning of ecological systems particularly in terms of plant growth and development. Climate change and variability is not only an ecological problem but also a socio-economic issue that must be dealt with at local level. The socio-economic influence include both the opportunities and consequences of a changing climate, and tourism activities need a clear review in order to gain a holistic picture of the kind of impacts that can be expected and that the tourists and local people in will have to adapt to. Climate change and variability may also increase the frequency of flooding, drought and land degradation, and subsequently reduce the viability of recreation activities and wildlife expeditions (WWF, 1999). These impacts will require coping and adaptation measures. Globally, impacts of climate change and variability will undermine developing countries due to widespread poverty and differential adaptive capacities. It is stated with much confidence by IPCC that efforts to achieve Millennium Development Goals (MDGs) will be impeded by CC impacts in the mid-21st century.

It is therefore with this background that this study attempted to contribute to an understanding of the potential socio-economic and ecological climate change impacts on tourism in KINAPA

Objectives

The study was guided by the following objectives

1. To analyze ecological and socio-economic implications of climate change and variability to KINAPA and communities adjacent to the park.
2. To identify climate change adaptation strategies on tourism and biodiversity in KINAPA
3. To examine policy implication on climate change and variability impacts in KINAPA

Study area location

Kilimanjaro region is located in the north east of Tanzania covering an area of 13,209km². It is among the small regions in Tanzania which comprise about seven districts namely Rombo, Same, Mwanga, Hai, Moshi Rural, Moshi Urban and Siha. Fig 1: below shows location of the study area:-

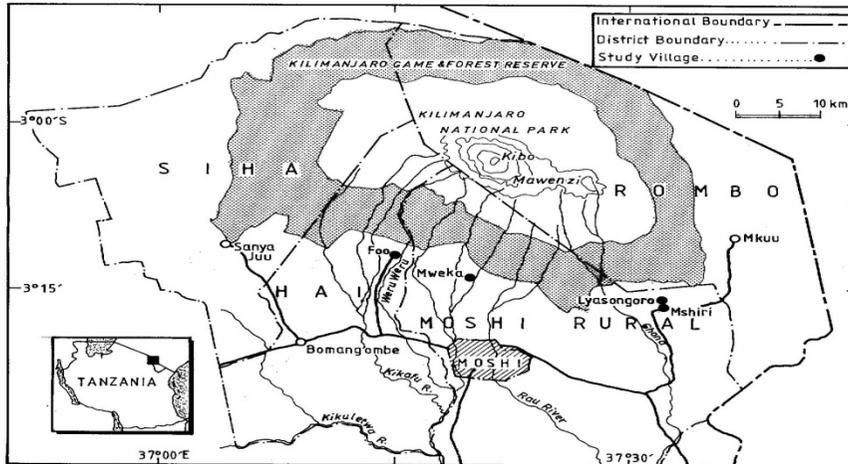


Figure 1: Location of KINAPA and the study Villages

Source: Geography GIS-Lab-UDSM.

Kilimanjaro National Park(KINAPA), covers 756km² and it was established in 1973. It became a World Heritage Site in 1989 with its forest reserves which were established in 1921. It has Africa's highest peak and the world's largest free standing mountain, Kilimanjaro (5,895m). Mt Kilimanjaro measures 80km by 50km on the Tanzania and Kenya border (3°04'S, 37°21'E). It is volcanic in origin with three single peaks, Shira (4,005m) Mawenzi (5,140m) and Kibo (5,895m), the only peak retaining glaciers (Agrawala, et al, 2003). The summit region of Kibo has collapsed to form a caldera 1.9 km by 2.4 km in diameter (Kaser *et al.*, 2004).

Social Economic Activities in KINAPA and Adjacent Communities

Mountain climbing is the major touristic activity dominating KINAPA due to the presence of Mt Kilimanjaro, the world tallest free standing mountain which attracts tourists and receives thousands of climbers every year (Carle, 1977 in Agrawala *et al.*, 2003). Communities adjacent to KINAPA were involved in climbing as guides and porters, and also engage in tourism-related livelihood activities such as cultural tourism, eco-tourism, small businesses such as shops and kiosks, curio shops, hotels, lodges, *bureau de change* and agribusiness. Some are employed by KINAPA as Park workers.

According to URT (2002), agriculture dominates the area accounting for 70% of the GDP for the region, mainly intercropping coffee, maize, banana, potato, fruit, beans and cassava, restricted to Chagga gardens adjacent to the park at about 900-1000 m.a.s.l (Mbonile, 1999b). Livestock keeping is zero grazing and includes cows, goats, sheep and chickens.

Biodiversity as Touristic Resources

Mt. Kilimanjaro is also very rich in flora and fauna, and includes about 2,200 vascular plant species and 140 mammals (Hemp 2001 a). Both flora and fauna are among of the resources in KINAPA which attract tourists. Due to its altitudinal nature, climbers explained to experience “four seasons in four days”. Various attractive flora are such as *Impatiens kilimanjari*, *Violeti eminii* and *Impatiens pseudoviola* were found in the 800-2800m cultivated zone. The heath and moorland at 2800-4000m a.s.l. is dominated by *Protea kilimandscharica*, *Knifolia tomsonii* and *Lobelia deckenii*. The desert zone comprises *Asteraceae sp* at 4000-5000m, and in the ice cap (5000-5895m) *Helichrysum newii* have been found (Grimshaw *et al.*, 1995; Hemp (2001, a b; 2002).

Apart from flora there are fauna such as honey badgers, bushbabies, small spotted gannets, tree hyrax and four striped grass mice. On the Rongai route that has access to Amboseli National Park where there are few day trippers, there are animals such as buffalo, giraffe, leopards, grey and red duikers and elephants. Avians in KINAPA include *Hartlaubs turaco*, silvery checked hornbills, speckled mouse birds, white napped ravens, augur buzzards and crowned eagles. All the above are biodiversity touristic resources that attract tourists to Kilimanjaro Grimshaw *et al.*, 1995)

Justification of Selecting the Study Area

KINAPA area and adjacent villages; Mshiri, Lyasongoro, Mweka and Foo were specifically selected for research on CC&V impacts on tourism, based on the fact that they are in the northern tourism circuit with potential tourist attractions being affected. Mountain climbing is the major activity adjacent to the park, with most communities involved in tourism related activities apart from farming. The impacts of CC&V on the mountain ice-cap, tourism resources and livelihood necessitate the undertaking of this research. Other resources such as water, forest, flora and fauna including communities adjacent the parks are vulnerable to CC&V impacts. Vulnerability to climate change will have socio-economic and ecological implications. All these necessitate undertaking this research in Kilimanjaro National Park and the named adjacent villages.

3. Methodology

Research Design

This study employed a survey design to accomplish its objectives. Both cross-sectional and longitudinal designs were used in the assessment. Vertically, six (6) climatic zones on two routes, camps, and huts inside the park were covered. The whole study area lies between latitude 3⁰⁰' and 3¹⁵' S and longitude 37⁰⁰' and 37³⁰' E. Also there was a summit expedition for observation of glacial recession, forest fire, biodiversity loss, and the expansion of campsites, decreased water in campsites, rivers, trail erosion and temperature measurements. Horizontally Four (4) villages located in southern KINAPA were purposefully selected for this study, due to their special characteristics in relation to tourism. Household interviews were conducted with a sample size of 5% of households in the four selected villages. Both simple random sampling and purposive sampling were used in this research. Simple random sampling was used in selecting 80 households in the four villages adjacent the park.

Sources of Data

Participatory Rural Appraisal (PRA)

PRA methods were used to collect primary data in this study. These methods include semi-structured questionnaires for interviews including key informant interviews focus group discussions and drivers of change. Through interviews socio-economic and ecological implications with adaptation options were obtained from household members and park officials. A driver of change method was involved in the assessment of climatic related drivers, both anthropogenic and natural. According to Devisscher and Harding (2009), changes in climate e.g. rainfall and temperature patterns including climatic frequency can have a significant impact on stressed ecosystems exacerbating the degradation which may affect livelihoods and economies that depend on ecosystem services. Anthropogenic drivers such as land use change, increased water demand and overexploitation of natural resources in the area were also assessed in relation to tourism and climate change. Seasonal calendar was used to depict the main activities, problems, and opportunities through an annual cycle in diagrammatic form. It was also used to summarize temperature and rainfall patterns, and the seasons for several communities' activities such as mountain climbing and horticulture. Event occurrence such as droughts and household livelihood activities impacted by climate change and their socio-economic implications, were also assessed using this tool. The transect walk was used to collect information on land use patterns, opportunities and impacts. Data collected using household questionnaires were compiled, processed and analyzed using the Statistical Package for Social Science (SPSS). Descriptive analyses such as frequencies

and cross tabulation were used to determine simple number of occurrences of variable or the relationship among variables.

4. Results and Discussion

The following results were obtained; Section one (1) presents findings on analyzed ecological and socio-economic implications of climate change and variability to KINAPA and communities adjacent to the park. Section two (2) covers adaptation strategies on impacts of climate change and variability on tourism and biodiversity in KINAPA. Finally section three (3) examines policy implication on climate change and variability impacts on tourism in KINAPA.

Socio-economic implications of CC&V on Tourism

Climate change is believed to have implications on socio-economic livelihood activities that are linked to tourism in the area of study. Implications on tourism livelihoods activities have different impacts according to place and time. However, implications vary both positively and negatively on livelihoods.

Different implications on socio-economic activities were reported in KINAPA and adjacent villages. From all four village 86.3 % of respondents agreed on the presence of socio-economic implications while 13.7% said that there were no implications. Responses to Yes were significance X^2 $0.05=7.81$, $Df = 3$. The presented calculated chi-square $X^2 = 9.214$ was larger than tabulated; therefore there was a significant statistical difference in socio-economic implications.

Table 1: Socio economic implications of CC&V

Villages	Common Implication %		Socio-Economic	Total
	Lyasongoro	Mweka	Foo	
HIV/AIDS	16.25	12.5	25	76.2
Changes in behaviors'	10	2.5	11.25	48.8
Migration during high season	20	3.75	23.75	73.8
Conflict over resources use	16.25	20	25	85
Decreased horticulture yield	2.5	8.75	2.5	16.2
Loss of properties.	1.25	3.75	1.25	7.5
Total/villages %	23.75	21.25	28.75	100

Source: Field Survey

Results presented in table 1 indicate that 76.2% of respondents said that there was high implication on diseases such HIV/AIDS among KINAPA workers and villagers adjacent the park. Another 48.8% of respondents said there were changes in behavior among porters and guides which had a negative implication on social life. They were engaged in irresponsible

sexual behavior and excessive alcohol consumption which leads to increased HIV/AIDS and STD's among local communities. It was reported that the majority of climbers were victims of HIV/AIDS due to behavior change. An implication of this will be the reduction of the workforce for tourism activities; hence this might affect tourism in KINAPA.

Furthermore, 85% of respondents said that there was conflict over resource use. Conflicts were reported between KINAPA authorities and locals because the latter were involved in activities that destroyed forests and fostered climate change. Villages with higher resource conflicts were Foo and Mshiri respectively where half a mile of forest at Mshiri was completely destroyed. The same results were obtained by Agrawala *et al.*, (2003) whereby people had entered in KINAPA forest for about 8km from village border to searching resources.

On the other hand, 73.8% of the respondents said there was a large immigration of people from different destinations who had come for tourism activities (businessmen, porters and guides). This immigration had implications on the resources and activities in the area especially during the low season when there is no climbing. Additionally, 16.5% of the respondents reported that there was a decrease in horticulture yields which mostly affected tourist hotels, restaurants and the provision of meals on the mountain. Finally 7.5% of respondents say there was a loss of a few properties during the heavy rains. This was recorded in the timeline in 2008 at the Uchira and Mabungo lowlands of Kilimanjaro.

Livelihood Challenges for People who depends on Tourism

There are various challenges reported to be facing people who depends on tourism as their major source of income due to the implications of climate change and variability. 81% of the respondents reported that the major challenge was low income from tourism and non-tourism jobs. 24% of the respondents from both Mweka and Mshiri villages reported that low income from mountain climbing activities was a big challenge. On the other hand 74% of respondents say there were few jobs due to changes in seasonality. Being on the main climbing route both villages reported that there were few tourism jobs. Information from key informants and FGD showed that the number of visitors was increasing but locals claimed that there were no climbing jobs. Tour companies from Moshi and Arusha were reported to come with their guides and porters hence locals missed out on these opportunities.

Another challenge was the cancellation of bookings which was reported by 53.2% of the respondents. Interviews with tour operators in Moshi revealed that extra costs were incurred for cancelled bookings. The incidence was reported by most tour operators in the 2009 economic crunch

and the 2010 October snow cover in most of Europe airports, which was due to climate change.

Social Implications of Malaria on Tourism in KINAPA & Adjacent Villages

It was reported that there was a high prevalence of malaria in the adjacent villages as a result of CC&V. The disease was said to have a contribution in hindering tourism.

Table 2: Implication of malaria on tourism in the area

	% of Malaria implication on tourism				Total
	Low N=15	Average N=52	High N=9	Not known N=4	
Mshiri	5	20	0	1.3	26.2
Lyasongoro	6.3	8.8	7.5	1.3	23.8
Mweka	3.8	13.8	2.5	1.3	21.2
Foo	3.8	22.5	1.3	1.3	28.8
Total	18.8	65	11.3	5	100

Source: Field Survey

Results presented in Table 2 above indicate that 65% of the respondents said that the presence of malaria was average while 18.8% said the prevalence was low. During an interview with a nurse household member in Mshiri village it was reported that there were several malaria cases for women and young children. FGD respondents claimed to have severe recurring fever which indicated that people were suffering from malaria. The distribution of mosquito nets to each household by the government proved that the area was infested by the malaria mosquito. Increased mosquito infestation was seasonal almost after every end of heavy rains “masika’ and also after “vuli’. The rains were succeeded by higher temperatures which favours the hatching of the mosquito larvae. Malaria will adversely affect the labor force involved in tourism activities adjacent to KINAPA.

Economic Implications of CC&V on Tourism

Climate change was observed to have implications on the economy in the area of study and the entire country in terms of jobs, revenue, income and G.D.P. both positive and negative.

Table 3: Economic implication of CC& V on tourism

	Economic implication CC&V %			Average
	Park Revenue N=54	Climbers Income N=60	Country G.D.P N=50	
Mshiri	21.3	20	14.7	23.3
Lyasongoro	21.3	22.7	16	24
Mweka	17.3	17.3	14.7	20
Foo	12	20	21.3	30.7
Total	72	80	66.7	100

Source: Field Survey

The result presented in Table 3 above indicate that 72% of the respondents reported that there was positive implication on revenue, 80% respondents said there was average income while 66.7% of respondents said there was positive implication on G.D.P.

According to HLA and ARA (1995) study on market tourism revealed that if climate change adversely affects the natural setting of mountain destinations (the loss of glaciers, special flora or fauna, fire and disease impacted forest landscapes), the quality of the tourism product would be diminished with implications on economies. Likewise, impact of climate change on natural setting of Mount Kilimanjaro will affect foreign income hence negative implication on G.D.P.

Results from interviewed key informants and Focus group discussions revealed that climate change has led to decreased pasture for livestock, and also drought which has in turn caused crop failure. Economically this has resulted in low purchasing power due to the poor/low income of the people.

However, data from URT (2009) revealed that there is increased tourism income from US \$ 259.44 mil in 1995 to US \$ 1,159.82 mil in 2009. For the past four years tourism has grown from a 12% contribution to a 17.2% contribution to G.D.P and 41.7 % of the country's foreign exchange inflow. Despite the fact that the number of tourists is increasing in KINAPA, if measures are not taken, the cost of recovery from the impacts will overshadow the benefits of the income. Furthermore, it was reported that over 200,000 new jobs were created in past four years. This has positive implications; however climate change is likely to reduce GDP, foreign exchange inflow and even jobs ([Stern, 2006](#)).

Ecological implications of CC&V on Tourism

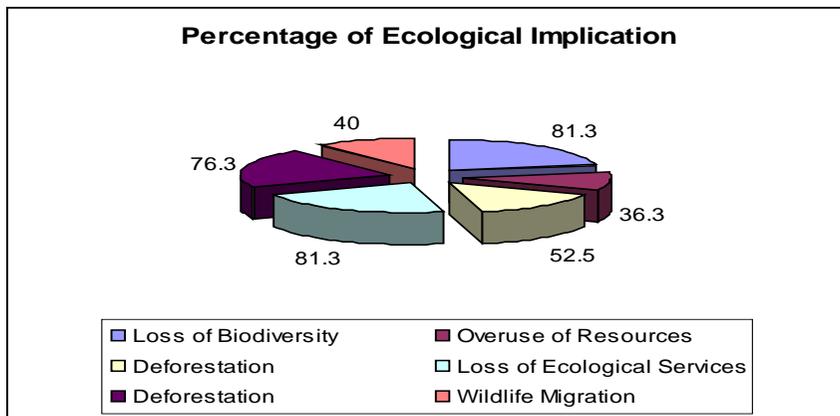
Ecologically there were implications on biodiversity stress and the loss of ecological services. In order to enhance sustainable tourism various adaptation strategies and policies were suggested to address climate change and tourism in KINAPA. The ecology and biodiversity of the area determine the beauty and nature of the tourist destinations. Changes in visitor's numbers and seasonal visitation patterns are important for park revenues and the economies of nearby communities, but also have ecological implications (Scott, 2003). As far as Kilimanjaro CC&V is concerned, various impacts were observed on ecology with implications for tourism. Different ecosystem services such as supporting, provisioning, regulation and cultural were affected differently in the study area.

The presented results indicate that 81.3% of the respondents said that there was a loss of biodiversity in KINAPA which had implications on tourist attractions. Direct field observation and climatic drivers of change

revealed direct negative implications on flora and fauna due to CC&V. Another 81.3% of the respondents said there was deforestation and forest degradation which affected the ecosystem through forest fires, firewood collection, grazing and timber harvesting in KINAPA.

76.3% of the respondents reported on decreased ecological services such as water due to climatic change. Moreover, 52.5% of respondents says that there was soil erosion especially on the mountain where a large number of people in the high season used the small mountain trails. Direct field observation revealed erosion due to increased drought affecting mountain campsites and trails. Additionally, during the rainy season the eroded soil was washed away hence affecting climbing trails. 40% of the respondents mentioned that there was wildlife migration due to the increased temperature which was said to have implications on ecosystem balance. The lack of food due to drought and the recurring forest fires contributed much to migrations. 36.3% of the respondents reported that there was an overuse of resources as an alternative to livelihood. By way of example, in Mshiri village a half mile strip of KINAPA forest was completely destroyed by local communities hence affecting the mountain ecosystems (Fig 2).

Figure: 2 Ecological Implications of CC&V.



Respondent's responses by cases

Source: Field Survey

Climate Change & Variability Adaptation on KINAPA Tourism

Most of the people in the area understood differently about adaptation mechanisms of CC&V on tourism. The majority were observed to be engaged in sustainable tourism activities that promote conservation through NGOs that were present in the area.

Different adaptation strategies for enhanced tourism and livelihood activities were mentioned. They include among others education and capacity building, soft loans and grants, environmental conservation projects and the promotion of domestic tourism (Table 4).

Table 4: Adaptation strategies for enhanced tourism and livelihood

Adaptation Strategies	Villages				
	Mshiri N=21	Lyasongoro N=19	Mweka N=17	Foo N=23	Average % N=80
Education/capacity building	13.8	13.3	11.3	13.8	52
Soft Loans/ Grants	8.8	0	5	10	24
Environmental conservation	3.8	8.8	3.8	3.8	20
Promotion of domestic tourism	0	1.3	1.3	1.3	4
Total	26.3	23.4	21.3	28.8	100

Source: Field Survey

The result presented in table 4 indicates that 52% of the respondents reported that education and capacity building were major adaptation strategies for enhanced tourism. This was equal in two villages with 13.8% of the respondents at Mshiri, and Foo respectively. 24 % of the respondents said soft loans and grants were used to enhance livelihood due to changing climate impacts on tourism. 8.8% of respondents in Mshiri said they obtained grants and soft loans offered by Floresta VICOBA. At Foo village 10% of the respondents were accessing loans which were offered by Foda foundation.

Furthermore, 20% of respondents said there were environmental conservation strategies monitored by KINAPA as community conservation projects. Promotion of domestic tourism was also an adaptation strategy which 4 % of the respondents said was practiced in the area. Key informants with TADOTO leaders said that domestic tourism was less promoted because there were no supporting funds for the programmes.

Policies Addressing Climate Change and Tourism

Currently a specific climate change and tourism policy does not exist in Tanzania but rather various policies have been introduced to address problems related to climate change and tourism. An environmental policy was most preferred by respondents in addressing tourism and climate change impacts. Table (5) present results on various policies addressing climate change and tourism.

Table 5: Policies addressing the climate change and tourism

Villages	Tourism Policy%	Environmental Policy%	Forest policy%	Wildlife policy%	Water policy%	Total
Mshiri	2.5	18.6	5	0	0	26.1
Lyasongoro	6.3	16.3	1.3	0	0	23.8
Mweka	1.3	17.5	1.3	0	1.3	21.3
Foo	10	17.5	0	1.3	0	28.8
Total	20	69.9	7.5	1.3	1.25	100.0

Source: Field Survey

The results presented in Table 5 show that 69.9% of the respondents mentioned environmental policy as the main policy that was presently addressing climate change. Slogans such as “*panda miti kata mti*” (cut tree plant trees) were posted at village and NGO offices. The policy was universal, dealing with conservation of all natural resources which affected tourism and related livelihoods. Tourism policy was mentioned by only 20% of respondents, showing little awareness.

The interview with the park warden tourism for KINAPA revealed that there was no tourism and climate change strategy available.

Furthermore 7.5% of the respondents said that forest policy was concerned, which is mostly addressed by environmental policy. However, REDD issues were not mentioned among those interviewed which seems to indicate that awareness is still low. The current impact of climate change on tourism in KINAPA therefore requires the development of a climate change and tourism strategy, which will contribute to the development of a Tanzania climate change and tourism policy

Conclusion

Socio-economic and ecological implications were studied and showed prevailing positive and negative trends. Communities adjacent to the park depend on tourism-related activities for income, mainly mountain climbing. This has resulted from the collapse of coffee farming due to the increased impacts of CC&V and diseases. Socially, the increased incidence of diseases such as malaria and HIV/AIDS were reported to have implications on tourism indirectly in terms of labour. It was also observed that there were conflicts on resource use between KINAPA and local communities due to increased impacts of climate change.

Various socio-economic challenges were mentioned to emerge such as low income, cancellation of bookings, few jobs, and less food for families. However, the income of both local people at Foo, Mweka, Mshiri and Lyasongoro has dropped due to the low level of education on tourism related livelihood activities. Revenue, G.D.P and foreign exchange have increased significantly due to the marketing and promotion of Tanzania tourism. Ecologically, the loss of biodiversity, over use of resources, soil erosion, deforestation and forest degradation, together with decreased ecological services and wildlife migration were all observed.

Various coping and adaptation mechanisms were being practised by individuals and organizations surrounding the study area. KINAPA and other NGOs in Mshiri, Mweka, Lyasongoro and Foo have outreach programs dealing with tourism and conservation activities. Adaptation policies on climate change were mentioned and people were very conversant with environmental policy. Other cross-cutting policies such as those related to

tourism, water, wildlife and forests were responsible for addressing the issue. Education and capacity building were presented as adaptation mechanisms for enhanced tourism due to impacts of climate change and variability.

Recommendation

Based on the presented results, discussion and conclusion, several issues would need to be addressed in order to reduce the impact of climate change and variability on tourism, resources, activities and livelihoods in KINAPA and adjacent communities.

Education and capacity building are required for the management and reduction of CC&V impacts on tourism. This is because the findings showed that communities were aware of CC&V but lacked the education on how to adapt. Adaptation education in proportion to local knowledge is also important. More research on tourism and climate change should be encouraged in KINAPA and the adjacent communities to reduce impacts

Providing alternative livelihood activities to the local communities will solve deforestation problems. The KINAPA outreach programme should focus on resource conflict resolutions and biodiversity conservation especially on the half mile strip which is the subject of great controversy at Mshiri Village and Mweka. Study on land use change for the park should be carried out in order to establish a tourism and climate change strategy for KINAPA. This will provide solutions for the near future to counter the impacts of CC&V.

Afforestation programmes should be promoted through climate change education to all surrounding secondary and primary schools. Grants and soft loans are highly required for these communities to run programmes that will benefit them and make them adapt to the changing climate. Tourism clusters which would enable porters and guides involved in tourism and related livelihood activities to cope and adapt to changing climate should be established. Finally, promotion of domestic tourism for sustainability in this changing climate and tourism era at KINAPA is required.

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