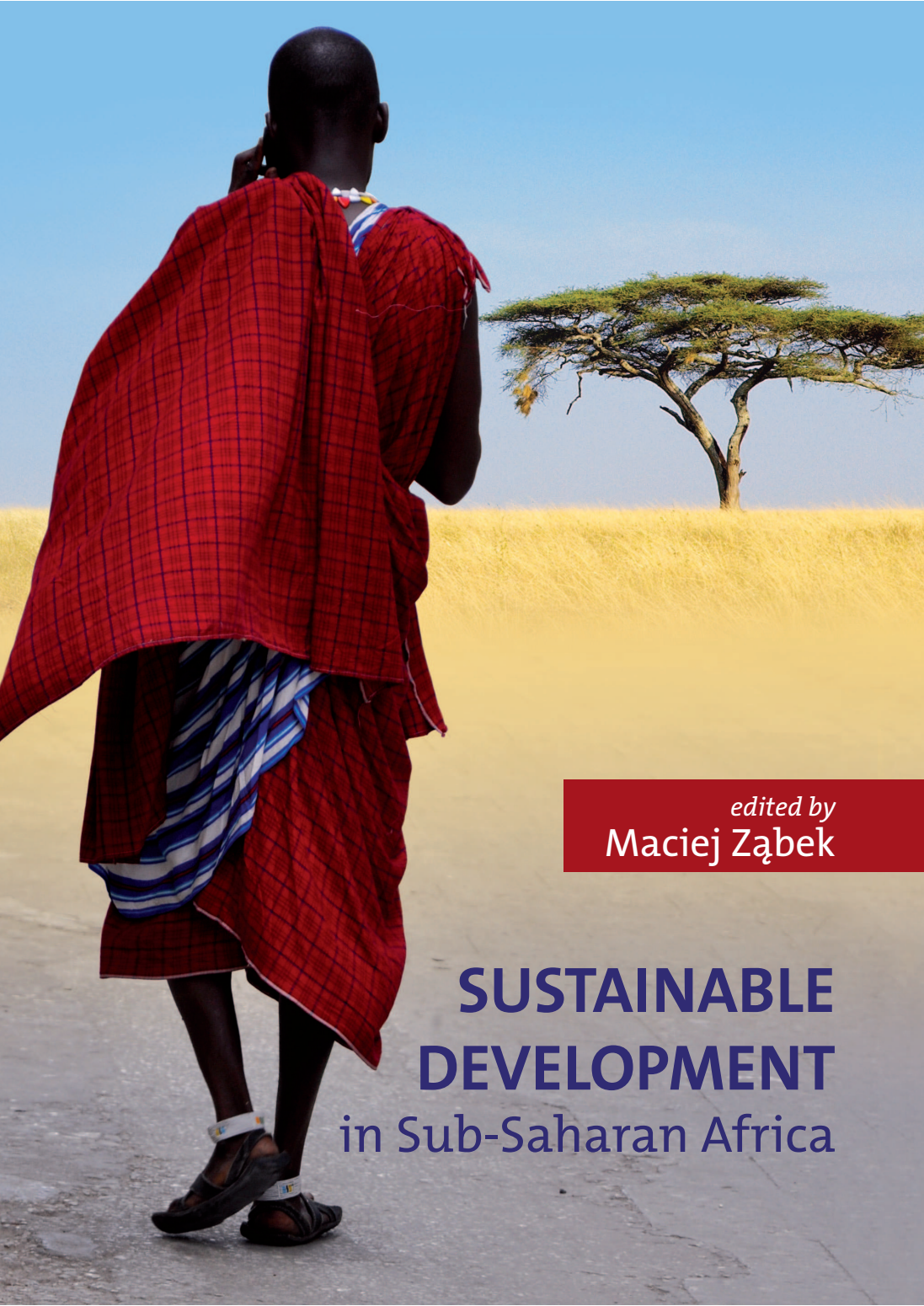

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Maciej Ząbek

SUSTAINABLE DEVELOPMENT
in Sub-Saharan Africa

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&
Institute of Ethnology and Cultural Anthropology
University of Warsaw

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Reviewers:
Prof. Nicholas T.A. Bangu
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RUHEZA S. MATTEE, Z.A., CHINGONIKAYA,
E.E. AND KILUGWE, Z.

INDIGENOUS KNOWLEDGE SYSTEM (IKS) AND BIODIVERSITY CONSERVATION IN SOUTH NGURU MOUNTAIN FOREST RESERVE, TANZANIA: Often neglected partner for sustainable management and use of biodiversity

ABSTRACT

This study examines the significance of indigenous knowledge system (IKS) in sustainable management and use of biodiversity in South Nguru

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SOSTHENES RUHEZA – Dr., Lecturer, Researcher and Consultant at Development and Conservation Studies, University of Iringa (UoI). He holds Masters Degree in Rural Development at University College Dublin (UCD) and PhD in Development Studies of Sokoine University of Agriculture. His research interests concern conservation of natural resources particularly conservation of biodiversity and indigenous knowledge system.

Z.A. MATTEE – Department of Agricultural Education and Extension, Sokoine University of Agriculture (SUA), Morogoro, Tanzania.

EMANUEL E. CHINGONIKAYA – Dr., Senior Lecturer, Development Studies Institute, Sokoine University of Agriculture, Morogoro. He holds a PhD in Development Studies. He has attended several professional courses such as interdisciplinary scientific research skills; concepts and theories of developments, poverty and policy analysis, participatory research methodology for researching with children, etc).

ZUENA KILUGWE – affiliated with the School of Public Administration and Management, Mzumbe University, Morogoro, Tanzania.

mountain forest reserve. Semi-structured and key-informant interviews, field observations and focus group discussions (FGDs) were used for data collection. This study observed that indigenous people had a bundle of IKS that significantly contributed to the management of biodiversity. The study also observed that neither the IKS nor the biodiversity conservation methods can sustainably manage and use biodiversity: their combination would achieve more than either in their separation. The study recommends: official recognition of IKS; active participation of potential actors; motivation and capacity building of indigenous social structures from which the IKS evolved, is enhanced and sustained, the cornerstone for a wide use and application of the knowledge system and to its integration into biodiversity conservation methods.

Keywords: Indigenous knowledge system, Biodiversity, Biodiversity conservation, Sustainable management and use, South Nguru Mountain Forest Reserve, Tanzania.

Introduction

Biodiversity is at the heart of sustainable development and life insurance in itself (Mc Neil and Shei, 2002 cited by Sajise, 2005), whereas overexploitation of biodiversity results in reduced capacity to support present and future generations. The South Nguru Mountain Forest Reserve is not excluded from the increasing worldwide problem of biodiversity decline, a problem that poses the greatest challenge to human survival and development (TFCG, 2007). The Mountains harbour one species which is critically endangered, eight endangered, ten vulnerable, two near-threatened and twenty vulnerable plant species based on IUCN threat classification (ibid).

Despite IKS being widely known for its roles in the conservation of natural resources, indigenous people are often considered backward and antithetical to conservation objectives. In lighting of the similar view, McGregor (2004); Sobrevilla (2008) and Kajembe *et al.* (2010) argue that many global environmental problems such as the decline

of biodiversity have been attributed to the failure of most biodiversity conservation initiatives to efficiently use IKS. Quite recently, there have been several calls for the integration of IKS into biodiversity conservation methods, to take complementary advantage of their strengths and weaknesses, as their combination may achieve what neither would achieve alone (Stevenson, 2005; Nganje, 2009; Fitzgerald and Stronza 2009; Kajembe *et al.*, 2010; Cobb, 2011 and Das Gupta, 2011). Moreover, their integration would create a mechanism of dialogue between indigenous people and scientists (Nyong, Adesina and Elasha, 2007), leading to less serious conflicts among actors.

In this study, IKS refers to a body of knowledge that has been generated, tested, improved overtime through human interactions with their supporting ecosystem, enhanced and safeguarded by norms, values, taboos, rituals and sacredness that is interwoven into local politics, spiritual and socio-economic characteristics of the people concerned. Wilfred *et al.* (2007) refer biodiversity as a variety of life forms (animals, plants and micro-organisms), ecosystems and the ecological process in which these components are interacting, and the spiritual consciousness of the people concerned on such a relationship (Kimmerer, 2002). This implies that for indigenous people, biodiversity is synonymous to a scientific view of ecosystem with spiritual value attached to it. It is from the above argumentation, this study perceived biodiversity as abundance and number of different species of wild species of plants and animals and the non-living organisms in a given geographic area, living in spiritual and reciprocal relationships between the living and the non-living things, whereas humans are perceived as being part and parcel of the supporting ecosystem.

According to Charnley, Fischer and Jones (2007) biodiversity conservation methods refer to conservation initiatives that are driven by theoretical models that are governed by testing of hypotheses and not necessarily utilitarian, often generalizable and

not always location-specific. In this study, biodiversity conservation methods refer to all forms of rules and regulations that are derived from scientifically derived approaches, and that perceive human beings as managers and part of the broader ecosystem. McGregor (2004) observed that the indigenous people in their own language (Ojibway language) had no single word to describe sustainable management and use of biodiversity. People simply believe that there should be a mutual taking and giving back to nature for the benefit of all components of the supporting ecosystem, and such duty is for the tiniest animals up to the powerful sun and spirits. This study refers to sustainable management and use of biodiversity as the management of humans' interactions with wild species of plants and animals and non-living things in a supporting ecosystem, to ensure a reciprocal taking and giving back to nature so as to meet the needs and aspirations of present and future generations of all creations, and their spiritual values herein.

It is against this background, using South Nguru Mountain Forest Reserve as a case study, that this research explores IKS and management and use of biodiversity. Integration of this knowledge system into biodiversity conservation initiatives, may improve biodiversity conservation outcomes.

Methodology

Study Area

The South Nguru Mountain Forest Reserve (Figure 1) is situated roughly at the centre of the Eastern Arc Mountain chain of Tanzania, lying between S 05° 53´ S – S 06° 17´ and E 037° 27´– E 037° 45´ in Mvomero District, Morogoro Region. The Mountain covers an area of 184 square kilometers (DIIS, 2007), with an altitude ranging between 760 and 2400 meters above sea level (Menegon, Doggart and Owen, 2008).

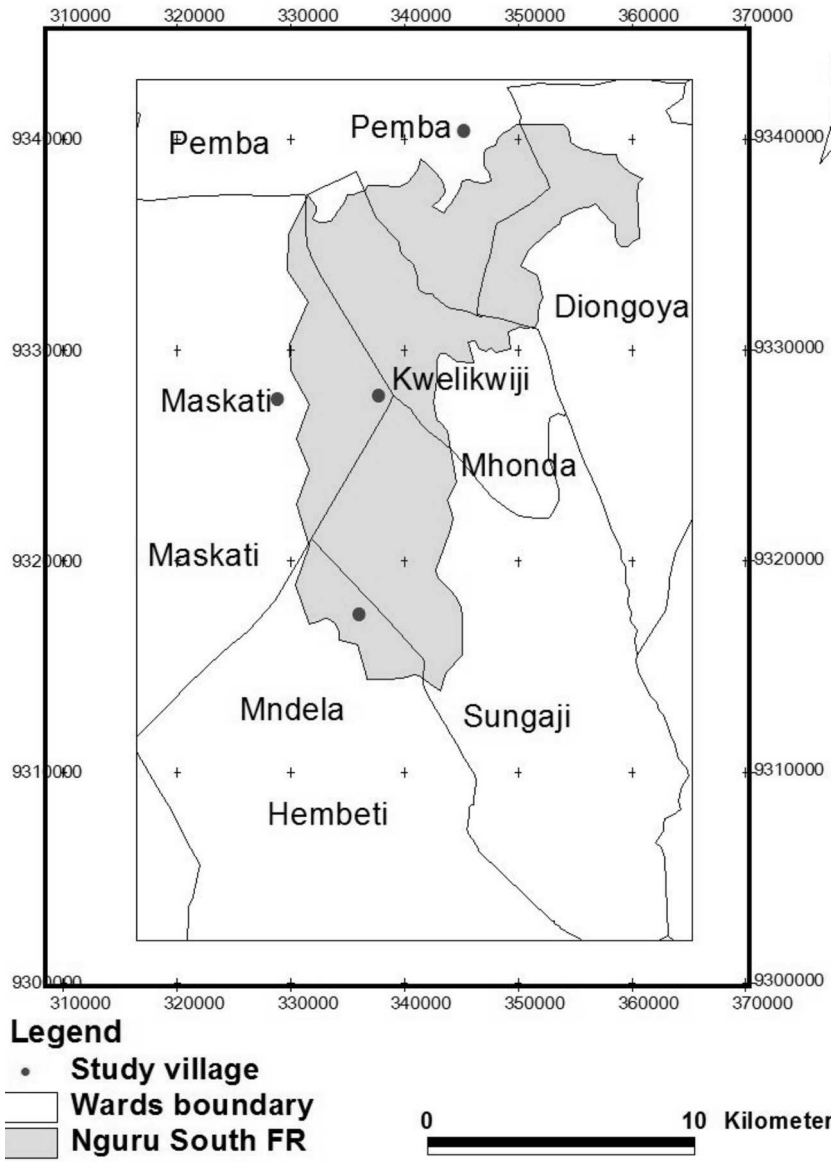

Figure 1: A map showing location of the study villages

Research design, sampling procedures, data collection and analysis

In this study, an exploratory cross-sectional research design was used. According to De Vaus (2002), a cross-sectional research design involves the collection of information from representative population sample in one time duration at a single point. The choice of this research design is grounded on the fact that it is more flexible to provide opportunity for considering different aspects of a problem under study (Kothari, 2004).

A purposive sampling was used to select 4 villages out of 25 villages bordering South Nguru Mountain Forest Reserve, each representing one ward within the landscape. Four villages were purposively selected, one village from the Northern, Southern, Eastern and Western parts of the mountain landscape, representing different socio-economic characteristics of the study population. The study village included Pemba (north), Mndela (south), Maskati (west) and Kwelikwiji (east) of the South Nguru Mountain Forest Reserve.

Based on the criteria of being an indigenous person, as being a person who has lived in an area for not less 20; a sampling list was created using the 2005 voting list. A sample of 60 interviewees was randomly selected from each of the four village's sampling list, making a total of 240 interviewees. Semi-structured and key-informant interviews, field observations and Focus Group Discussions were used for data collection. Four Focus Groups Discussions (FGD), (one in each of the four selected villages), that included walukolo, members of village environmental committees and the village chairperson, and/or the Village Executive Officer (VEO) were held to complement the information collected through interviews and field observations. Data collected in phase one was analyzed using both qualitative and quantitative methods. The Statistical Package for Social Sciences (SPSS) was used to analyze the quantitative data whereas content analysis was used to analyze the qualitative data.

Results and Discussion

Respondents' views on the origin of biodiversity in the South Nguru montane forest

The results (Table 1) showed that most respondents (90.0%) believe that biodiversity was created by God/gods, while only 10.0% of the respondents did not know the origin of biodiversity. Based on these findings, it is apparent that there is a spiritual belief amongst most of the respondents that biodiversity is God's/god's creation. Similarly, Anis (1994) cited by Mokuku and Mokuku (2004), added that most indigenous people believe that all living organisms share a creator and the creative process, and therefore they relate to one another, and such spiritual relationship has been determining human relations with other living things.

However, in his study Mapara (2009) reported that the indigenous teaching among the Shona ethnic group of the present day Zimbabwe was normally through proverbs, starting with the words "Vakuru vedu vanoti"... or "Vakulu vedu vaiti" ("our elders used to say "..." or "our elders said "..."), whereas Vakuru implies either the dead or the elders who are knowledgeable/or were knowledgeable on IKS, indicating existence of a spiritual belief among indigenous people on existences of connectivity with their ancestors.

Arguing on the significance of spiritual beliefs on conservation, Ylhäisi (2006) puts it that spiritual reasons have played a significant role in the management and use of biodiversity, as they determine human-biodiversity interactions of a particular ethnic group (Berkes 2008, Turbull 2007 and IIRR 1996b cited by Tanyanyiwa and Chikwanha 2011, Cobb 2011) and less labour and more cost effective as compared to biodiversity conservation methods (Kideghesho, 2009). Moreover, management and use of biodiversity and the degree of adoption of new innovation, rests on the spiritual beliefs of a particular group of people about nature (IIRR, 1996a cited by

Tanyanyiwa and Chikwanha 2011). This suggests that appreciation and consideration of spiritual values attached to biodiversity by indigenous people might reduce conflicts among actors, promote and enhance the knowledge system and significantly contribute to sustainable management and use of biodiversity.

Table 1: The respondents' views on the origin of biodiversity in the South Nguru Mountain Forest Reserve

Response Item	Frequency (n=240)	Percentage
Respondents' views on the origin of biodiversity		
Created by God/gods	216	90.0
I don't know	24	10.0
Total	**240**	**100**

The presence of, status and custodians of sacred groves/places

Results (Table 2) show that most (93.3%) of the respondents appreciate the presence of sacred groves/place(s) in their communities, while 6.3% of the respondents said there were no sacred groves/places in their community and only 0.4% of the respondents expressed their ignorance on the presence of sacred groves in their village. This implies that most of the respondents were appreciating the existence of sacred groves/places in their respective village. This study observed several sacred groves/places in all the villages, and the respondents who claimed that there were no sacred groves/places in their village might have been influenced by other factors: sacred groves/places were obvious, though they were increasingly less respected.

According to Dash (2005) cited by Jaryan *et al.* (2010), sacred groves refer to patches of forests conserved through human's spiritual beliefs and faith, whereas Ylhäisi (2006) refers to sacred forests/groves as being those forests/groves which are conserved by pre-colonial indigenous institutions and spiritual structures, and

believed to be inhabited by supernatural powers which influence the life of the people living in the area, and where ritual practices take place to strengthen the harmony between living people and supernatural powers, acting on behalf of the dead ancestors on the one hand and the unity among the people themselves, on the other hand. Their destruction has been prohibited to avoid destruction of the harmony of people livelihoods and the home of their ancestors (Ylhäisi, 2006). Arguing on the distribution of sacred groves, Jaryan *et al.* (2010) claimed that sacred are not restricted to any particular place or community and are well distributed across the globe and vary in sizes. Unfortunately, many are fast disappearing as a result of the influence of rapid socio-economic transformation, materialistic attitudes of the people that lead to the overutilization of resources.

Table 2: Respondents' views on the presence, status of and custodians of the sacred groves

Presence of sacred groves/places in the village	**Frequency (n = 240)**	**Percentage**
Yes	224	93.3
No	15	6.2
I don't know	1	0.4
Total	**240**	**100**
Custodian(s) of sacred grove/place (n= 224)		
walukolo	173	77.0
The village government	7	3.0
walukolo and village government	42	19.0
None	2	1.0
Total	**224**	**100**
Status and density of the sacred groves as of the past 20 years (224)		
Are of the same size(s)	59	26.0
Have decreased	98	44.0
Almost extinct	66	29.6
I don't know	1	0.4
Total	**224**	**100**

(Table 2) shows that most (77.0%) of the respondents claimed that sacred grove(s) were under the management of *walukolo* (indigenous leaders, elders in most cases), while 19.0% of the respondents said that sacred groves/places were managed by both *walukolo* and the village's government officials. Results further show that 3.0% claimed that sacred groves were managed by their village government and only 1.0% of the respondents said sacred groves/places are under the management of no one. According to PEMA (2006), conservation of sacred groves and/places has been historical practice of the Nguu ethnic group, mostly under the custodian of heads of the clan (*mlukolo* in Nguu language, meaning a head of people sharing common norms, values and practices). In lighting of the presence of the *lukolo*, Kajembe *et al.* (2010) and Shemdoe (2003) contend that all over Tanzania there are indigenous leaders responsible for the formulation and enforcement of taboos, norms and rules which, among others, determine humans-biodiversity interactions. For example, *Steiner et al.* (2004) cited by Hens (2006) argue that despite the fact that sacred groves have been biodiversity reservoirs, they were ignored by governments, conservation agencies and policies, so, their survival depends on the indigenous people (*walukolo* in such a case).

According to PEMA (2006) sacred groves/places have been devoted to worship, rituals, tribal ceremonies and cemeteries. Grave forests in Ghana are protected to respect the dead as it is believed that the ancestral spirits live there, and entrance to those places is limited to certain members of the community such as the royal family members, village leaders and clan heads during burial purposes. Collection of products from grave places is an invitation of evil spirits and may instigate calamities such as famine, floods or death, resulting in conservation of biodiversity in such places (Ntiamou-Baidu 1995 cited by Mbwambo 2000).

1. A sacred grove in public land in Maskati village of the South Nguru Mountain Forest Reserve: Photo Ruheza S. Mattee

Reporting on the status of sacred grove(s)/place(s) for the past 20 years (Table 2), the majority of the respondents (44.0%) claim that the size of scared groves has decreased and almost 29.6% of the respondents said that sacred groves were almost extinct. Of all respondents, 26.0% said that size of sacred grove(s)/place(s) had remained the same, as of the past 20 years, and only 0.4% of the respondents said they did not know. It was further observed that some pieces of lands, which were previously restricted from farming, called *ng'alimwa* in Nguu language (meaning places that should not be farmed), have been converted to farmlands. Similarly, a study by Ylhäisi (2006) in the Usambara Montane Forests found that sacred groves were encroached on for agricultural purposes,

fetching of fuel wood and valuable timber trees species had led to a decrease in their taxonomic diversity, size and densities of most sacred groves and of biodiversity.

The Nguu ethnic groups and sacred groves and/or places

The results of different Nguu ethnic groups and their respective sacred groves/or places are presented in Table 3. This study revealed the existence of sacred groves/places with a total estimated area of 47.5 ha, managed mostly by 9 Nguu clans. The largest sacred grove is 4.8 ha, while the smallest grove is 0.05 ha, with a mean area of 1.8 ha.

In Maskati village there are seven sacred groves with an estimated size of 10.45 ha, managed by three clans: Wanyagatwa (9.2 ha), Waganaza (1.2 ha) and Gombero (0.05ha). The Mndela village is dominated by a single clan, Wasongo, which manages a total of three sacred groves, totaling 4 ha. Results also show that in Pemba village there are a total of sixteen sacred groves managed by six clans: Wasongo (8.2 ha), Wanyasa (11.2 ha) and Kilangulu (6.4 ha). Others include Wakwigina (4.4 ha), Waluhanga (2.8 ha) and Waruwi (1.2 ha). Table 3 shows that Kwelikwiji village is also dominated by a single clan, having a single sacred place referred to as Luamba ritual site with an estimated size of 0.05 ha that is under the custodian of Wanyagatwa. The study further disclosed that some of the clans are dominating more than one village, and therefore, the indigenous territories are not conforming to government village demarcations.

The study further reveals that the Maasai, like the Nguu ethnic group, have sacred groves/or places, probably because of their forest-livestock relationships in this particular area. Furthermore, traditionally the Maasai do not hunt or consume wild meat and are less involved with forest clearing for agricultural purposes. Moreover, the Maasai perform annual rituals, aiming for health

and wishes, though currently they are no longer practiced, as most of them prefer to sell their cattle rather than to offer sacrifices for rituals. This finding is supported by a study by Shemdoe (2003) in Lake Manyara National Park which reveals that Maasai spiritual leaders, referred to as *laiguinan*, who were acquainted with their clan culture, are respected in terms of their decisions, rules and regulations on the management and use of biodiversity, among others.

A study by Ylhäisi (2006) finds great variation in size and density of sacred groves among different *lukolos* within and between villages, as a result of differences in the degree of social solidarity exercised by a particular clan and on the presence/absence of the responsible head of a clan (*mlukolo* in Nguu tribe) to manage the use of the clan's sacred grove(s)/place(s). Similarly, studies by Kweka (2004), Msuya and Kideghesho (2009) also observed that dominance of a certain ethnic group in a particular area determines their strengths in the emphasis of their indigenous knowledge for the management and use of biodiversity, and sacred grove(s) being part of it. It is worth noting that the Nguu and Zigua ethnic groups are closely related in their culture, norms, values and language. A study by Ylhäisi (2006) revealed that the Zigua, the first clan to settle in an area, established a clan (a *lukolo* in both Zigua and Nguu languages), and a *mlukolo* is responsible for the conservation of the sacred groves, ritual practices and enforcement of the IKS, among other duties (Ylhäisi, 2006). The *lukolo* is mainly based on having a common ritual place, and not necessarily being a blood relation (Oppen, 1992 cited by Ylhäisi, 2006). It is from the study findings and literature that this study argues that sustainability of sacred groves and/places that have been widely reported to conserve biodiversity mostly rests on the *walukolo*, in a context of increased external and internal pressure for their encroachment.

Table 3: The Nguu ethnic groups' sacred groves/places in the study area

Name of the village	Name of the sacred grove/place	Estimated size (Ha)	Custodian clan
Maskati			
	Mpeele (Kwentingu)	4.0	Wanyagatwa
	Magole	2.0	Wanyagatwa
	Manyasa	1.6	Wanyagatwa
	Disalaza	0.8	Wanyagatwa
	Mazinde	0.8	Wanyagatwa
Sub total		**9.2**	
	Pangai	***1.2***	Waganaza
	Gombero	**0.05**	Wafati
Total		**10.45**	
Mndela			
	Kochamazi	0.8	Wasongo
	Kwedimongo	1.2	Wasongo
	Mlima Mteke	2.0	Wasongo
Total		**4.0**	
Pemba			
	Finta	4.0	Wasongo
	Nyanyiunga	1.8	Wasongo
	Mkunvuru	2.4	Wasongo
Sub total		**8.2**	
	Kwevirango	4.4	Wanyasa
	Heviziwa	4.8	Wanyasa
	Mgoroka	2.0	Wanyasa
Sub total		**11.2**	
	Khwarike	**1.2**	Waruwi
	Msente	0.4	Waluhanga
	Kwevilulu	0.8	Waluhanga
	Kikangazi	1.6	Waluhanga
Sub total		**2.8**	

	Mheza	2.8	Kilangulu
	Rwinyi	1.2	Kilangulu
	Kimwege	2.4	Kilangulu
Sub total		**6.4**	
	Vikinga	1.6	Wakwigina
	Gereza	1.6	Wakwigina
	Mapalamba	1.2	Wakwigina
Sub total		**4.4**	
Total		**33.0**	
Kwelikwiji			
	Luamba	**0.05**	Wanyagatwa
Grand Total		**47.5**	

Presence of sacred wild plant species and reasons for their sacredness

Most of Nguu people are aware of the existence of sacred wild tree species in their village. Table 4 demonstrates that most of the respondents (81.0%) agreed on the presence of sacred wild tree species, while only 19.0% of the respondents expressed their ignorance of the presence of sacred tree species in their village. The study further disclosed that *Mvumo* (*Ficus inges, F. scassellatii*) were mentioned by most of the respondents (53.0%) as a sacred tree species, while 27.0% of the respondents mentioned *Mkuyu* (*Ficus altissima*) and only 8.0% of the respondents claimed that Mdala (*Euclea divinorum*) was sacred. Of all the respondents, only 7.0% and 5.0% of the respondents mentioned any big tree/very old trees and Mnyasa (*Newtonia buchananii*) as sacred trees, respectively.

Results (Table 4) have further shown that majority (47.0%) of the respondents claim that tree species that are sacred are believed to inhabit ancestral spirits and/or used for traditional ceremonies, while 27.0% of respondents say those trees improve soil fertility and conserve moisture, and 18.0% of respondents say that sacred

trees are believed to cause curse, sickness and death to a person or a close relative, if destroyed. Results further show that 5.0% of the respondents believe that all edible wild fruit trees are sacred and only 3.0% of the respondents claim that medicinal trees are sacred.

Scattered wild tree species on public lands are also considered sacred, varying in size from very big and probably very old trees to small ones. It was revealed that in case it is deemed necessary to cut down such very big/very old trees, some rituals have to be performed as a way of appeasing ancestral spirits. For example, according to the Maasai, trunks of cut sacred trees have to be covered by fresh leaves as a way of appeasing ancestral spirits for cutting such a tree. Tanyanyiwa and Chikwanha (2011) also found that very big/very old wild trees were perceived among the Shona/Ndebele ethnic group as inhabiting ancestral spirits and capable of rainmaking. They are normally used for shade and traditional ceremonies, and therefore have been considered sacred and were protected from any malpractices that threaten their survival. Ancestral spirits are believed to use such tree species to reach people. It is from the above findings and literature review that this study argues that beliefs in sacred trees have significantly contributed to management of biodiversity. Sacred attachment to flora species is varied within different ethnic groups, probably because of their socio-economic characteristics and perceived contribution of such species to their livelihood and spiritual beliefs.

Table 4: Respondents' views on the presence of sacred wild plants and their reason(s) for their sacredness. Sacred wild animals and reason(s) for their sacredness

Presence of sacred wild species	**Frequency (n = 240)**	**Percentage**
Yes	195	81.0
No	45	19.0
Total	**240**	**100**

Name of sacred tree species (n = 195)		
Mvumo (*Ficus inges, F. Scassellatii)*	124	53.0
Mnyasa (*Newtonia buchananii*)	11	5.0
Mdala (*Euclea divinorum*)	19	8.0
Mkuyu (*Ficus altissima*)	63	27.0
Any big tree	16	7.0
Reasons for sacred wild plants (n = 195)		
Harbors evil spirits and used for traditional practices	218	47.0
Medicinal plants	14	3.0
Improve soil fertility and conserve water	126	27.0
Provide wild fruits	21	5.0
Can lead to curse, sickness and death	82	18.0

The sanctity of wild animals is another aspect of the linkage between IKS and biodiversity conservation. Table 5 shows that most of the respondents (75.0%) agreed on the presence of sacred wild animals in their community, while 23.0% of the respondents said there were no sacred wild animals and 2.0% of the respondents said they did not know. *Mbega* (*Colubus angelensis*) is mentioned by most of the respondents (74.2%) as being sacred and 13.4% of the respondents mention *Gwalangwa* (millipede) being sacred (Table 4). Of the respondents, 7.4% claim that *Kunguru* (*Corvus albus, C. albicollis*) is a sacred animal while only 5.0% of the respondents mentioned *Dondoro* (*Cephalophus harveyi*) as a sacred wild animal. Despite *Dondoro* (*C. harveyi*) being mentioned as a sacred animal, the study and literature show that duikers are some of the most hunted wild animals for bush meat and can rarely be seen nowadays. Arguably, it is possible that the animals are mentioned as sacred either because they are illegally hunted inside the forests, a practice that has been restricted by the forest officers, or as a way of trying to hide activities as facts on the ground.

Most of the respondents (86.0%) express that wild animal species are neither destructive, harmless, nor consumable and those which contribute to people's livelihood strategies are normally considered sacred, and killing such animals has been perceived as a taboo, as such action goes against the God's reasons for creation and management and use of biodiversity. About 11.0% of the respondents say that they do not know why some wild animal species are perceived as sacred, though they believed killing such animals can lead to curse and/or death of an offender or a close relative, and only 3.0% of the respondents said that harmless animals such as *Galangwa* (millipede) were sacred.

Table 5: Respondents' views on the presence of sacred wild animal

Presence of sacred animal(s)	Frequency (n = 240)	Percentage
Yes	179	75.0
No	56	23.0
I don't know	5	2.0
Total	**240**	**100**
Name of sacred species (n = 179)		
Mbega (Colubus angelensis)	150	74.3
Gwalangwa (millepede)	27	13.4
Dondoro (Cephalophus harveyi)	10	5.0
Kunguru (*Corvus albus, C. albicollis*)	15	7.4
Reason(s) for sacredness (n = 179)		
Non-destructive and not consumable	187	86.0
Harmless	7	3.0
Killing can lead to curse and death	23	11.0

Mokuku and Mokuku (2004) contend that some animal species are perceived as being sacred as they have powers to cause certain awesome consequences for humans and communicate

with humans, once seen or encountered, suggesting the existence of complex interactions between physical and spiritual beings of indigenous people into other species. For example, an owl's call is believed to warn about or cause death in the family (Mokuku and Mokuku, 2004; Kweka, 2004). Mokuku and Mokuku (2004) also found that the pied-crows (*C. albus*) are believed to bring good luck, such as one may get money, and therefore favour their conservation. In summing up the discussion on sacred animals and management, and use of biodiversity, Mokuku and Mokuku (2004) put it that association of some organisms with fearsome consequences if destroyed and providence seen or encountered shrouds them with spiritual powers, sacredness and awe, creating a basis for their respect and therefore their conservation. Mapara (2009) also reported that in pre-colonial Shona society, taboos were used to discourage people from transgressing norms on totemic species, and there were several fines for the transgressor of those norms, resulting in conservation of the species of concern.

What needs to be done to revive the IKS for management and use of biodiversity

Results (Table 6) show that half of the respondents (51.0%) say that the youth must be formally taught on the significance of the IKS for management and use of biodiversity to ensure sustainability of the knowledge system, while 27.0% of the respondents proposed official recognition of and capacity building for the custodians of the knowledge system. Of the respondents, 7.0% said that integration of IKS into village bylaws will enhance and sustain a wide use application of the knowledge system, while 15.0% of the respondents express their ignorance of what should be done to revive the knowledge system.

Arguing on the lack of the official recognition of IKS, Kideghesho (2009) states that there is a minimal official recognition of this

knowledge system in conservation policies despite the government being a signatory of the CBD of 1992 which emphasized, among others, on the wide use an application and integration of the IKS. In lighting of the similar view, Mattee (2007) argues that policies in Tanzania are formulated through a centralized system of public interest resulting in failure of such policies: the process of policies formulation has ignored power relationships and roles among potential stakeholders making them being almost irrelevant and leading to conflicts among actors interested in management and use of biodiversity.

Table 6: Strategies to revive the indigenous knowledge system

A strategy	Frequency (n = 240)	Percentage
There should be more teaching on the significance of IKS	199	51.0
Official recognition and capacity building of IKS	105	27.0
Integration of IKS into village bylaws	30	7.0
I don't know	58	15.0

Respondents' views on the significance of the IKS/ biodiversity conservation methods on management and use of biodiversity

The respondents' views on the significance of the IKS and biodiversity conservation methods in their separation on management and use of biodiversity are shown in Table 7. Result show that most of the respondents (97.0%) express their view that the IKS alone cannot effectively conserve biodiversity, with only 3.0% of the respondents claiming that the knowledge system alone can effectively and sustainably conserve biodiversity.

Results also show that of the respondents who claim that the IKS cannot sustainably manage and use biodiversity, almost 80.3%

said that lack of legitimacy and power of IKS to deal with offenders of the system has limited its effectiveness on management and use of biodiversity, while 9.1% of the respondents said that labeling the IKS as out-dated has limited its effectiveness, and almost 6.6% of the respondents said that as not all areas are under the custodians of the IKS, its effectiveness on management and use of biodiversity is thus limited. Results further reveal that almost 2.6% of the respondents say that the knowledge system can effectively and sustainably manage and use biodiversity since the system is still respected by most people, while 1.4% of the respondents claim that the knowledge system alone cannot sustainably manage and use biodiversity, unless otherwise, poverty is dealt with. Poverty has compelled people to abuse their knowledge system just to make a living.

Arguing on the lack of legitimacy amongst the custodians of the IKS, Ylhäisi (2006) states that regardless of the significance of the *walukolo* on management and use of biodiversity through enforcing the IKS, their roles have increasingly been eclipsed by national legislation, government institutions and village administration, with most of the duties of the forestry officers being limited inside boundaries of the forest reserves, with the exception of some exported plant species such as *Mninga* and *Mvule*. Through key-informant interview, it was disclosed that limited budget and staff were the reasons why the forestry officers have limited effectiveness inside the forest reserves. In furtherance of the discussion on the exclusion of the indigenous people in the realm of biodiversity conservation, Ylhäisi (2006) further added that, despite the Tanzanian government being a signatory of the CBD of 1992 and the Forest Act of 2002 emphasizing active participation of the indigenous people, most forest officers still consider indigenous people as harmful to biodiversity, rather than potential partners in management and use of biodiversity. In light

of this, several studies have pointed out that both colonial and post-colonial government policies and regulations marginalized the IKS, triggering a struggle for legitimacy between the knowledge systems (Mutta, *et al.*, 2009, Kideghesho, 2009 and Ossai, 2010).

Results (Table 7) have shown that most of the respondents (97.5%) claimed that biodiversity conservation methods alone cannot effectively and sustainably conserve biodiversity, while only 2.5% of the respondents expressed that biodiversity conservation methods alone can effectively and sustainably conserve biodiversity. Results also indicate that half of the respondents (50.2%) claim that limited resources hampered the effectiveness of biodiversity conservation methods, while 24.3% of respondents mention lack of spiritual connectedness amongst forestry officers and other practitioners of sustainable management, which reduces their seriousness on management and use of the same. Of the respondents, 18.4% said that biodiversity conservation methods alone could not effectively conserve biodiversity in the absence of a complementary partner, the IKS, while only 7.1% of the respondents said that biodiversity conservation methods could not effectively conserve biodiversity as they are less known to most people.

Table 7: Respondent's views on the effectiveness of the IKS/ biodiversity conservation methods on management and use of biodiversity

Effectiveness of the indigenous knowledge system alone on conserve biodiversity	**Frequency (n = 240)**	**Percentage**
Yes	7	3.0
No	233	97.0
Total	**240**	**100**
Reasons for the effectiveness status of IKS (n = 240)		
IKS has no legitimacy and legal power to deal with offenders	220	80.3
Indigenous knowledge system is perceived as outdated	25	9.1
Not all areas are under indigenous knowledge system	18	6.6

People still respect IKS	7	2.6
Income poverty has to be dealt	4	1.4
Effectiveness of biodiversity methods alone on conservation of biodiversity		
Yes	6	2.5
No	234	97.5
Total	**240**	**100**
Reason for the effectiveness status of biodiversity conservation methods (n = 240)		
The government officials lack spiritual connectedness to biodiversity	65	24.3
The government has limited resources for meaningful conservation	134	50.2
Biodiversity conservation methods are less known	19	7.1
Indigenous knowledge system is an ignored complementing partner	49	18.4

Through a key-informant interview, it was reported that conservation initiatives of the forestry reserve were limited by funding and field forestry officers. For example, in the last financial year (2011–2012), the allocated funds were only 60.0% of the requested budget, with a shortage of seven field forestry officers needed for conservation of the South Nguru Montane Forest Reserve as per the Mkingu Nature Reserve Forest strategic plan. According to FBD (2005); Kideghesho (2009) limited budgets and inadequate workforces which have limited the capacity of most governments in enforcement of the biodiversity conservation methods. Similarly, Sabuni (1998) cited by Mbwambo (2000) and Burgess *et al.* (2007) also noted that insufficient funds limited effective management and use of biodiversity in the Eastern Arc Mountains Forests.

PEMA (2006) also found that poor enforcement of poorly understood government rules and regulations for the management and use of biodiversity has limited their effectiveness. Arguably, limited resources have hampered the capacity of the government

on the management and use of biodiversity. Moreover, through interviews, it was found that negligence of the spiritual aspects attached to biodiversity amongst the government officials has also limited the effectiveness of biodiversity conservation methods. Similarly, citing Gibson *et al.* (1999), Kweka (2004) also put it that a meaningful participation of primary beneficiaries could do much better for the management and use of biodiversity. It would address the problem of limited government staff for the enforcement of the rules and regulations, by increasing indigenous people's sense of ownership of the biodiversity to be conserved, enhance peoples' attitude towards conservation and the forestry staff and increase mutual trust between forestry staff, and the indigenous people.

For example, a study by Ylhäisi (2006) observed that in Simbomu and Vuchama Ngofi villages of Mwanga district, village by-laws were supporting protected indigenous forests, whilst the caretakers of the indigenous forests (*walukolo*, in the case of this study) are officially recognized and continue to protect their forests using their IKS. In cases where a caretaker of a certain sacred grove converted into either Christianity or Islam, the management of the sacred groves would become the responsibility of the respective village government (Ylhäisi, 2006). Moreover, village governments have been responsible for all cases of destruction of the protected indigenous forests instead of the care takers of these forests, who in most cases are elders, unable to meet the costs and all other bureaucracy associated with dealing with the offenders (ibid). Citing the Simbomu and Vuchama Ngofi examples of the integration of IKS and biodiversity conservation methods, Idd (2002) cited by Ylhäisi (2006) argues that such an integration of the knowledge systems was a very important strategy and a good example to the whole of Tanzania, as it resulted in recovery and improvement of the sacred groves in Simbomu village. This suggests that integration of IKS and biodiversity conservation methods would achieve

more on sustainable management and use of biodiversity than either in their separation.

In summing up the discussion of the effectiveness of the IKS and biodiversity conservation methods in their separation on sustainable management and use of biodiversity, Ylhäisi (2006) puts it that bylaws, laws and the IKS in their separation have less influence in preventing people from using forest land as most people prefer and follow the unwritten policies that enable them to survive, despite being aware of the fact that by doing so they are destroying their most important partner in their survival (Mvungi, 1998 cited by Ylhäisi, 2006). In furtherance of this view, citing Guyer and Richard (1996), Korhonen (2009) argued that the western idea of separating humans and nature is a strange idea in some cultures, yet perceiving indigenous people as having lived in harmony with biodiversity is also not true. This suggests that both the IKS and biodiversity conservation methods are perceived as not being effective in sustainable management and use, and thus it has been widely argued for their integration. Sadly, the IKS has been excluded from the management and use of biodiversity as it has been perceived as being primitive, barbaric and backward, just a few to name.

Conclusions

Biodiversity is a cornerstone for sustainable development, and the IKS has a great role to play in attainment of the same. It is from the findings and the literature the following conclusions are drawn by the study. First, in the South Nguru Mountain Forest Reserve, local people possess a wealth of IKS that determined humans-biodiversity. The knowledge system was interwoven into people's indigenous social structure and politics, whereas the social structure links humans, the land in which ancestors were

buried and the ancestral spirits, with the latter being believed to affect the lives of the people. The knowledge system included but not limited to sacred groves and places, globally known for their biodiversity richness and sacred species of both, flora and fauna.

The study also revealed that most of the indigenous people believed that all the living and the non-living things were the God/or gods' creation and deserved upmost respect, so they had to be used in a reciprocal relationship among themselves, whereas restrictions in forms of taboo, sacredness, totemic, just to list a few attached to favour their conservation. Sadly, despite the significance of the IKS on management and use of biodiversity being extensively documented, most of biodiversity conservations initiatives relied on the western view of conservation with written rules and regulations excluding the IKS. Conclusively, the integration of the IKS on its own ways of knowing and doing, and biodiversity conservation methods and for sustainable management and use of biodiversity is a cornerstone for the achievement of the same, as the knowledge systems are complementing each other on their weaknesses and strengths.

Recommendations

- To the government and non-governmental organizations, official recognition, motivation, capacity building and promotion of indigenous social structures from which IKS relevant for management and use of biodiversity gets evolved, enhanced and sustained is a corner for cherishment, sustainability and integration of IKS into biodiversity conservation methods for management and use of biodiversity. The IKS should be used based on its own ways of knowing, teaching and learning.
- Last but not least, an in-depth study on biodiversity richness and taxonomic diversity of the sacred groves and places in the

South Nguru Mountain Forest Reserve and elsewhere, by the government and biodiversity conservation practitioners, is of paramount importance as sacred groves and places are globally acknowledged for being the habitat of endangered and nearly extinct species of both flora and fauna.

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