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Tourist Industry and its Negative Effects on Mount Kilimanjaro Ecosystem, Tanzania.

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Abstract

Kilimanjaro National Park (KINAPA) has recently been a centre for attraction for both local and international visitors. This is because of its aesthetic and scenic beauty, which has been very appealing and an adventure of a lifetime for those who have had an opportunity to climb it. The tourism and related activities at KINAPA have been contributing tremendously to the national economy. However, these activities have some negative impacts to the mountain ecosystem. Such effects include soil trampling and littering by the tourists, guides and porters. The study characterised these impacts in four eco-climatic zones namely Mountane Forests, Low Alpine, Heath/Moorland and Alpine Desert. This study was conducted in the KINAPA, but the attention was taken to Marangu and Mweka route trails. The data were collected through using interviews with different stakeholders such as tourists, guides, porters, officers from KINAPA and local communities. Participant observation was the highest proportion of data collection process. Of the four eco-climatic zones studied, waste comprised of different items such as plastic materials, Polyethylene materials, decomposable materials, metal materials and glass materials has been observed to increase with an increase in altitude. The eco-climatic zones arranged in the order of increasing litter were: Montane Forest, Low Alpine, Heath/Moorland and Alpine Desert. The soil trampling was mostly observed in the two eco-climatic zones namely the Low Alpine and Heath/Moorland compared to the Alpine Desert and the Montane Forest. Littering was pointed out to cause risk to animals as well as other aquatic and non-aquatic life of other organisms when feed on the litter and make use

of water. The study recommends that there should be appropriate litter collection measures and education to stakeholders on the disposal of waste materials.

Key words: Tourist, ecosystem and negative effects

Introduction

Mount Kilimanjaro in Tanzania is one of the very few features Worldwide, which are well renowned for their beauty. Mount Kilimanjaro is a rich and has diverse flora, which includes over 1800 species of flowering plants and 700 species of lower plants (KINAPA, 1993). Not only is, Mount Kilimanjaro rich in endemic plant species, but also in fauna ranging from small animals to large mammals. Richness in flora and fauna species in the mountain is in line with Villeneuve *et al*., (2002) who assert that mountain areas are biodiversity-rich ecosystems often hosting unique fauna and flora.

The soil of Kilimanjaro is of volcanic origin and naturally rich and productive. Over the generations, the mountain dwellers have developed a multi-storeyed cropping system, which has made Kilimanjaro one of the richest agricultural areas of Africa supporting cash crops such as coffee and cardamom and food crops such as banana, beans, potato, yam and vegetables such as chill, eggp lant, onion, tomato and cabbage (FAO, 1978). Livestock include cattle, goats and pigs. The West Kilimanjaro ranch (36,350 hectares) has mainly cattle (Okting'ati *et al.,* 2000). Mount Kilimanjaro is a major source of drinking water for the plains below. Small farm holders use it for irrigation and it is also a power-generating source for the National Grid through the Nyumba ya Mungu, Hale and Pangani Falls hydroelectric plants all generating a total of 91 megawatts. The Pangani Water Basin Development System also depends on water from Kilimanjaro's rivers and springs as a major source (Saleh, 2003). It is also a major climate modifier of the weather for neighboring regions like Mount Meru and Amboseli National Reserve in Kenya. In addition, Kilimanjaro attracts visitors for various reasons, including tourism, and is therefore an important source of foreign earnings for the country (Byers, 2002).

The growing attraction of mountain areas as tourist destinations has led to an expansion of leisure activities, with an increase in accommodation facilities,

amenities and infrastructure. However, such activities can undermine the natural and cultural environment of mountain ecosystem (Villeneuve *et al.*, 2002). Human impact such as tourism development is often responsible for producing a major change to a single component of an ecosystem, which in turn can threaten the whole community. Water pollution is one example of this, as is the issue of soil erosion (Foskett, 1999).

According to KINAPA (1993), trash now accumulates along all trails, at resting points for hikers and around campsites and huts. In addition, soil erosion is accelerating along these trails due to poor location of the trail in relation to contours, lack of trail maintenance, frequent wet conditions and increasing use. With an addition to increasing number of tourists, the soil erosion in many trails has been growing to deep gullies.

Holden (2000) describes the careless behaviour of tourists as having adverse effects to wildlife and ecosystems. A common problem associated with tourists is littering of various items such as plastic bags, boxes, bottles, pieces of mattress, clothes and broken glasses to mention a few, which can potentially result in death of animals on them. The litter may also lead to an attraction of predators of endemic species into areas they would normally not go.

Waste disposal is a leading problem at KINAPA (KINAPA, 1993). High volumes of litter that are being generated by increasing number of tourists are threat to Mount Kilimanjaro ecosystem. Despites of efforts to create proper waste disposal systems as well as provision of environmentally sensitive education to tourists, porters, guides and climbers on appropriate trail use, importance of the flora and fauna, natural processes, ecological relationships as well health and safety the problems associated with tourist industry remain on keeping pace (Hoffman, 2002).

Despite the fact that several measures have been put in place by KINAPA regarding the control of the Mount Kilimanjaro ecosystem, there are still problems in fulfilling that goal. Littering and soil degradation are still increasingly threatening the mountain ecosystem. Probably, an extent of littering and soil degradation in trails in the Mount Kilimanjaro ecosystem is not disclosed to public, scientific groups and policy makers. The disclosed information on the extent of littering and soil trampling would lead to formulation of appropriate measures, which would have resulted to

decreasing the negative effects even if the number of tourists and climbers increases. The study, therefore, examined the extent and impact of littering and soil trampling to the Mount Kilimanjaro ecosystem. Four eco-climatic zones namely Mountane Forest, Low Alpine, Heath Moorland and Alpine Desert in the mountain ecosystem were considered.

Materials and Methodology

Study area

Mount Kilimanjaro is the highest mountain in Africa. It is the highest free standing peak in the world and the highest `walk able` mountain in the world with the height of 5 895 m a.s.l. It is the natural focal point for much of Tanzania and Kenya, and a source of water for surrounding areas. The Mount Kilimanjaro ecosystem is presented in Figure 1.

It was declared as a national park of 753 km^2 in 1973. Kilimanjaro is a Biosphere Reserve and a World Heritage site, just as Serengeti National Park and Ngorongoro Conservation Area (NCA). It is located in the Northern part of Tanzania, between latitudes 2° 50' and 3° 20' South, and between longitudes 37° 00' and 37° 35' East.

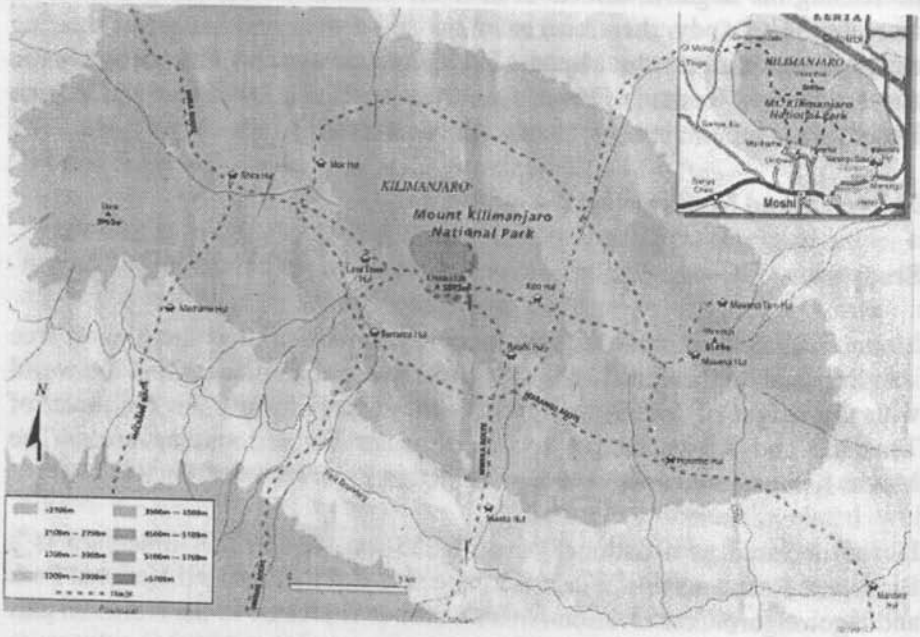

Figure 1. Map of Mount Kilimanjaro Ecosystem (Kilimanjaro National Park), Tanzania.

Climate

There are two wet seasons, November to December and March to May, and the driest months are August to October. Rainfall decreases rapidly with increase in altitude; mean precipitation is 2300mm in the forest belt (1 830 m), 1 300 mm at Mandara hut on the upper edge of the forest (2 740 m), 525 mm at Horombo hut in the Moorland (3 718 m), and less than 200 mm at Kibo hut (4 630 m), producing desert-like conditions. Winds are predominantly from the southeast. The north slopes receive less rainfall. Temperature range varies based on altitudes. Mist frequently envelops much of the massif.

Geology

Mount Kilimanjaro was a result of the tectonic movements in the Earth's crust that created the Great Rift Valley that runs from the Red Sea through

Tanzania to Southern Africa. It is the result of comparatively recent volcanic activity. Originally, approximately 750 000 years ago, Kilimajaro consisted of three large vents namely Shira, Kibo and Mawenzi. Eventually, the Shira cone collapsed and became extinct followed by Mawenzi. The Kibo cone however remained active and about 360 000 years ago endured a massive eruption that released black larva across the Shira Caldera creating the saddle at the base of Mawenzi. Kibo eventually leveled out at 5 900 m and has been periodically covered with ice and glaciers.

Ecology

Mount Kilimanjaro has five major zones and the activity within each zone is controlled by the five factors of altitude, rainfall, temperature, flora and fauna. Each zone occupies an area of approximately 1000m in altitude and is subject to a corresponding decrease in rainfall, temperature and life from the forest upwards.

The major vegetation types represented on Mount Kilimanjaro are termed montane forest, moorland, upland moor, alpine bogs, and alpine desert. There is no bamboo zone, nor a *Hagenia-Hypericum* zone. Over 4 600 m a.s.l, very few plants are able to survive due to the unfavourable conditions, although specimens of *Helichrysum newii* have been recorded as high as at 5 760 m a.s.l (close to a fumaroles), and mosses and lichens are found right up to the summit. A number of mammal species have been recorded above the tree line although it is likely that many of these also use the lower montane forest habitat.

The forest has several notable bird species including Abbot's starling (*Cinnyricinclus femoralis*), which has a very restricted distribution. The butterfly (*Papilio sjoestedti)*, sometimes known as the Kilimanjaro swallowtail, is restricted to Kilimanjaro, Ngorongoro and Mount Meru, although the subspecies *atavus* is only found on Kilimanjaro.

Research Settings, Data collection and analysis

Marangu and Mweka wards were purposefully selected as in these wards there are trails and increasing influx of tourists and climbers.

Interview with various stakeholders such as tourists, villagers, officers from KINAPA, guides and porters and participant observation were the main methods of data collection adopted in this study. The interview was guided by well structured questions in a check list, while the participant observation was guided by a set of criteria in a score card prepared. Direct observation was done for both soil trampling assessment and littering, and the data obtained were recorded in the scorecard according to the criteria as shown in the score card in Appendix 1.

The data included the assessment of the trail condition, the extent of littering, distribution, vigour and type of vegetation, which helped to determine the species most affected (by these factors) according to eco-climatic zones. The study used mainly qualitative techniques in data analysis. Content and structural-functional analysis techniques were used to analyse qualitative data and information. The components of verbal discussions held with stakeholders during interview were analysed in detail with the help of content analysis method. In this way, the recorder dialogue with stakeholders was broken down into smallest meaningful units of information or themes and tendencies. Structural-functional analysis helped to establish manifest and latent functions. Manifest functions are those consequences, which are "intended and recognized by the actors in a system" while Latent functions are "those consequences which are neither intended nor recognized" (Thomlinson (1965) in Kajembe, 1994).

Results and Discussion

The negative effects of tourists' activities to the Mount Kilimanjaro ecosystem

The most highly ranked problems affecting Mount Kilimanjaro ecosystem in this study were littering and trampling (see Table 1). Other problems were impact of the tourist activities on wildlife, loss of soil nutrient due to erosion, cultural value distortions, picking of leaves and flowers and human life.

Table 1. The effects of tourists' activities to the Mount Kilimanjaro ecosystem

Problem	Ranking
Littering	1
Trampling	1
Affecting animal life	2
Loss of nutrients for fauna through erosion	3
Tourist walk off trail trampling plants	3
Cultural values distortion	4
Picking leaves/flowers	5
Affecting human life	5

Littering

The amount of litter and types of litter collected from different eco-climatic zones in Marangu and Mweka Route Trails are as shown in Table 2 below.

Table 2. Amount of litter collected from different eco-climatic zones of Mount Kilimanjaro

Litter Category	Eco-climatic zone											
	Montane Forest			Low Alpine			Health/ Moorland			Alpine Desert		
	Marangu	Mweka	Total	Marangu	Mweka	Total	Marangu	Mweka	Total	Marangu	Mweka	Total
Plastic materials	26	228	**254**	159	172	**331**	64	488	**552**	339	434	**773**
Polyethylene materials	131	235	**366**	166	144	**310**	366	212	**578**	154	203	**357**
Decomposable materials	37	23	**60**	158	109	**267**	98	382	**480**	204	552	**756**
Metal materials	15	69	**84**	64	117	**181**	79	103	**182**	68	93	**161**
Glass materials	4	44	**48**	4	114	**118**	51	149	**200**	71	155	**22**

												6
Total	213	599	812	551	656	1207	658	1334	1992	816	1457	2273

NOTE:

1. Plastic materials: Bottle seal, Bottle tops, Empty gallons, Juice straws, Piece of gloves, Piece of mattress, Plastic empty bottle, Plastic pieces, Shoe soles/sandals, Tooth brush.

2. Polyethylene materials: Biscuit paper, Chocolate paper, Plastic bag, Polythene paper.

3. Decomposable materials: Cigarette packets, Food remains, match box, Match sticks, Normal paper, Tissue\napkins

4. Metal materials: Aluminium, Battery, Bottle top (metal), Empty cans.

5. Glass materials: Glass empty bottle, broken glass materials

The total amounts of litter in Montane Forest, Low Alpine, Heath and Moorland and Alpine Desert eco-climatic zones for both the Marangu and Mweka route trails were 812, 1207, 1992 and 2273 respectively. This implies that the Alpine Desert is the most impacted eco-climatic zone, followed by the Heath/Moorland, Low Alpine and lastly the Montane Forest.

More litter was observed in the alpine desert eco-climatic zones probably because there are no thick forests or bushes, which made possible the trash to be observed easier compared to the lower altitude zones like the Montane Forest and Low Alpine, which are thicker and therefore, irresponsible visitors, porters and guides hide the trash in an attempt to reduce their luggage. The thickness of the vegetation decreases with increases in altitude and as such the higher the attitude the higher the possibility of encountering trash as depicted from the study. The study noted also that there is an antagonistic relationship between the park staff and the porters and guides which cause difficulties in controlling the littering caused by the tourists. For example, the park rangers at Horombo and Mandara huts in Marangu route trail and at Millennium uniport and Mweka hut in Mweka route trail are not cooperative with the guides and porters which complicate the cleanliness

operation at the huts. In addition, the cleaning crew recruited by KINAPA authority was not enough to clean the large area in the huts, uniports, campsites and along the trails. The observation made by this study is that the guides and porters sometimes do litter wastes intentionally with the reason that there is a cleaning crew.

Also it was found out that the guides and porters contribute to a large extent in littering and disposing wastes in improper places. Some wastes were found in the bushes about 20 meters from the Mweka route trail. This attributed to the fact that the porters, who are responsible in carrying the wastes down the trail to the gates, do this littering in an attempt to reduce the weight of the load they are carrying.

Furthermore, pollution in form of littering is the most critical problem caused by the tourists' activities in KINAPA. The pollution is due to improper waste disposal and inefficient sewage system. Different reasons accounted for, among others include lack of facilities to effect waste disposal. Other reasons include carelessness, ignorance, arrogance and negligence of tourists, porters and guides. The high number of tourists compared to the available facilities for waste disposal was witnessed at the Crater. Camping at the crater is allowed, but there are no toilets. Also at Horombo hut, the toilets were pointed out that they were not enough to accommodate high number of tourists. Godfrey and Clarke (2000) reported that more built-up areas, such as towns and cities, will generally be better able to absorb visitors without significant environmental degradation because they are already manipulated by construction of different infrastructures including buildings, tarmac roads, aircrafts and playing grounds. In contrast, more ecologically sensitive destinations such as rural areas, mountains and lakes, tend to be less resilient to visitor use and more susceptible to environmental damage

The littering can have several impacts to the park ecosystem. Among others include reduction of its aesthetic appeal, killing a variety of fauna and flora directly by choking or burning effect or indirectly by reducing the water quality. The animals living in water and those which do not live in water, but they depend on water for their survival including human beings are affected as well. In addition, littering can cause fire hazards when lit cigarettes being thrown by hikers get into the accumulated fuel.

Littering problems are associated with current level and management of visitors, including spillage of sewage from huts, accumulation of rubbish and lack of refuse collection, use of fuel wood for cooking, overbooking resulting in use of natural caves for shelter cause among other things, damage to endemic plants, lowering of water quality, and unsightliness (Hoffman, 2002 and Harcourt and Stewart, 1995, in Roe *et al.*, 1997).

Recently, a research by KINAPA Ecology Department discovered and declared Kilimanjaro mouse shrew (*Myosorex zink*), which is endemic to the Mount Kilimanjaro ecosystem has been becoming vulnerable to existing littering as it feeds on it. Three species of primates which are found within the Montane forests, blue monkey (*Cercopithecus mitis*), western black and white colobus (*Colobus polykomos abyssinicus*), and bushbaby (*Galago sp.*), are also affected by the litter.

Soil erosion

The study also estimated an extent of soil erosion in the four zones in terms of volume of soil removed due to tourist industry in the Mount Kilimanjaro ecosystem. The estimates were made per year basis (Table 3).

Table 3. The total volume (m^3) of holes and corrugations according to eco-climatic zones in Mount Kilimanjaro ecosystem

Eco-climatic zone	Marangu	Mweka	Total
Montane Forest	1.2	0.4	1.6
Low Alpine	2.2	4.2	6.4
Health/Moorland	1.9	4.0	5.9
Alpine Desert	0.8	0.9	1.7
Total	6.1	9.5	15.6

The Low Alpine seemed to be more impacted with erosion (6.4 m^3) than others. The soil erosion at the Health/Moorland zone was estimated as 5.9 m^3, while for the Alpine Desert (1.7m^3) and lastly the Montane Forest zones were 1.7 m^3 and 1.6 m^3 respectively. The soil erosion in the Montane Forest zone was observed to be the least. Probably due to an existence of thick vegetation that helps to reducing it. The soil erosion was the highest in the Low Alpine due to the vegetation in the zone is less thick and the trail in the zone is more of soil than rocky nature, which may lead to high exposure to

soil erosion agents. The same applies to the Health/Moorland zone. In the Alpine Desert zone, the trails are rocky and therefore not easily to be eroded.

The mountain flora and fauna along the trail along the trail are affected by trampling when the guides, porters or tourists walk off the trail. These include sensitive plants like the balsams, lichens, bryophytes, giant groundsels and giant lobelias. Also even when the tourists do not walk off the trail their large number per unit time on the trail can cause trampling which when coupled with heavy rainfall result into erosion which sometimes leading to deep gullies like at the Masheo point in the Marangu route trail. Loss of nutrients for growth of flora can also result from the erosion caused by trampling.

Tourism development requires some degree of land clearance for structures such as buildings, staff housing, roads, pathways, recreational facilities and hiking trails. The clearing of vegetation and cutting of steep slopes are of particular concern as it leads to altered topography, soil erosion and flooding (Mohammed Nor&Wayakone, 1990 in Bornemeier *et al.*, 1997). Tourism activities like trekking, mountaineering and skiing has led to reduction in number and diversity of plants and animals, soil erosion and littering. In mountain areas for example, construction of tourist accommodations, mechanical lifts, power lines and sewage systems has led to disturbance of plant and animal life, disruption of soil stability, alteration of drainage system and water run off which may result in increased numbers and scale of landslides, rock fall and floods, visual impact of scars on the landscape (Roe *et al.*, 1997).

Human life and cultural values distortion

The study also noted that the growing tourist industry tends to ignore norms and traditional values, which helped in the conservation of the mountain flora and fauna during the past. With an advancement of science and technology, globalisation and urbanisation it has become easy to access information about the external world. This has been both advantageous and disadvantageous to the people adjacent and far away from the protected areas like KINAPA and consequently to the management of natural resources. Erosion of culture has had its impacts to the local people, which are reflected on how they perceive conservation compared to the past. Then they had their own ways of conservation by use of norms, customs,

traditions, rules and regulations, which helped in conservation but these are now not as effective as they used to be since most people are now westernised.

The impact of tourism on the local people, their culture, natural resources and built environment has been substantial. Two striking effects of tourism development have been: (1) disproportionate shift of capital to mass tourism-related construction and real estate developments at the expense of other sectors such as agriculture and small industry which are locally oriented; and (2) the promotion of over-consumption and excessive local resources with attendant new social and environmental pressures on local people and environments (Pholpoke, 1998, in Harris *et al.*, 2002).

Unless the environment is safeguarded, tourism is in danger of being a self-destructive process, destroying the very resources upon which it is based and compromising all the foregoing interests in tourism. Tourists, present and future, will be denied the opportunity of visiting and experiencing environments different to those at home. Local people will stand to lose out in two ways. First, environmental degradation will affect not only their immediate prospects, but also their future needs, which depend very much on the welfare of the environment to provide necessary requirements including food. Second, this will affect not only tourism development but also development in general (i.e., agriculture, health etc) (Cater, 1992, in Bornemeier *et al.*, 1997).

Conclusion and Recommendations

Conclusion

Littering problems have been contributed by lack of facilities to effect waste disposal, high number of tourists compared to the available facilities for waste disposal, carelessness, ignorance, arrogance and negligence of tourists, porters and guides. The effect of littering increased with increasing altitudes as the vegetation thickness decreases with increasing altitude which enabled the researcher to observe easily the disposed wastes.

Geological and vegetation cover factors have a natural control against soil erosion especially for the Alpine Desert where the trails are rockier and for

Montane forest eco-climate with thick vegetation thus more difficult to be eroded.

The impact of littering to the water system through improper sewage disposal or trash disposal can potentially or actually harm the aquatic life including other non aquatic species, which depend on water especially for drinking. In addition people who depend on water from the mountain may be affected especially from the cumulative effect of wastes disposed which get into the water.

Recommendations

Based on the study, the following are recommended:

- The effort for litter collection should be emphasized at all altitudes, especially at high latitudes, at Horombo, Kibo and the Crater situated within the Heath/Moorland and Alpine Desert which are highly littered.

- There should be two cleaning crew; one for collecting litter and the other for carrying down the collected litter. This requires more people to be recruited for cleaning purposes. Otherwise, the tender for collection of litter should be given to private owned company or any tour company, whereby porters collect litter and on reaching at the gate weigh it and get paid. Further, the trash-in-trash-out (TITO) approach to combat littering should be incorporated with incentives for the people bringing down the litter to the Marangu and Mweka gates.

- Visitor information and interpretation should be provided through pamphlets, newsletters, leaflets, newspapers, magazines, mails and posters. This should be made compulsory for every guide to give the briefing information on waste disposals so that the tourists may not affect the Mount Kilimanjaro ecosystem.

- The rehabilitation should be done to repair the route trails with holes and corrugations especially in the Low Alpine and Heath/Moorland, which are highly affected by soil erosion due to trampling, especially in the Mweka route trail.
- The tourist facilities should be improved in Umbwe, Rongai and Machame route trails to encourage the tourists to distribute themselves to reduce the impact to the more used Marangu and Mweka route trails.

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References

Byers, A. (2002) *Ecotourism for forest Conservation and community development proceedings of an International Seminar held at Chiang Mai*, Thailand 28-29 Jan., 1991, FAO, Rome. Retrieved on 7th October 2004 at 1:13 pm from a website: http://www.mtnforum.org

Cater, R., (1992). In Bornemeier, J., Victor, M. and Durst, P.B. (editors) (1991). FAO (1978). *Agriculture in Tanzania*, FAO, Rome, Italy. Pp 18

Foskett, N. and Foskett, R., (1991). *Teach yourself Conservation*. Hodder & Headline, London. Pp. 57-59,121.

Godfrey, K. and Clarke, J., (2000). *The Tourism Development Handbook*, Continuum, London. Pp 22-29.

Hoffmann, C. (2002). Booming Tanzania Tourism. Retrieved on 5th October, 2004 at 9: 24 am from a website: http://www.africa.ata.org.

Holden, A., (2000). *Environment and Tourism*, Routledge, New York. Pp 89.

Kilimanjaro Environmental Conservation Management Trust Fund (KEMCTF) (1998). Retrieved on 24th October, 2004 at 9:47 am from a website: http://www.kilimanjarotrust.org

KINAPA, (1993). *Kilimanjaro National Park General Management Plan/Environmental Impact Assessment.* TANAPA Planning Unit. pp19, 20

Mason, P. (2003). *Tourism Impacts, Planning and Management,* Butterworth-Heinemann, Oxford. 200pp.

Mohammed Nor, T. and Wayakone, F. (1990) *Ecotourism for forest Conservation and community development:* In Bornemeier, J., Victor, M. and Durst, P.B. (editors) (1991). *Proceedings of an International Seminar held at Chiang Mai*, Thailand 28-29 Jan., 1991, FAO, Rome.

Okting`ati, A., Fernandes, E. and Maghembe, J., (2000). *Agroforesty in Kilimanjaro Region*, ICRAF, Nairobi. Retrieved on 24th October 2004 at 10:34 am. from a website: http://www.unu.edu/unupress/food/8fo73E06.htm

Pholpoke, E. (1998) *Sustainable Tourism: A global perspective:* in Harris, R., Griffin, T. and Williams, P. (editors) (2002). Elsevier Butterworth-Heinemann, Oxford. Pp. 145

Roe, D., Nigel, L. and Dalal-Clayton, B. (1997). *The environmental impacts of wildlife Tourism*, IIED, London. Pp 29-30, 54.

Saleh, M. *The environmental impacts of wildlife Tourism:* In Roe, D., Nigel, L. and Dalal-Clayton, B. (editors).TANAPA (1993), IIED, London. Pp 29-30, 54. Retrieved on 20th October, 2004 at 8:30 pm from a website: http:// www.esi.co.za/last/ESI.

Villeneuve, A., Castelein, M.and Mekouar, A. (2002). *Mountains and the law emerging trends*, FAO, Rome. Pp19, 41, 55.

Appendix 1. Score card used during participant observation in the data collection phase

S/N	Factor	Quantity	Scale of scores	Actual scores* (recorded at every 200m)				
				1	2	3	4	5
1.	Plant vigour	a) Healthy b) Stunted c) Weak	26-32 19-25 8-18					
2.	Plant distribution	a) Very Dense b) Dense c) Scattered d) Very scattered	11-16 6-10 2-5 0-1					
3.	Trees & shrubs a) Grassland b) Bushed-grassland c) Wooded grassland d) Bushland e) Woodland	0-250/ha 251-500/ha 501-1000/ha 1000-2000/ha > 2000/ha	14-18 10-13 6-9 2-5 0-1					
4.	Erosion a) None b) Slight c) Severe d) Very severe	0-10% 11-20% 21-40% > 40%	17-22 10-16 4-9 0-3					

5.	Litter (plastic bottles, polythene bags, cigarette butts etc)	a)< 20 pieces b) 20- 50 pieces c)>50 pieces	9-12 4-8 0-3					