



Convention on biological diversity and rural-urban connections with reference to Kenya



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ABSTRACT

In many biodiversity-rich countries, biodiversity which is a natural resource is known to power their green economy. This is because billions of people depend on it directly and indirectly. Today many countries are trying to implement the biodiversity Multilateral Environmental Agreements (MEAs) so as to build a robust biodiversity economy for sustainable development. One way in which this is being done is by setting up protected areas (PAs). Most of the PAs are being set up in rural areas away from the urban jungles and broadening the rural based economic development so that both rural and urban areas can become the key drivers for biodiversity conservation. The focus of this paper is on rural-urban connections with the Convention on Biological Diversity (CBD) MEA. The case studies are Lake Nakuru National Park which is located in an urban set up and the Arabuko Sokoke Forest which is in a rural set up. Data was collected from the sites of the two PAs. Purposive sampling was used to collect the data. The results were based on infrastructure and human resources and the challenges faced in the individual sites. SWOT analysis was used to show the potential of the CBD MEA so as to strengthen the rural-urban links in terms of biodiversity. Biodiversity can be better safeguarded through rural-urban linkages with institutional management, education and support for the biodiversity sector.

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INTRODUCTION

The value of biodiversity has been much appreciated since 1987 when the report of the World Commission on Environment and Development was released. People have begun to realize that they are part of the ecosystems in which they live and any changes in ecosystems, species or genes would also affect their livelihoods. Biodiversity is continuously maintaining the world's rural and urban population of over 7.6 billion people who depend on bio-resources for their livelihoods (Swiderska et al., 2008). For example approximately 1.6 billion people rely on forest resources, 150 million depend on wildlife for a living and over 200 million derive their daily livelihood from fishing [Millennium Ecosystem Assessment (MA), 2005].

However with the decline of both biodiversity and ecosystems, both the rich and the poor, urban and rural dwellers are going to suffer with the poor and rural dwellers bearing the brunt harder as they depend directly on biodiversity for their survival.

Urban areas house majority of the world's population together with man-made and natural ecosystems. In spite of this, many of them still contain native species of biodiversity and other conservation concern species at regional and global levels (Ives et al., 2016). These species are found in open green spaces including national parks and reserves. The open spaces in urban areas are a great blessing in terms of air quality, climate regulation, education, aesthetic values, tourism and connection with nature. Rural areas are the pillars of all types of biodiversity. They contain vast species of biodiversity which not only attracts rural and urban people through tourism but also feeds, provides medicines,

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water, fuel and shelter for the world's population. Most of the world's national parks and reserves are located in rural areas. The rural urban linkage is through environmental services of ecosystems and rural-urban boundaries. However the disconnection of the linkages is increasing. This is because to cater for the needs of the fast growing urban population, rural ecosystems are being degraded.

Africa's wealth is based on its rich biodiversity with most being concentrated in the rural areas. This biodiversity is the key pillar of the continent's economic and social successes through tourism, agriculture and raw materials for the manufacturing industry. This emerging scenario calls for innovative methods to make rural-urban linkages more effective and sustainable in the conservation of biodiversity resources.

Kenya is a biodiversity rich country with 35,000 known species of flora and fauna (Manek, 2001). The country contains five of the eight biodiversity hotspots in Africa namely a) the West Indian Ocean Islands, b) the coastal forests of eastern Africa which includes the Eastern Arc forests, c) the Guinean Forests of Africa such as the Kakamega Forest, d) the Eastern Afromontane ecosystems comprising of forests such as Mt. Kenya and Mt. Elgon and, e) the Horn of Africa rangelands including the Somali-Maasai region. All these ecosystems and species are under pressure from population growth, land use changes, climate change variability, tourism, agriculture, inadequate knowledge on environmental awareness and education, use of inappropriate technology and political factors (NEMA, 2011).

Since independence in 1963, Kenya has made tremendous efforts to sustain biodiversity by signing biodiversity conventions and setting up national parks and reserves. One of the remarkable conventions the country has signed is the Convention on Biological Diversity (CBD) (1992). This Convention deals with critical biodiversity issues which include sustainable use, equitable benefit sharing, and indigenous knowledge and biodiversity conservation through *in-situ* and *ex-situ* conservation. The country has also set up over 67 national parks and 150 community conservancies in both rural and urban areas with most being in the rural areas due to species abundance (Shah, 2016; Weru, 2016). Kenya is trying to meet the obligations of the CBD through institutional set ups so that the rural and urban biodiversity sites are maintained through rural-urban interdependence.

This paper focuses on maintaining rural-urban links through protected areas (PAs) under the CBD. The context of this paper is that many PAs which initially were part of rural areas are now incorporated under town and urban set ups thus posing challenges to planning and governance. The challenges facing both rural and urban ecosystems in terms of institutional capacity and threats to the sites are discussed. The paper uses the strengths,

weaknesses, opportunities and threats (SWOT) analysis to establish the potentials of rural-urban linkages in biodiversity protection. The paper also uses primary data collected from site managers and officials.

Defining biodiversity

Since 1985, diversity of life on Earth has been coined as "biological diversity". Biodiversity is defined as the variability among living organisms from all sources including, *inter alia*, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part and this includes diversity within species, between species and of ecosystems (United Nations Conference on Environment and Development [UNCED], 1992). The three distinctions of biodiversity are:

- 1) *Genetic diversity* which is the combination of different types of genes found within a population of a single species, and the pattern of variation found within different populations of the same species.
- 2) *Species diversity* which is the variety and abundance of different types of organisms which live in an area.
- 3). *Ecosystem diversity* which consists of the variety of habitats that occur within a region, or the mosaic of patches found within a landscape.

Worldwide, approximately 1.7 million species of plants, animals, fungi and microorganisms have been recorded (Wilson, 2000) while 3-100 million species are yet to be discovered (Godfray, 2002). Biodiversity is more than just the variation in composition and appearance of species as it includes the numbers in terms of individuals, population or even genes based on distribution and composition, behavior patterns as well as interactions between different components of biodiversity like plants and pollinator species like birds and bees.

Biodiversity and sustainable development

Biodiversity is a life insurance asset for all as it supports most functions for life's survival on Earth [United Nations (UN), 2002]. It contributes to sustainable development, regulates natural systems and provides enormous resources for sustaining life and welfare. Sustainable development is defined as "the development which caters for the present generation without jeopardizing the future generation" (Brundtland Commission, 1987). It is based on three pillars namely environmental, social and economic. The environmental pillar includes biodiversity, land, water and soils; social pillar consists of food security, health, gender, knowledge and skills; and economic pillar includes policies, finances, energy, markets and livelihoods.

In order to achieve the Sustainable Development Goals (SDGs) biodiversity is very important. The 6th CoP (Conference of Parties) of the CBD, also known as Rio +20 and held in 2002 recognized that if biodiversity was messed up, there would be no sustainable development. The use of biodiversity to achieve the SDGs has been well focused by the Water, Energy, Health, Agriculture and Biodiversity (WEHAB) framework developed during the World Summit on Sustainable Development in September 2002 in Johannesburg. The WEHAB framework considers biodiversity as the “*life insurance policy for life itself*” (McNeill and Shei, 2002).

Africa is home to many of the world's known biodiversity (UNEP-WCMC, 2016). It has more than 50,000 plants, over 1,000 mammals and 1,500 birds' species (Mittermeier et al., 1999; UNEP, 2013, 2016). East Africa has the highest numbers of endemic species including 55% of mammals, 49% of reptiles and 40% of amphibians in the continent [Global Biodiversity Forum (GBF), 2004]. In spite of this wealth, biodiversity is declining. For example in 2014, 6,419 animals and 3,148 plants in the continent were threatened with extinction as per the IUCN Red List [International Union for Conservation of Nature (IUCN), 2014].

The 21st Century has seen major negative changes in biodiversity and ecosystems whereby ecosystem services have decreased and biodiversity, declining. In many places, the rate of species extinction is estimated to be over 10,000 times high (Pimm and Raven, 2000). This has been the case because of unsustainable consumption and production patterns associated with population increase, land use changes like draining of wetlands, urbanization, unsustainable exploitation of natural resources like clearing rain forests for palm oil, invasive species, climate change and pollution (UN Environment, 2019). At the same time there are continuous debates on whether conservation and development can be integrated (Roe and Elliot, 2004). Many view that conservation should be restricted to rural areas as “islands of conservation” while development should be more urban based. Others are of the opinion that both can be integrated for better management (IUCN, 2003).

All this continues to lead to a paradigm shift in terms of conservation – most PAs are now in rural areas than in cities and towns. PAs are referred to as places which are natural reserves, national parks, protected landscapes and other forms of designated conservation areas including conservancies. Many African countries are trying to conserve their biodiversity through PAs and many including Seychelles have surpassed the terrestrial PAs target of 17% while others are working hard to achieve this (Dogley, 2011).

However with the predictions that the global population will exceed 9 billion by the Year 2050, the PAs in urban areas which are few, are now shrinking due to the impact

of urbanization. One of the best examples is of Kenya which has the Nairobi National Park in the heart of its capital city. This is the only PA in the world which is located in a capital city. It is only 117 km² in size (Owino et al., 2011), and still undergoing reduction due to infrastructural development in terms of road by-pass and the Standard Gauge Railway. It is also important to emphasize that many rural areas worldwide are also undergoing transformation. A unique example is the famous Maasai Mara ecosystem in Kenya where the Talek region in 2008 was just a small village but by 2013, it had developed into a small town. This is now a common problem for many African, Asian and Latin American rural areas which are now expanding as towns and bringing in challenges of planning and governance issues (South African Cities Network, 2014).

Such changes were visible in Europe during Industrial Revolution. A global predicament indicates that if such a revolution spread across the world, it would be a doomsday for the natural world and leading to the sixth extinction of species which will be 100 to 1000 times greater than before humanity (University of Joensuu et al., 2007). This biodiversity extinction fear due to the destructive practices of humans has brought in the need to use a precautionary approach for global policy intervention in form of biodiversity Multilateral Environmental Agreements (MEAs) (Shah, 2016). The focus of this paper is on rural-urban connections within the CBD MEA with specific case studies of the Arabuko Sokoke Forest, a rural based ecosystem in the Coastal area and compares it with Lake Nakuru National Park, an urban based CBD site in the Rift Valley. It looks at the institutional and individual capacities in both ecosystems under the CBD. The paper also shows the similarities and differences between the threats in the rural and urban set ups.

Biodiversity related Multilateral Environmental Agreements (MEAs) and Kenya

MEAs are divided into five clusters based on the UNEP framework of International Environmental Governance, namely a) atmosphere; b) chemicals and hazardous waste; c) land; d) seas; and e) biodiversity (UNEP, 2001). This paper is centered on the biodiversity cluster and in particular on the CBD MEA and was part of a larger research. Biodiversity MEAs have been in place since 1900 when the first biodiversity MEA, the London Convention for Protection of Wild Animals, Birds and Fish in Africa was ratified. This was followed by the Convention on the Preservation of Fauna and Flora in their Natural State in 1933. This Convention led to the achievement of setting up PAs (Harmon and Putney, 2003) which further gained momentum at the Bali World Parks Congress (WPC) in 1982 and the UN Conference

on Environment and Development in 1992. At the WPC it was unanimously agreed that 10% of the world's land should be under the *in-situ* PA status (Miller, 1984).

Kenya is a mega rich biodiversity country with unique habitats and 35,000 known animal, plant and microorganism species diversity [Ministry of Environment and Natural Resources (MENR), 2000], endemic species and ecosystems with ecological interconnections (Weru, 2016). The country's ecosystems range from terrestrial to aquatic and include fresh water and marine; forests, savannahs and arid and semi-arid lands (ASALs). Its fresh water ecosystems are amongst the unique in Africa with diverse biodiversity while its savannahs are a hub of Africa's jewel of migratory wildlife and include the lion (*Panthera leo*), elephants (*Loxodonta africana*), black rhino (*Dinecous bicopris*) and wildebeests (*Connochetes taurinus*).

In order to safeguard biodiversity, Kenya has signed global and regional biodiversity MEAs which include the (a) CBD, (b) Convention on International Trade in Endangered Species of Plants and Animals (CITES), (c) Convention on Conservation of Migratory Species of Wild Animals (CMS), (d) Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar Convention) and, (e) World Heritage Convention (WHC) amongst others.

At the national level, attempts are being made to domesticate the MEAs through a wide range of measures such as National Biodiversity Strategy Action Plans (NBSAPs), National Environmental Action Plans (NEAPs) and policy and legal frameworks. The country aims to improve its MEAs' implementation capacity and boost its national economic growth and eradicate poverty while at the same time contribute towards the global ecosystem integrity.

The Kenyan Government has taken good measures to implement various biodiversity MEAs at national level in line with the international obligations. Approximately 8% of its land and water are under biodiversity protection. All the 67 national parks and reserves in the country are under the CBD. However, despite Kenya's efforts towards protecting biodiversity, the country has been losing a lot it.

The aim of the CBD is to protect valued ecosystems of the world which have critical natural heritage. The Convention has been one of the most remarkable and to-date 196 State Parties are members. The Convention has adopted the ecosystem approach as a strategy for the integrated management of land, water and living resources for promoting conservation rather than focusing on a single species.

Kenya signed the CBD on 11th June 1992 and ratified it on 26th July 1994. The MEA focal (national) institution in the country for the CBD is the MENR and its site offices are managed by the lead agencies namely Kenya Wildlife Service (KWS) and Kenya Forest Service (KFS).

Rural-urban linkages

The concept of rural-urban linkages is broad and embraces diverse systems of interconnections. However, population movements have dominated scholarly writings on rural-urban linkages. Other types of linkages connected to rural-urban issues in biodiversity conservation include; agricultural activities, water systems, infrastructural developments such as roads, railways, airways, housing (urban sprawl due to demand for shelter); flow of goods and services as driven by trade and commercial policies; institutional policies that influence diffusion of ideas, knowledge and education, and cultural norms and practices, telephone and mobile services including emails and other ICT technology and diffusion of diseases and wildlife movements. Only a few of these examples are used to illustrate their impact on rural-urban linkages.

Wildlife are migratory species moving from different set ups including rural and urban. For them, there is no rural-urban interface boundary. It is man who has been at the forefront to put these boundaries and continues to change as most areas are becoming peri-urban. Kenya's Vision 2030 has shown the importance of managing its natural resources like water, wildlife and forests as they play an essential role in sustaining all life. Any disturbances to the ecological set up of natural resources can result in environmental degradation, extinction of species and hamper the health of both ecosystems and its population including humans. This degradation is unsustainable and calls for the set up of biodiversity policies, legal frameworks and MEA focal institutions to safeguard the PAs. In spite the fact that Kenya has many biodiversity-related policies and legislations; its biodiversity is declining with 325 species of flora and fauna facing vulnerability (Weru, 2016). Research by Norton-Griffiths (1998) shows that from 1977 to 1998, Kenya lost 44% of its wildlife while Western et al. (2009) indicates that from the 1970s to 2008 the country's biodiversity was at 41% decline. Statistics of large mammal population like the elephant shows a decline from 167,000 to 24,000 between 1973 and 1999 (Thouless et al., 2008) and that of the black rhino reduced from 20,000 to 350 between 1970 and 1986 due to poaching and habitat destruction (KWS, 2012). For the well being of the current and future generations, biodiversity and ecosystems in both urban and rural areas must be safeguarded.

Coincidentally, areas of species richness and habitat diversity are mainly found in rural areas and these are the country's conservation hotspots. Examples include Maasai Mara, Lake Naivasha and Mt. Kenya which continue to lose their biodiversity. In comparison, Lake Naivasha is more of a peri-urban area and with increasing urbanization, its biodiversity is declining. Research carried out by various scholars like Shah (2016), Ogutu et al. (2011) and Kiringe and Okello (2007)



Figure 1. The administrative characteristics of Arabuko Sokoke Forest.
 Source: ASFMP (2002).

have indicated that in rural areas biodiversity loss is contributed by habitat loss, farmland expansion and poaching amongst others while in urban set ups, biodiversity loss is mainly contributed to infrastructural development and urbanization. Research carried out by Ogutu et al. (2011) in the Maasai Mara National Reserve (MMNR) indicate that species like the giraffe (*Giraffa camelopardalis*) have declined from 27,000 to less than 500 between 1975 and 2010; the ostrich (*Struthio camelus massaicus*) from over 1,000 to slightly more than 200 and the African elephant from 15,000 in 1976 to less than 800 animals in 2010. According to Bolger et al. (2008), the wildebeests (*Connochetes taurinus*)

population in the MMNR had declined by 81%.

Study areas

Arabuko Sokoke Forest–A rural protected area

Arabuko Sokoke Forest is the largest remaining coastal forest block in the Eastern African region with an area of 416 km². It is located between the Kilifi and Malindi Counties at approximate of 3°20' South and 39°50' East (ASFMP, 2002) as shown in Figure 1. This site was selected based on rural set up and its close proximity to

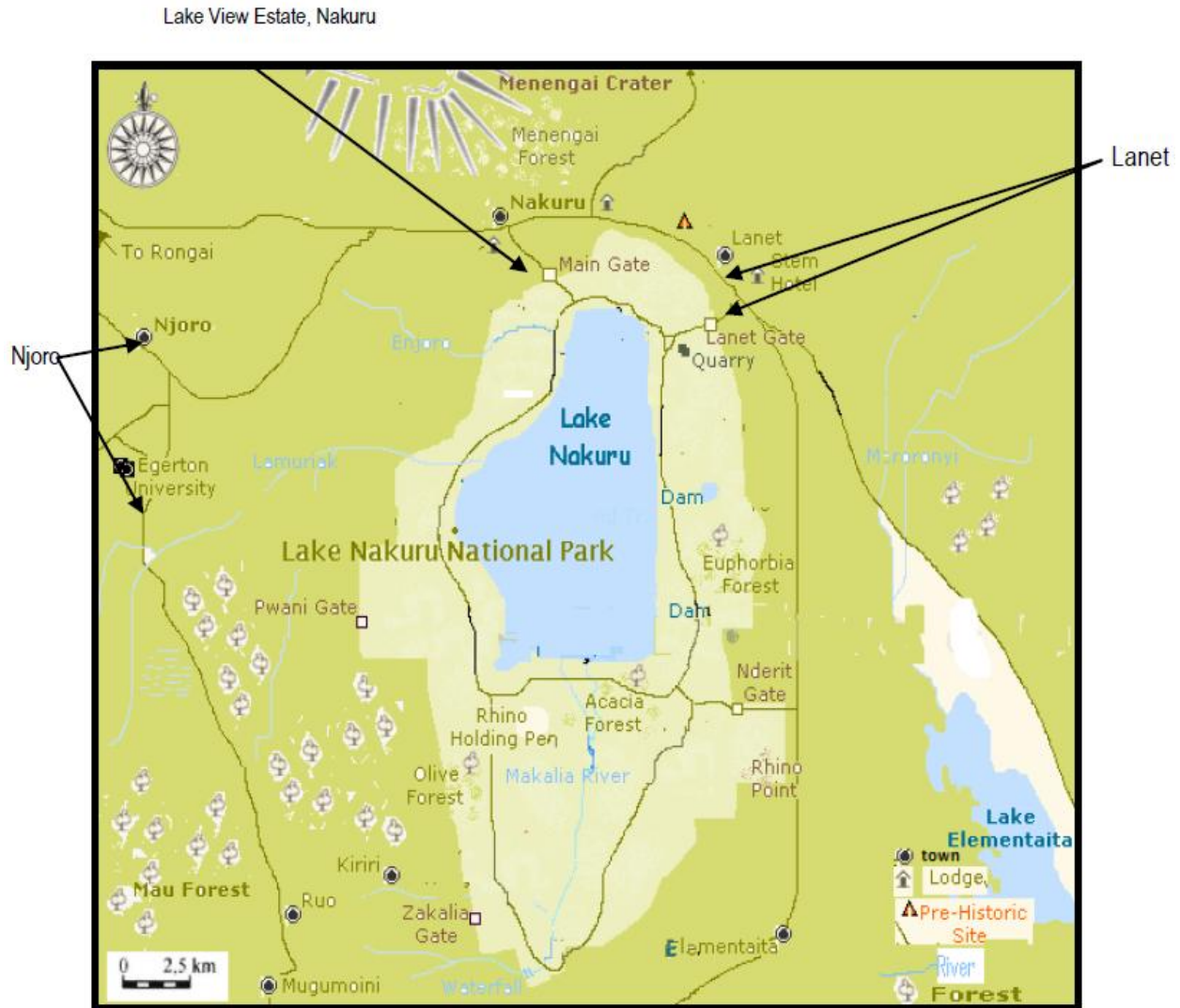


Figure 2. Lake Nakuru National Park and the study sites.
Source: Shah (2016).

local communities and the wide stakeholder involvement from both the state and non state actors. In 1999 its population was 100,000 [Kenya National Bureau of Statistics (KNBS), 1999] while in 2009 it increased to 160,000 (KNBS, 2009).

The forest gazetted as a forest reserve in 1943 is part of World Biodiversity Hotspot 8, namely the Coastal Forests of Eastern Africa. It has three vegetation zones namely mixed forest, *Brachystegia* forest and *Cynometra* forest. Arabuko Sokoke has over 600 plants species, 270 birds and close to 52 mammal species [KFS and Gede Community Forest Association (GCFA), 2011]. The forest is ranked as the second most important forest for conservation of threatened bird species in the African mainland and includes the Sokoke Scops Owl (*Otus*

irenae), Ripley and Amani Sunbird (*Anthreptes pallidigaster*) (ASFMP, 2002).

Lake Nakuru National Park – An urban protected area

Lake Nakuru is a shallow alkaline and saline endorheic (closed basin) lake in the eastern part of Nakuru County in the Rift Valley region. It is part of Lake Nakuru National Park whose size is 188 km². The park lies between the latitudes 0°17' and 0°30' South and longitudes 36°2' and 36°9' East as indicated in Figure 2. The park was selected as a CBD site because it is located south of Nakuru, a major urban town with high population growth. In 1999 the town's population was 239,000 (KNBS, 1999)

while in 2009 it was 286,411 (KNBS, 2009).

The park comprises of Euphorbia and Acacia forests. It is dominated by savannah wildlife which has fifty (50) different types of mammals including lions, the black rhino and over 450 birds' species including the Greater Flamingo (*Phoenicopterus ruberroseus*) and the Lesser Flamingo (*Phoenicopterus minor*). The park was the first fenced park in the country and declared as a national park in 1957 (Kassilly et al., 2008).

METHODOLOGY

In terms of research design, the study used both quantitative and qualitative approaches. Quantitative approach involved the collection of numeric data to get phenomena results of interest using bar graphs and percentages. Qualitative approach was used to collect extensive narrative (non-numeric) data in order to get insights into the phenomena of interests like threats to the study areas and included open-ended questions so that respondents could express their own views.

Primary data was collected through the use of standard questionnaires which were administered to MEA site officials in both the study sites. At Arabuko Sokoke there were ten site officials while at Lake Nakuru there were twelve site officials available on the day of data collection. All were selected as part of the study under purposive sampling which was used for specific target population. Furthermore the site managers of the study sites were selected using purposive sampling as they were one each in each study site. Purposive selection for each site was done because these were specialists in their areas. For example, at Arabuko, the officials were foresters who had experience in the forest sector while at Lake Nakuru the officials were wildlife experts. Moreover data from the site officials was collected on the site infrastructure and human resources.

The data collected was both primary and secondary. Primary data was obtained from staff working in KWS and KFS through standard questionnaires. The secondary data was obtained from the relevant MEA secretariats, UNEP and UNESCO, their respective websites and UNEP publications. Journal articles were also used to check on the successes and failures of the two sites. The main aim of the data collection was to identify the challenges faced in the individual sites. The focus was on institutional capacity of each site as influenced by planning and governance as well as community involvement.

Data analysis was based on the SWOT methodology which was extremely useful in identifying potentials of each site. The basic aim was to show the strengths of rural-urban linkages in terms of biodiversity. It was further analyzed through the use of percentages and ranking system. The analysis is further guided by the SDGs role

between biodiversity and human well being as shown in Table 1. Each SDG shows direct or indirect link with biodiversity for the well-being of the humans.

Furthermore, rural-urban linkages are analyzed by examining the management of resources such as water, wildlife and forests as they play a key role in sustainable development. The two sites namely, Arabuko Sokoke Forest and Lake Nakuru National Park were selected because they are unique ecosystems with natural heritage features and Arabuko Forest is a rural set up while Lake Nakuru is an urban set up. Therefore, it is important to establish the strengths of the focal institutions in both urban and rural set ups so as to see the effectiveness in terms of the rural-urban linkages in conservation.

RESULTS AND DISCUSSIONS

In terms of the lead agencies managing the sites, Arabuko Forest is being managed by the KFS while Lake Nakuru is being managed the KWS. This is similar to Tanzania where national parks are being managed by Tanzania National Parks Authority (TANAPA) and forests by Tanzania Forest Service. When education levels were measured, it was found that the highest education qualification for the site managers was first degrees. This is good as it shows be it urban or rural set ups, conservation obligations in terms of staff qualifications are high. In terms of expertise, the KFS site of Arabuko Forest is being managed by a forester while Lake Nakuru is being manned by a resident scientist/researcher. This is also in line with the MEA focal institution – MENR's employment policy whereby the operational manager is either an expert in forests if the site is a forest reserve or a wildlife specialist if the site is a wildlife zone. Kenya is really trying to have experts for all PAs in spite of the fact that it is difficult to get experts in biodiversity. Research carried out by Turpie and de Wet (2008) and Vass et al. (2009) in South Africa indicated a shortage of staff in terms of biodiversity expertise.

However while the biodiversity sector has been undermined by skills shortage, the staff hired are very competent. Kenya has been trying to balance the rural-urban links of its PAs by ensuring that its entire staff are professionally trained and involved in continuous training. According to the site managers, all professional staff undergoes two to three trainings annually. Unlike research carried out by Githonga and Nyambegera (2015) which indicated that mainly it is the staff based at the KWS headquarters in Nairobi (urban set up) that get most trainings and venture into research, this study found that the site managers of the two case study areas namely Arabuko Forest and Lake Nakuru indicated that their staff undergo two to three trainings annually and are even involved in research. Furthermore, most of the

Table 1. Role of SDGs in biodiversity conservation and human well-being.

SDGs	Biodiversity and human well being
Goal 1 – No poverty	Use of agriculture, livestock, wildlife and clean water
Goal 2 – Zero hunger	
Goal 3 – Good health and well being	Good diet, medicines and clean water supply
Goal 4 – Quality education	Protection of biodiversity and in turn well-being of humans
Goal 5 – Gender equality	Role of men and women towards biodiversity conservation and education for all (equal rights)
Goal 6 – Clean water and sanitation	Clean and adequate water provided through conservation of forests and rivers
Goal 7 – Affordable and clean energy	Protection of biodiversity through use of renewable energy which also protects human health
Goal 8 – Decent work and economic growth	Use of biodiversity through conservation e.g. tourism and blue economy
Goal 9 – Industry, innovation and infrastructure	Use of natural resources including bio-resources for industrial growth and innovation e.g. through blue economy
Goal 10 – Reduce inequalities	Jobs for all through biodiversity protection and agriculture
Goal 11 – Sustainable cities and communities	Protection of biodiversity and well-being of communities through provision of clean water etc.
Goal 12 – Responsible consumption and production	Wise use of natural resources including bio-resources
Goal 13 – Climate action	Smart adaptations e.g. renewable energy leading to conservation of forests
Goal 14 – Life below water	
Goal 15 – Life on land	Protection of biodiversity which is also part of food security, jobs and poverty reduction
Goal 16 – Peace, justice and strong institutions	With reduction in human-wildlife conflicts, biodiversity is conserved and humans are at peace. Good institutional command in conservation e.g. IUCN, WWF
Goal 17 – Partnerships for the goals	Government, communities, international bodies, private stakeholders, NGOs

Source: Shah and Ayiamba (2019)

trainings take place within the PAs. For example the trainings of the Horse Unit where horses are trained to go to hilly areas so that data on threats and other challenges can be obtained are carried out in areas like Longonot and Tsavo National Parks. To add to this, the KWS Law Enforcement Academy which provides paramilitary training to rangers from other countries like Somalia and South Sudan so as to combat poaching is in the rural setting of the Tsavo West National Park in Manyani (KWS, 2013). Also, there is evidence to show that research takes place in both urban and rural settings especially where there are transboundary resources. For example, in 2012 the KWS research scientists in the Maasai Mara ecosystem undertook Bovine tuberculosis epidemiological study in non-human primates with the assistance from the German Research Foundation (KWS, 2013). In the same year, KWS researchers undertook research on the record breaking depth of Lake Nakuru which had reached 6.1 metres (KWS, 2013). However, there are still loopholes in research and training and improvement is required as indicated in Shah's (2016) research which showed that it was not possible for all PAs especially in rural set ups like Lake Bogoria to have their staff trained annually and there were hardly

any researches being conducted due to lack of funds.

In both the sites, the MEA site managers had been working for a period of between 1 to 5 years. This is explained by the fact that many staff had reached the retirement age in the last five years and new ones were being recruited. This is good as it can lead to the employment of youth whose numbers are the highest in the country. This is also proved by studies undertaken by Githonga and Nyambegera (2015) and Mboya and Ngugi (2013). According to Mboya and Ngugi (2013) findings, 25.6% of the staff had been working for less than 5 years; 48.7% had worked between 6 to 10 years and 25.7% had worked for more than 10 years while Githonga and Nyambegera's (2015) study showed that 36% of the staff had worked for less than 5 years, 34% from 6 to 10 years and 30% had worked for over 10 years.

Although most of the research shows a balance in terms of the rural-urban linkages, the number of staff employed shows a gap in the linkage. In Arabuko Forest the KFS has employed a total of 13 (43.3%) staff that includes foresters, scientists and education officers. In Lake Nakuru, a total of 17 (56.7%) staff including scientists, researchers and education officers have been employed by the KWS. This is shown in Figure 3. This

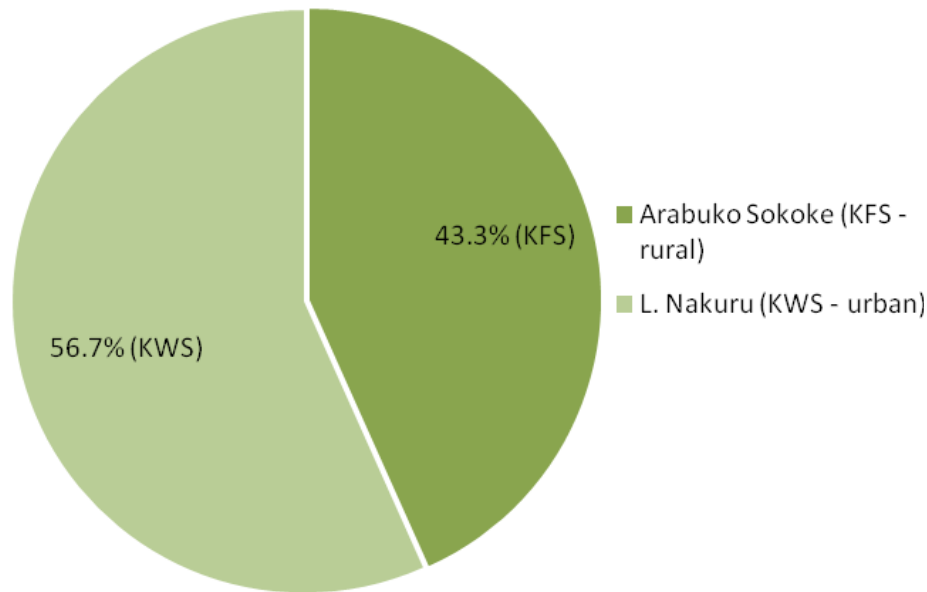


Figure 3. Employment status at the CBD sites. **Source:** Shah (2016).

indicates that still in the minds of institutions, rural set ups are small and need less staff unlike its urban counterpart in spite of the vast size difference. Arabuko Forest is more than double the size of Lake Nakuru National Park but still has less than 50% staff in comparison to the lake ecosystem. However this also varies based on the lead agency in-charge of the PA.

Both the sites namely Arabuko Forest and Lake Nakuru have an annual budget allotment of Ksh1.5 million per annum each for the implementation of the CBD. These sites have two funding bodies namely, nongovernmental organizations (NGOs) and the Government of Kenya (GoK). For Arabuko Forest (rural site), most funding was from NGOs namely the Peregrine Fund, National Museum of Kenya, Arocha Kenya, Friends of Arabuko Sokoke Forest, Nature Kenya and Birdlife International. The Government funding was from the research institutes namely, Kenya Marine and Fisheries Research Institute, Kenya Forest Research Institute and the lead MEA agencies namely, KWS and KFS. For Lake Nakuru funding was from the NGO of World Wide Fund (WWF) and from the government it was from the lead MEA institution namely, MENR and the lead agency of KWS. However, the amount of funding is not sufficient to carry out activities in both the sites including hiring of competent staff, training and facilitation of rural-urban links through activities like ecotourism and education. The funding clearly indicates that both the GoK and the NGOs do not see whether these are rural or urban based PAs but the stakeholders look at the importance in terms of habitat, endangered and threatened species; endemic species, benefits to communities and their natural

heritage.

The institutional capacity for the urban site of Lake Nakuru indicated that its Information Communication and Technology (ICT) capacity in terms of computers was 15 (55.6%) in comparison to Arabuko Forest (rural site) which had 12 (44.4%). This is shown in Figure 4. In terms of vehicles Lake Nakuru had 8 while Arabuko had 7. For both the sites the computers were mostly donated by the NGOs while some of the vehicles were also donated by NGOs and others were bought from funding under the GoK.

In terms of the computers and vehicles, it may look that the urban site of Lake Nakuru is more favoured than Arabuko as the former has more of these institutional capacities. However this is not the case. In terms of vehicle capacity it is very important to see the access to the site especially for poachers and endangered species like rhinos which are found in Lake Nakuru. For computers, it depends whether the site has education centres and their capacity. For example, the KWS has the largest education centre in the country at Lake Nakuru which it collaborates with the Wildlife Clubs of Kenya to create awareness and provide education on biodiversity and the status of the lake.

The vehicle and ICT capacity was found to be very important as both the sites house migratory species. Arabuko is a home to migratory birds including the Spotted Ground Thrush and the East Coast Akalat; migratory butterflies and mammals including elephants, antelopes and baboons. Most of the antelopes and elephants are known to be moving within the coastal forests only but there are cases where the Arabuko

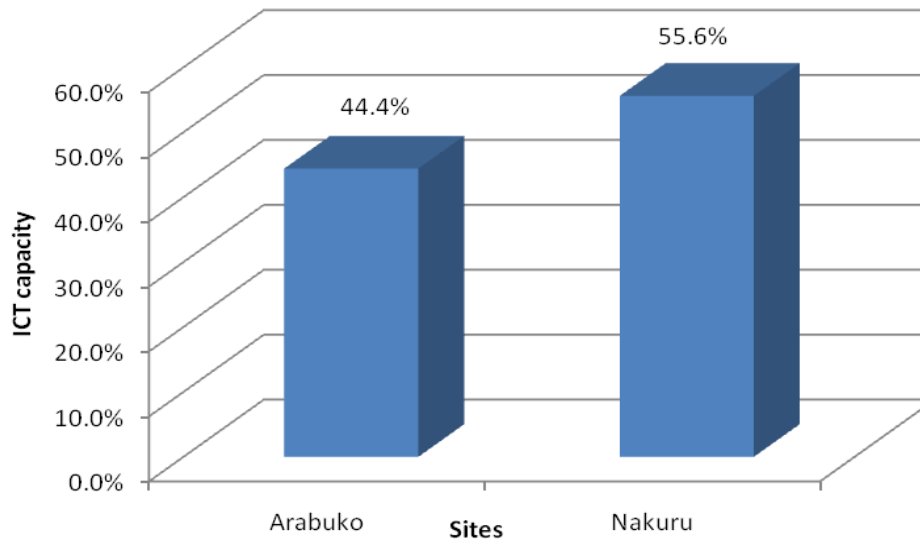


Figure 4. ICT capacity in the CBD sites.
Source: Shah (2016)

Table 2. Threats to the sites.

Arabuko Forest (rural)	Rank	Lake Nakuru (urban)	Rank
Poaching	1	Illegal harvesting of wood	1
Illegal harvesting of wood	2	Water pollution	2
Bush meat	3	Hostile communities	3
Climate change	4	Fire	4
Invasive species	5	Invasive species	5
		Climate change	6
		Poaching	7

Source: Shah (2016).

elephants have been migrating as far as the Shimba Hills. In comparison, Lake Nakuru is an island ecosystem and is fenced all round so the chances of in and out migration are limited except for small mammals and migratory birds like flamingos. Species like antelopes are known to be migrating to and from Elementaita and Naivasha and the baboons keep on moving from the park to Nakuru town in search of food. This migration is good for the maintenance of ecosystems and their habitats and tourism. The good vehicle and ICT capacity helps in preventing human-wildlife conflicts, maintaining the rural-urban wildlife corridors and in combating poaching. This is also well articulated in the management plans for both the sites. The Arabuko Forest has a management plan from 2002 to 2027 (ASFMP, 2002), while Lake Nakuru has a management plan from 2012 to 2022 (LNMP, 2012).

The threats to these sites were also listed and ranked in terms of the highest to the lowest. This is shown in

Table 2 which indicates that the threats are high in Lake Nakuru (urban set up) compared to Arabuko (rural). The threats undermine the sustainability of biodiversity and their contribution to the country's sustainable development.

The threats listed by the MEA site office of Arabuko are 5 while those of Lake Nakuru are 7. Threats to urban PAs are usually high due to competition for land (Shah and Irandu, 2015). In both the sites, illegal harvesting of wood is a high threat because the demand for wood is high as wood is used for various purposes including fuel wood and furniture making (Kiringe and Okello, 2007; Shah, 2016). This is similar to the research carried out by Ajonina et al. (2009) along the coastlines of Senegal, Madagascar, Guinea and Sierra Leone and Rufiji Delta in Tanzania (Burgess et al., 2014). Furthermore, in both the sites, illegal loggers are mainly from the neighbourhood and are well known by the local communities.

Other common threats in both the sites are climate

Table 3. SWOT analysis for the CBD and strengthening of rural-urban linkages.

Strengths	Weaknesses
<ul style="list-style-type: none"> ➤ Management plans ➤ Involvement of local communities ➤ Wildlife resources and wetlands to promote rural-urban linkages ➤ Institutional capacity in terms of ICT and vehicles ➤ Biodiversity experts in MEA sites 	<ul style="list-style-type: none"> ➤ Lack of sufficient funds ➤ Lack of sufficient man power ➤ Insufficient research and training
<p>Opportunities</p> <ul style="list-style-type: none"> ➤ Developing links between urban and rural PAs ➤ Increasing awareness and education on PAs and MEAs ➤ Declining greenery in towns and urban areas which encourages people to visit the rural and urban PAs 	<p>Threats</p> <ul style="list-style-type: none"> ➤ Illegal harvesting of wood ➤ Climate change ➤ Fire ➤ Hostile communities ➤ Water pollution ➤ Poaching ➤ Bush meat ➤ Invasive species

Source: Shah and Ayiemba (2019)

change, invasive species and poaching. The threats in these two sites are similar to the threats found in all PAs of Kenya (Kiringe and Okello, 2007). Furthermore in most PAs climate change is becoming a real threat as species are moving from their ranges with the climate shift (Foden et al., 2007). While poaching is the topmost threat in Arabuko, it is the lowest threat in Nakuru. This can be explained by the fact that there is a lot of poverty around Arabuko so the communities illegally carry out poaching for survival. In comparison Lake Nakuru is a total fenced island ecosystem with high level security to combat poaching especially of rhinos since the park is a rhino sanctuary. Similarly pollution is seen to be the second highest threat in Lake Nakuru while in Arabuko it is not a threat. This is because Lake Nakuru is within the vicinity of an urban area and polluted water from homes and factories enters the lake (Gichuki et al., 2005). This is similar to other fresh water lakes like Victoria which experience water pollution due to close proximity to urban centres (Darwall et al., 2011).

The threats are a risk to biodiversity and are a big hindrance to the country's sustainable development. For example if the rhino population reduces in Lake Nakuru, it would not only have an impact on the food chains but also reduce tourism on which Kenya highly depends. With the continuing threats, it would become very difficult for the country to achieve the Aichi Targets and also its Vision 2030. This is why the country is very keen to implement the NBSAP it developed in 2002.

Finally, the SWOT analysis was used to determine the potential of the CBD to strengthen rural-urban linkages. This is shown in Table 3. From Table 3, it is apparent that management plans, involvement of communities in safeguarding PAs, wildlife and wetlands are some of the major strengths of the rural and urban MEA sites in order

to increase rural-urban linkages. Lack of sufficient funds, human resources, insufficient research and training for staff are major weaknesses towards improvement of rural-urban linkages. In terms of opportunities the CBD has many PAs in both rural and urban areas thus the potential to develop urban-rural links. Furthermore, the PAs in both urban and rural areas enable the CBD to create increasing awareness and education on the protected status and these PAs encourage both local and international communities to visit them especially in urban areas as they are unique islands in the middle of urban jungles. The common threats to the CBD sites in terms of rural-urban linkages are illegal harvesting of wood, water pollution, climate change and invasive species.

CONCLUSION AND RECOMMENDATION

In order to make the CBD strong in terms of rural-urban linkages, some strategies need to be adopted. These include better collaboration between urban-rural PAs especially where migratory corridors are involved, the promotion of education and awareness on the PAs, increasing human and financial resources and having policies which are backed by scientific evidence. Due to the nature of linkage, effective partnership between the two areas and stakeholders is the key. Therefore there is need for local communities, NGOs, institutions and the GoK to work closely in order to develop a robust and sustainable PA rural-urban linkage so as to conserve and sustain the existing biodiversity and its habitats.

A serious effort should be made by all stakeholders to conserve biodiversity so that the rural-urban links can be made stronger. This is very important especially in Kenya as it is a mega rich biodiversity country and the natural

heritage should be preserved as much as possible as this heritage is irreplaceable. There is an urgent need to sustain this biodiversity because if it becomes extinct, it can never be replaced.

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