ENVIRONMENTAL STATUS AT SAMUNGE VILLAGE (TANZANIA) FOLLOWING A SHARP INCREASE IN VISITORS

R Senzota
Department of Zoology and Wildlife Conservation, University of Dar es Salaam,
PO Box 35064, Dar es Salaam, Tanzania, Email: senzota@udsm.ac.tz

ABSTRACT

Starting early 2011, people from all over Tanzania, Africa and overseas flocked Samunge Village in northern Tanzania, to drink a cup of Carissa spinarum *concoction claimed to treat diseases hitherto known to be incurable by conventional medicine including HIV-AIDS, hypertension and diabetes. The big number of visitors resulted into vivid environmental impacts including trampling on plants and animals, unplanned discarding of drink and food containers, haphazard sanitation undertakings and overall change in panorama. The present study made some quantification on environmental status in the village during the peak visitor days in March 2011. There was widespread trampling and denudation of vegetation up to 200 m around the road leading to the village centre where the medicine was being administered. Small animals were trampled by vehicles and humans. Litter from mineral water and food containers was significantly more concentrated nearer the road than further away, but was spread to over 200 m from the road as was human refuse resulting from sanitary undertakings. The hitherto panorama of alternating green hills and lowlands became bisected by a long chain of different types of vehicles including large and small lorries, large and small buses, Land Cruisers, Land Rovers and saloon cars. There was widespread tree and shrub harvesting for firewood, temporary shelter and medicine. To reduce level of environmental impact the road needed improvement to ease vehicle movements, the number of vehicles and people going to the village for the medicine needed to be regulated and sanitary facilities installed along the road.*

Key words: Samunge, Medicine, Incurable diseases, Environmental status.

INTRODUCTION

Samunge village in northern Tanzania is inhabited by people of the Sonjo tribe and is close to the famous protected areas of Loliondo Game Reserve, Serengeti National Park and Ngorongoro Conservation Area (Fig. 1). In late 2010, a resident of the village (Mr Ambilikile Mwasapila) announced that he was able to cure diseases presently known to be incurable by conventional medicine (ANON 2011a, Malebo and Mbwambo 2011). He did this by administering a cup (popularly known as *kikombe cha babu* (babu's cup)) of the concoction containing roots of the shrub *Carissa spinarum* (formerly *C. edulis*) boiled in water. Diseases said to be cured include infertility, hypertension, diabetes, asthma, cancer and Acquired Immuno-deficiency Syndrome (AIDS) through elimination of the causative agent, the Human Immuno-deficiency Virus (HIV) (Damian *et al.* 2011, Malebo and Mbwambo 2011, Nkwame 2011). Subsequently, people flocked the village, mostly from all over Tanzania but also from the region and overseas (ANON 2011b, ANON 2011c, Juma 2011a,b,c, Magongo 2011, ANON 2011d, Meena and Juma 2011a, Nsungwe 2011). Visitors were of many categories including infants, young, very old, poor, rich, junior and senior employees, healthy looking people and very sick ones (Juma 2011d, Meena *et al.* 2011). By late March 2011, the congestion of people in the village was so high that it was now taking up to 10

days to travel from the nearby towns of Arusha or Bunda and get the medicine at Samunge, a journey that would hitherto take only about eight hours (Jackton 2011, Mbonea 2011a, Powa *et al*. 2011).

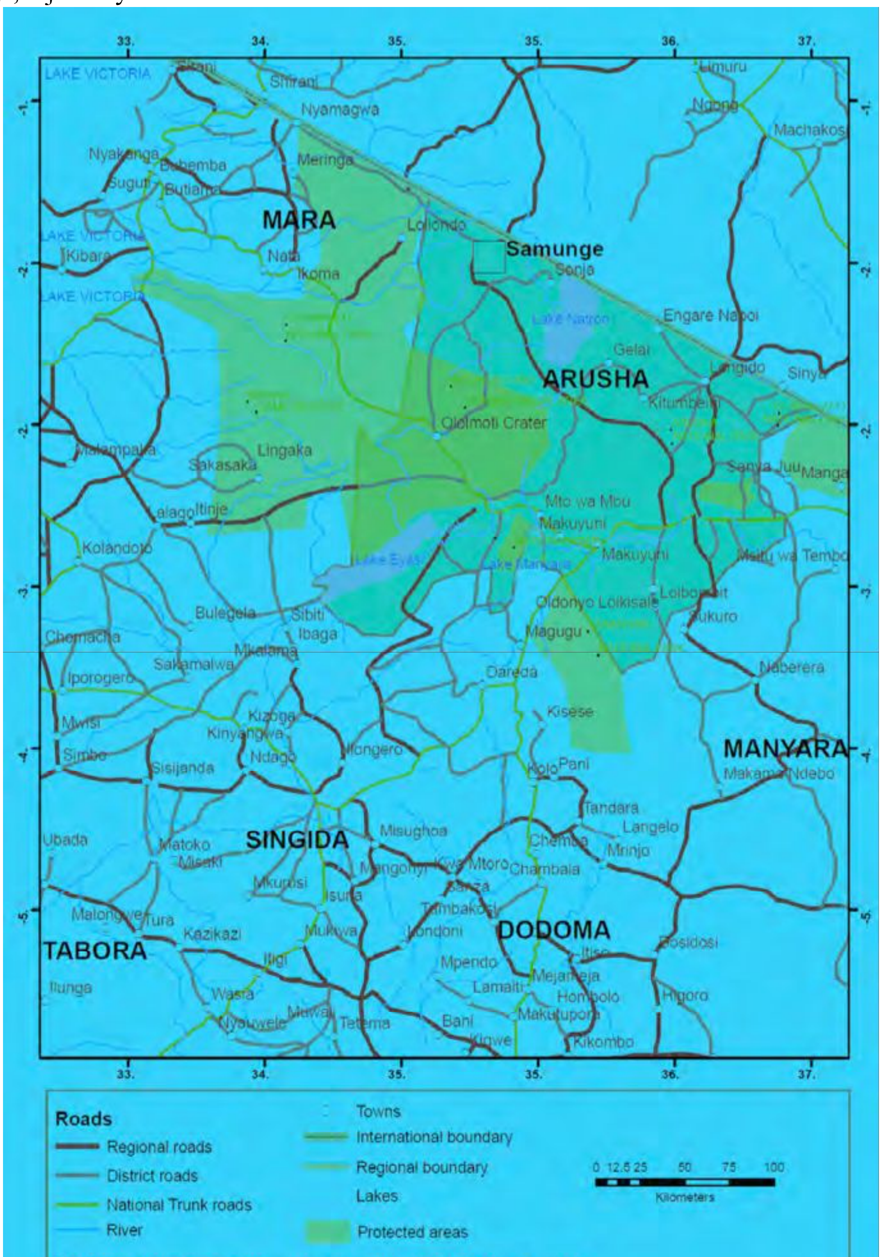


Fig. 1 Map of Northern Tanzania showing approximate location of Samunge village.

I report here observations on environmental status at the village using data collected during my travel and stay at various parts of the village, mostly along the inward road, in late March 2011. Observations presented include vegetation status, plants and plant uses, trampling on plants and small animals, setting fires for warmth and cooking, sanitation leftovers, spread of litter and water quality. While it took about eight hours to reach the border of the village, visitors spent at least seven days in the car queue leading to the spot where the medicine was being administered. While in the queue, visitors moved around, cooked and ate at various places along the road thus causing the ensuing environmental situations.

STUDY AREA AND METHODS

Samunge village is located in Loliondo ward, Ngorongoro District, Arusha Region, Tanzania at 325 km from Arusha town. It is inhabited by the people of Sonjo tribe, a small tribe living 50 - 60 km west of Lake Natron and surrounded by the much larger and more widespread Maasai people. Sonjo is a name given to the tribe by the Maasais, their native name is Batemi. The number of immigrants from other parts of Tanzania to Sonjoland had ordinarily been low.

My vehicle, a four wheel drive land-cruiser, joined the queue on March 22nd and reached and left the village centre on March 28th 2011. During this period records were made on habitat types and common plant species. Some of the plants that could not be identified in the field were collected and taken for identification at the Department of Botany, University of Dar es Salaam. Counts were made on types of vehicles in the queue (lorries, big busses, small buses, Land Rovers, Land Cruisers, saloons, other). Gender of car drivers (male or female) was recorded from a section of cars in the queue and later (for comparison) from four road sections along four roads in the Dar es Salaam city between 0720 hrs and 0750 hrs on 19th May 2011. Ownerships of vehicles (private, business, government, other) were also enumerated. Counts were also made of cooking fire places, types of visitor thrown litter (soda and juice plastic bottles, metal/aluminium soda and juice containers, paper containers, tissue papers, other). Estimates were visually made of percent cover of debris on the broadway, bottom edge of the road and between bottom of the road and 10 m away. These records were made during day time while the vehicles were standing still on the queue at different locations on the road. Vehicles were allowed to enter the village centre in turns and thus moved and stopped for varying durations. Records were made at some of the stop stations mostly by disembarking the car and walking along the road; the lengths of record stations thus differed mostly in relation to the duration for which vehicles stopped at a station.

Water was collected from a river that ran parallel to the road at about 300 m and from a tap water supply point. The river water was extensively used for washing, cooking and bathing. The two water lots were each tightly sealed in a plastic water bottle (KILIMANJARO brand) and taken to Dar es Salaam for microbial and mineral content analyses. Both water types were collected at approximately 5 km from the Samunge village centre. Readings obtained from the two water lots were compared with those obtained from bottled mineral water of the KILIMANJARO brand which was one of the bottled mineral water brands widely sold along the road in Samunge. Water analysis was carried out in the Department of Molecular Biology and Biotechnology of the University of Dar es Salaam (UDSM) for microbiological analysis and the Department of Botany (UDSM) for mineral and organic content. Analysts were not given the source of the water before they carried out the analysis; bottles were simply labeled as A,

B, C. Analysis and interpretation followed procedures detailed in Allen (1989), Emtery (1989) and Lenore *et al*. (1998).

Differences between types of cars, gender of drivers and ownerships of cars, amounts of litter from the road, types of litter and sex of visitors were compared using one way ANOVA and two-tailed tests. Coefficient of Variation (CV) for a predictor or response was worked out as % standard deviation divided by the respective mean. Statistics were carried out using InStat Graph Pad Software (http://www.graphpad.com/instat/instat.htm). Cut-off level for significance was 0.05.

RESULTS

Samunge and surrounding villages have a mixture of different sized hills, flat lands and seasonal and permanent rivers. Different vegetation types including croplands, fallow lands, bush grasslands, bush lands and bush thickets (*sensu* Pratt and Gwynne 1977) were recorded along the road. Rocky hills harboured most of the natural vegetation and indigenous plants while flatlands were mostly cultivated and had a variety of crop plants (Table 1; Fig. 2). Dominant crop plants included maize and beans. Typical Sonjo houses were made of tree and shrub poles and sealed with mud; roofs were grass thatched. Along the main road leading to the village centre were a few buildings (mostly shops and schools) that were roofed with corrugated iron sheet and some of these were built with concrete blocks (Fig. 2).

Different types of cars travelled to Samunge (Table 2). The most common cars were four-wheel land-rovers, land-cruisers, hard tops and lories. Pick-ups, lories and four-wheel drive vehicles recorded high occurrence values; the mean variation between car types was significant ($F_{3,16}$ = 3.778, P < 0.05). However, only four-wheel drives had a significantly higher mean value than large buses (Tukey-Kramer test q = 4.082, P < 0.05). Car ownerships were mostly private and private business ($F_{2,18}$ = 75.396, P < 0.05; Table 3). Although many of the cars were those conventionally used elsewhere as public transport vehicles, private use cars were significantly the most common (Tukey-Kramer test q = 4.857, P < 0.05).

On the Samunge inward road, drivers of cars were all males; at Dar es Salaam, car drivers were also found to be predominantly males (t_6 = 2.589, p = 0.0413; Table 4). There were equal number of visitor males and females (t_6 = 0.068, P > 0.05; Table 5). Visitors were predominantly adults; visual estimation at one station suggested 10% infants (< 1 year), 15% very young (1 – <3 years), 10% young (3 - <15yrs), 5% sub adults (15 - 20 yrs) and 60% adults (>20 yrs).

There was widespread trampling, land denudation, fire setting and litter deposition along the road leading to the village (Figs 3 – 4). Most of the litter was concentrated at the edge of the road which contained significantly more litter than either the broad way or off-road locations ($F_{2,39}$ = 111.04, P < 0.05 (for litter number) and $F_{2,39}$ = 58.943, P < 0.05 (for litter cover), Tukey-Kramer test q > 12, P < 0.05); Table 6). Different types of items constituted the litter along the road (Table 7). Plastic water bottles topped the list of litter counts and except for plastic bags they were significantly more numerous than the other containers ($F_{5,24}$ = 3.848, P < 0.05, Tukey-Kramer test q > 5, P < 0.05). About 90% of water bottles were of the Kilimanjaro brand; the Azam brand juice paper containers were the most numerous among the paper juice containers.

Microbial and minerals contents in the water showed big variation depending on source of water (Table 8). Under World Health Organisation (WHO) standards, both tap and river water contained microbial levels that would be considered too high for human consumption without treatment.

Table 1: Conspicuous habitat characteristics, plants, animals and human activities, at sample stations in Samunge village, Tanzania. March 2011.

Station	Vegetation on the left and/or right
1	Farm land to 100 m and *Combretum – Acacia* woodland further away. Plants: maize (*Zea mays*), beans (*Phaseolus vulgaris*) and peanuts (*Arachis hypogaea*) on the farmland. *Combretum* sp., *Acacia* sp., *Grewia* spp., *Rhus natalensis*, *Solanum incanum*, *Sida errata*), custard apple (*Annona senegalensis*), *Terminalia* sp.
2	*Acacia – Grewia* shrubland. Plants: *Acacia* sp, *Grewia bicolor*, *Sclerocarya caffra*.
3	**Left:-** *Acacia* bushland thicket. Plants: *Acacia* sp., *Combretum* sp., *Sansevieria* sp., *Aloe* sp. **Right:-** Fallow land to 50 m and *Acacia – Balanites* bushland further away. Plants: *Acacia* sp., *Balanites aegyptiaca*, *Aloe* sp., *Agave sisalana*.
4	Bare land to 15 m from road edge and *Combretum* bush thicket further away. Plants:*Combretum* sp., *Acacia* sp., *Euphorbia tirucalli*, *Commifora africana*, *Sansevieria* sp., *Elaeis* sp., *Aloe* sp., *Agave sisalana*, *Balanites aegyptiaca*, *Sclerocarya caffra*.
5	**Left:-** Fallow land to 150 m and *Balanites – Acacia* bush thicket and riverine from 150 m. Plants included *Balanites aegyptiaca*, *Acacia* sp., *Ficus glumosa*. **Right:-** Fallow land to 150 m and *Acacia* bushland further uphill. Plants included *Acacia* spp., *Sansevieria* sp.
	Overall
Natural/ wild plant species	*Ozoroa mucronata, Grewia* spp., *Sclerocarya caffra, Thespesia danis, Combretum* sp., *Acacia zanthophloea, A. sieberiana, Euphorbia tirucalli, Commiphora* sp., *Sansevieria* sp., *Acacia* spp., *Loranthus* spp. *Elaeis* sp., *Aloe* sp., *Agave sisalana, Balanites aegyptiaca, Rhus natalensis, Solanum incanum, Sida errata, Annona senegalensis, Ficus glumosa, Euphorbia clandelabrum, E. gossypina, E. tirucalli, Achyranthes aspera*.
Crop plants	Maize (*Zea mays*), beans (*Phaseolus vulgaris*), peanuts (*Arachis hypogaea*), bananas (*Musa* sp.), mango (*Mangifera indica*), orange (*Citrus sinensis*), grevillea (*Grevillea robusta*), mchicha (*Amaranthus hybridus*), *Bouganvelia spectabilis*, custard apple (*Annona cherimola*), papaya (*Carica papaya*), musk okra (*Hibiscus abelmoschus*), sugarcane (*Saccharum officinarum*), cassava (*Manihot esculenta*), tangerine (*Citrus nobilis*), mlusina (*Leucaena leucocephala*), *Catharanthus roseus*, *Terminalia catappa*, *Melia azedarach*, sweet potato (*Ipomoea batatas*), cabbage (*Brassica oleracea*), *Ricinus communis*, *Senna siamea*.
Animal and other features	Hymenopterans, beetles, moths, lizards, birds (White-necked Raven, weavers, Superb Starlin, Ring-necked Dove, Mourning Dove, other doves, weaver bird nests, wagtails, chicken), donkeys, goats, cows, domestic dogs, snakes, butterflies. Beehives, termite mounds, termites, ant burrows, ant runways, rodent runways, rocks, porous rocks.
Human caused litter/ activities	Faeces, blood stained cloth and other sanitary pads, milk paper containers, news paper pieces, thermos flasks, aluminium coke containers, plastic bottles for fanta, coke, sprite and juice), Azam juice paper containers, shoes, pineapple pills, medicine packs, bottle seals, tissue/toilet papers, plastic water bottles. Debarked trees, cooking and warmth fires. Foods:- mostly stiff porridge, roast meat, rice, soup, beans, porridge, donuts, boiled maize, tea.

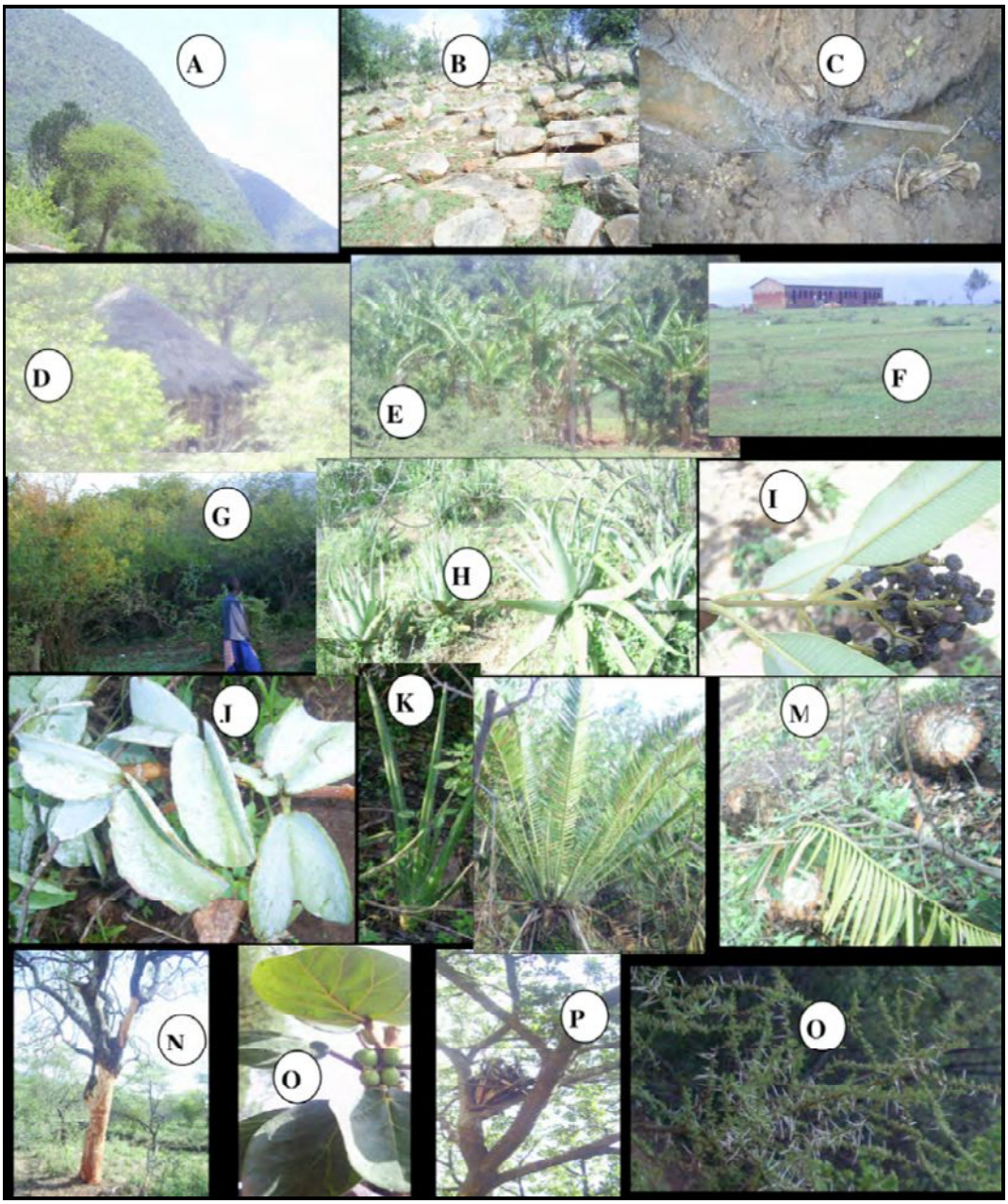


Figure 2: Sample landscapes and plants in Samunge Village, Tanzania. March 2011. A: Steep hill; B: Rocky hill; C: Flowing river; D: Typical Sonjo house; E: Banana plantation; F: Fallow land and school building; G: *Acacia-Grewia* bush thicket; H: *Aloe* shrubland; I: *Ozoroa mucronata*; J: *Cissus integrifolia*; K: *Sansevieria sp.*; L: *Eleis sp.*; M: Cut *Eleis sp.*; N: Debarked *Sclerocarya birrea*; O: *Ficus glomosa*; P: Beehive on *Ficus glomosa, Q: Acacia tortilis*.

Table 2 Sample count of types of cars travelling to Samunge village, Tanzania. March 2011

Type of vehicle	Station					
	1	**2**	**3**	**4**	**5**	**Total**
Large buses	3	0	0	3	0	**6**
Medium buses	3	0	0	0	0	**3**
Small buses	0	3	0	0	6	**9**
Land Rovers	0	3	3	6	0	**12**
Toyota Land Cruisers	6	6	0	3	9	**24**
Big lorries	3	3	9	6	3	**24**
Pick ups	0	0	6	0	0	**6**
CV	**106.1**	**106.1**	**142**	**105.1**	**142**	**72.2**

Table 3: Ownership of a sample of cars travelling to Samunge village, Tanzania. March 2011

Station	**Private personal**	**Private business**	**Other** (Government (ST, SU, SM, DFP), Other countries (KAP), United Nations (HJCI), Church)
1	18	12	0
2	22	12	0
3	16	10	0
4	14	8	0
5	12	12	0
6	14	14	4
7	18	12	2
Total	**114**	**80**	**6**

Table 4 Gender of drivers of cars along sections of four closeby roads in Dar es Salaam, Tanzania. 19th May 2011.

Road	**Males**	**Females**
Changanyikeni	106	19
University	52	14
Sam Najoma	23	4
Morogoro	47	6
Total	**228**	**43**

Table 5 Sample count of gender (male or female) of adult visitors at Samunge village, Tanzania. March, 2011.

Station	**Male**	**Female**
1	30	37
2	18	28
3	16	27
4	40	14
Total	**104**	**106**



Figure 3: Human and animal features and impacts. Samunge village, Tanzania. March 2011. A: Donkey dung; B: Termite mound; C: Termite vent and termites; D: Sign post on AIDS; E: Vehicle queue and visitors; F: Visitors at a waiting stop station; G: Trampling and litter; H: Trampled snake; I: Trampled blind snake; J: Trampled flat-backed millipede; K: Trampled darkling beetle; L: Trampled moth; M: Trampled scorpion; N: Trampled centipede.

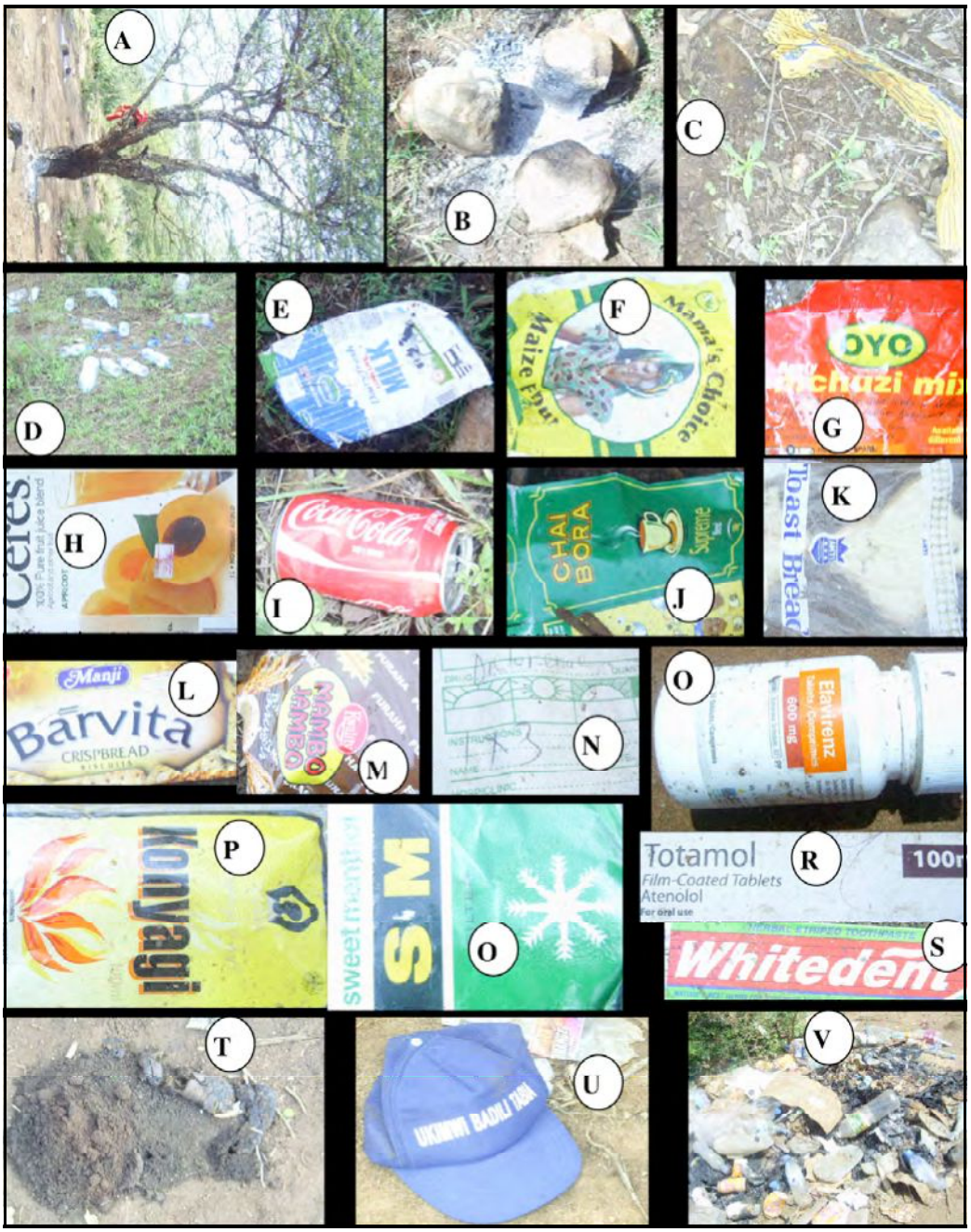


Figure 4: Litter and other human impacts. Samunge village, Tanzania. March 2011. A: Burnt base of an *Acacia* tree; B: Cooking fire; C: Sanitary cloth; D: Water bottles; E – M: Food and drink containers; N: Drug prescription; O,R: Drugs (medicine); S: Toothpaste box; T: Partially degraded human faeces; U: Head cap with message on AIDS; V: Burnt litter.

Table 6: Percent land cover by litter and number of debris items at various stations along the road leading to Samunge village, Tanzania. March, 2011.

Station	Broadway		Edge of road		Edge of road to 10 m	
	Cover	Number	Cover	Number	Cover	Number
1	3	10	30	40	30	40
2	3	10	50	40	0	0
3	2	7	40	70	2	3
4	3	7	40	100	1	1
5	1	10	20	100	3	7
6	2	3	15	70	2	3
7	1	5	25	80	4	5
8	1	7	30	80	3	4
9	4	8	30	100	1	3
10	2	8	30	80	1	3
11	2	7	30	80	5	15
12	3	8	30	100	5	30
13	3	15	40	120	3	20
14	3	10	10	80	3	10
Total	**33**	**115**	**420**	**1140**	**63**	**144**
Average	**2.4**	**-**	**30**	**-**	**4.5**	**-**

Table 7: Types of debris encountered at sample stop stations along the road leading to Samunge village, Tanzania. March 2011

	Station					
	1	**2**	**3**	**4**	**5**	**Total**
Plastic water bottles	26	16	12	23	80	**157**
Plastic juice bottles	6	3	2	2	2	**15**
Biscuit wraps	3	4	6	2	14	**29**
Nylon bags	26	7	22	3	10	**68**
Other paper containers	6	3	9	6	2	**26**
Metal/Aluminium containers	3	1	3	0	4	**11**
Paper juice/milk containers	0	6	8	8	9	**31**
Others	0	3	5	1	2	**11**
CV	**124.1**	**87.2**	**76.3**	**133.4**	**172.3**	**113.6**

Table 8 General physical and chemical indicators and microbial content of bottled mineral water (Kilimanjaro Brand), and river and tap water collected at Samunge village (Loliondo, Tanzania) in March 2011.

Analysis	Parameter	Bottle water	River water	Tap water
Physical observations	Suspended matter	None***	Slight**	None***
	Smell	Odourless***	Strong earthy**	Odourless***
	Appearance	Clear***	Slightly opalescent**	Clear***
Chemical characteristics	pH	6.9***	7.2***	6.8***
	Total Alkalinity mg/l $CaCO_3$	95***	430*	10***
	Total Nitrogen mg/l	0.625***	0.192***	0.162***
	NH_4-N mg/l	<0.001***	0.19* 0.18[ag] NH3	<0.001***
	NO_3-N mg/l	2.78*	<0.001***	0.722***
	PO_4-Pmg/l	0.82**	1.40**	0.08***
	EC µS/cm	248***	710*	469**
	SA ‰	0.1***	0.3*	0.2**
	COD mg/l	29***	176** 24[fs]	35***
	F mg/l	<0.001***	1.52***	<0.001***
	TDS mg/l	119***	322**	218**
Microbial content (MPN/100 ml)	Total coliforms	0	>24,000[x]	1,600[x]
	Fecal coliforms	0	9200[x]	700[x]
	Escherichia coli	0	470[x]	0

Key: N = Nitrogen; NH_4-N = Ammonium Nitrogen; NO_3-N = Nitrate Nitrogen; PO_4-P: Phosphate Phosphorus; EC: Electroconductivity; SA: Salinity; COD: Chemical Oxygen Demand; F: Flouride; TDS: Total Dissolved Salts; [ag]: Ammonium gas; [fs]: COD filtered sample; MPN: Most Probable Number; *: water needs treatment before domestic use (However, no standard had been set for EC); **: fairly clean - water needed some pretreatments especially filtration; ***: clean - water required little or no special pretreatment; [x]: doubtful - unsafe for human consumption without treatment.

DISCUSSION

The Sonjo people of Samunge appear to have been living much in harmony with the environment. Cultivation was mostly done on flatlands where the level of erosion is much lower than would be on the sloppy hills. From time immemorial, the Sonjos are known to have practiced a form of cultivation and irrigation that have been so well done as to minimize on erosion and ensure food availability (Goldsmith 1984, Gray 1963). Livestock keeping was also widely practiced in the village constituting mainly goats but also cattle and chicken. Donkeys were frequently seen and were used mostly for carrying harvested crops and water. Overall, there was little sign of unsustainable cultivation or overgrazing. The apparently good levels of farming and livestock keeping much enabled near

adequate provision of food (rice stew, stiff porridge, porridge, meat) for the sudden increase of people visiting Samunge for the medicine. As expected, there was hiking of prices whereby most items such as food, soft drinks and water were all selling at about double their respective prices in most towns in the country (ANON 2011e). The business boom soon attracted people from outside the village and by mid March 2011 nearly every other vendor was a non Sonjo. Some people who had come for the medicine changed their return schedule, decided to stay on and started businesses (ANON 2011e). A number of Sonjo girls and boys became engaged as employees. The author came across two cases whereby a visitor was calling his wife and relatives to stop whatever they were doing back home and come to Samunge to assist in the running of business, mainly cooking and owning of stalls for sell of items such as flour, sugar and soft drinks. Business also boomed in nearby towns of Arusha, Mto wa Mbu and in other parts of Ngorongoro involving mostly restaurants, transportation and lodges (Juma 2011b, Mbonea 2011a,b). In addition to helping visitors and villagers, big mobile telephone companies, such as AIRTEL and VODACOM, were also quick to prospect in the area which has not had any telephone communication before (ANON 2011f, Lyamuya 2011).

Indigenous life style of the Sonjos appeared to be a humble one, most conflicts had been with the Maasai. However, increased immigration would change the status quo; in March 2011 there were already seductive approaches, by some visitors, to Sonjo girls but who appeared to be very vigilantly defiant at such approaches. Drinking of bottled alcohol was very low if any; the man administering the medicine had warned against alcohol drinking, promiscuity, theft and all forms of cheating (ANON 2011g). However, this did not hold for long; on March 25th I noticed two vendors openly drinking bottled beer (Kilimanjaro brand) around their vehicle which had just brought in food, drinks and other items for sale. The drinking clearly aimed at enticing visitors and residents to buy and drink the beer. By May 2011, news was already full of reports on temporary shelters built for lodging and as pubs. These are socioeconomic and socio-ecological areas which needed to be investigated and understood so as to aid in instituting checks and balances; lest a tradition worth learning from would be wiped out unnoticed. The agricultural practices, livestock keeping, traditional medicine approaches and honey gathering practices of the Sonjo people were perhaps some of the most advanced undertakings worth emulating elsewhere. Honey sold by the Sonjo was one of the best the present author had come across and beehives were very frequent encounters along the road. Concoctions made from tree barks that were mixed with meat and soup might be one of the ways that guard against formation of gout that is frequent with eaters of red-meat in cities such as Dar es Salaam.

The high level of interest for Samunge, if continued, would increase settlements in the village and most likely change the natural vegetation covering the hills into hills covered by settlements and non-native plants. Trampling of indigenous biota and land denudation have been major issues of global concern in places where traffic of both vehicles and humans increase (Newmark *et al.* 1996, ANON 2003h, Senzota 2003, 2012). Although there were attempts to control the accumulation and spread of litter, more concerted efforts were needed since litter deposition rates much outweighed such efforts and debris was prevalent all over. Increased levels of visitors often lead to accumulation of litter involving both biodegradable and none degradable material such as plastic and metal cans which can lead to long-term environmental pollution. In Kilimanjaro

Mountain, some 4,500 pieces of trash were collected along a ten kilometer stretch of a tourist trail (Harcourt and Stewart, in Roe *et al.* 1997). On Mount Everest, some 1,000 bags of garbage have been collected along hiking trails (Bullock 2003). At Samunge, control mostly involved trash burning at various places along the road. However, emanating smoke and chemicals would be harmful to both humans and other biota. Other better ways, such as instituting litter bins and other sanitary facilities along the road, could have been explored. By end of March 2011, the Government of Tanzania intervened to allow only the number of vehicles and people that could be administered with the herbal medicine in a day in an attempt to reduce hardships experienced by visitors (Jackton 2011, Powa *et al.* 2011, Shayo *et al.* 2011). Simultaneously, this would reduce level of environmental pollution.

Preliminary chemical analysis suggested that the medicine had some potential to cure a number of diseases and had no side effects (ANON 2011i, ANON 2011j, Damian *et al.* 2011, Nsanzugwanko 2011, Shayo *et al.* 2011, Mwakyusa 2011, Malebo and Mbwambo 2011, Masudi 2011). There were cases where the sick confessed to be cured and some even escaped from hospitals to go for the medicine without formal discharge (Musa 2011, Musa *et al.* 2011, *Mwananchi* March 10, 2011 p6, www.mwananchi.co.tz). Simultaneously, there were some complaints that the medicine was too hastily promoted, especially since its use and efficacy were also purported to involve religious beliefs and its cure capability had not yet been scientifically established (ANON 2011k, ANON 2011l, Ernest 2011, Florian 2011, Kayoka 0211, Kayombo 2011, Masalu and Everest 2011, Mbonea 2011, Mjema 2011, Mjengwa 2011, Mtagaluka 2011, Ndillamie 2011, Ngilisho 2011, Urrio 2011, Welu 2011, Editorial 2011, Lyamuya 2011). The large number of visitors going to Samunge for the treatment, despite the tremendous hardships and high costs (ANON 2011m, Meena and Juma 2011b, Juma 2011e), was also suggested to be an indication that many people were sick and conventional medicare fell much short of meeting their treatment expectations (ANON 2011d, Florian 2011, Issa and Butahe 2011, Kapinga 2011, Nsungwe 2011). Efforts were underway to improve infrastructure to facilitate visits to Samunge (ANON 2011n, ANON 2011j, Kalulunga *et al.* 2011, Mbonea 2011a). Only four wheel drive cars and high clearance vehicles could travel through the rather rough road; the complete absence of a female driver and very low number of saloon cars attest to the treacherous nature of the road to Samunge (Kapinga 2011).

Simultaneously, other healers emerged purporting to offer treatment similar to that of *kikombe cha Babu* (ANON 2011o, Fundisha 2011, Kalulunga *et al.* 2011, Kayoka 2011, Mkwinda 2011, Mwakipesile 2011, Omary 2011, Masese and Mwaijega 2011, Mapunda 2011). The plant in use (*Carissa spinarum*) is widespread in Africa and Tanzania from lowlands to highlands (Mbuya *et al.* 1994, Heine and Legere 1995, Rufo *et al.* 2002, Senzota and Mbago, 2005). However, as of June 2011, recruitment for people to go to Samunge was still going on in Tanzania, Africa and overseas (ANON 2011p, ANON 2011q, ANON 2011r, Mkwame 2011, Michael 2011, Mwishehe 2011) and the government was said to be exploring possibilities for issuing a patent on the medicine to the herbalist (Damian 2011). A main lesson is that there is high inadequacy of medical treatment and what happened at Samunge has the potential to be repeated elsewhere. The Samunge event offers some hints on logistical and environmental measures to be taken by individuals and authorities in such or similar situations.

ACKNOWLEDGEMENT

I thank Messrs C Kweyunga and F Kimati for chemical and microbial analyses of water samples, and Messrs F Mbago and H Selemani for assistance in the identification of plant material. I thank Dr B Nyundo for assistance in statistical analysis and identification of insects and other invertebrates, and Mrs C Mshana for assistance in map-making. Anonymous reviewers and Professor AM Nikundiwe and Drs CL Nahonyo and HYD Kiwia provided very useful ideas and inputs.

REFERENCES

Allen SE 1989 (Ed). *Chemical analysis of ecological materials.* Blackwell Scientific Publications, Oxford.

ANON. 2011a Taarifa ya utafiti kuhusu dawa ya Babu Loliondo. *Mtanzania*, **5530 (March 29):** 3 (www.newhabari.co).

ANON. 2011b Babu aanza biashara Loliondo! *Kiu ya Jibu*. **955 (May 13-15):** 1-2

ANON. 2011c Serikali yaingilia tiba ya Ukimwi: wataalamu watumwa Kijiji cha Samunge. *Mtanzania*. **5407 (March 7):** 1-2. (www.newhabari.com).

ANON. 2011d Mrema atua Loliondo kuimarisha afya yake. *Mwananchi*. **03914 (March 14)**: 1,4 (www.mwananchi.co.tz).

ANON. 2011e Upatikanaji wa chakula Samunge kitendawili: wajasiriamali wanaotoa huduma wanakomoa. *Mtanzania*, **5530 (Marh 29):** 12-13 (www.newhabari.co).

ANON. 2011f Airtel: Loliondo sasa tumewafikia. *Mwananchi*, **03951(April 20):** 1 (www.mwananchi.co.tz).

ANON. 2011g Dawa Loliondo yazua taharuki: ukinywa kikombe cha Babu ngono zembe haitakiwi. *Jambo Leo*. **557 (March 14):** 1,4.

ANON. 2003h *Berlin wall built for frogs.* BBC Science; 3rd August, 2003.

ANON. 2011i Serikali: tiba ya Loliondo safi. *Mtanzania*, **5530(March 29):** 1,3 (www.newhabari.co).

ANON. 2011j Serikali yamwaga misaada kwa Babu. *Majira*, **6292 (11/4302)(March 29):** 1,4 (www.majira.co.tz).

ANON. 2011k Mchungaji Katunzi: kikombe cha babu Loliondo ni uchawi, hakituhusu. *Kiu ya Jibu*, **133 (April 17-23):** 7.

ANON. 2011l Loliondo 'Babu' lashes out at rumour mongers. *Daily News*, **10351(June 01):** 3 (www.dailynews.co.tz).

ANON. 2011m Kwa Babu Loliondo: balaa jipya; hakuendeki tena. *Uwazi*, **687 (May 31 – June 6):** 1 – 2.

ANON. 2011n Halmashauri ya Ngorongoro ikabiliane na changamoto hizi. *Nipashe*, **056968 (March 29):** 6 (www.ippmedia.com).

ANON. 2011o Loliondo miracle herb still investigated. *Daily News*, **10373(July 01):** 1-2 (www.dailynews.co.tz).

ANON. 2011p Kikombe cha Babu chazidi kupigiwa debe. *Tanzania Daima*, **2388(June 18):** 16 (www.freemedia.co.tz).

ANON. 2011q Loliondo Travels: Lusaka Loliondo roundabout. http://loliondotravels.com /lusaka_loliondo_roundabout.html and http://loliondotravels.com/ loliondo_helicopter_hop-1.html (visited on 16th June 2011).

ANON. 2011r Cluster maps; map of visitors locations – zoom map. http://www2.clustermaps .com/counter/maps.php?url=http://www.loliondotravels.com (visited on 16th June 2011).

Bullock G 2003 Creating positive synergies in mountain-based ecotourism development: case studies from the Yunnan Great Rivers Project. In: Lijiang P.R., Jianchu Xu, and Mikesell S. (eds) *Landscapes of diversity: indigenous*

knowledge, sustainable livelihoods and resource governance in montane mainland Southeast Asia. Proceedings of the III Symposium on MMSEA 25-28, August 2002. Kunming, Yunnan Science and Technology Press, Kunming. 567 – 576.

Damian N 2011 Dawa ya Babu mbioni kupata hatimiliki. *Mwananchi* **04024(July 04):** 3 (www.mwananchi.co.tz).

Damian N, Juma M and Meena N 2011 Serikali: dawa ya Loliondo ni salama. *Mwananchi*, **03929(March 29):** 1, 4, 16 (www.mwananchi.co.tz).

Editorial 2011 Majibu ya ubora wa dawa ya Babu kutibu magonjwa yasicheleweshwe. *Tazama Tanzania*, **444(May 3-9):** 4.

Emtery O 1989 *Chemical and physical analysis of inorganic nutrients in plant, soil, water and air*. Department of Forestry, Swedish University of Agricultural Sciences. Uppsala.

Emest E 2011 Ghasia: Msibweteke kikombe cha Babu. *Mwananchi*, **03991(May 30):** 2 (www.mwananchi.co.tz).

Florian N 2011 Tujiulize hivi tiba ya Babu yetu wa Samunge imetoka mbinguni! *Mwananchi* **03914(March 14)**: 9 (www.mwananchi.co.tz).

Fundisha P 2011 Mganga mwingine kama 'Babu' aibuka Mbeya. *Mtanzania,* **5530 (March 29):** 6 (www.newhabari.co).

Goldsmith E 1984 The traditional irrigation system of the Sonjo of Tanzania. In: *The social and environmental effects of large dams* (Eds. E. Goldsmith and N. Hildyard). Wadebridge Ecological Centre, Cornwell, UK.

Gray RF 1963 *The Sonjo of Tanganyika: an anthropological study on an irrigation-based society*. Oxford University Press, Oxford.

Heine B and Legere K 1995 *Swahili Plants: an ethnobotanical survey*. Rudiger Koppe Verlag, Koln.

Issa H and Butahe F 2011 Kasi ya maambukizi ya VVU ni kubwa. *Mwananchi*, **03936(April 5):** 3 (www.mwananchi.co.tz).

Jackton M 2011 JK aingilia Loliondo. *Mtanzania*, **5530(March 29):** 1-2 (www.newhabari.co).

Juma M 2011a Maofisa Ikulu Kenya wapata kikombe cha Babu. *Mwananchi*, **03948(April 17):** 1, 4 (www.mwananchi.co.tz).

Juma M 2011b Kikombe cha Babu kilivyobadili uchumi wa Ngorongoro. *Mwananchi*, **03987(May 26):** 4 (www.mwananchi.co.tz).

Juma M 2011c Waomani watua Samunge kunywa kikombe cha Babu. *Mwananchi*, **03987(May 26):** 5 (www.mwananchi.co.tz).

Juma M 2011d Maofisa wa JWTZ watua Samunge. *Mwananchi*, **03972(May 11):** 1,4 (www.mwananchi.co.tz).

Juma M 2011e Majambazi yaua, yapora Wakenya. *Mwananchi*, **04040(July 19):** 2 (www.mwananchi.co.tz).

Kalulunga G, Vullu T and Frank D 2011 Babu Loliondo amtibu Mrema: KKT kuboresha miundombinu; tabibu mwingine aibuka Mbeya. *Tanzania Daima*. **2292(March 14):** 1,2.

Kapinga J 2011 Safari yangu kwa Babu. *Nipashe Jamii*. **056968(March 29):** 4-5 (www.ippmedia.com).

Kayoka C 2011 Babu alivyotuweka njia panda Loliondo. *Nipashe Jamii*, **056968(March 29):** 8 (www.ippmedia.com).

Kayombo C 2011 Serikali imefanya vizuri kusikiliza kilio cha wananchi. *Jambo Leo*. **557(March 14):** 12.

Lenore SC, Arnold EG and Andrew DE (eds) 1998 *Standard methods for examination of water and waste water*. 20th Edition. American Public Health Association; Washington DC.

Lyamuya S 2011 The declining Loliondo miracle cure treasure trove. *The African*,

4081 (June 29): 7 (Mwananchi Communications Ltd, Dar es Salaam).

Magongo O 2011 Wagonjwa Same wavamia ofisi za Chadema kutaka waende Loliondo. *Mwananchi*. **March 21:** 14. (www.mwananchi.co.tz).

Malebo HM and Mbwambo ZH 2011 *Technical report on miracle cure prescribed by rev. Ambilikile Mwasupile in Samunge Village, Loliondo, Arusha*. National Institute for Medical Research and Institute of Traditional Medicine, Dar es Salaam, Tanzania. March 2011.

Mapunda K 2011 Serikali yapata majina wanaodai kupona Ukimwi. *Mwananchi*. **04028 (July 07):** 13 (www.mwananchi.co.tz).

Masalu B and Everest E 2011 Anywa dawa ya Babu, azidiwa, ajinyonga. *Uwazi*, **679 (March 29- April 4):** 1,2.

Masese B and Mwaijega A 2011 Kikombe kingine chaibuka Dar. *Majira*, **6328(May 04):** 3 (www.majira.co.tz).

Masudi Z 2011 Dawa ya Babu yazidi kukubalika. *Nipashe*, **057004(May 04):** 3 (www.ippmedia.com).

Mbonea E 2011a Serikali Arusha yakubali kumsaidia Babu. *Mtanzania*. **5514(March 14):** 1, 3 (www.newhabari.com).

Mbonea E 2011b Membe aombwa asaidie Samunge; wingi wa wageni wawa tishio. *Mtanzania* **5572 (May 10):** 1-2 (www.newhabari.com).

Mbuya LP, Msanga HP, Rufo CK, Birnie A and Tengnas B 1994 *Useful trees and shrubs for Tanzania*. Regional Soil Conservation Unit. SIDA, Nairobi.

Meena N and Juma M 2011a Waliofariki dunia Loliondo wafikia 78. *Mwananchi*, **03936 (April 5):** 1, 4 (www.mwananchi.co.tz).

Meena N and Juma M 2011b Wakenya 700 wanywa kikombe Loliondo. *Mwananchi*, **April 10:** (and http://www.mwananchi.co.tz/mwananchi-jumapili/40-habari-mwananchi-jumapili/ 10875-wakenya-700-wanywa-kikombe-loliondo.html (vitited on June 19, 2011)).

Meena N, Juma M, Mjema D and Maregesi C 2011 Majaji 12 wapata kikobe kwa Babu; raia 500 wa kigeni wapata tiba. *Mwananchi*, **03933(April 02):** 1, 4 (www.mwananchi.co.tz).

Michael G 2011 Mbunge: Kenya imemteka Babu Samunge. *Majira*, **6383(II 4393, June 28):** 4 (www.majira.co.tz).

Mjema D 2011 Masheikh Kilimanjaro wapinga tiba ya mchungaji Mwasapila. *Mwananchi*, **03986(May 25):** 5 (www.mwananchi.co.tz).

Mjenwa M 2011 Ya Babu Loliondo na ushauri wa Wamarekani. *Raia Mwema*, **187(May 21-31):** 16 (www.raiamwema.co.tz).

Mkwinda R 2011 Mganga aliyeibuka Mbeya apigwa 'stop'. *Majira*, **6292(II/4302)(March 29):** 9 (www.majira.co.tz).

Mtagaluka R 2011 Serikali ina siri gani na kikombe cha 'Babu'? *Umma Tanzania*. **129 (May 6-11):** 3,11.

Musa J 2011 Tiba ya Babu: mwingine adai kupona ukimwi. *Mwananchi*, **3986(May 25):** 1 – 2 (www.mwananch.co.tz).

Musa Y, Chuwa H and Njuki S 2011 Vimbwanga Loliondo: waliokimbia hospitali wakutana na madaktari wao kwa babu. *Majira*. **6277/II/4287(March 14)**: 1,4 (www.majira.co.tz).

Mwakipesile C 2011 Wananchi waandamana kudai 'tiba ya Mbeya'. *Majira*, **6292(II/4302)(March 29):** 1,3 (www.majira.co.tz).

Mwakyusa A 2011 Local researchers give Babu's cure credit. *Daily News*, **10332(May 04):** 1,3 (www.dailynews.co.tz).

Mwishehe S 2011 Babu wa Loliondo ageuka mtaji Kenya. *Jambo Leo*, **662(June 28):** 4.

Newmark WD, Boshe JI, Sariko HI and Makumbule GK 1996 Effects of a highway on large mammals in Mikumi

National Park, Tanzania. *Afr. J. Ecol.* **34,** 15-31.

Ndillamie S 2011 Dawa ya Babu: Fides et Racio. *Habarileo*, **01624(June 02):** 19 (www.habarileo.co.tz).

Ngilisho J 2011 Vifo vyatikisa Loliondo. *Uwazi*, **679(March 29-April 4):** 1,2.

Ngilisho M 2011 No child yet? Go to Babu. *Daily News*, **10364(June 20):** 1,3 (www.dailynews.co.tz).

Nsanzugwanko T 2011 Dawa ya Babu wa Loliondo ni salama. *Habarileo*, **01559 (March 29):**1,4 (www.habarileo.co.tz).

Nsungwe T 2011 Loliondo, Chinese medicine emerge need explanations. *The African*, **4095(July 13):**4 (New Habari Ltd, Dar es Salaam).

Omary A 2011 Mwanamke mwingine aibuka Tanga akitibu kama Babu. *Mtanzania*, **5565 (May 03):** 8 (www.newhabari.com).

Powa S, Damian N and Juma M 2011 Serikali yasitisha tiba ya Loliondo: wananchi waishangaa; wataka wachunguze walioitumia. *Mwananchi*, **03910(March 10):** 1, 4 (www.mwananchi.co.tz).

Pratt J and Gwynne MD 1977 *Rangeland Management and Ecology in East Africa.* Hodder and Stoughton, London.

Roe D, Leader-Williams N and Dalal-Clayton B 1997 Take only photographs, leave only foot-prints: the environmental impact of wildlife tourism. *IIED wildlife development series*, **10(October),** London. (and http://www.ecotourism.org/textfiles/roe.pdf).

Ruffo CK, Birnie A and Tengnas B 2002 *Edible wild plants of Tanzania.* Regional Land Management Unit & Sida; Nairobi.

Senzota R 2012 Wildlife mortality on foot paths of the University of Dar es Salaam, Tanzania. *Trop. Ecol.* **53 (1):**81-92.

Senzota RBM 2004 Ecological impact in Amani Nature Reserve following the rush for gold. In: *Ecological Monitoring in the East Usambara Mountains: Proceedings of the second workshop* (Eds A.M. Nikundiwe, J.D.L. Kabigumila, F.S.S. Magingo and R.B.M.Senzota). Departments of Botany / Zoology and Marine Biology,University of Dar es Salaam, Tanzania.

Senzota RBM and Mbago F 2005 *Updated checklist of plants in the Salasala Bioenvironmental Area.* Occassional Publications of KIBISA. Dar es Salaam, Tanzania.

Shayo B, Mwilolezi C, Shizza W and Ngereza C 2011 TFDA yasafisha dawa ya Babu. *Nipashe*, **056968 (March 29):** 1,4 (www.ippmedia.com).

Urrio T 2011 Dawa inachunguzwa, watu wanaikimbilia. *TanzaniaDaima*, **23 65 (May 26):**16 (www.freemedia.co.tz).

Welu M 2011 Waliokunywa dawa Loliondo waanza kulia. *Jibu*, **133 (April 17-23):** 1,5.

Yassin A 2011 Kamati yashauri waathirika kutumia kikombe cha babu. *Mwananchi*, **04019 (June 28):** 10 (www.mwananchi.co.tz).