

UNIVERSITY OF NAIROBI
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**BENEFITS OF FOREST BIODIVERSITY: COMMUNITIES' PERSPECTIVES IN
WITU MPEKETONI AND AWER**

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DECLARATION

I, the undersigned, declare that this is my original work and has not been submitted for any award in any university

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DEDICATION

This Thesis is dedicated to my husband Oliver Wambua, my late dad, Mr. Trevor Daniel Mwachiro my mother, Joyce Mwachiro and my brother, Andrew Penda.

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List of abbreviations

CFA	Community Forest Associations
EU	European Union
FGDs	Focus Group Discussion
ICRAF	International Centre for Research in Agroforestry
KES	Kenya Shillings
KFS	Kenya Forest Service
KI	Key Informants Interview
KWS	Kenya Wildlife Service
LAPSSET	Lamu Port South Sudan Ethiopia Transport
LCG	Lamu County Government
MEA	Millennium Ecosystem Assessment
NEMA	National Environmental Management Authority
NRT	Northern Rangeland Trust
NTFP	Non Timber Forest Product
PFM	Participatory Forest Management
UN	United Nations
WCMA	Water Conservation Management Act
WWF	World Wildlife Fund

ABSTRACT

Globally, biodiversity is under threat due to an increasing population over the years leading to an increased demand on goods such as fuel, timber and medicine. Involvement of people living in the vicinity of such ecosystems in conservation becomes integral in ensuring that these resources are not only well utilized, but also properly managed. Sustenance of individuals' livelihoods is important as well. To elicit attitudes and perceptions of local residents regarding how they benefit from biodiversity, household interviews, literature review, Focus Group Discussions (FGDs) and Key Informant Interviews (KIs) were carried out in Lamu County focusing on provisioning and cultural ecosystem services. The objectives of the study were to establish from these communities the values that they attach to land, how they benefit from biodiversity and threats and opportunities of biodiversity to enhanced livelihoods. Results indicate that these three communities are unwilling to sell, lease, donate or relocate if given an opportunity to. This is true as when asked for opportunities and threats, these communities identified farm related ones. The three areas also exhibited similarities in their sources of food. They also had similarities in the type of energy used for cooking as they mainly rely on wood fuel. Differences however lay in lighting energy.

Differences can also be observed in type of construction material used for roofing in the three communities. The study also revealed that traditional medicine is used by all the three communities albeit at different degrees.

The study also revealed that biodiversity contributes to cultural services although in the three areas, some cultural practices have faded away with time. Access to the natural resources is a threat that was identified and land conflict although collective action, involvement in nature conservation, sale of NTFPs and participation in the development of a community action plan were seen as opportunities.

The study recommends further studies to be conducted for the people in Awer as over time there has been a complete shift in their lifestyle as this study established that the people there in practice farming. The current information about them is outdated and not in line with the current situation yet interventions in this area should be in line with the true picture on the ground.

CHAPTER ONE: INTRODUCTION

1.1 Background of the study

Many African societies are well endowed with a wide array of natural resources (Natural capital) that include forests and vegetation, water, wildlife and soils. This is called biodiversity. These have been utilized at different levels as a way of boosting such capital as social, human and financial capital as well as address the issue of poverty in the region. The challenge however is that there has been little or no control over how these resources are utilized resulting in the ecosystem being overwhelmed to degrees where their capacities to produce goods and services have dropped significantly thus negatively impacting the human wellbeing (UNEP 2011).

Biodiversity is a general term that includes all natural aspects, the variety of life on earth that includes land, lakes, rivers and forests; the wildlife and landscapes and the beautiful and bountiful marine areas. There are varied definitions that have been advanced by various people on what biodiversity is. The Convention on Biological Diversity in 1992 came up with a blanket definition of biodiversity 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; this includes diversity within species, between species and of ecosystems”.

The importance of biodiversity to the existence of human beings cannot be over emphasized. This is due to its great value. Its value lies in such things as food, medicine, building and construction materials as well as spiritual purposes and for worship. For instance, at the Kenyan Coast the Mijikenda have shrines that they refer to as *Kayas*, for observance of cultural traditions or rites and aesthetic services. Elements like carbon, oxygen and nitrogen require aspects of biodiversity for their recycling, which helps in regulating the climate, soil fertility, and the prevention of outbreaks and diseases from pests. Forests, as part of biodiversity in areas that have pollution are responsible for mitigating these as well as combating soil erosion and protecting water sheds.

Due to the above, biodiversity offers multiple opportunities for development and improving the welfare of human beings. It is the basis on which essential environmental services upon which life on earth depends. Thus, its conservation and sustainable use are of critical importance. Less

obvious, but just as important, are the services that allow natural and human-altered ecosystems (such as agricultural and urban landscapes) to function properly. –Some level of biodiversity of which the exact amount is at this stage unknown – is a necessary condition for the delivery of ecosystem services, but it is especially important for maintaining functional ecosystems (Millennium Ecosystem Assessment, 2005)

Even with the benefits that biodiversity presents, human beings continue to destroy the same. The biodiversity has mainly been affected by destruction of the natural habitats with activities such as burning or felling of old indigenous trees and forests, excessive hunting of wild animals like elephants and rhinos, as well as pollution majorly from industrial emissions causing acid rains (NEMA, 2011).

It is estimated that Kenya's biodiversity contains at least 315 mammal, 1,133 avifauna, 191 reptile, 88 amphibians, 872 fish, 25,000 invertebrate, 21,575 insect, 2,000 fungi and bacteria, and 7,000 plant species (NEMA, 2011). The rich biodiversity is primarily attributable to favorable climatic conditions. Kenya's biodiversity provides for food, herbal medicine, housing materials, wood fuel as well as spiritual nourishment and support economic activities in the agriculture, energy and tourism sectors. Further, the ecosystem diversity provides a series of services such as water and air purification, soil erosion control, flood and storm mitigation, groundwater recharge and climate regulation (NEMA, 2011).

Proudly, Kenya is home to five hot spots that are of global important in relation to biodiversity and 61 Important Bird Areas (IBAs). These unique and biodiversity-rich regions include the Indian Ocean Islands of Lamu and Kisite; the coastal forests of Arabuko-Sokoke and the lower Tana River delta (NEMA, 2011).

Kenya's biodiversity is highly threatened by such activities as destruction of plant and animal habitat, human-wildlife conflicts, and introduction of alien species that dominate over the indigenous species and overwhelm the indigenous species in the race for essentials like water, food and light. Other issues include pollution, and overpopulation in a given area resulting to a

shift in the natural environment like alteration of wildlife corridors as well as overexploitation of the natural resources therein (Matiku, 2002). Destruction of natural landscapes, soil erosion and water pollution are additional examples. This situation has been exacerbated by the lack of a comprehensive biodiversity policy as well as weak and compromised enforcement of existing laws and regulations.

1.1.1 The Coastal forests

As coastal populations in Africa continue to grow, and pressures on the environment from land-based and marine human activities increase, coastal and marine living resources and their habitats are being lost or damaged in ways that are diminishing biodiversity and thus decreasing livelihood opportunities and aggravating poverty. Degradation has become increasingly acute within the last 50 years (Crossland et al., 2005). Arresting further losses of coastal and marine resources, and building on opportunities to manage the resources that remain in a sustainable way, become of paramount importance. The main causes of this degradation, apart from natural disasters, are poverty and the pressures of economic development at local to global scales. The ecosystem is being greatly threatened as human beings pursue making economic gains, albeit short term. Communities therein become vulnerable to the vagaries of the ecosystem. An example is the observable decline in marine life at the coast which has an impact on the food security for the coastal population. Another key concern is the modification of river flows to the coast by damming and irrigation, and pollution from land, marine and atmospheric sources (Crossland et al., 2005). The capacity of most coastal nations to utilize their coastal and marine assets, while simultaneously protecting them from degradation, is lacking.

Kenya's coastal forests are part of what is considered a biodiversity hotspot which extends from Somalia to Mozambique (Conservation International, 2008). Kenya's coastal forests are considered to harbour at least 105 globally Threatened Species (North Coast Conservation, 2013). They consist of mangrove forests of the salt-water coasts, the forests of the mountain systems and the lowland forest patches. The coastal forests of Kenya cover Lamu to the North, Malindi and Kilifi in the middle and Kwale in the south including Mombasa City (Matiku, 2002). Mangrove forests are an example of endangered species at the Coast. Aside from providing nurseries for varied fish species, they provide wood for construction of houses, boats

and provide energy and are instrumental in pollution filtering. They are also breeding ground for sea grass and corals and are a good resource for making charcoal. Because of their value, they are overharvested and cleared to pave way for other activities such as farming. Degraded mangrove forested areas can take many decades to recover if left to natural restoration (North Coast Conservation, 2013).

The coastal forests are vital to our country. The forests are located at the center of the county's tourism industry, which is a major contributor to the country's economy; they are important water catchment areas for the rivers and streams on which the local communities at the Coast rely upon; and they are hubs for a wide variety of globally threatened flora and fauna (NEMA, 2011). The Coastal forests in Kenya also provide a platform for economic activities that provide food that is consumed locally and internationally. A number of livelihood activities can be found along the Coast. These include fishing both within and away from the mangrove areas, agriculture, tourism, harvesting of medicinal plants, salt production, harvesting of mangroves and wildlife harvesting for animals such as the Dikdik that are used as game meat by the local communities. The products that are extracted from the coastal forests include, wood for fuel and poles for building houses, timber, logs for carving, water, pasture for livestock, herbs for medicine, butterflies and honey. With such benefits, it is inevitable that the coastal forests are threatened with such issues as uncontrolled cutting of forest produce, overgrazing and charcoal burning, due to increased human population and activities; poverty, unregulated use, insufficient local and national institutional capacities, policy gaps and weaknesses and lack of alternative means of livelihood among others (Matiku, 2002).

1.2: Problem statement

Human beings greatly rely directly or indirectly on the ecosystem for their livelihood. According to Claude Martin Director General of WWF International, the livelihood of the poorest 1.2 Billion people on earth depends on wild resources. According to The Millennium Ecosystem Assessment (2005), over the past 50 years, humans have changed ecosystems more rapidly and extensively than in any comparable period of time in human history, largely to meet rapidly growing demands for food, fresh water, timber, fiber, and fuel. This has resulted in a substantial and largely irreversible loss in the diversity of life on Earth. It further reports that the

changes that have been made to ecosystems have contributed to substantial net gains in human well-being and economic development, but these gains have been achieved at growing costs in the form of the degradation of many ecosystem services, increased risks of nonlinear changes, and the exacerbation of poverty for some groups of people.

According to a proposal generated by ICRAF, the extent to which the forests have been affected by the communities living within these areas at the Kenyan Coast is undocumented. Land tenure which is a perpetual problem in Kenya, is worse at the Coast leading to human populations being displaced from their ancestral land and inhabiting prohibited land such as forests as is the case with the Awer (formerly known as Boni), who are found in the area of Awer, an indigenous community living at the Kenyan Coast who largely depend on the forest for their livelihood (Nunow A.A, 2012). In the newly settled areas, parcels of land are cleared causing localized fuel wood shortages as well as soil exposure and erosion. Export of timber from indigenous tree species for the construction and furniture industries within and outside the reserves continues to exert pressure on the forest resources.

Further, at the Kenyan Coast, specifically Lamu County, there is no documented information about the views of communities living in the vicinity of the forests on their take on what value they attach to land including the benefits that they derive from it, the opportunities available to them as well as the threats to the opportunities of biodiversity and where they have, disseminated results are not accessible to the general audience leading to inadequate or limited information that can enable relevant bodies like civil society organizations and government to generate appropriate policies and informed decisions and plans. The study therefore aimed to find out and document the perspectives of the communities living in Witu and Awer towards the natural resources; how they benefit and utilize land and the possible threats to these benefits.

1.3 Research questions

1. What value do the Witu, Mpeketoni and Awer communities attach to land?
2. How do the Witu, Mpeketoni and Awer communities benefit from biodiversity using an ecosystem perspective?

3. What opportunities are available from biodiversity to enhance Witu, Mpeketoni and Awer community members' livelihoods?
4. What are the communities' perspectives of the threats to the benefits of biodiversity?

1.4: Study objectives

General objective

The overall objective of the study was to gain an understanding on how communities gain from biodiversity.

Specific objectives are:

1. To find out from the community what value they attach to land
2. To establish from the community how they benefit from biodiversity
3. Identify from the communities opportunities of biodiversity to their livelihoods
4. Establish the communities' perspective on the threats to the benefits that they derive from biodiversity

1.5: Justification of the study

Land as a natural resource and a holder of biodiversity plays an integral role in the continued existence of ecosystems. Whether or not these ecosystems continue to exist is greatly dependent on human activity on the land and more importantly whether those activities done on the land help in the sustenance of the ecosystems. Whether or not these ecosystems thrive largely depends on the activities carried out by human beings, which is influenced by whether or not they appreciate the benefits that nature provides. This study was important as it helped determine the value that these communities attach to land as well as identified from them, the benefits that they derive from it as well as what opportunities land presents to them and their livelihood. Threats that hinder the benefits from being attained were also established. This will contribute towards informed decision making for the relevant stakeholders when addressing environmental issues.

Environmental sustainability is millennium development goal number seven. This study was about environmental sustainability through sound management of biodiversity thus a major contributor towards achieving this goal.

1.6: Scope and limitation of the study

This study was carried out in three regions in Lamu County; Witu, Mpeketoni and Awer. The study looked into the views of the communities living in and within the vicinity of these forest areas, mainly to establish from them the following:

What value they attach to land- the term ‘value’ has many meanings, for this study, the meaning of value was adapted from (Brown, 1984) who equates value to preference and defines it as “the setting by an individual of one thing before or above another thing because of a notion of betterness.” According to Brown, the preference value concept involves three realms namely the conceptual (basis of preference), relational (act of preference) and object realm (the result of preference). In this study, the value was equated to preference which was determined by establishing from the community members whether they own land and finding out what activities they preferred to carry out on the land they own; specifically the research looked at agricultural activities such as farming and bee keeping. The study also found out from the communities the degree to which they attach their land by posing certain value statements across. Whether land is a source of conflict was also be established as well as the mitigating factors to these conflicts.

The benefits that the communities derive from land/nature; this was assessed under two main ecosystem service categories; provisioning and cultural. The provisioning service was established by looking at foods, fruits, oils and sugars that are derived from nature and drawn from the respondents whether they source these from their own farm, from nature or from the shop so as to determine their extent of reliance on nature. Aside from food under the provisioning services, medicines for common ailments, construction material and sources of energy for lighting and cooking were also established. The cultural service looked at the role of nature in beauty and aesthetics as well as religious rituals.

Opportunities from biodiversity available to enhance community members’ livelihoods looked at collective action and conservation of nature as well as sale of Non-Timber Forest Products (NTFPs) like honey, medicine, fruits and vegetables.

Threats to benefits of biodiversity looked at land tenure and land related conflicts as hindrances to enjoy the benefits from nature and also looked at whether the communities have difficulties sourcing for provisioning services like food, medicine, construction materials and energy.

The study was limited to community members and institutions/ organizations that address environmental issues.

1.7: Definition of key terms

To avoid any conceptual misunderstanding, this section aims at defining some terms that will be used in this study.

Livelihood

Ellis (2000) in (Sunderlin, Belcher, & Wunder, 2005) defines livelihood as that which comprises: “... the assets (natural, physical, human, financial, and social capital), the activities, and the access to these (mediated by institutional and social relations) that together determine the living gained by the individual or household.’ The adoption of this definition is because it stresses the process rather than the result.

Sustainability

The term above is in relation to the environment. It is integrating development while conserving the environment as according to (Freeman, 2015).

Ecosystem

This is a biological community that lives within an area combined with the physical and chemical factors of the non-living things, otherwise known as abiotic components. Examples of ecosystems include forests or water bodies like a pond or river. It is a “dynamic complex of plant, animal and micro-organism communities and their non-living environment interacting as a functional unit” (Millennium Ecosystem Assessment, 2005).

Daily and Elrich 1995 in (Naeem et al., 1999) implore on human beings to keep in mind that biodiversity benefits enjoyed by human beings are conveyed through ecosystems, which are populations of species confined in specific physical settings in living communities.

There is a great interplay between ecosystems and biodiversity in that ecosystem provide for the services that human beings greatly rely upon while biodiversity provides for an environment for these ecosystems to thrive (Proenc, Pereira, & Lisboa, 2011).

Ecosystem services

(Thompson, 2011) defines ecosystem services as the contributions, both goods and services that they make to the well-being of people and includes such goods as food and freshwater, and services like reduction of floods and carbon sequestration. Ecosystems are sometimes referred to as natural capital as they contribute to production of goods and services the same way that human, financial and manufactured capital produce other goods and services. They are involved in certain goods as food, medicine and ritual material and services like formation, retention, and sustaining soil fertility (Díaz, Fargione, Chapin, & Tilman, 2006). Ecosystem services are context dependent; that is, the same ecosystem function can produce an ecosystem service that is highly valued by one society or stakeholder group but not highly valued by other societies or groups. Ecosystem services are many and varied. (Naeem et al., 1999) summarized Holdren JP and PR Ehrlich's *Human Population and the global environment* listing of ecosystem services as:

- Purification of air and water, mitigation of droughts and floods.
- Generation and preservation of soils and renewal of their fertility
- Detoxification and decomposition of wastes
- Pollination of crops and natural vegetation
- Dispersal of seeds
- Cycling and movement of nutrients
- Control of the vast majority of potential agricultural pests
- Maintenance of biodiversity
- Protection of coastal shores from erosion by waves
- Protection from the sun's harmful ultraviolet rays
- Partial stabilization of climate

- Moderation of weather extremes and their impacts
- Provision of aesthetic beauty and intellectual stimulation that lift the human spirit.

The above are general ecosystem services. In classifying the ecosystem goods and services, an approach that was taken is the ecosystem service approach. This approach was widely made known the Millennium Ecosystem Assessment (MA), a body that was formed in 2000 by the then UN Secretary- General, Kofi Annan to “assess the consequences of ecosystem change for human well-being and the scientific basis for action needed to enhance the conservation and sustainable use of those systems and their contribution to human well-being”. The Millennium Assessment has clustered ecosystem services into four service aspects; provisioning, cultural, supporting and regulating services. Provisioning and cultural services are well known as they are direct ecosystem services; provisioning services are those obtained from the environment and involves creation of renewable resources such as food, water, raw materials, and medicine (Cardinale et al., 2012); cultural services are non- material such as spiritual benefits and recreation; tourism and leisure sites, and natural heritage sites. (Egoh et al., 2012) refer to cultural services as use of the natural environment to not only perform rituals and worship of the spirits but also for learning. Supporting services include functions such as soil formation, nutrient cycling and primary production (NEP, 2013) while regulating services are the indirect benefits derived from regulation of ecological services such as regulating climate and prevention of soil erosion (Proenca and Pereira 2011). In their research, a key finding by the MA was that 60% of the ecosystem services are either degraded or unsustainably utilized (Young Haines, Potschin Roy, 2009).

CHAPTER TWO: LITERATURE REVIEW AND THEORITICAL FRAMEWORK

2.1 Introduction

This chapter highlights literature on the benefits of forests biodiversity, the threats to the benefits as well as opportunities of forest biodiversity to their livelihoods using an ecosystem services approach. It will also look at literature on land and what communities do with it as well as the values they attach to it.

2.2 Value communities attach to land

When Kenya gained her independence in 1963, it inherited a largely unequal land distribution pattern that saw the colonialists acquire the more arable land that was referred to as the highlands. Since then Kenya has been in the process of reviewing land laws, planning, tackling the squatter and landlessness issues among other issues (Abongo, 2015).

Land is valued as it can be used for different purposes and people prefer land for the different roles it can play on an individual or in a community. Aside from the main function of land which can be used for agriculture, land can act as a source of security, for status affirmation, others hold land for speculation with the hope that it will appreciate with time then sell it off. Land can be bought then later subdivided into smaller pieces then sold fetching more income from it while it can also be used for the development of other projects. A study done in Ethiopia to establish farmer's perceptions towards value for land showed that the farmers not only considered the physical properties of land such as water retention and soil fertility but they also considered the social and cultural issues such as the history of the land and how it had been managed in the past (Brown, 1984).

Value of land in Lamu County portends an interesting perspective given the land dynamics experienced at the Coast. Land has been a contentious issue and the people at the Coast continue to deal with issues of land reclamation, land tenure and land ownership, many of whom live on land without title deeds. The Awer for instance have for a long time been known to be hunters and gatherers literally living in the forest and have perpetually used their land for gathering herbs, wild fruits as well as honey (Rahel, 2011). Like other traditional communities, the Awer have used their indigenous knowledge to preserve their forest as they largely depend on the natural resources for economic and cultural reasons. The Witu area also faces challenges with

land tenure, based on the cosmopolitan nature of the area as it has different communities represented, use of land and value for it portends an interesting outlook that the study hopes to establish.

2.3 Benefits of biodiversity; an Ecosystem service perspective

There has been significant change on the environment now than any time in history in the last 50 years due to an increased demand in food, fuel, timber, fresh water and fibre (MA 2005). This is because the well-being of human beings is closely related to biodiversity. Biodiversity provides a platform for ecosystem services that human health and well-being rely on. This therefore means that loss of biodiversity translates to a decline in some components of human health and their well-being. Naeem et al (1999), postulates that there is no way that human beings can exist away from biodiversity regardless of class as everybody is in need of food, fuel, clean water, a stable environment among other things. They state that natural ecosystems provide essential services vital to life such as air and water purification, decomposition and detoxification, soil fertility regulation among others where agricultural and pharmaceutical products are generated from. The absence of these services would mean the societies would not progress. Further, these services are significant to life and quite many thus very easy to be taken for granted and difficult to fathom that they can be depleted by human beings. There is a relationship between human health and nature or biodiversity; some credible studies have shown that exposure to microbial diversity helps in reducing certain allergic and respiratory diseases (Sandifer et.al.,2015).

In a bid to appreciate the different roles that biodiversity and ecosystem services provide, different people have documented these goods and services as below:

2.3.1 Provisioning services

Provisioning services are crucial and have a direct bearing on basic services thus when they are affected, so are the basic goods and services. For instance, disasters like floods and floods affect access to food, forest material and clean water (Proenc et al., 2011).

More than 99% of the total worldwide human food supply is produced on land, whereas only 0.6% comes from oceans and other aquatic ecosystems FAO 1991 in (Pimentel et al., 1997). So crucial are the forests for provisioning that it is estimated that a staggering \$90 billion per year in food and in related products are harvested from forests which are consumed by

about 300 million people in developing countries Pimentel 1997a in (Pimentel et al., 1997). Many African countries depend on plants and forests to derive medicine as a result of limited access to hospitals and medical facilities. (Naeem et al., 1999) draws on the work of (Farnsworth et al. 1985) who relays that a significant population of about 80% depends on traditional medical systems while about 85% of traditional medicines are extracts from plants and that of the United States' top 150 prescription drugs, 118 are from natural sources of plants, fungi, bacteria and snake species. Mander, 1998 in (Shackleton, Shackleton, Buiten, & Bird, 2007) indicate that in South Africa, there are 27 million consumers of traditional plant medicine presenting a vibrant multi-million industry. FAO 2002 in (Egoh et al., 2012) report that in Cameroon, medicinal plants export is a major foreign exchange earner gaining 2.9 million dollars annually. These are generated from the forests in addition to other related uses as self-medication, collection by herbalists, and small-scale traders (Mander, 1998 and Dold and Cocks, 2002) in (Shackleton et al., 2007).

In their quantitative survey of 14 villages in the savannah biome, Shackleton and Shackleton (2004a) observed that 85% or more households mostly used wild spinach, fuel wood, wooden utensils, grass hand-brushes, edible fruits and twig hand-brushes. Further, above 50% of the surveyed households made use of edible insects, wood for construction, bush meat, wild honey and reeds for weaving (Shackleton et al., 2007).

(Sunderlin et al., 2005) state that hunters and gatherers use the forest predominantly for food, for those that use the forest as a source of new agricultural land and other economic activities (swidden cultivation), then they use the forest land as agricultural land that uses the forest ecosystem for maintenance of the soil fertility in a rotational manner while those that exclusively practice agriculture at the forest frontier convert the forest land to new agricultural land and delink from the forest fallow systems. They add that the forests are depended upon for timber and non-timber forest products which are sold for cash income. This is alluded to by (Sunderlin et al., 2005) on timber hence, "timber is by far the most valuable commercial commodity in most forests". Such is the case that for example FAO, 2001 reported that in 1998, international forest exports of timber from developing countries was valued at \$10.4 billion (Sunderlin et al., 2005).

(Ros-tonen & Wiersum, 2003) have compiled a number of studies for different forest populations and categorized forest conditions and people's dependence on forest resources into three;

- Relatively undisturbed forest areas, where hunting, gathering and fishing are still substantial sources of livelihood for forest-dwelling people- study done in Guyana, Honduras and NW Amazonia
- Areas where natural forests have been partly replaced with anthropogenic vegetation types and where people make a living from a mix of forest-based and agricultural economic activities-studies done in Cameroon, Indonesia and Phillipines
- Forest areas of either type where the rural-urban interface and links with outside markets predominate people's livelihood strategies-study done in Bolivia

The studies established that in Guyana in the hunting and gathering community, there were more commercialization options like palm heart, wildlife, the aerial roots of several hemi-epiphytes (trees that grow on other trees) which in turn avail raw materials for the furniture industry, fibres for hammocks, baskets and tourist souvenirs, medicinal plants, palm leaves for roof thatching, and mangrove bark commonly used for tanning leather. The main commercial forest products in NW Amazonia are large catfish and ornamental fish to a small degree. In Cameroon, there is trade for bush meat and wood to some extent. In Cameroon and Guyana alike, the small scale trade is targeted for the local market translating to a limited opportunity for increasing the community's income. While it is appreciated that this compilation has similar characterizations to the study areas, the boundaries between the first two categorizations are often indistinct. It may not be uncommon to find hunting and gathering communities practicing some form of agriculture for instance.

(Nasi, Taber, & Vliet, 2011) zero in on bush meat as a provisioning service. They relay that bush meat, in a number of African societies is the cheapest source of protein in a number of poor urban households and draw in the works of Fargeot 2010, van Vliet et al. who state that "bush meat is cheaper than many other alternative sources of protein". It is important as it is used not only for a family's subsistence needs but also to supplement the monies that they get on a daily basis.

Plants and trees are collected for other activities such as house construction, fencing and making ornaments. Baskets made of palms in Namibia is a major income generating activity among women (Egoh et al., 2012). The Kenyan coastal forests are used for pole collection, used to collect edible plant and honey, mining and building touristic hotels (Matiku Paul, 2002). Indeed pole collection is has been prevalent at the Kenyan Coast “...*the rampant development of hotels and other infrastructure along the Kenya Coast threaten the very basis for conserving the resident biodiversity*” (NEMA and UNDP 2009). A study that was done in Benin to establish people’s perceptions on biodiversity in protected areas revealed that 99% of the respondents used the park for food while 93% used it for medicinal plants (Vodouhê, Coulibaly, Adégbidi, & Sinsin, 2010).

The Kenyan coastal forests are rich in minerals. At the Coast, Silica sand has been mined at Arabuko Sokoke forest. Salt works in such places as Gongoni have been linked to be responsible for the destruction of mangroves. Wood curving has generated wealth and employment and in the early 2000, it was estimated to generate for the country USD 20-25 million annually in revenues (Matiku 2002). In South Africa, about 28% of the gross income of rural livelihoods is drawn from forest products (Shackleton et al., 2007). Another major forest product widely utilized is fuel wood as observed by Williams and Shackleton, 2002 in (Shackleton et al., 2007), that more than 80% of rural households still utilize wood fuel as their main energy source.

2.3.2 Cultural service

“The cultural and spiritual benefits afforded by forests to rural communities are clear, but little studied... culture has different meanings and interpretations, and is frequently difficult to define or describe in tangible or monetary terms”(Shackleton et al., 2007).

Majority of human beings love nature and this is manifested through art, religions, and traditions of diverse cultures. Other people are interested in nature related activities like gardening and pet-keeping, nature photography and film-making, bird feeding and watching, hiking and camping, eco-touring and mountaineering, river-rafting and boating, fishing and hunting, and in a wide range of other activities (Naeem et al., 1999). Culturally, trees provide abstract benefits like spiritual, recreational, aesthetic/artistic, inspirational and for education (Leeuw J et.al 2014).

Many African communities designate some land or river bank sections for performing rituals and traditional activities like circumcision (Egoh et al., 2012). Cocks et al., 2012 in (Egoh et al., 2012) indicate the role of the sacred places across Africa- that they significantly contribute to the physical, mental and spiritual well-being of the local communities along being instrumental to their sense of cultural identity. Traditionally, the coastal people like the Mijikenda used the forests to set up sacred places known as *Kayas*, where they performed spiritual sanctification rituals and ceremonies. These sites are important for biodiversity conservation and certain plant species can only be found here (Githitho & Forest, 1998).

In Arabuko Sokoke, some households benefited from forest guiding of tourists as well as beekeeping and butterfly farming. In 2001, the community earned USD 37,000 from these activities (Matiku 2002). (Ceballos-Lascurain, 1996) in (Manu, Isaac Kuuder, 2012) defines ecotourism as “tourism that involves travelling to relatively undisturbed natural areas with the specific objective of studying, admiring and enjoying the scenery and its wild plants and animals, as well as any existing cultural aspects (both past and present) found in these areas. Ecotourism implies a scientific, aesthetic or philosophical approach, although the ‘ecotourist’ is not required to be a professional scientist, artist or philosopher. The main point is that the person who practices ecotourism has the opportunity of immersing him or herself in nature in a way that most people cannot enjoy in their routine, urban existence. This person will eventually acquire a consciousness and knowledge of the natural environment, together with its cultural aspects, that will convert him into somebody keenly involved in conservation issues”. A study done in Ghana therefore established that people’s livelihoods had improved as a result of eco-tourism; that ecotourism is a tool for poverty reduction (Manu, Isaac Kuuder, 2012). Podgett and Begley 1996 in (Pimentel et al., 1997) show that in Costa Rica, ecotourism generates \$500 million per year. Individuals and groups can generate income from tourism through entry fees, the sale of handmade items such as crafts, baskets and mats, accommodation, food sales, or local transportation (Egoh et al., 2012).

Bush meat also has some cultural connotations in it. It is part of the process of some rites and rituals in some African communities like in Gabon, during circumcision (Angoué et al.2000, van Vliet and Nasi 2008) in (Nasi et al., 2011) while Kümpel 2006a indicates that some type of bush

meat in Equatorial Guinea is thought to have healing and supernatural attributes, while others are forbidden for consumption (Nasi et al., 2011).

2.3.3 Supporting services

This service is important although not explicitly manifest as it does not directly benefit people but is “part of the often complex mechanisms and processes that generate them”(Young Haines, Potschin Roy, 2009). Trees are used for such supportive ecosystem services as enhancing soil fertility, availing an environment for photosynthesis, retaining soil moisture, water cycling and sustaining biodiversity. It also includes such services as production of oxygen through photosynthesis, nutrient cycling and habitat provisioning (Proenc et al., 2011). This is better explained by Pimentel et al. 1995 who state that combined snail, earthworm and other organisms aid in nutrient redistribution, soil aeration as well as support in top soil formation and increase water infiltration rates leading to plant productivity (Pimentel et al., 1997).

Supporting services boost health and nutrition through increased food production as well as production of other provisioning services; it also remotely contributes to increased income through the sale of provisioning, regulating and cultural services (Leeuw Jan, Njenga Mary, 2014).

(Egoh et al., 2012) aptly brings out the supporting ecosystem role in Africa; the rural population in Africa rely on subsistence farming for such crops as maize, rice, and millet for their livelihoods, while using minimal inputs. As a result, they rely on soil fertility, water supply and regulation, erosion prevention, and pest control ecosystem services for productivity. Soil fertility, which is obtained via soil and organic matter build up is assuredly one of the most critical supporting ecosystem services in Africa. Cultivation practices are dependent on irrigation; therefore rainfall capture and storage are necessary.

The stability of climate and natural ecosystems is a critical ecosystem service as it helps in weather moderation. Morning transpiration for instance leads to afternoon thunderstorms thus inhibiting loss of moisture and increases surface temperature. Forests help in temperature moderation through shade provision and surface cooling; they also act as insulators through wind blocking and warmth trapping hence act as a local greenhouse agent (Naeem et al., 1999). (Leeuw Jan, Njenga Mary, 2014) bring in an interesting dimension of the supporting role that

tree species support- that through a larger option of food and medicine, then there is increased healthier people thus more productivity. There are also more options for different occupations and enhanced value chains and where there is breeding, then there are better tree species that are less prone to disease and pest attack.

Seed Dispersal: Plants move from one site to another through seed dispersal- majority are wind dispersed like dandelion, others by water like the seafaring coconut, others are buried by other animals while others attach themselves on passing animals using their sticky or sharp tentacles to attach themselves to the passing animal until they detach themselves at a given destination or are wiped off. Therefore, animals acting as seed dispersers ensure successful reproduction (Naeem et al., 1999).

2.4 Regulating services

According to Leeuw et al (2014) the regulating services of forests and dry land trees include such things as improving soil temperatures, soil moisture and recharge of ground water, reduction of raindrop velocity and momentum thereby reducing water runoff as well as flood control resulting in improved soil temperatures and moisture. They argue that trees in the dry lands lessen dust movement leading to a reduction in respiratory illnesses. This is alluded to by (Egoh et al., 2012) who states that forests improve air quality leading to a reduction in air borne diseases. There are tree species that are responsible for nitrogen fixing that sequester carbon resulting in regulation of the micro and macro-climate of the ecosystem (Leeuw et.al., 2014). Through sequestration of carbon dioxide, global warming is reduced (Pimentel et al., 1997).

“Trees also protect land from erosion hence making it available for other uses such as settlement and agriculture” (Leeuw Jan, Njenga Mary, 2014). The existence of plants and plant litter prevent destruction as a result of raindrops to the soil and hold it in place. Further, existence of deep rooted vegetation supports in transmitting ground water into the atmosphere; consequently, no plant cover leads to soil run off, nutrient and soil loss. On the other hand, wetlands are very instrumental in flood control and mitigate the need for flood control structure construction. Floodplain forests slow down flood waters and let deposits of sediments that would have otherwise have been washed away (Naeem et al., 1999).

Sunderlin et al., (2005) have identified other benefits which may not necessarily fall in the Ecosystem services categories as below:

Provision of employment: ILO 2001 reported 47 million employees in both formal and informal forestry sector with 17.4 Million employees being from the formal sector. What is unknown though is its contribution to poverty alleviation.

Local multiplier effects: due to the trade of timber, other spill over effects include increased food, goods and services demand from the logging workforce; making of a logging road that opens remote forest dwellers' access to markets and improves possibilities for delivery of health services and education to them; and compensation to the community by the logging company for access to forest resources.

2.5 Threats to benefits of biodiversity

Communities, as earlier indicated benefit from biodiversity in such aspects as food, fuel and medicine some of which are not easily accessible, for example hard wood. Challenges that come with these however include a limited market for these products due to infrastructure challenges hence limited access. Further, destruction of these natural resources leads to reduced availability of Non-timber Forest Products (NTFPs) and in the case of logging there are conflicts with the logging companies as well as forest destruction leading to a reduction in the access of these goods (Sunderlin et al., 2005).

According to Brechin et al.,2002, restriction and displacement can result in impoverishment as it has a direct effect on people's livelihoods yet it is one of the great impacts of protected areas. An example is the Kenyan Masai nomads that were restricted from moving into certain selected areas with an aim of warding off poachers. The nomad's livelihoods were affected. (Agrawal and Redford, 2009) aptly summarize this as thus "while some argue for the increase in the size of protected areas and the rigor with which they are protected, these measures would likely result in even higher rates of displacement."

Habitat loss is a direct result of increased human activity like deforestation, overexploitation of natural resources and pollution (Laurila-Pant, Lehtikoinen, Uusitalo, & Venesjärvi, 2015). Similarly, (Sandifer et al., 2015) contend that loss of biodiversity is now a daily occurrence as a

result of population growth, climate change, and rampant development. Such losses directly impact on people's livelihood as they are not able to access what they previously could and if they do they only access to limited extents. For example, road effects on biodiversity include the habitat transformation occurring as a result of their construction, fragmentation, increased mortality through road kill incidences, barriers to movement, conduits of exotic plant species invasion (Forman & Alexander, 1998), chemical pollution by vehicles, modification of animal behaviour (Trombulak & Frissell 2000) to list a few. According to Theobald 2003, their presence and utilisation pose a serious threat to biodiversity. Furthermore, the effects of roads on biodiversity extend for some distance away from the actual road itself and the width of this road effect zone depends on the nature and utilisation of that road (Reyers et al., 2001). Reyers et al., (2001) used a method similar to that used by Stoms (2000) to determine the road-effect zone for the South African road network as a threat to biodiversity in the country.

Areas that are natural resource rich are bound to experience high population growth hence population pressure. By virtue of the LAPSET project, Lamu County is bound to experience population pressure hence exert pressure on biodiversity.

Land tenure and development is a threat to the benefits of biodiversity as majority of the people at the Coast do not hold titles as land is communally owned. It is estimated that more than 70% of the land currently inhabited by the Awer community in Lamu county will be taken up by the construction of the new port (Nunow A.A, 2012). This will have a direct bearing on the people's livelihoods.

2.6 Opportunities of biodiversity for livelihood

Shackleton et al., (2007) portend that the forests benefit largely the rural communities given their locality and remoteness. Because of their locality, the likelihood of development in terms of infrastructure, government services, markets and jobs is unlikely therefore exacerbating the poverty situation and limiting opportunities for their livelihood Wunder, 2001 and Sunderlin et al., 2005 in (Shackleton et al., 2007). However, they argue that use of the forest resources potentially offers significant returns that could be in cash, direct-use or indirect use values as stated in this statement; "...forestry is frequently an important economic activity in these rural

areas, and is therefore posited as a potential key player in rural poverty alleviation, or at the very least, poverty mitigation”.

(Sunderlin et al., 2005) draw on the example of direct payment for forest service as an opportunity for poverty avoidance or mitigation. These include four specific services; carbon storage, hydrological protection, biodiversity conservation, and recreational values, mostly done in Latin America. A direct way through which the communities can benefit is by ensuring the forest ecosystems are safe and healthy, thereby assuring quality goods and services therein.

Nonetheless, barriers to entry are relatively low compared to other livelihood options, and hence use of and trade in forests resources is a viable strategy for the poorest of the poor (Dubois, 2003). The consequences of these characteristics and dynamics are that informal sector use of forest resources by rural communities, especially poorer households, rarely leads to poverty alleviation, but it may prevent intensification of poverty (Neumann and Hirsch, 2000, Wunder, 2001 and Sunderlin et al., 2005); only with sustained capital intensification and perhaps cultivation can high benefits be sustained (Belcher et al., 2005).

Non Timber Forest Products (NTFPs) greatly contributes to the livelihoods of African rural communities. These are plant and animal products that emanate from forested landscapes which could also have been modified by human beings (Ros-tonen & Wiersum, 2003). They play a significant role in supplementing for a household needs like food, energy and health and act as a buffer when the main livelihood option fails (Heubach, Wittig, Nuppenau, & Hahn, 2011). They also bring in monies as is the case with sale of bush meat, herbs for medicine and honey from the forest. As such they can boost income for households. A research done by (Heubach et al., 2011) in Benin indicated that 39% of the total household income emanated from NTFPs thus a major opportunity for rural households.

Noteworthy though is that there are studies that indicate that dependence on biodiversity for livelihood has waned. Tobias, 1967; Ebert, 1978; Deacon, 1984 in (Sallu, Twyman, & Thomas, 2009) have argued that secondary evidence collected from archaeological literature show that at the settlement level, the relative importance of biodiversity has changed in each location over time. (Sallu et al., 2009) also state that “secondary literature suggests that the level to which

people rely on biodiversity for subsistence in the Kalahari has declined over time with moves from hunter-gatherer dependency towards diversified forms of livelihood”.

2.7 Theoretical framework

2.7.1 Access theory

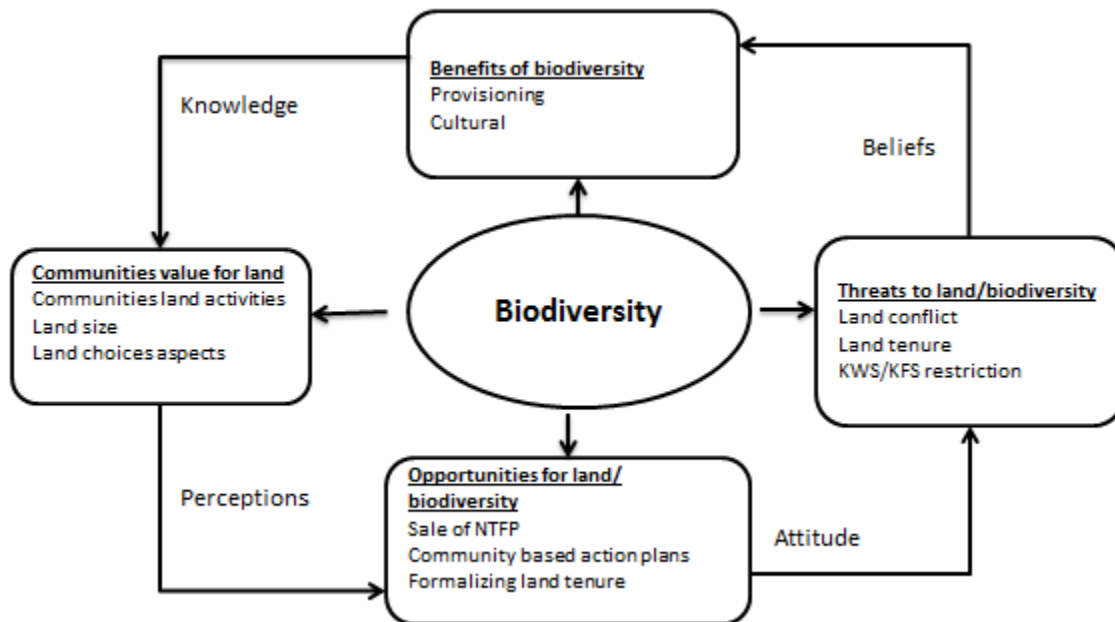
Access is defined by Ribot et al., (2003) as “the ability to derive benefits from things.” These things include material objects, persons, institutions, and symbols. This is different from the mainstream definition of access that is linked to property as “the right to benefit from things.” In essence, this therefore means that access is a bundle of power as opposed to a bundle of rights. Neale 1998 in (Ribot & Peluso, 2003) contend that access focuses on the issues of who does (and who does not) get to use what, in what ways, when and in what circumstances. As regards access, people and institutions are positioned differently in relation to resources at various historical moments and geographical scales. The strands thus shift and change over time, changing the nature of power and forms of access to resources. Relations as regards access change depending on an individual’s or group’s position and power within various social relationships. Generally, people have more power in some relationships than in others, or at some historical moments and not others. In this case for instance, the high and mighty may be allowed access to timber in truckloads that the local community member may find difficult to access due to the limited resource available. Ribot & Peluso (2003) classified access into two; access control and access maintenance. They defined access control as the ability to mediate others’ access while they defined control “as the checking and direction of action, the function or power of directing and regulating free action.” They equated access control and access maintenance to Marx’s notions of the relations between capital and labor. According to them, the relation between actors who own capital and those who labor with others’ capital or means of production parallels the relation between actors who control others’ access and those who must maintain their own access. In both cases, it is in the relation between these two sets of actors that the division of benefits is negotiated. To maintain access, subordinate actors often transfer some benefits to those who control it. They use resources either to nurture or relegate benefits to those who control access in order to derive their own benefit. This is true of the natural resource that is the forest; those that control the forest include KFS and KWS as well as the CFAs mandated with the responsibility of protecting the forest resources therein. Since they control access to the

forest, those with resources are able to access the resources therein while access is restricted to those without the ability to influence.

2.7.2 Modernization theory

Modernization theory has evolved with time with contemporary sociologists having their take on it. One such sociologist is Ulrich Beck who, like Giddens, argue that a modern society is a risk society; that modern society portends a large risk to the people. The current world contends with such aspects as global warming, environmental degradation and introduction of fast foods and Genetically Modified Foods (GMO) yet there is no clear cut solution to these challenging issues. Due to this challenge, individuals in society have to accept the situation and deal with the repercussions. Beck argues that social justice, reasoning as well as mass production which are the effects of enlightenment are past due to the speed at which the world is changing. As such, what we now have is referred to as second modernity, which refers to the fact that modern institutions are becoming global, while everyday life is breaking free from the hold of tradition and customs (Beck, 2006). With second modernity, the associated risks are different from the ones of before. In line with Ulrich, modernity has had its impact on the environment with such aspects as infrastructure development, pollution due to industrialization, population increase and demand for agricultural produce taking the center stage. Biodiversity is therefore affected thus the need to assess viable options for sustainable development as when nature is affected so are human beings. In the current age, human beings live in a risk society as there is increased concern over the misuse of natural resources yet human beings can never exist if the resources are unavailable.

2.8 Conceptual framework



Source: Researcher's

Summary of conceptual framework

How people perceive their attachment to land and the value that they attach to it largely depends on their attitudes, beliefs, perceptions as well as their knowledge. Land biodiversity presents benefits and opportunities to people, but there are also threats that hinder the thriving of biodiversity as well as individuals from benefiting from it. The study therefore established how communities value land and within it looked at the benefits that people derive from forest biodiversity looking at the provisioning and cultural aspects of ecosystem services as well as the opportunities to enhance biodiversity. It also established from individuals what they perceive and see are the threats to land biodiversity.

CHAPTER THREE: RESEARCH METHODOLOGY

3.0: Introduction

This chapter deals with the methodology and procedures for carrying out the study. First, the chapter describes the study site, the research design, units of analysis and the sampling techniques used. It then describes sources of data and techniques of data collection. Finally data analysis procedures are discussed.

3.1: Study Sites

3.1.1. Witu

The study was carried out in Witu, Mpeketoni and Awer, more precisely on the community members living in and within Witu and Awer (Boni) forests as well as in Mpeketoni.

Witu, situated in southern Lamu district, consists of the Witu Forest Reserve (020° 22' S – 02° 37' S E – 41° 30' E – 41° 50' E) and adjoining lands to the North and East. The 3937 hectares Witu Forest Reserve was created in 1927 by combining the Utwani Forest with the adjacent Gongoni Forest Reserve, managed Kenya Forest Services (KFS). The Witu forest, has an estimated area of 39 km² which is also a coastal forest. These areas are rich in flora and fauna that are endemic to the particular biomes (IUCN, 2006; Leslie, 1992; Wiru, 2010). Witu forest has an altitude of 1 – 20 meters above the sea level and has a highly fertile soil, which makes it suitable for agricultural production. Witu is cosmopolitan in nature and has a combination of inhabitants that are considered indigenous like the Orma, Swahili and Bajuni and those that moved in to Witu and have resided there for many years like the Watta, Pokomo, Awer(Boni), Giriama, Somali, Kikuyu and recently the Kamba.

3.1.2. Mpeketoni

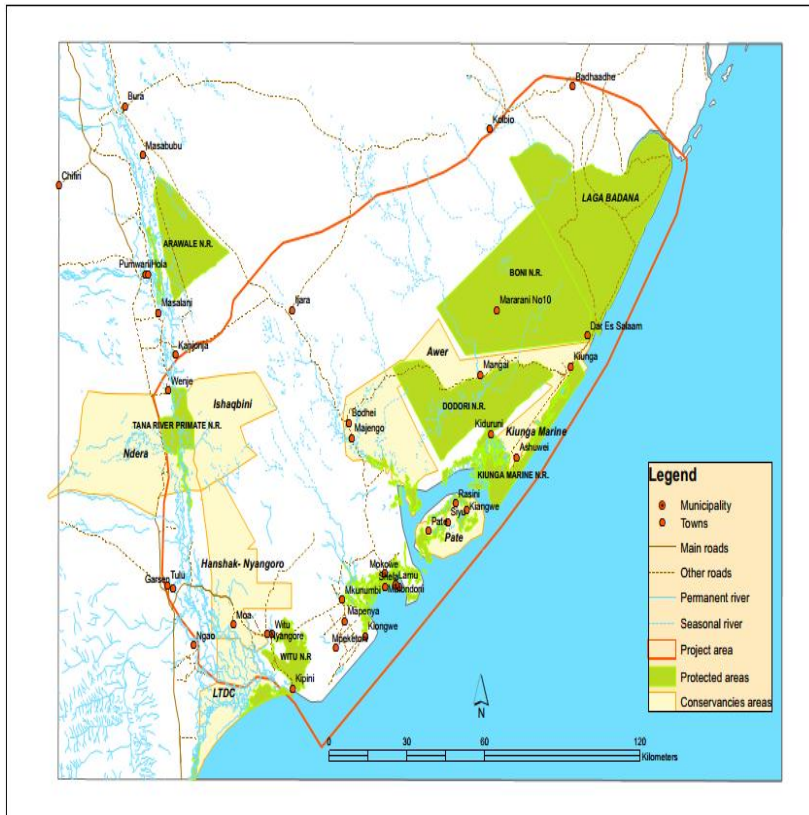
Mpeketoni area has the highest population in Lamu County which may be due to an agricultural settlement scheme that was initiated by the government as part of a countrywide rural agricultural programme back in the seventies. Mpeketoni has a vibrant economy mainly agriculturally led which has attracted banks such as Equity, KWFT and KCB and loaning institution like Agricultural Finance Corporation (AFC) and Tertiary institutions including the Egerton University. The road network is murrum.

Other social amenities found in the area include churches, mosques and entertainment hotspots which contribute to the economy. These institutions have a positive impact on the economy.

3.1.3 Awer

The Awer study area includes the Boni and the Dodori National Reserves (NR) and the Lunghi forest. Boni and Dodori National Reserves were established to allow elephants migrating from regions of Ijara and Lamu counties in 1976 (WWF, 2014; KWS, 2014). The Awer study area is placed between Lamu and the Somali border and consists of two National Reserves; Boni and Dodori and adjacent stretches of government land known as the Lunghi forest. The 1339 km² Boni National Forest Reserve (40°83E and 41°66E and 1°76S and 1°25S) is located in Garissa County at 40km from the Somalia border, and is managed by Kenya Wildlife Service (KWS) while Dodori National Forest Reserve (1°50 S,41°8E) is situated in Lamu County. The approximately 10 km Lunghi forest is inhabited by the Awer community. This area is currently under provisional gazette. To the east, the study area is bordered by Kiunga National Marine Reserve, which extends from north of Lamu Island to close to the Somali border. In the Awer area are the Awer community members. Formerly known as the *Boni*, they renamed themselves as Awer with the new constitutional dispensation due to the derogatory undertones that the name *Boni* carried. They occupy the villages of Bargoni, Basuba, Mararani, Milimani, Mangai and Kiunga. The Awer are considered one of the least populous tribes in Kenya. The Kenya Population and Housing census of 2009 places their population as 7,026 people, (3896M 3130F) which is a cumulation of the total number of people in the six villages that the Awer comes from. The Awer are almost exclusively muslim and occupy the northernmost coastal region in Lamu and Garissa county.

Fig 3.1 Map of the study areas. Source: ICRAF GIS



The selection of Witu, Mpeketoni and Awer area was purposive. These areas, like most other areas along the Coast areas are strongly impacted by anthropogenic activities such as human settlements, population growth, agriculture, charcoal burning, wood carvings, boat making, logging, food and medicinal herbs, poaching, cultural erosion, land use, government’s vision 2030 LAPSSSET development project and change in land tenure (Nielson & Sick, 2008; Mbora & Meikle, 2004). These activities have greatly hindered conservation and management activities to be efficiently carried out by organizations that also face inadequate capacity to carry out a holistic approach. If these trends continue, there will be further reduction of forest cover, loss of biodiversity, water, soil erosion, and loss of land productivity that will impact negatively on livelihoods of neighbouring communities, biodiversity conservation and national and global benefits of goods and services. A proposal by ICRAF highlighting the challenges faced in these areas aptly summarizes the issues as below:

- Massive planned infrastructure and agricultural developments (especially Lamu Port development, Dam developments on Tana River, biofuel production)
- Deforestation and degradation of forest (especially illegal logging and degradation through fires)
- Inappropriate fishing practices and overfishing (e.g. foreign prawn trawlers in Tana delta)
- Unsustainable livelihoods for forest-dwelling and forest-fringe communities
- Inadequate knowledge of biodiversity, ecosystem functioning and the socio-economics of local communities for effective planning and management;
- Inadequate common-vision approach to conservation initiatives
- Lack of an integrated overall ecosystem based management plan
- Protected areas in the land and seascape are suffering from lack of management capacity and resources. Some of the areas have no management plans, the boundaries are poorly defined (e.g. actual boundaries of Boni and Lunghi Forest Reserves unknown) and some areas still await formal gazettement. Several areas important for biodiversity have no form of protection at all.

3.2: Research Design

According to Kumar (2005), a research design is “a procedural plan that is adopted by the researcher to answer questions validly, objectively, accurately and economically”. This study adopted a survey design. There are three features about the survey design that makes the researcher to consider it appropriate. According to Singleton et al., (1988:239), “...surveys permit one to describe large heterogeneous populations accurately and economically.” Therefore, a large number of respondents can be selected from the communities using the probability sampling method. This is to ensure a true representation of the entire population of biodiversity users living in and around Witu and Awer forests and Mpeketoni. Further, it is possible to use interview procedures to obtain information from the respondents in a reliable and unbiased manner.

Through a survey, the researcher is able to collect data on personal attributes of the respondents. More importantly, it makes it possible to collect data on the areas of interest that include the benefits that people derive from biodiversity, the threats that reduce these benefits and the opportunities to enlarge them in the communities. The third reason for using survey research design in the study is that it enables the researcher to make inferences about the entire population on the use of the ecosystem services.

3.3: Target Population

Neuman (2006) defines, target population as a specific pool of cases that the researcher wants to study. This study covered people that live in the forest and those in the vicinity of the forest, thus direct and indirect users of Witu and Boni(Lunghi) forest. It also included a community practicing farming and living away from the forest as well as community members, the local government and institutions dealing with the environment. This ensured reliability of data generated from the respondents.

3.4: Unit of Analysis and Observation Units

According to Schutt (1966), “unit of analysis is the level of social life on which the research question is focused, such as individuals, groups, towns or nations.” It is therefore the category across which the study variables vary. Singleton (1993) defines a unit of analysis as “the entity about who or which a research gathers information.” It is simply what or who is to be described or analysed. Babbie (1995) adds that, “a unit of analysis is that which the study attempts to understand.”

The unit of analysis in this study was the communities living in and within the vicinity of the coastal forests in Awer and Witu areas and Mpeketoni to establish their perspectives towards land and benefits of forest biodiversity. The study sought to explore perspectives of the local communities on the benefits of biodiversity, what threats exist to the benefits of biodiversity as well as assess the opportunities they foresee for forest biodiversity to their livelihood.

The observation unit which is also known as the unit of data collection is the element or aggregation of elements from which one collects information (Babbie, 1995). The observation units are the direct and indirect users of forest biodiversity in these areas.

3.5: Source of Information

The data sources for this study were both primary and secondary data. The primary sources of data were the community members who are actual users and potential users of biodiversity. The community members were the main respondents while select institutions and workers of conservation bodies were key informants. Community opinion leaders were also be part of the key informants.

Published literature provided secondary data. These were sourced through electronic websites, libraries, media reports, published research work and journals. This ensured that relevant information is obtained.

3.6: Sampling Techniques

All community members of the villages in Awer, Mpeketoni and Witu were targeted for the study. The study adopted both non-probability and probability sampling to get the respondents. The difference between probability and non-probability sampling is the basic assumption about the nature of the population under study. In probability sampling, every item has a chance of being selected (Robson, 2002). In non-probability sampling, elements are chosen arbitrarily.

This study adopted multi-stage sampling; more specifically multi-stage cluster sampling was used to get the study respondents. The first stage was choosing the villages that were convenient to the researcher. These were villages that were in close proximity to the selected areas targeted for the study on biodiversity. In Witu and Awer communities the people targeted were the people living on the buffer zones and in the forest from an area known as Maisha Masha and Didewaride while in Awer two villages were reached due to insecurity in the area; Basuba and Kiunga. In Mpeketoni, respondents were drawn from Mkunumbi, Mpeketoni town, Ndambwe and Hongwe. Study participants were limited to those who had lived in the area for at least six months.

In order to get the respondents, contacts for participants from the three communities were obtained from a training that had previously been done by ICRAF targeting local farmers drawn from the study areas. The assumption was that each contact was a member of a family and that each of these represented at least 5 members (according to the Kenyan Community Strategy

Implementation Guidelines, each household represents 5 members). The training consisted of 99 participants of whom 50 were from Mpeketoni, 35 Witu and 14 from Awer.

For this study, the sample will be derived using the formula below:

$$n = \frac{z^2 pq}{E^2}$$

Where:

- *n is the required sample size*
- *p and q are the population proportions (p and q are the probability that the target population will be willing or unwilling to participate in the study which in this case is 50% or 0.5)*
- *z is the value that specifies the level of confidence. In this case, I have set it at 95% which gives a z-statistic of 1.96*
- *E sets the accuracy of sample proportions. (5% which is 0.05)*

This will then lead to:

$$n = \frac{1.96^2 * 0.5 * 0.5}{0.05^2}$$

n=384

Therefore,

Mpeketoni's population would be 50*5=250

Awer's population would be 14*5=70 and

Witu's population would be 35*5=175

Total for both this sample population is 250+150+175=495

Through stratification the sample would be:

Table 3.1 Sampling proportion

Area	Linked contacts	Sample	Total
Witu	175	175/495*384	136
Awer	70	70/495*384	54
Mpeketoni	250	250/495*384	194
Total	495		384

Mugenda & Mugenda (2003) recommends that for a descriptive study, a sample size of at least 10% of the target population is convenient. Kombo and Tromp (2005) point out that the sample population should have at least 30 respondents in order to have an accurate analysis. Since the target population involves individuals of different villages, stratified random sampling was employed to select respondents from these villages. This sampling technique is used when the population of interest is heterogenous. In this case, the population of interest is composed of various cadres of villages, is above 10% of the target population and exceeds 30 respondents. For the above target population of 384 a sample size of 40% was taken in order to compensate for the non response rates . This is as indicated in table 3.2 below.

Table 3.2 Sampling design Population frequency

Villages	Population frequency	Ratio	Sample Size
Witu [Maisha Masha 30 & Didewaride 15]=45	136	0.4	54
Mpeketoni 50	194	0.4	78
Awer [Mangai, Mararani, Basuba, Kiangwe and Milimani]= 30	54	0.4	22
Total=125	384		154

However, at the end of the data collection period the following was the final sample: 36 (Witu), 50 (Mpeketoni) and 30 (Awer)

Purposive sampling was used to get the key informants for the interviews. Mugenda and Mugenda, 2003 explain purposive sampling as “a technique that allows a researcher to use cases that have the required information with respect to objectives of the study”. The researcher used expert judgment to select key informant from the community to guide the study.

3.7: Data collection methods

The primary data for this study was mainly quantitative data complimented by qualitative data. The following are the methods that were used for data collection:

3.7.1 Interviews

Interviews in research are either structured, semi structured or unstructured. Structured interviews are questionnaires that are administered verbally using questions that are prepared with the aim of capturing requisite information. Unstructured interviews on the other hand are open conversations that are not planned and do not reflect any ideas. Finally, semi structured interviews consist of important or key questions that aim to give more details about the subject in question. These allow for more flexibility as compared to the structured interviews. Key Informant interviews are an example of semi structured interviews; these are in-depth interviews that are qualitative in nature and done to people who have wealth of information in a given topic. These could be such people as opinion leaders, residents of a given community and professionals who can provide insights into a given issue or provide solutions and/or recommendations to a given issue. Interviews for this study were open ended questions that targeted individuals that are well versed with the area as well as the subject matter. Open ended questions were used to ensure detailed information is obtained. Interviews generate more detailed responses than self-completed questionnaires and can readily adapt to participant responses due to their flexible nature (Bell, 2005). Moreover, interviews can demonstrate to the respondent that the researcher is equally committed, in terms of time, effort and thought, to the research (Oppenheim, 1992). A major disadvantage of interviews, however, is that when multiple interviewers are used to interpret and analyse interviews and associated data inconsistencies can occur (Oppenheim, 1992). To overcome this disadvantage, I sat with the interviewers to guide them on how to administer the questionnaires and conducted a practical session on the same. Further, piloting of the tool was done to identify any anomalies before actual data collection.

Dictaphones were used to record answers to open-ended questions verbatim.

3.7.2 Focus Group Discussions

This is a collection of individuals between 8-12 people who share similar characteristics and are homogeneous in nature and are brought together to draw their knowledge, attitudes, beliefs,

feelings and experiences by answering set of open ended questions. Focus Group Discussions were conducted targeting men and women separately in Witu and Mpeketoni with an aim of complimenting data that was collected from households.

3.7.3 Observations

This is a way of collecting data through watching behavior and events, or documenting physical characteristics in their natural setting. The observations are done either openly or discrete. Observations were done throughout the study period to note the natural environment.

3.8: Tools for data collection

3.8.1: Questionnaires

A questionnaire is a tool containing survey questions which is administered to respondents and designed to elicit specific information. Macmillan English dictionary defines questionnaires as a set of questions that a lot of people are asked as a way of getting information about what people think or do generally (Oladeji, 2012). Questionnaires may contain either closed ended questions, open ended questions or both. They are useful for collecting data for large populations and data that can be compared. For this study, data was collected mainly through a questionnaire administered by the researcher and some assistants. The questionnaire contained both open and closed (semi-structured) questions. These were mainly administered at household level and separated into different sections in line with the study objectives.

3.8.2 Interview schedule

This is developed with the aim of holding in depth discussions with individuals from the study communities that are well versed in the topic for discussion. For this study, the interview schedule contained open ended questions.

3.8.3 Focus Group Discussion guide

An FGD guide was used to facilitate the session. Guidelines for conducting an FGD were observed such as maintaining homogeneity in the group as well as facilitating the group to ensure that those that are selected for the discussion all get to contribute their insights into the issues being discussed.

3.9: Data Analysis

3.9.1: Quantitative data analysis

The basis of the quantitative data analysis is univariate descriptive analysis. This approach is commonly used to summarise the characteristics of a phenomenon based on the distribution of variables (Blaikie, 2003). The aim is to identify relationships between variables. Frequency tables will be used for much of the data presentation.

3.9.2: Qualitative data analysis

Memos & coding

Memos are written records of analysis (Corbin and Strauss, 2008) and are used to extract major concepts from the qualitative responses, which are then developed in terms of their dimensions and properties (Corbin and Strauss, 2008). Codes are developed to detect the expression of the major concepts in each response. Coded responses are categorised according to the most applicable major concept.

3.9.3: Reliability and validity

The reliability and validity of a survey are integral to its use and application to ensure that the survey actually measures what it was designed to measure. Reliability refers to the consistency of the various measures of a concept and includes internal reliability and inter-observer consistency (Bryman, 2008). Internal reliability is particularly important to closed-ended questions and ensures that respondents consistently answer items that aim to measure the same concept or idea. Inter-observer consistency relates to situations when multiple individuals are involved in the subjective judgment of the collection, analysis and interpretation of data. To overcome these reliability challenges, a tool was piloted with multiple questions that assess the same topic. Items that consistently measure the same responses were considered to be reliable; the most directly worded item were included as part of the questions. Items that the pilot group did not immediately understand were either omitted or reworded in conjunction with the group.

There are three types of validity that can apply to surveys. Construct validity relates to the use of correct measures for concepts being examined. Internal validity refers to the ability of a survey to predict cause and effect. This type of validity is not relevant to descriptive case studies (Yin,

2009). External validity refers to the context in which the research findings can be applied. To meet construct validity requirements, pilot interviews were conducted to ensure that the correct language is used and that questions related to the dominant themes that relate to biodiversity. To ensure external validity, the study participants were randomly sampled in the two communities. Moreover, the survey was designed upon an extensive literature review so that comparisons of the data in this research may be compared with similar studies.

CHAPTER FOUR: DATA ANALYSIS AND PRESENTATION

4.0 Introduction

The results of the household surveys for this study are organized into two main sections. The first section describes the demography and characteristics of the households that were surveyed in the Awer, Mpeketoni and Witu communities. The second section describes the findings based on the study objectives that were to establish the value that the communities attach to land, the benefits from the various ecosystem services, opportunities and threats with excerpts from the FGDs and Key Informant interviews.

4.1 Household characteristics

Table 4. 1: Characteristics of households surveyed in Awer, Mpeketoni and Witu

	Awer		Mpeketoni		Witu	
Household type	F	(%)	F	(%)	F	(%)
Male headed monogamous	20	66.667	39	78.000	27	77.143
Male headed polygamous	3	10.000	2	4.000	4	11.429
Male headed single/divorced/widowed	5	16.667	2	4.000	0	0.000
Female headed single/divorced/widowed	2	6.667	7	14.000	3	8.571
Child headed	0	0.000	0	0.000	1	2.857
Total	30	100.00	50	100.00	35	100.00
Occupation HH	F	(%)	F	(%)	F	(%)
Farming	26	86.667	41	82	25	69.444
Other	4	13.333	9	18	11	30.556
Total	30	100.00	50	100.00	36	100.00
Occupation Spouse	F	(%)	F	(%)	F	(%)
Farming	17	56.667	41	82.000	18	50.000
Housewife	4	13.333	0.000	0.000	10	27.778
Other	9	30.000	9.000	18.000	8	22.222
Total	30	100.00	50	100.00	36	100.00
Education HH	F	(%)	F	(%)	F	(%)
1	10	33.333	2	4.000	12	33.333
2	10	33.333	16	32.000	17	47.222
3	4	13.333	22	44.000	6	16.667
4	4	13.333	9	18.000	1	2.778
5	2	6.667	1	2.000	0	0
Total	30	99.999	50	100.00	36	100.000

Table 4.1 reveals that the majority of households were male headed and monogamous for all three communities (Awer, 66.7%, Mpeketoni, 78% and Witu, 75%). Polygamous male-headed households made up a higher proportion of the households in the Witu (11.1%) and Awer (10%) communities than in Mpeketoni (4%). Table 4.1 further shows that farming is the major occupation of the household head. While there are no major differences in the three communities on occupation, the highest percentage of farmers is drawn from Awer. This is surprising given their history as hunters and gatherers who reside in the forest. This shift of their livelihoods could be attributable among other factors to increased restriction of entry into the forest for conservation and to enhance security necessitating them to look for alternative means of survival hence farming. It could also mean that the current literature on the lifestyle of the Awer that depicts them as hunters and gatherers e.g. (Nunow A.A, 2012) is outdated.

Table 4.1 further reveals that in Witu and Awer, one third of the heads of the households do not have had any form of education. In all three areas, primary level of education is the category that has the largest number of household heads with Mpeketoni having a higher proportion of household heads that have primary education (76%).

The average age of the head of the households surveyed in Awer, Mpeketoni and Witu was 50, 46 and 43 years respectively. In relation to the family size, majority of the households in Awer and Mpeketoni harbor between 4 and 6 people, 46.7% and 62% respectively. In Witu on the other hand, majority of households (44.4%) harbor between 7 and 9 people depicting the communal lifestyle that this community has adopted; the fertility rate is also high. In the three sites, the average number of people that contribute to income is two although the dependency ratio varies in the three sites with Witu taking lead in the number of dependents. In Awer a significant number of households 43.3% have between 1 and 3 people and only 10% of households have 7 to 9 people.

Figure 4.1: Number of immigrants and non-immigrants in Awer, Mpeketoni and Witu

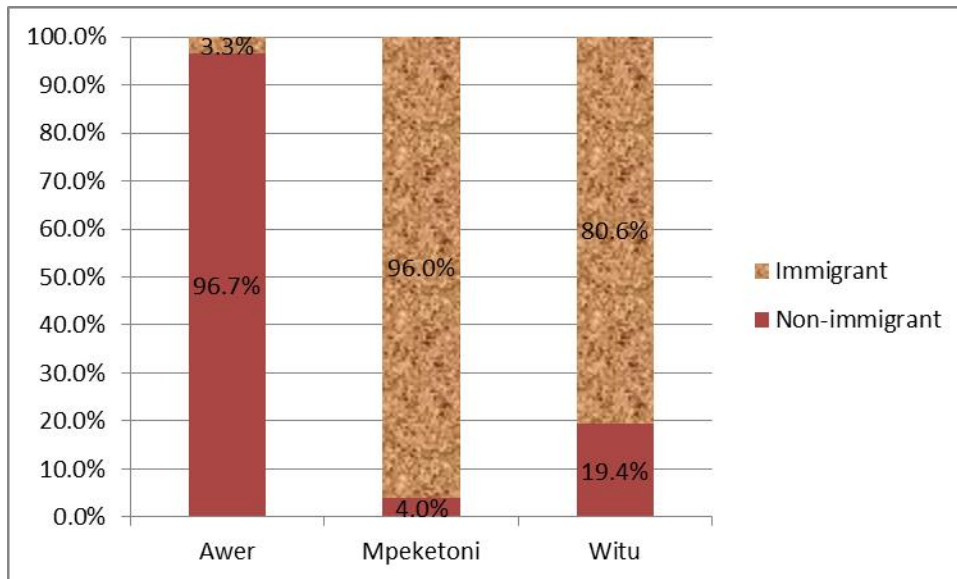


Figure 4.1 reveals that the large majority of the population in Mpeketoni (96%) and Witu (80.6%) consist of immigrants whereas there are very few (3.3%) in Awer. The immigrant populations in Mpeketoni are majorly Kikuyu who were brought into the area in the late 1970s by the then president, the Late Kenyatta. Later on other Kikuyus have continued to get into the area through a system known as *Witemere* where new entrants are allocated land by the *Witemere* committee that consists of elders and community members. This study revealed that the major reason for moving to the area is because land was easily available (96.4% of respondents in Witu and 100% in Mpeketoni).

Table 4.2: Primary reason for migrating

Reason for moving	Awer		Mpeketoni		Witu	
	F	(%)	F	(%)	F	(%)
Employment	1	100	-	-	-	-
Land and natural resources available	-	-	47	100	27	96.4
Other reasons	-	-	-	-	1	3.6
Total	1	100	47	100	28	100

Witu also carries a large number of immigrants (80.6%) who are predominantly Giriama. The Orma are the non-immigrants in Witu as they are the ones that were born and bred in Witu.

In terms of level of immigration, Lamu county is ranked 9th in Kenya with an immigration rate of 31.1% against 20.9% for the nation as a whole according to the socio economic atlas of Kenya 2014.

Table 4.3: Sources of water for cultivation in Awer, Mpeketoni and Witu

Water Source	Awer		Mpeketoni		Witu	
	F	(%)	F	(%)	F	(%)
Rainfall	26	96.3	28	71.8	31	96.8
Groundwater	-	-	9	23.1	-	-
Surface rainwater storage	1	3.7	2	5.1	1	3.2
Total	27	100	39	100	32	100

A question was posed on the main source of water used for farming in the three communities; it emerged that the main source of water used in cultivation for the three places was rain water giving a clear indication that the communities in this part of the coastal area like many other communities depend on rain fed agriculture. Mpeketoni has more diversified sources of water for cultivation in comparison to Awer and Witu.

In summary, demographic data is useful as it aids in making informed decisions for interventions. Similarities can be seen in the aspects of occupation, type of household heads and the level of education of the household heads in the three areas. What is surprising is that farming is the main occupation in the three areas including the Awer who have always been depicted as hunters and gatherers.

From the demographics, it can be concluded that Witu is weaker of the three socio economically. This is concluded looking at the number of people living in a household and the number of people contributing to the household income.

4.2 Values that communities attach to land

This study was carried out with an aim of establishing, among other things, what value these communities attach to land. In a bid to establish this, a number of questions were posed to the respondents; the questions had to do with whether or not the individual had titles, their land sizes, mode of acquisition and the consideration they put in place when purchasing the land. A question was a further posed to the respondents on whether or not they agree to different degrees on selling, leasing, relocating and donating their land. The results of these questions are herein discussed.

Table 4.4: Proportion of households with and without land title deeds

Title deed	Awer		Mpeketoni		Witu	
	F	(%)	F	(%)	F	(%)
No	29	96.7	33	66.0	34	94.4
Yes	1	3.3	17	34.0	2	5.6
Total	30	100	50	100	36	100

Land tenure remains an issue in this coastal region as depicted by Table 4.4 which shows that in all the three study areas, none of the three places has 100% of the interviewed population claiming ownership of land that they use with title deeds. Indeed, less than 10% of the respondents in Awer and Witu hold title deeds. Among the Giriama, the community that immigrated in the Lamu area none holds a title deed; the 8.3% of the total in Witu who hold a title are the Orma who are indigenous to the area. A much higher fraction of the respondents interviewed in Mpeketoni (34%) have title deeds because these were settled in the area in the 70s and were issued with title deeds. It is however surprising that a paltry 34% hold title deeds despite the community being settled in the area. This could be due to the fact that majority of the respondents are immigrants that have bought land under the *Witemere* arrangement as earlier discussed. The lack of title deeds is also backed up with the collected data that indicates that 74.4% of the respondents in Mpeketoni bought the land that they reside in (Table 4.5).

Table 4.5: Forms of land acquisition for Awer, Mpeketoni and Witu

Land acquisition	Awer		Mpeketoni		Witu	
	F	(%)	F	(%)	F	(%)
Inherited	26	86.7	8	20.5	23	71.9
Bought	4	13.3	29	74.4	9	28.1
Hired	-	-	2	5.1	-	-
Total	30	100	39	100	32	100

The assertion that ‘land is easily available’ as given by inhabitants in Mpeketoni (97.9%) and Witu (89.3%) as to their reason for moving to the area (table 4.6) is supported by data that indicates that households in Awer, Mpeketoni and Witu have an average of 10.6, 6.8 and 5.4 acres respectively (Table 4.7).

Table 4.6: Number of immigrants and primary reason for migrating

No. of immigrants and primary reason for moving	Awer		Mpeketoni		Witu	
	F	(%)	F	(%)	F	(%)
Employment	1	100	-	-	-	-
Land and natural resources available	-	-	47	100	27	96.4
Other reasons	-	-	-	-	1	3.6
Total	1	100	47	100	28	100

While Witu holds the least number of acres among the three areas, given that they are disadvantaged among the three areas, the size of land that they own is significant vis a vis their socio economic status.

Table 4.7: Average land size (acres) in Awer, Mpeketoni and Witu

	Awer			Mpeketoni			Witu		
	Min	Average	Max	Min	Average	Max	Min	Average	Max
Land size	3	10.6	45	1	6.8	18	0	5.4	15

Of the three places, Witu has the least land in acres while Awer holds the most number of acres which could be attributed to the fact that the land owned is by the indigenous community handed down from one generation to another as depicted in table 5 which shows that 87% of the land was acquired through inheritance.

Table 4.8: Percentage of Awer views on Selling, Leasing, Relocating and Donating

	Selling		Leasing		Relocating		Donating	
	F	%	F	%	F	%	F	%
Strongly Disagree	19	63	10	33	23	77	2	7
Disagree	3	10	10	33	3	10	6	20
Not sure	2	7	5	17	2	7	10	33
Agree	6	20	4	13	2	7	12	40
Strongly agree	0	0	1	3	0	0	0	0
Total	30	100	30	100	30	100	30	100

Still in line with the values that the three communities attach to land, a question was posed on whether the respondents strongly disagree, disagree, are not sure, agree or strongly agree to sell, lease, relocate or donate their land. The graphs herein reveal a few similarities but much difference in opinion as regards these issues. All the three communities have a strong stance in regards to relocation and selling their land as all of the three communities strongly disagree to either relocate to another place (77% Awer, 66% Mpeketoni and 94% Witu) or to sell their land (63% Awer, 56% Mpeketoni and 89% Witu).

Up to 40% of the population in Awer agrees to donate their land for consumption although a significant population of 36% is not sure whether or not they would want to donate their land. Interestingly, almost 70% of the population in Mpeketoni agrees to donate their land for somebody else to reside in. This may be in line with the *Witemere* arrangement where people get into the area and are identified for an uninhabited place to reside. In the meantime, these people are hosted by those that have resided in the place for some time and can be donated for land to use as they wait for their allocation.

Table 4.9: Percentage showing Mpeketoni views on Selling, Leasing, Relocating and Donating land

	Selling		Leasing		Relocating		Donating	
	F	%	F	%	F	%	F	%
Strongly Disagree	28	56	17	34	33	66	4	8
Disagree	16	32	12	24	7	14	7	14
Not sure	3	6	9	18	8	16	5	10
Agree	3	6	1	2	2	4	33	66
Strongly agree	0	0	1	2	0	0	1	2
Total	50	100	50	100	50	100	50	100

Of the three communities, the community in Witu strongly disagrees to anything land related; they do not want to sell, lease, relocate or donate their land. This is interesting as they do not have titles to this land. However, they have a deep sense of belonging and ownership to this land and do not imagine parting with this that they feel belongs to them.

While Awer and Mpeketoni have their views spread among disagree, not sure and agree; all the three have low to negligible percentages when it comes to strongly agreeing.

Table 4.10: Percentage of Witu views on Selling, Leasing and Donating land

	Selling		Leasing		Relocating		Donating	
	F	%	F	%	F	%	F	%
Strongly Disagree	32	89	28	78	34	94	28	78
Disagree	1	3	0	0	1	3	2	6
Not sure	2	6	1	3	1	3	0	0
Agree	0	0	5	14	0	0	1	3
Strongly agree	1	3	2	6	0	0	5	14
Total	36	100	36	100	36	100	36	100

Generally, the data reveals that the three communities are not willing to sell or relocate to another place; the data shows that these communities have a strong attachment to land which may be attributed to the fact that they use it mainly for crop farming as collected data revealed that crop farming is the main activity carried out on the land (97% Awer, 80% Mpeketoni and 91% Witu). Aside from farming, the two other main activities carried out in their lands are livestock and bee keeping.

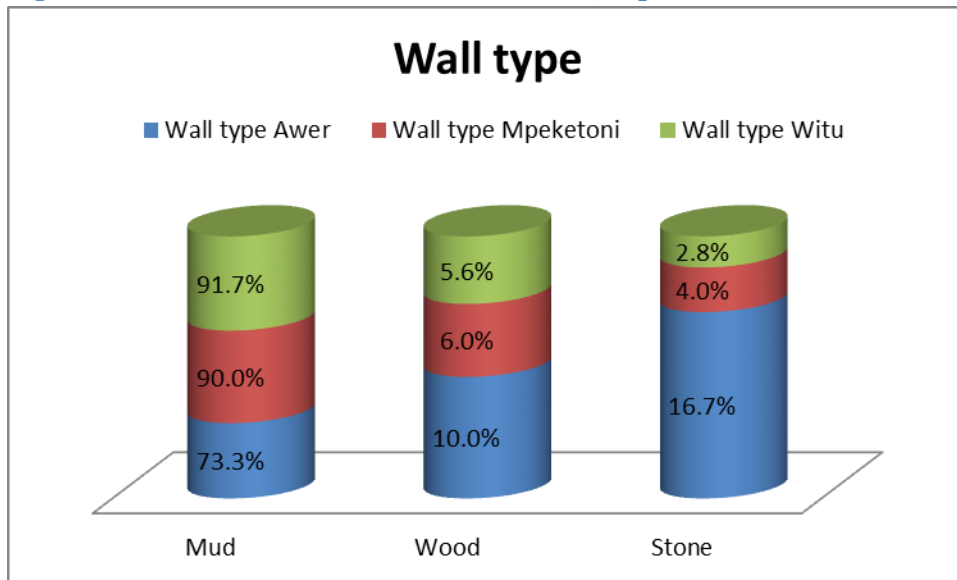
In conclusion, this data has gone to show that the three communities value and as they directly benefit from it and use it to sustain their livelihood. While Awer and Mpeketoni agree and disagree at varying degrees, Witu is seen as adamant in its views on land. The challenge lies in tenure insecurity as one of the threats identified by these communities.

4.3 Benefits derived from biodiversity:

4.3.1 Provisioning services

4.3.1.1 Construction material

Figure 4.2: Wall construction material in Awer, Mpeketoni and Witu

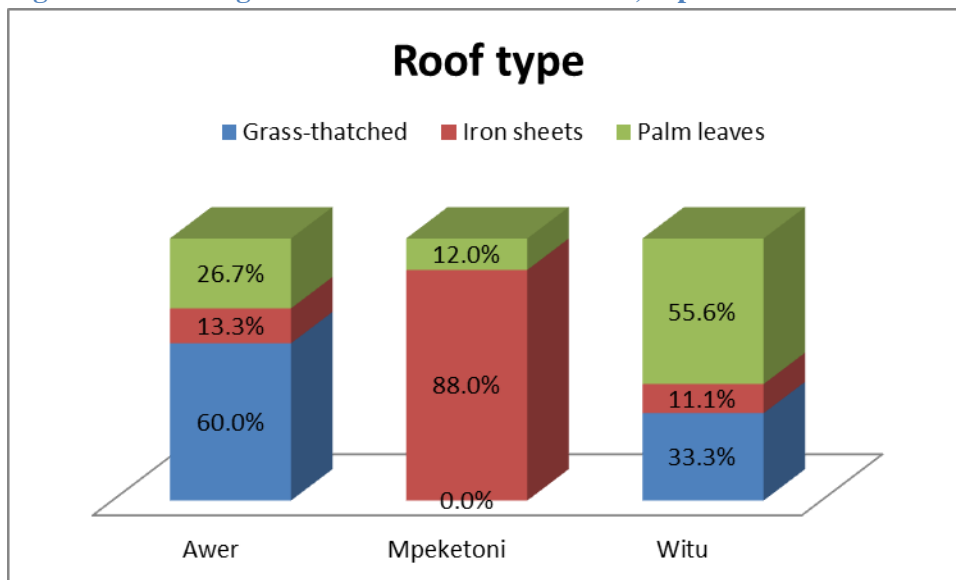


This study revealed that all three communities are nature dependent for the material that they use to construct their houses; subsequently, the common construction material for the walls in these areas was mud. Interestingly, 90% of households in Mpeketoni use mud for constructing their walls, a figure that is close to their Witu counterparts and lower than the community in Awer (Fig.4.2). This phenomena could be attributed to the fact that majority of the respondents in Mpeketoni are immigrants that have settled in the area through the *Witemere* process who live in a place with no title deeds and are uncertain of their future, whether or not they would permanently be settled therein. In view of this, having simple structures that are not cost intensive is seen as the better option in these parts of Mpeketoni. Notable also is that wood is hardly used even in Witu which has the community living in the vicinity of the forest. This could be an indication of how prohibitive the product is. So low is the rate as 5.6% (Fig. 4.5) is a combination of wood and mangrove.

Figure 4.3: Sample of materials used for roofing and walls in Witu



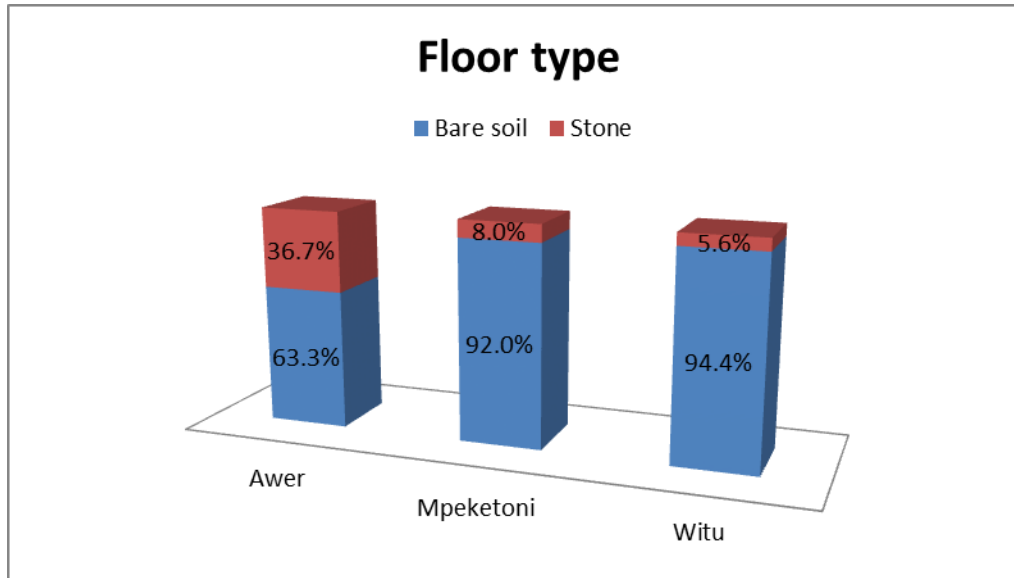
Figure 4.4: Roofing construction material in Awer, Mpeketoni and Witu



For the construction material, differences lie in roofing material. 88% of the interviewed households in Mpeketoni have used iron sheets for their roofing material in comparison to 13.3% and 11.1% in Awer and Mpeketoni respectively. This may translate to a higher purchasing power on the part of Mpeketoni. Awer and Witu use the local material available in their areas; palm leaves in Witu (56%) and grass thatch in Awer (60%) for roof construction. None of the households interviewed in Mpeketoni use grass thatches for roofing, even for households that use mud for their walls and bare soils for their floors; a great percentage (90%) use iron sheets for roofing.

The study revealed that bare soil stood out as the flooring material of choice for the three communities (Figure 4.5). However, a larger majority of households in Awer (37%) use stones for their floors as seen in Figure 4.5 below.

Figure 4.5: Flooring material in Awer, Mpeketoni and Witu



In concluding this section, the study has gone to show that minor differences have been observed in the three communities as regards their dependence of natural resources for use in constructing of their walls and floors of their houses. A remarkable difference however is observed in the material used for roofing as seen in Mpeketoni where the greater majority of houses have corrugated iron roofs whereas grass and palm leaves were the most frequently used materials for roofing in the Awer and the Witu community respectively. These findings are in line with (Wells, R, & Haddar, 1998) who in their study on the housing and building material used in Dar es Salaam, Tanzania, revealed that in the construction material used for low cost housing was poles that were filled with mud and palm trees for roofing.

4.3.1.2 Food

This study started with the assumption that there would be significant differences in reliance of foods consumed in the three communities based on their proximity to the forest biodiversity. The household survey provided little evidence to support this hypothesis. Indeed the Awer households reported consuming three food items that were derived from nature more regularly than the two other communities, namely honey, game meat and freshwater fish (Table 4.8 and table 4.10). The Awer and the Witu communities also reported consuming wild fruits more regularly than the inhabitants of Mpeketoni. Apart from these few food items, the study reveals little dependence of people living closer to the forest to draw and consume their food on biodiversity of the forests.

Instead the data reveals a remarkable congruence of the three communities in relying on foods from farmland for their livelihoods (Table 4.11 and Table 4.13). Table 4.11 shows that most of the food items that were reported as frequently occurring in their diets (Table 4.11) were obtained from farmland. This finding contradicts the prior assumption that people like the Awer and the Giriama, who are living close to protected areas and natural vegetation would rely to a greater extent on foods derived from this biodiversity. One possible reason for this finding could be a wrong perception on the agricultural practices of these communities. While it is true that the Awer have come from a background as hunter gatherers, it might as well be that people consider them living close to nature therefore still practice hunting and gathering since there is little recent documented information on their livelihoods. Another reason to explain this finding could be that people underreport their reliance on foods that are derived from natural biodiversity.

Table 4.11: Percentage (daily, weekly, monthly, and only when available) of consumption of food eaten in Awer, Mpeketoni and Witu

***Color codes:** Orange color range 70-100%, blue 40-70% and green from 10-40%

Food	Awer				Mpeketoni				Witu			
	D	W	M	A	D	W	M	A	D	W	M	A
Maize	0	3	7	90	0	0	0	100	4	48	26	22
Maize meal	40	46	14	0	82	18	0	0	83	11	3	11
Rice	54	43	3	0	52	46	2	0	9	21	32	38
Wheat flour	43	43	14	0	4	76	20	0	9	12	42	36
Cassava	47	37	6	10	2	33	13	51	42	24	12	21
Arrow roots	0	4	34	62	0	0	4	96	100	0	0	0
Sweet potatoes	0	0	29	71	0	5	10	85	19	25	12	44
Coconut milk	42	38	13	8	9	0	9	82	30	30	18	22
Milk	27	23	30	20	98	0	0	2	40	15	15	30
Fermented milk	4	10	17	69	0	0	5	95	6	27	27	40
Beef	0	7	31	62	2	0	71	27	0	16	12	72
Goat meat	0	24	17	59	4	4	73	19	0	6	24	70
Rabbit meat	0	0	0	100	0	0	40	60	0	0	0	100
Game meat	0	15	11	74	0	0	0	100	0	0	14	86
Lamb	0	0	0	100	0	0	68	32	0	27	0	73
Beef	0	7	31	62	2	0	71	27	0	16	12	72
Chicken	0	24	59	17	0	16	76	8	0	3	73	24
Fresh water fish	6	50	6	38	4	13	2	81	3	23	20	53
Sea fish	43	13	10	33	3	3	3	91	0	10	37	53
Crabs	0	0	10	90	0	0	0	100	0	0	17	83
Prawns	0	0	3	97	2	0	0	98	0	3	22	75
Honey	47	33	17	3	0	0	9	91	14	0	43	43
Sugar	100	0	0	0	100	0	0	0	49	21	9	2
Cooking oil	100	0	0	0	100	0	0	0	85	9	0	6
Cooking fat	11	7	35	47	90	0	10	0	43	0	14	43
Margarine	7	0	18	75	0	4	4	92	0	0	33	67
Beans	3	43	47	7	40	54	4	2	6	39	42	12
Green grams	7	62	28	3	77	19	2	2	3	73	15	9
Cowpeas	21	52	24	3	65	28	2	5	3	76	17	3
Peanuts	11	22	0	67	0	5	5	90	0	56	12	32
Mnavu	0	8	0	92	0	13	6	81	43	39	14%	4
Mkunde	4	36	39	21	68	12	2	23	53	43	0	4
Mchicha	3	70	17	10	72	22	2	4	56	35	6	3
Sukuma wiki	0	13	53	34	34	56	8	2	7	23	13	57
Cabbage	0	3	20	77	0	6	4	90	0	13	0	87
Mangoes	0	24	63	13	0	0	10	90	3	9	50	38
Bananas	0	23	53	24	13	0	80	7	24	50	11	15
Oranges	0	10	43	47	0	0	20	80	0	7	13	80
Cashew	0	17	17	66	4	2	27	67	0	12	68	20
Pawpaw	3	73	17	7	0	4	25	71	43	40	8	8
Madafu	7	70	16	7	6	9	34	51	32	52	8	8
Passion	0	0	18	82	0	0	7	93	40	23	27	10
Kunazi	0	0	27	73	0	0	0	100	0	67	33	0
Guavas	0	0	7	93	0	0	0	100	25	25	38	12
Matomoko	0	0	0	100	0	0	0	100	0	25	0	75
Wild fruits	14	14	10	62	0	0	0	100	38	7	24	31

In the African context, a significant percentage of the diet is drawn from maize, rice, sorghum and millet which are starchy in nature (Oniang, & Malaba, 2003). This study revealed the same as true; the difference was that there were variations in the types of starchy foods consumed. The starchy diet of the Awer consists of maize meal, rice and wheat flour. This they interchange throughout the week as they do not have a specific food (starch) that they eat on a daily basis. In Mpeketoni, maize meal is taken daily but this is interchanged majorly with rice (52%). However, in Witu, maize meal is the main staple (83%) which is taken on a daily basis; rice and wheat flour, which is taken on a daily basis by the Awer, is consumed on availability in Witu.

The data reveals that cassava is eaten more frequently in Awer and Witu than in Mpeketoni and of the three Awer takes lead-80% of people in Awer and 66% in Witu eat cassava on a daily or weekly basis. Further, cassava is complimented with arrow roots in Witu. This could mean that arrow roots are available in Witu but not available in Awer.

There are differences between communities in type of animal proteins consumed. 43% of the Awer that were interviewed indicated that they consume fish from the sea on a daily basis, most likely due to their proximity to the sea. 91% of respondents in Mpeketoni indicated that they eat the sea fish only when available. This could be more of a social than an economic issue as it is well known that culturally the Kikuyu do not indulge in fish, but rather in beef or goat meat. This is true as data collected indicates that 71% and 73% of the respondents in Mpeketoni eat beef and goat meat respectively on a weekly basis. This is high in comparison to Awer (7% and 24%) and Witu (16% and 6%). Milk is easily available in Mpeketoni where 98% of the households reported that they consume milk on a daily basis compared to only 27% in Awer and 40% in Witu. 26% of respondents in Awer eat game meat on a daily or weekly basis; for the other places the meat is taken only when available indicating the scarcity of the same. This is also true of rabbit meat, to also mean that this meat is not a common type of meat for the people in this area. In all the three areas, crabs and prawns are a rare delicacy and are taken only when available. This could be due to their prohibitive cost as a result of them not being easily available. This has an effect even to the people in Awer as up to 90% and 97% of the respondents indicated eating crabs and prawns only when they are available.

The three communities further differed in the types of oils consumed. This data reveals that cooking oil is more commonly used than cooking fat in all the three communities. All the respondents in Awer and in Mpeketoni mentioned that they used cooking oil on a daily basis. Up to 85% of the respondents in Witu use cooking oil on a daily basis; however, there is a small pocket of the population that use the oil only when it is available. That said, cooking fat is also utilized in these areas but at varying degrees, it being popular in Mpeketoni as 90% of the respondents reported that they consume it on a daily basis, a far cry from Awer that has less than 20% consuming it either on a daily or weekly basis. Coconut and hence coconut milk is widely used by the Awer- 42% of the respondents use it daily and 38% weekly in comparison to respondents in Mpeketoni where a paltry 9% use it on a daily basis. The community in Witu relatively utilize the coconut milk; 30% on a daily and weekly basis. This could be as a result of the fact that the Awer and Witu communities emanate from the Coast and are more dependent on the palm tree and its products as it forms part of nature at the Coast. People in Mpeketoni use it only when available as this is a product that they have learnt to use over time by virtue of its availability. This is supported by data that indicates that the coconut fruit (Madafu) is eaten on a weekly basis by 70% of the respondents in Awer while the same is eaten by only 9% of the population in Mpeketoni while a relatively significant number of 52% of respondents in Witu utilize it on a weekly basis.

Sugar is consumed on a daily basis by 100% of the respondents in Mpeketoni and the Awer community. It is consumed less frequently in Witu; 49% on a daily basis while up to 21% of respondents only use it when available reflecting the relative poverty of some members in this community. Of the three places, honey is widely available in Awer as up to 80% of the respondents therein use it either on a daily or weekly basis which is in contrast with Mpeketoni where 91% of the population use it only when it is available. This could be attributed to the fact that 67% of respondents indicated that they source the honey from nature (Table 4.13). In Witu, only 14% of the population consumes honey on a daily basis while 43% use it when available. 86% of people in Witu indicated that they get their honey from the shop (Table 4.13) which could explain the low percentage of respondents indicating consuming it frequently.

The three communities differed in the types of vegetables consumed. The data reveals that the green vegetable that is easily available in the three areas is Mchicha (*Amaranthus hybridus*). The green vegetables play a significant role in the diets of people in Witu as they interchange between mchicha (*Amaranthus hybridus*) (56%), mnavu (*Solanum nigrum*) (43%), and mkunde (*Vigna unguiculata*) (53%), on a daily basis. The Awer community members do not eat green vegetables on a daily basis. Sukuma wiki (*kales*) is easily and locally available in Mpeketoni as 34% consume the vegetable on a daily basis and 56% on a weekly basis. On the contrary, none of the respondents in Awer indicated consuming this vegetable on a daily basis and only 13% stated using it on a weekly basis while 53% respondents alluded to consume it only when available showing its scarcity in the area. In Witu, the vegetable is consumed but in lower amounts which could be attributed to preference being placed on the other vegetables as seen above. Cabbages are consumed at minimum level in all the three places as seen in Table 4.10 above. The FGDs that were conducted in Mpeketoni and Witu revealed that cabbage is one of the vegetables purchased from the market; 97% and 94% of respondents in Awer and Mpeketoni respectively consume it at least once a month or when it is available. Only 13% of respondents in Witu stated that they consume cabbage on a weekly basis. The rest consume it when it is available. Having to purchase the vegetable in the market as opposed to sourcing it from the farm could explain its low consumption in the three areas and the fact that there is availability of other vegetables in the farms to choose from.

There are further differences in the type of fruits consumed in the three areas. In Witu, 45% of the respondents eat wild fruits on a daily or weekly basis. This is followed by Awer that has 28% of the population eating these fruits on a daily or weekly basis. In Mpeketoni these wild fruits are only eaten when available. Witu is seen as having a greater variety of fruits that are eaten either on a daily or weekly basis while Mpeketoni has the least variety of fruits of the three places. Pawpaw, kunazi, passion and guavas are eaten on a daily basis in Witu. The wild fruits that were identified and commonly found in all the three areas are duom palm, *Udaudo*, *Wamo* in Orma, while *zambarau* (*Syzygium cuminsi*), *vitoria* (*Garcinia Mangostana*), *kongojii*, and *kungu* are eaten among the Giriama in Witu. The FGDs in Witu and Mpeketoni revealed that both places grow a variety of fruits. In Mpeketoni for instance, Mangoes, oranges, passion, pineapples, bananas and Matomoko were identified as some of the fruits grown in the area while

in Witu pawpaw, mangoes, oranges, passion and sugar cane were mentioned as some of the fruits grown in the area. However, these fruits are seasonal thus the reason behind an indication that for the three places, majority of the respondents indicated that they eat these fruits only on availability.

The three communities vary in the consumption of pulses; consumption of pulses is higher in Mpeketoni as 40%, 77% and 65% of the population consume beans, green grams and cowpeas on a daily basis in comparison to less than 10% consumption in each of the pulses in Witu and the same for Awer save for Cowpeas (21%). Green grams and cowpeas are highly consumed in Awer while in Witu, cowpeas are consumed slightly more than green grams; they are more available in comparison to beans in the three areas. From the data, it can be concluded that pulses greatly contribute to the protein diet in the three areas.

Table 4.12: Percentage of people that sell their farm produce

Sale of farm produce						
	Awer		Mpeketoni		Witu	
	F	%	F	%	F	%
Do not sell	2	7	2	4	8	22
Sell produce	28	93	48	96	28	78
Total	30	100	50	100	30	100

In all the three study areas, the respondents indicated that aside from eating the food that they grow on their farms, they also sell mostly to the local markets the surplus foods and products. What they sell varies from one area to another depending on its availability as well as market for the same. From the analyzed data, what is common across the three areas is that game meat is hardly sold. However, during an FGD with men in Mpeketoni, the men revealed that wild animals are eaten as they are sold at night in drinking dens known as *Mangwenis* at KES 200 per kilo. The wild animals include buffalos, hippos, topi and antelopes.

Table 4.13: Percentage of main food sources in Awer, Mpeketoni and Witu

***Color codes:** Orange color range from 70-100%, yellow 40-70% and blue 10-40%

Food	Awer						Mpeketoni						Witu					
	Farm		Nature		Shop		Farm		Nature		Shop		Farm		Nature		Shop	
	F	%	F	%	F	%	F	%	F	%	F	%	F	%	F	%	F	%
Maize	30	100	0	0	0	0	48	96	0	0	2	4	29	91	0	0	3	9
Maize meal	11	37	0	0	19	63	48	96	0	0	2	4	28	80	0	0	7	20
Cassava	27	93	0	0	2	7	19	49	0	0	20	51	25	74	0	0	9	26
Arrow roots	0	0	0	0	28	100	1	4	0	0	26	96	1	50	0	0	1	50
Sweet potatoes	1	3	0	0	28	97	13	36	0	0	23	64	7	41	0	0	10	59
Rice	1	3	0	0	29	97	2	4	0	0	48	96	0	0	0	0	35	97
Wheat flour	1	3	0	0	29	97	0	0	0	0	50	100	0	0	0	0	34	94
Sugar	2	7	0	0	28	93	0	0	0	0	50	100	0	0	0	0	35	97
Honey	3	10	20	67	7	23	1	2	11	30	25	68	0	0	3	14	19	86
Cooking oil	1	3	0	0	29	97	0	0	0	0	49	100	0	0	0	0	35	97
Coconut oil	4	14	0	0	25	86	1	3	0	0	29	97	6	27	1	5	15	68
Ghee	1	33	0	0	2	67	1	4	0	0	24	96	5	56	0	0	4	44
Castor oil	0	0	0	0	1	100	0	0	0	0	24	100	0	0	1	10	9	90
Chicken	23	77	0	0	7	23	47	96	0	0	2	4	34	94	0	0	0	0
Beef	2	7	0	0	28	93	0	0	0	0	46	100	2	7	0	0	26	93
Goat meat	3	10	0	0	27	90	0	0	0	0	48	100	6	22	0	0	21	78
Rabbit meat	0	0	0	0	5	100	0	0	0	0	26	100	0	0	0	0	1	100
Lamb	1	4	0	0	26	96	1	4	0	0	26	96	1	7	0	0	13	93
Game meat	0	0	21	84	4	16	0	0	0	0	3	11	0	0	4	57	3	43
Fresh water fish	0	0	12	80	3	20	0	0	1	2	45	98	1	3	4	12	29	85
Sea fish	1	3	1	3	27	94	0	0	2	6	34	94	0	0	0	0	23	100
Prawns	0	0	1	4	26	96	0	0	0	0	25	100	0	0	0	0	19	100
Crabs	0	0	1	4	25	96	0	0	0	0	25	100	0	0	0	0	4	100
Beans	1	3	9	31	19	66	2	4	0	0	48	96	2	6	0	0	32	94

Green grams	28	97	0	0	1	3	48	96	0	0	2	4	27	77	0	0	8	23
Cowpeas	27	93	0	0	2	7	46	96	0	0	2	4	27	84	0	0	5	16
Peanuts	3	100	0	0	0	0	12	30	0	0	28	70	16	62	0	0	10	38
Mnavu	2	29	0	0	5	71	4	12	0	0	30	88	26	90	0	0	3	10
Mkunde	25	100	0	0	0	0	4	12	0	0	30	88	29	91	0	0	3	9
Mchicha	28	93	0	0	2	7	43	88	0	0	6	12	28	80	0	0	7	20
Sukuma wiki	3	10	0	0	13	45	18	37	0	0	30	63	10	38	0	0	16	62
Mangoes	16	55	0	0	13	45	40	82	0	0	9	18	27	79	0	0	7	21
Bananas	10	34	0	0	19	66	18	37	0	0	30	63	29	83	0	0	6	17
Oranges	0	0	0	0	29	100	33	69	0	0	15	31	4	29	0	0	10	71
Cashew	28	97	0	0	1	3	40	95	0	0	2	5	26	84	0	0	5	16
Pawpaw	29	100	0	0	0	0	25	56	0	0	20	44	30	86	0	0	5	14
Madafu	25	86	0	0	4	14	20	54	0	0	17	46	20	95	0	0	1	5
Passion	9	36	0	0	16	64	11	26	0	0	32	74	23	85	0	0	4	15
Kunazi	18	62	11	38	0	0	0	0	17	59	12	41	3	75	0	0	1	25
Matomoko	0	0	0	0	1	100	3	10	3	10	25	80	1	25	0	0	3	75
Guavas	2	13	0	0	14	87	3	11	0	0	25	89	3	43	0	0	4	57
Wild fruits	1	5	21	95	0	0	0	0	4	100	0	0	21	68	10	32	0	0

In summary, the data presented in this section reveals that people acquire relatively little food from natural biodiversity. Instead crop and livestock farming emerge as the primary and dominant source of the food eaten by these communities. Those that are derived from the shops are the ones that require manufacturing and processing such as cooking oils, wheat flour and rice as well as foods that are not grown on their farms like beans and cabbages. Glaring also from this study is that although the Awer derive more products from nature than those from Mpeketoni and Witu, the difference is dismal. Indeed, the Awer, who are living closer to nature practice farming as much as the communities in Mpeketoni and Witu. They do however rely on biodiversity for a few specific food items, notably honey, game meat and freshwater fish and are in the consumption of wild fruits with the community in Witu.

4.3.1.3 Medicine

Similar to the preceding section, this study was done with the assumption that communities living closer to nature would rely more on medicine derived from natural biodiversity. When asked to indicate their primary source of medicine for the ten ailments listed in table 4.14, respondents from the Awer community reported using medicine from nature in 15.4% of the cases on average. This reliance on medicine from nature among the Awer was higher than the 3.1% and the 2.5% among respondents from Witu and Mpeketoni respectively. Hence, this analysis revealed evidence in favor of the assumption that people living closer to nature and forest biodiversity rely to a larger extent on medicine that is derived from biodiversity.

Table 4.14: Sources of medicine (% of respondents) for ailments in Awer, Mpeketoni and Witu

	Awer			Mpeketoni			Witu		
	Farm	Nature	Shop	Farm	Nature	Shop	Farm	Nature	Shop
Headache	6.9	3.4	89.7	4.3	6.4	89.3	2.8	5.6	91.6
Tooth ache	15.4	11.5	73.1	8.3	6.3	85.4	15.0	10.0	75.0
Stomach upset	20.0	10.0	70.0	6.1	4.1	89.8	30.8	11.5	57.7
Sprains	0.0	0.0	100.0	0.0	0.0	100.0	0.0	0.0	100.0
Eye problems	8.0	16.0	76.0	0.0	0.0	100.0	22.7	0.0	77.3
Teething in children	0.0	3.8	96.2	0.0	0.0	100.0	0.0	4.8	95.2
Body ache	0.0	53.3	46.7	6.3	2.1	93.8	15.0	0.0	85.0
Ear ache	3.4	0.0	96.6	0.0	0.0	100.0	0.0	0.0	100.0
Animal sting/bite	0.0	35.5	65.5	0.0	2.1	97.9	0.0	0.0	100.0
Skin infection	0.0	17.9	82.1	92.0	4.0	4.0	10.0	0.0	90.0
Average	5.37	15.4	79.59	11.7	2.5	86.02	9.63	3.19	87.18

Table 4.14 shows that the differences between the communities in their reliance on medicine from nature are particularly large for a few specific ailments. The Awer take lead in using products from nature to treat ailments than the communities in Mpeketoni or Witu. The study revealed that the Awer depend on nature to treat 8 out of the 10 ailments identified while Witu only draws medicine from nature to treat only four of the ailments (headache, toothache, stomach ache and teething in children) while Mpeketoni follows Witu with six ailments. 16% of medicine obtained from nature in Awer to treat eye problems is honey and simsim oil which they administer as eye drops. A significant percentage in Awer, (53.3%) rely on nature to address body aches in comparison to Mpeketoni that has only 2% of the population depending on nature while inhabitants in Witu get medication from the shop to address body pains. The study

established that they use material from the neem tree to address this issue. Aside from this, they also identified *Balamal* and *Akakar* as other products from nature that they use to address this issue. Further, the Awer treat animal stings with products from nature (35.5%) and identified trees known as *Yongei* and *Warkoni* as those used to treat animal stings and bites. Around 18% of respondents in Awer use products from nature, specifically *Mjafari* and *Msabuini* to treat skin infection. In Witu, the highest percentage of medicine from nature is used to treat stomach upset by using aloe vera (*kisikiro paka*) followed by toothache whereby either a tree known as *Gadayu* or castor oil is used. Bearing in mind that Maisha Masha is close to the forest biodiversity, it is expected that there would be a higher number of reliance on nature to address these ailments like in Awer yet the results herein are on the contrary. This phenomenon could be attributed to cultural restrictions that prohibit access to these plants, trees and herbs by the general population; only a select older people are allowed to access and use these products, also a way of sustainably using the available resources.

A Key Informant interview with an elder from Mpeketoni Mr. Kamau Kimani aka *Mzee Nyuki* established that the populace in Mpeketoni use traditional medicine. Being a herbalist himself, Mr. Kamau outlined the following trees and herbs that he uses as part of his treatment regime; neem tree for treating malaria, *Mnyondo tree* for relieving body pain, *Muthithi tree (Mayterus Senegalensis)* for treating skin diseases, bark of the cedar tree is used to treat liver infection while the roots of the *Mkodoro tree* help to relieve joint pains. Mzee Nyuki has grown many of these trees and herbs in his farm.

An FGD with community members in Witu established that the following trees are used for addressing different ailments: Neem-treating malaria, aloe vera used for cleansing the blood, treating pneumonia and treating skin diseases, ribena is used for adding blood, passion leaves used to stop diarrhea, Moringa tree and leaves used for regulating pressure and diabetes as well as strengthening eye sights and finally tobacco as well as guava leaves are used to stop toothache and diarrhea. In Mpeketoni, two FGDs were held separately with the men and women from the area and the following were identified as the trees and herbs used as traditional medicine for treating different ailments: Neem- treating malaria, aloe vera leaves for treating skin disease, cleansing the blood and curing pneumonia, moringa seeds for cleansing the digestive system, an

appetizer, improving eye sight and treating blood pressure and diabetes as well as increasing libido, mjaafari use to strengthen joints and the leaves for treating ulcers, aloe vera for typhoid, guava used to stop tooth ache and stop diarrhea.

Interestingly, some of the Awer use honey to address eye problems by putting drops of honey in the eyes.

Based on the discussions held with the different groups in Witu and Mpeketoni, it emerged that these communities use herbs and trees at varying degrees for treating different ailments. More importantly the study revealed that these herbs and trees are obtained from their farms and not from nature. In Awer however, traditional medicine is used and this medicine is obtained from nature.

Overall these results thus provide evidence that the community living closest to nature (Awer) rely to a greater extent on medicine that they collect from natural biodiversity than the two other communities.

4.3.1.4 Energy

This study was premised on the assumption that significant differences would be observed in the three communities on the type of energy used for lighting and cooking; that the communities nearer biodiversity rich areas would rely heavily on those resources than those away from these areas and that those that are far away would rely on the more conventional energy sources like electricity and solar. The results herein depict otherwise.

Fig. 4.13 below shows that the lighting energy common in the three places is kerosene, Witu taking lead on its reliance (77.8%) followed by Awer (56.7%) then Mpeketoni (48%). Aside from kerosene, Witu and Mpeketoni rely on solar energy as an alternative source while Awer relies greatly on electricity (26.7%), an indication that the area has also been connected to the electricity grid which could be an indication of development in the area which has for long been depicted as underdeveloped such that options like electricity are far-fetched.

The communities in Awer and Witu also use firewood for their lighting while torches are used in Mpeketoni and Awer. Of the three, Witu has a lesser variety in the energy sources.

The data therefore goes to show that the biodiversity rich communities still rely on biodiversity for their lighting needs but in a small scale as they have identified alternative sources for lighting which are more conventional.

Figure 4.6: Types of lighting energy in Awer, Mpeketoni and Witu

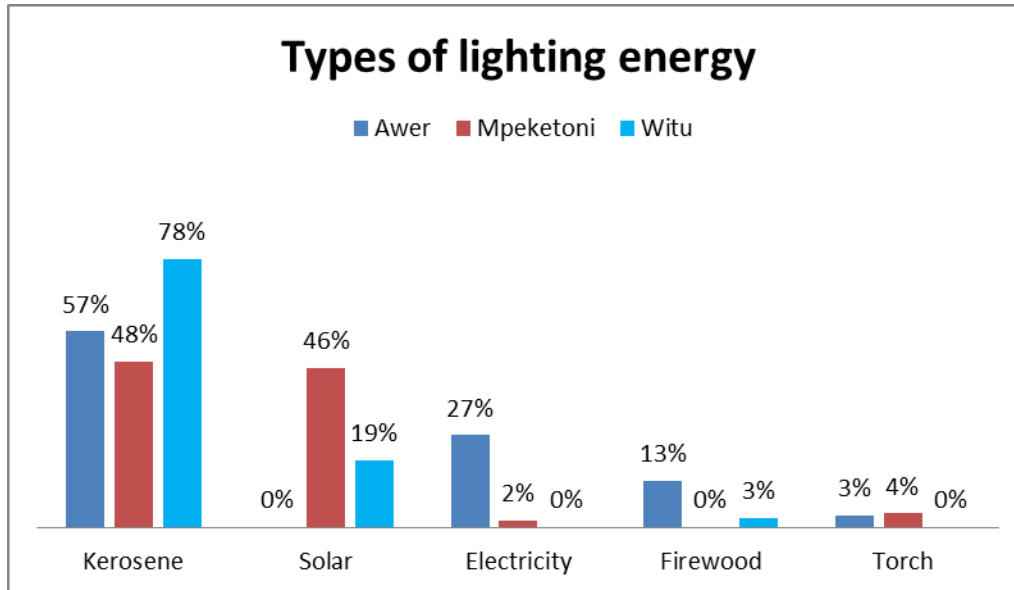
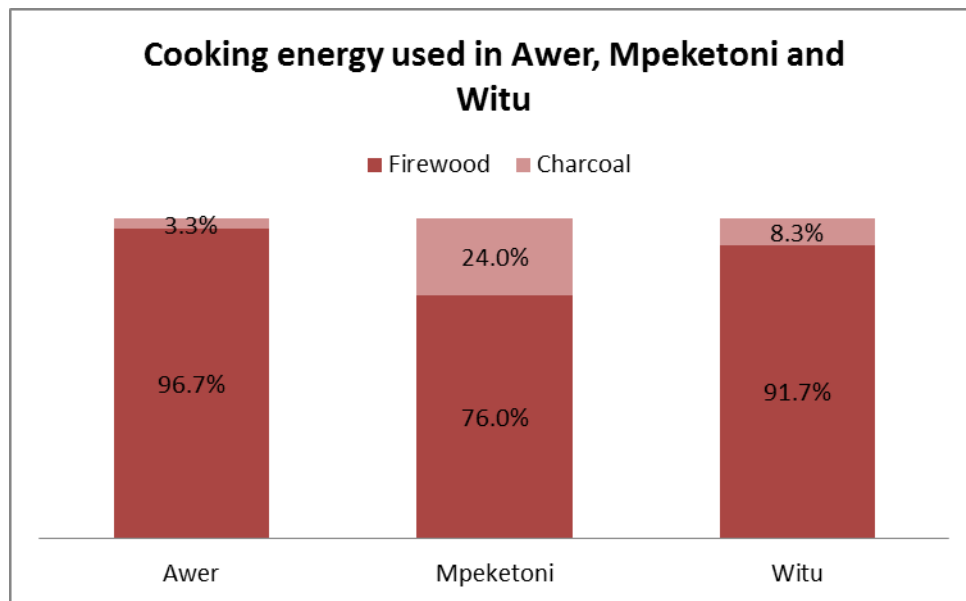


Table 4.15: Source of lighting energy

Aspects	Awer		Mpeketoni		Witu	
	F	(%)	F	(%)	F	(%)
Market/shop	26	86.7	47	96.0	34	97.2
Nature	3	10.0	1	2.0	0	0.0
Farm	1	3.3	1	2.0	1	2.9

The source of lighting differs from the source of cooking in all the three areas. While kerosene is used as the main lighting energy, and is obtained from the shop, firewood is the main cooking energy source for the three areas (Figure 4.9).

Figure 4.7: Cooking energy used in Awer, Mpeketoni and Witu



While all the three places use firewood as their main source of cooking energy, difference lies in the source of the firewood. Table 4.16 reveals that Awer draws its major bulk of fuel from nature (approximately 57%) and also from the farm. This is in contrast with Mpeketoni whose source of fuel is majorly from the farm.

Witu source their fuel from their farms (78%) although there is a smaller percentage that draws their firewood from nature (22%).

Table 4.16: Source of cooking energy

Aspects	Awer		Mpeketoni		Witu	
	F	%	F	%	F	%
Market/shop	2	6.7	2	4.0	0	0
Nature	17	56.6	1	2.0	8	22.2
Farm	11	36.7	47	94.0	28	77.8
Total	30	100	50	100	36	100

This data therefore supports the assumption that communities living close to the forest (nature) rely on the same to source for their cooking energy and thereby benefit from nature. However, the extent to which they rely on nature is greatly reduced by the fact that the firewood can also be accessed from the farm.

Benefits of biodiversity

4.3.2 Cultural role

Biodiversity supports the provisioning of a number of cultural services, including religion, community recreation and tourism. During the surveys little evidence was found to support the role of trees in religion which could be interpreted to mean that the traditional practice of worshipping trees may have disappeared. However, people value trees for their contribution to community building and potentially the biodiversity of the region could support tourism.

People worshipping particular places for religious purposes and the role of trees in there is a common example of a cultural service provided by biodiversity (Kinyanjui *et al.*, 2014). Traditionally, the coastal people like the Mijikenda used the forests to set up sacred places known as *Kayas*, where they performed spiritual sanctification rituals and ceremonies. “These sites are important for biodiversity conservation and certain plant species can only be found here” (Githitho & Forest, 1998). However, the validity of these examples on the cultural role of trees in religious practices was questioned during interviews with respondents who were questioned whether this still holds today. In discussing with the communities it was evident that there has been a shift with culture and what people do. In the past, trees were instrumental among the Mijikenda, the Giriama being one of them, as they would identify big trees, conduct traditional ceremonies such as circumcision and communicating with the spirits and offer sacrifices therein where they would bury offerings around the identified tree. During the FGD with the women in Maisha Masha, the women said that their children are nowadays circumcised in hospitals and as such do not conduct any ceremonies in the homestead. They also stressed that they no longer communicate with the deities on rites of passage because they have been converted to Christianity or Islam. “...*hayo mambo yamekuwa ya kizamani sasa, siku hizi twaenda kanisani...*” translated to “...*those have become things of old; nowadays we go to church!...*” Remarkd one Sidi Ziro on enquiring whether they still make offerings on roots of big trees. The same was the case in Mpeketoni where the FGD revealed that people no longer hold any religious or spiritual ceremonies under trees. However, the trees are used as meeting places as they provide adequate shade and cooling.

Apart from their role in religion, which may have slowly disappeared, biodiversity and trees play an important role in building communities. This community building is done in a variety of ways. First, trees play a role in community building by providing a sheltered environment that brings people together for meetings and developing their social relations. Further, there are certain trees that are so engrained in a local culture that they become a symbol of that culture. While the oak tree has such symbolic cultural value in Europe, the palm trees have a similar deeply engrained symbolic value to the coastal cultures of East Africa. So symbolic was the palm tree to the Coastal community in Kenya that it was taboo for the tree to be cut down for use as fuel wood or construction material unless the tree was old. The preceding data has revealed the Awer and the Giriama in Witu use coconut and palm oil for cooking and its leaves for roofing. These usages are part of their culture and differentiate them from other communities such as the Orma and the Kikuyu who do not consume the palm oil. The palm leaves also become a pointer to peoples' culture because the Kikuyu and the Orma use corrugated iron sheets and grass thatches for their roofing. The FGD with the Orma women in Witu revealed that the Duom palm may have a similar cultural value as they make brooms, and are valued for non-religious issues as it provides the material for mats (*jamvi*), baskets (*kikapu*) and praying mats (*mswala*). Some of the women sell these products at the local market.

Tourism and recreation are common ecosystem services provided by nature and the biodiversity that it supports. For reasons of insecurity, the coastal forests of Lamu County do not attract tourists and hence do not provide such cultural service. However, if security could be provided there would be good potential for tourism because the terrestrial part of the county hosts a variety of wildlife, including the endemic Hirola and unique forests. Together with the Lamu County Government which is responsible for security, other government agencies like KFS and KWS play an important role in developing nature based tourism in the area. Further, the commitment of such organizations as the Northern Rangelands Trust and Lamu Conservation Trust to develop conservancies in Lamu district is a step in the right direction for developing biodiversity based tourism in the area.

4.3.3 Discussion

This study has revealed that people living in the vicinity of the forest rely on it for the provision of their medicinal needs and cooking energy as is the case of the Awer who take lead in use of traditional medicine and cooking energy sourced from nature. Further, it has revealed that they rely on their farm for the provision of food, lighting energy and construction material.

Indeed the study has revealed that in relation to medicine, the Awer rely more on nature to obtain medicine which is in contrast to the two other areas that draw their traditional medicine from their farms. However, (Shackleton et al., 2007) argues that use and demand of medicinal plants are mainly used for cultural purposes as opposed to conventional medicinal use. They point out a study that was done by Cocks and Wiersum (2003), who stated that communities use specific fuel wood species to conduct specific rituals and ceremonies. In view of this, it may be argued that the Awer, who take lead in use of traditional medicine, use it for both purposes; medicinal and cultural therefore concluding that the trees also play a pivotal role in culture. This therefore affirms the assumption that communities living closer to nature rely more on this for their medicine (Nyunja, Onyango, & Erwin, 2009).

The three communities that were surveyed had striking similarity in the origin of their foods, which mostly came from their farms. The difference lay in the fact that the Awer used honey, fresh water fish, and game meat derived from nature more frequently than the community at Mpeketoni and Witu. Similarities are drawn in the main source of lighting energy in the three communities that is kerosene, although in Mpeketoni solar is also widely used almost in equal measure while the same is used in Witu. The alternative source of energy used in Awer is electricity. The study revealed little differences in the type of energy used for cooking as fuel wood was the main cooking energy in the three places. These results are in agreement with Williams and Shackleton (2002) who indicated that over 80% of rural households utilize fuel wood as their main energy source (Shackleton, et.al, 2007). Noteworthy is that in Awer a significant population derives their cooking energy from nature as compared to their counterparts that mainly draw this resource from their farms. The hypothesis on communities living in the vicinity of the forest benefit significantly from its resources therefore stands.

Construction material looked specifically at the walls, floor and the roof. Striking similarities were drawn on the wall and floor materials used for construction; mud and bare soil were the common construction materials for walls and floors respectively in all the three places. The glaring difference lay in the material used for roofing as Awer and Witu use products that have been derived from their farms (grass thatch and palm leaves respectively) while Mpeketoni use iron sheets obtained from the shop. Indeed, palm leaves are materials that are commonly used at the Coast. A study done in Dar es Salaam Tanzania revealed that majority of the Swahili houses in the coastal rural areas are constructed using palm leaves, poles and mud (Wells et al., 1998).

This research revealed some differences in the use of traditional medicine and source of cooking energy in the three communities, with Awer using traditional medicine and mainly sourcing its cooking energy from nature. What was more surprising however was the overall similarity of the three communities relying primarily on their farms and shops for food, lighting energy and construction material. These results however confirm the assumption that native people living in the vicinity of forests rely on forest biodiversity for their livelihoods in as far as fuel wood and medicine is concerned. Moreover, these communities do supplement their goods through their farms and shops.

Aside from the benefits and threats to biodiversity, the study also sought to establish opportunities that biodiversity avails. The opportunities that the respondents identified were farm related indicating that these communities benefit significantly from their farms. As a result, these communities do not actively participate in protecting and conserving the forest as they do not benefit from it significantly. This could be as a result of past policies that were very stringent and with limited consideration for community participation in conservation management plans. The current policies however are accommodative and more supportive of community based natural resource management. The question that begs however, is to what extent the policies like Kenya's New Wildlife Conservation and Management Act (WCMA 2013) that provides for, among other things, community participation and compensation, aspects that were not previously included, are implemented as this research has revealed a disconnect among forest communities and associated frustrations. With the shift in forest conservation, there is need of ensuring that communities collaborate with the conservation bodies for conservation

of the forest. The concerned bodies like KFS and KWS therefore need to reach out to the communities, sensitize them for instance on opportunities for communities provided in policies like WCMA Act, 2013, Water Act 2002 and the Kenyan constitution and work with them so as to ensure there is participation in the conservation of biodiversity.

The Forests Act

The Forests Act is an act of parliament that was established in 2007 that provides for the establishment, development and sustainable management, conservation and rational utilization of forest resources. The Act acknowledges the importance of forests for the benefits of soil and ground water regulation, agriculture as well as absorption of greenhouse gases. Among other things that the act addresses is the inclusion of management of all types of forests, the involvement of adjacent forest communities and other stakeholders in forest conservation and management, the use of an ecosystems approach to forest management planning, the provision of appropriate incentives to promote sustainable use and management of forest resources, the development of a framework for a forest legislation and the establishment of Kenya Forest Service. Further, the Act recognizes the existence of Community Forest Associations (CFAs). These associations participate in forest conservation and management under KFS. This Act is important as it provides for access to the forest resources by the neighboring communities and benefit sharing arrangements. It also stipulates the role of the communities in the utilization of forest resources and protection of forests. More specifically, Part iv section 47 (2) of the Act talks about community participation. The Act under this section provides for of the forest user rights. The community therein benefits in a number of ways that include but not limited to collection of medicinal herbs, honey, timber, grass and wood fuel harvesting, collection of forest produce for community based industries, ecotourism and recreational activities as well as scientific and educational activities. This therefore goes to show that it is in the interest of the surrounding communities that they benefit directly from the forest. The results herein go to show that the communities benefit in some aspects only like honey harvesting and collection of medicinal herbs with the main challenge being as a result of limited access through restriction by the authorities such as KWS and KFS. As such, the communities may need empowerment to know such provisions and look for ways through which they can optimally benefit since as it is

the benefits that they derive are not commensurate to what is available for them due to restrictions by KFS and KWS as will be seen documented under threats below.

4.4 Threats to benefits of biodiversity

In relation to threats and benefits, the survey started with the assumption that native communities living close to forests do rely significantly on ecosystem services from these forests and would therefore consider deforestation and forest degradation a threat to their livelihoods. This is so as there is a body of literature indicating that people relying on forest biodiversity for their livelihood consider deforestation and degradation a threat, for example (Blay et al., 2008) in their study in three communities in Ghana established that the locals were willing to participate in forest rehabilitation as they wanted to regain the forest resources, get money and timber as well as gain access to fertile forest lands, resources that they had previously benefited from. (Boissie, 2009), in interviewing local residents of a village in Vietnam, established that the locals agreed that having an open access by all and sundry to the natural forest would be detrimental to its existence and they would lose out on its benefits. Based on these findings it was anticipated that the native communities living close to the coastal forests would consider its degradation and deforestation a threat to their livelihoods.

Following the household interviews which had revealed a detailed picture of the various ecosystem services that people derived from their farms and from nature, FGDs were then organized to identify aspects and issues that threaten the continued provisioning of these ecosystem services. Interestingly, many of the threats that were mentioned were crops and livestock related. Consequently, the table below draws a distinction between crops and livestock related threats which were frequently mentioned and the threats that affect the benefits that arise from natural biodiversity (Table 4.17).

Table 4.17: Specific threats/constraints faced in sourcing food, medicine, construction material and energy

	Awer	Mpeketoni	Witu
Food from farm	<ul style="list-style-type: none"> • Pests (73.3%), • Unpredicted rainfall (6.7%) 		<ul style="list-style-type: none"> • Lack of food for livestock (23.1%) • Access to water (7.6%) • Land is unavailable (23.1%)
Food from nature	<ul style="list-style-type: none"> • Wild animals (6.7%) • Insecurity limiting access (6.7) 	<ul style="list-style-type: none"> • KWS restriction (100%) 	<ul style="list-style-type: none"> • KWS restriction (15.4%) • Wild animals (30.8%)
Medicine from farm			
Medicine from nature	<ul style="list-style-type: none"> • Identification of tree species (6.2%) • Distance (12.5%) • Wild animals (81.3%) 	<ul style="list-style-type: none"> • KFS restrictions (100%) 	<ul style="list-style-type: none"> • Culture (33.3%) • Unavailability owing to overutilization (66.7%)
Construction material from farm			
Construction material from nature	<ul style="list-style-type: none"> • Permit (38.5%) • High transport cost (23.0) • Wild animals (38.5%) 	<ul style="list-style-type: none"> • Permit (100%) 	<ul style="list-style-type: none"> • Permit (94.7%) • Wild animals (5.3%)
Energy from farm			
Energy from nature	<ul style="list-style-type: none"> • Permit (20%) • Wild animals (80%) 	<ul style="list-style-type: none"> • KFS (100%) 	<ul style="list-style-type: none"> • Scarcity due to over exploitation (7.7%) • Permit (84.6%) • Wild animals (7.7%)

The table reveals a large number of threats to the provisioning of food, medicine, energy and construction materials on farm. Some of these threats were common agricultural problems that have little to do with the neighboring forest environment like unreliable rainfall, pests, grazing land etc. For instance, pests have been identified as a major hindrance to a bountiful harvest in Awer as they attack the food that has been grown; in addition, they do not have extension service officers that would advise them on what to do. Insecurity, unpredictable rainfall and wild animals also contribute in equal measure to the provision of food challenge. In Mpeketoni, a few people mentioned that they have a challenge accessing food; they shared that their challenge had to do with restrictions from KWS on entry into the forest hence limiting their access to food.

Respondents in Witu mentioned a myriad of challenges ranging from wild animals such as baboons, elephants and monkeys attacking their farms. The damage created by wildlife however is directly related to the adjacent forest and its biodiversity. When asked for threats, respondents

considered biodiversity a threat to their crop land (wild animals like elephants, monkeys and baboons). The pastoralists in Witu also had a challenge on land- in the village that the interview was conducted there was an invasive species that had attacked the delta and dried up the water and the cattle also do not eat that type of grass; food for livestock especially during the dry season which was during the time that the data was collected was another challenge identified; access to water is also a challenge to some of the respondents as they have to walk for long distances to get to their water source. The residents complained that access to food and water was greatly hampered by a plant that grows on their delta resulting in complete loss of water as the plant completely usurps the water. The cattle that they possess are unable to feed on the plant as well. One resident complained, *“hii mmea haitusaidii na haisaidii ng’ombe zetu, ni hasara tupu!”* translated to *this plant does not benefit us or our animals, it is a total waste*. These threats are in line with (Laurila-Pant et al., 2015) who identified habitat loss as a threat to biodiversity.

During FGDs, land tenure security or lack of it, emerged as a major threats for the three areas; all the three areas reported that there is land related conflicts. The issue of land conflicts was also alluded to by the assistant County Commissioner, Mr. Elijah Kipterop who stated: *“Lamu is a county that has problems with land; if you solve land issue you will solve 70% of the issues in Lamu”*.

In Awer, the major issue had to do with lack of titles on the part of the residents and the residents feel that the issue of title deeds needs to be addressed; that the government ought to ensure that the residents are given title deeds.

In Witu the main land related conflict is between pastoralists and farmers. These pastoralists feel that the land belongs to them and have a right of grazing the animals in their land while the farmers feel that the pastoralists are infringing on their land and actually feeding on their hard earned crops. Indeed, so serious is the issue that there is infighting between these communities. On interviewing the Orma members one man said *“...this issue is very serious, it is a ticking time bomb”*. In Witu, while holding the FGD with the women, the women shared horror stories of pastoralists invading their shambas and threatening to come back at night to avenge if at all they tried to ward off the cows from eating their maize and other crops they have grown. Aside

from them attacking they have also threatened to rape them; Mrs. Tabu Katana narrated how a herdsman got into her shamba and as she was warding off the cows she was told “...*acha gombe ikule!*”...*unajua hii kiboko?*” translating to *leave the cow alone to graze... do you understand this cane?*) pointing to his manhood. Both communities, the Orma and the Giriama reported of their youth being attacked by the other community.

In Mpeketoni, the land related conflicts have a little to do with the pastoralists communities but also title deeds allocation as there is a fear that the ‘big shots’ will come and displace those that have resided in the area for a long time but do not have title deeds. Land tenure remains a big issue in all the three areas. This information is corroborated with the collected data that indicates that up to 93% of the population in Awer, 66% in Mpeketoni and 91.7% in Witu do not possess land titles.

Lack of land title deeds means that the residents live in perpetual uncertainty thus making it challenging for the residents to make any long term plans around the land they reside in.

Aside from land conflicts, the FGD in Mpeketoni revealed different responses between the men and the women. Surprisingly, the men identified increase in population and charcoal burning resulting in reduced tree and water density due to farming along water routes as threats. These have a bearing on the biodiversity of the area. On the other hand, the women in Mpeketoni identified loss of soil fertility and reduced rainfall as challenges. These are in relation to the crops that they grow.

As regards threats that arise from the benefits derived from natural biodiversity, wild animals like snakes limit access to the forest, KWS restriction and insecurity resulting in limited access are identified as the main threats to access of food from nature. In relation to medicine, its unavailability due to its overutilization, distance coupled with KFS restriction, culture and inability to identify the appropriate tree species for a specific ailment were the threats identified. For instance, medicine that was available in the past is difficult to access nowadays and it is for this matter that the FGD members were suggesting that only mature trees ought to be harvested; this and encouragement of community members to practice reforestation.

Inability of getting a permit due to the process and cost involved, high transportation costs due to poor road infrastructure and wild animals were the threats hindering access to construction material from nature while the threats from energy had to do with scarcity due to overexploitation, expensive permits, KFS restriction and wild animals. Forest degradation and destruction do not factor in in any of those that have been identified.

Noteworthy also, is that for all the provisioning services, the issue of LAPSSET did not emerge in any of the discussions both in the FGDs and household interviews as a threat yet it is recognized that infrastructure developments of such magnitude have challenges such as displacement which may affect livelihoods of many e.g. (Gellert & Lynch, 2003).

4.4.1 Summary

Looking at the threats, the emergent issue is that the communities herein regard challenges that impact on their farm productivity as important as they have a direct bearing on their livelihood. This is true as majority of the threats identified were to do with crop and animal related challenges. The other main challenge aside from the ecosystem services had to do with land tenure security, an issue cutting across the three areas. The assumption therefore that forest degradation and deforestation are considered as a threat does not hold water. Instead, from the interviews conducted, threats that have a bearing on biodiversity include restriction by authorities that be, that is KWS and KFS and scarcity of the natural resource (forest trees) to access products like medicine.

4.5 Opportunities of biodiversity

In the previous sections the reliance of three communities on ecosystem services derived from their farms, shops and natural biodiversity have been described. The results have shown a dominant reliance of all three communities on ecosystem services derived from their farm lands. Consequently, the results in this section include opportunities for conservation of forest biodiversity as well as on-farm opportunities.

As regards to forest biodiversity, participants in groups and at household level were asked whether they consider collective action as important in managing and conserving the natural resources, whether they are involved in any nature conservation efforts as well as whether they would wish to participate in a community based action plan. Table 4.15 below presents the results from the three areas. These opportunities are geared towards forest biodiversity, with the aim of preventing forest degradation and deforestation.

Table 4.18: List of opportunities of biodiversity

Aspects	Awer		Mpeketoni		Witu	
	F	%	F	%	F	%
Collective action	30	100	50	100	30	85.7
Involvement in nature conservation efforts	25	83.3	50	100	23	79.3
Participation in community based action plan	30	100	50	100	28	100

Collective action has to do with individuals voluntarily working together as a group to address a common interest. In Awer and Mpeketoni, 100% of the respondents think that collective action is a way or an opportunity of addressing environmental problems.

In discussing with some of the community members they felt that if they came together as a group then it would be easier to address the title issue as they would follow it as a block meaning more people would be heard than an individual trying to address the issue by themselves. In line with that, all the respondents expressed willingness to participate in generating an action plan for improving the management of natural resources at community level.

In Mpeketoni, every household is involved in tree planting in their farm and they view this effort as contributing towards nature conservation. In Awer those that are involved in nature

conservation talked of planting trees as well as being involved and participating in the Awer conservancy as their way of being involved in nature conservation while in Witu the 79.3% of the households involved in nature conservation talked of planting trees as well as desisting from cutting trees as their effort towards nature conservation. Interestingly, the community members do not perceive conservation of the forests around them as a possible threat to their existence.

When asked whether they would be willing to participate in development of a community based action plan if called upon, all the respondents expressed their willingness to participate on the same.

Aside from the forest related opportunities, the communities also discussed on-farm opportunities which are outlined as below.

4.5.1 Land tenure security: in all the three communities, as has been earlier established, land tenure continues to be an issue and a challenge. Many expressed that this is an issue that needs to be addressed as it will present a sense of satisfaction and settle the residents; they will be able to carry on their activities without the fear of being evicted any time; they will practice farming wholeheartedly, build permanent structures for their homes and get involved in other long term plans.

4.5.2 Infrastructure development: Generally, Lamu County has very poor road infrastructure since independence and it is only in 2016 that the Kenyan President, Mr. Uhuru Kenyatta announced the construction of tarmac road to be done in the area. In Awer, farming is practiced but ready market is a challenge as access to the place remains a challenge due to poor road infrastructure. Aside from improving road infrastructure, the community in Witu and Awer were proposing that consideration could be made of erecting an electric fence around the protected areas so as to restrict wild animals like baboons from attacking people's farms hence increase productivity.

4.5.3 Working with authorities: the communities expressed that it might be a good opportunity to engage with the authorities like KFS and KWS so as to agree to what extent the community can derive materials from the forest at a favorable rate as well as work closely with each other to ensure that both animals and plants are protected.

4.5.4 Linkage to markets: all the three communities reported selling the produce that they grow besides consuming it at household level. Challenges however include obtaining adequate market for their produce and exploitation resulting in poor prices for their produce. Products that are available for sale include but not limited to honey in Awer, mangoes in Mpeketoni and green grams in Witu. On the same breathe, some women in Mpeketoni expressed that having a juice factory in the area would be a great opportunity to boost their livelihoods.

4.5.5 Women involvement: taking cognizance that community participation is important, the women felt that it would be of greater benefit to involve them more in decision making around farming as they would greatly contribute to increased productivity in their produce; besides, they are naturally nurtures!

4.6 Discussion on opportunities

Based on the opportunities established from the study, what is emerging is that these communities benefit greatly from their farms as opposed to the forest which is in their vicinity. This means therefore that the people therein do not participate actively in protecting and conserving the forest as they do not benefit from it significantly. This could be as a result of past policies that were very stringent and did not consider community members. The current policies however are friendlier and more supportive of community based natural resource management. The question that begs however, is to what extent the policies like Kenya's New wildlife Conservation and Management Act (WCMA 2013) that provides for, among other things, community participation and compensation, aspects that were not previously included, are implemented as research reveals high disconnect among forest communities and associated frustrations. With the shift in forest conservation, there is need of ensuring that communities collaborate with the conservation bodies for conservation of the forest. The concerned bodies like KFS and KWS therefore need to reach out to the communities and sensitize them on opportunities for communities provided in policies like WCMA Act, 2013 so as to ensure there is participation in the conservation of biodiversity.

CHAPTER FIVE: SUMMARY, CONCLUSION AND RECOMMENDATION

5.1: Overview of Study

This survey started with the assumption that local communities attach a lot of value to their land and that they benefit significantly from the biodiversity in the areas surrounding their settlements and farms. The results have revealed that indeed these communities greatly value their land and that they depended mostly on their farms for foods. Honey, game meat, and wild fruits were mentioned as specific cases of foods sourced from the forest.

These results have further gone to show that these communities do not mainly rely on biodiversity to carry out cultural activities such as circumcision but use them for community enhancement such as holding community meetings under the trees as well as use them for making brooms, mats and baskets.

The study has also revealed a shift in lifestyle from nature dependence to complimenting products derived from nature with those from farms and shops. This was mentioned as to have been caused by increased restriction to access forest products due to the previous policies will restricted communities from harvesting products from nature.

This study has identified both on farm and forest conservation related opportunities. Since these communities depend on their farms for their livelihoods, linkages to markets, women involvement and development of infrastructure have been identified as some of the farm based opportunities while collective action and participation in community based action planning have been seen as opportunities for forest conservation.

5.2 Recommendations and areas for future research

The study provides evidence that the biodiversity has significant effect on the livelihood of the communities in Lamu County and thus there is need to conserve the later for continued benefit generation. From this study it was evidenced that some communities (Awer) who were hunters

and gatherer have had to change their life styles due to increased restriction to access to timber and non-timber products.

The Kenyan coastal forest plays host to unique biodiversity yet this has not been tapped as an opportunity for not only publicizing the area but also use this as an avenue of enhancing the neighboring communities' livelihoods through eco-tourism. There is therefore need to think about how this wonderful natural resource can be optimized to ensure its continued existence as well as improve the quality of life of its stakeholders. Key stakeholders like KFS and KWS can take lead, together with other relevant bodies to promote ecotourism in the area.

There is need of promotion of biodiversity based value chains. When the communities benefit from the forest by drawing some resources from it sustainably, they can become active in ensuring its posterity. This means that the forest is sustainably used and livelihoods of these communities are enhanced.

There is further need to increase community awareness to reduce threats to biodiversity as well as share with the community the importance of conservation so as to reduce human-wildlife conflict. The community also needs to be educated on the benefits of conserving the forest and how they can gain from it.

There is also need of developing conservancies that will assist in reducing human wildlife conflict as well as enhance communities' livelihood through employment creation as well as promotion of tourism.

To enhance their crop productivity thus improving their livelihood, the county government needs to ensure that agricultural extension services are available and consistent to the farmers as these communities practice farming with their indigenous knowledge yet they have expressed their need of having extension services as they see this as an avenue of improving their farming.

In a bid of ensuring that the forest resources are not depleted, communities can be encouraged to plant trees on their farm lands so as to generate their fuel wood from their farms. Land conflict in the area needs to be addressed through holding community peace dialogues as well as coming up

with amicable ways of addressing these conflicts. On the same breathe, the issue of title deeds needs to be addressed by the government.

There is need to focus on Participatory Forest Management as this has been seen as an effective approach to forest protection. This would mean having on board different stakeholders from the community to conservation bodies get involved in conserving the forests and its resources involving the people gives them a sense of ownership thereby protecting what they own.

5.3 Further research

There is need of conducting further research on the livelihoods and lifestyle of the people in Awer to get a clear and deeper understanding of the people therein towards ensuring proper use of biodiversity as available literature is contrary to the findings of this study.

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Annex 1: Household questionnaire

BENEFITS OF BIODIVERSITY: COMMUNITIES' PERSPECTIVES IN WITU AND AWER

UNIVERSITY OF NAIROBI

DEPARTMENT OF SOCIOLOGY AND SOCIAL WORK

Introduction and consent to participate in research

Hello,

My name is Linda Mbeyu, a student at the University of Nairobi pursuing a Masters degree in Rural Sociology and Community Development. In partnership with the Biodiversity Management in the Horn of Africa project at World Agroforestry Centre (ICRAF), University of Nairobi is conducting research to establish the benefits that people in this area derive from on farm and off farm biodiversity. If you agree to participate in this research, the research will take approximately one hour of your time. Please note that all the answer you provide will be treated with utmost confidentiality and the information/data gathered will be used anonymously and that you are free to interject if you are uncomfortable to answer a given question. Feedback and recommendations from this research will be communicated through the Biodiversity Management in the Horn of Africa project.

I hereby seek consent for your participation in the interview.

SECTION A: INTERVIEW INFORMATION

Questionnaire code:	Sub-county:	
Location:	Village name:	
GPS coordinates: Elevation:	Longitude:	Latitude:
Interview date: Start time: End time:	Name of interviewer	Mobile number
Name of respondent:	Mobile number:	
Sex of respondent: Male = 1 Female = 2	Age of respondent(years)	

SECTION B: RESPONDENT PROFILE/HOUSEHOLD CHARACTERISTICS/DEMOGRAPHICS

The household head is the ultimate decision maker in a household while household members are those that eat and stay in the same house on a regular basis

1. Relation of respondent to household head 1= Self 2= Spouse 59= Other(<i>specify</i>)	
2. Name of household head	3. Age of household head
4. Household type ¹ [1] [2] [3] [4] [5]	5a. Main occupation of household head 5b. Main occupation of spouse/respondent

¹ 1= male headed monogamous; 2= male headed polygamous; 3= male headed single, divorced or widowed; 4= female headed single, divorced, widowed or deserted; 5= child headed;

6. Level of formal education of HH head				7. Level of education of spouse									
[1]	[2]	[3]	[4]	[5]	[6]	[7] ²	[1]	[2]	[3]	[4]	[5]	[6]	[7]
Household composition(include all members including the respondent) NB: Household members are those that eat and stay in the same house on a regular basis													
8.HH member	Sex Male =1 Female =2	Age	Name					Does this member contribute to HH income? 0=No 1=Yes					
1.													
2.													
3.													
4.													
5.													
6.													
7.													
8.													
9. Ethnic group (of respondents, and/or HoH:													

² 1=None; 2=Some primary; 3=Primary finished; 4=Secondary; 5=College; 6= University; 59=Other(*specify*)

<p>10. Migrated to current location?</p> <p>0= No 1=Yes</p> <p>a. If yes, Where from? when? (year)</p>	<p>11. Reason for moving to this area?³</p> <p>[1] [2] [3] [4] [59]</p>
--	--

SECTION C: PHYSICAL ASSET AND ON-FARM PRODUCTION

Possession of HH/farm items

15. At present, how many of the following list does the HH own that are usable (=not broken):

	Asset name	Total no. owned	Farming implements
			0=Absence 1=Presence (Write Code (0/1) where applicable)
	Radio		Spade
	Mobile Phone		Fork Jembe
	Television		Ladder
	Bicycle		Wheelbarrow
	Car/pick up/Lorry		Sickle
	Motorcycle		Sprayer
	Ox cart		Hammer
	Fridge		Manual water pump
	Gas cooker		Storage shed

³ 1= Employment 2=Easy access to natural resources 3=Land easily available 4=Referred by a relative 59=Other (*specify*)

	Paraffin stove		Tarimbo	
	Electric stove/oven		Hoe	
	Water tank		Panga	
	Generator		Tractor	
	Solar panel		Plough	
	Computer		Baskets/crates/cases to store fruits	
	Others		Others	
16.	Source of water (1=Rain, 2=Borehole, 3=Tap, 4=Well, 5=Lake,6=River, 59=Other-specify)			
	Water use	Source of water	Distance (Km)	Distance (min.)
a.	Drinking water			
b.	Cultivation water			
17. Do you have electricity? 0=No 1=Yes				
If yes please specify whether own connection or shared connection 1=own connection 2= shared connection				
Housing				
18. Number of bedrooms available for HH members?				

<p>19. Wall type of main house construction material:</p> <table border="1"> <thead> <tr> <th></th> <th>F=1</th> <th>N=2</th> <th>S=3</th> </tr> </thead> <tbody> <tr> <td>1=Mud</td> <td></td> <td></td> <td></td> </tr> <tr> <td>2=Wood</td> <td></td> <td></td> <td></td> </tr> <tr> <td>3=Stone/brick</td> <td></td> <td></td> <td></td> </tr> <tr> <td>4=Palm leaves</td> <td></td> <td></td> <td></td> </tr> <tr> <td>5=Mangrove</td> <td></td> <td></td> <td></td> </tr> </tbody> </table>		F=1	N=2	S=3	1=Mud				2=Wood				3=Stone/brick				4=Palm leaves				5=Mangrove				<p>20. Roof type of main house construction material:</p> <table border="1"> <thead> <tr> <th></th> <th>F=1</th> <th>N=2</th> <th>S=3</th> </tr> </thead> <tbody> <tr> <td>1=Grass thatch</td> <td></td> <td></td> <td></td> </tr> <tr> <td>2=Iron sheets</td> <td></td> <td></td> <td></td> </tr> <tr> <td>3=Palm leaves</td> <td></td> <td></td> <td></td> </tr> <tr> <td>4=Roofing tiles</td> <td></td> <td></td> <td></td> </tr> </tbody> </table>		F=1	N=2	S=3	1=Grass thatch				2=Iron sheets				3=Palm leaves				4=Roofing tiles				<p>21. Floor type of main house construction material</p> <table border="1"> <thead> <tr> <th></th> <th>F=1</th> <th>N=2</th> <th>S=3</th> </tr> </thead> <tbody> <tr> <td>1=Bare soil</td> <td></td> <td></td> <td></td> </tr> <tr> <td>2=Stone</td> <td></td> <td></td> <td></td> </tr> <tr> <td>3=Wood</td> <td></td> <td></td> <td></td> </tr> <tr> <td>4=Floor tiles</td> <td></td> <td></td> <td></td> </tr> </tbody> </table>		F=1	N=2	S=3	1=Bare soil				2=Stone				3=Wood				4=Floor tiles			
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<p>22. What is the main source of income for this household?⁴</p>	<p>23. Are there additional income generating activities in this household? Please specify</p>																																																																	
<p>SECTION D: VALUE THAT COMMUNITIES ATTACH TO LAND</p>																																																																		
<p>24. Do you have a title for this land? 0=No 1=Yes</p>	<p>25. What is the size of this land in acres?</p>																																																																	
<p>26. How did you acquire it? 1=Inherited 2=Bought 3=Hired</p>	<p>27. What aspects do you consider in choosing land? (list all)</p>																																																																	

⁴ 1=Employment [on-farm labor] [off-farm labor]; 2=Sale of farm produce; 3=Sale of products from nature (forest); 4=Remittances; 5=Others (*specify*)

28. For each of the following statements please indicate whether you strongly agree, agree, not sure, disagree or strongly disagree to them

Statement	Strongly agree=5	Agree=4	Not sure=3	Disagree=2	Strongly disagree=1
If asked to surrender my land in exchange for money I can accept					
If asked to lease out my land for some time I can accept					
If asked to relocate to another area with the same land size I can accept					
If asked to donate part of my land to my relatives I would agree					

Kindly indicate which of the following farming activities that are currently being carried out on your land. (rank them in order of the most important to the least important)

Activity	Rank
Crop Farming	
Livestock keeping	
Bee keeping	
Cultural practices (traditional ceremonies)	
Selling water(boreholes)	
Other (specify)	

<p>31. Kindly indicate (list) some of the challenges you are faced with as a farmer</p>	<p>What do you suggest that should be done to alleviate these challenges?</p>
---	---

SECTION E: DIRECT BENEFITS FROM BIODIVERSITY (FOOD PROVISIONING, MEDICINE, ENERGY)

32. Of the food categories below, please indicate your family consumption in the table below

Food category	Food	Frequency			
		1=Daily	2=At least once a week	3=At least once a month	4=Only when available
Cereals and cereal products (e.g. maize, spaghetti, rice, bread)	Maize				
	Maize meal				
	Rice				
	Wheat flour				
Milk and milk products (e.g. goat/cow fermented milk, milk powder)?	Milk				
	Fermented milk(maziwa mala)				
Sugar and honey?	Honey				
	Sugar				
Oils/fats (e.g. cooking fat or oil, coconut milk ,butter, ghee,	Cooking oil				
	Cooking fat				

<i>margarine)?</i>	Margarine				
<i>Meat, poultry, offal (e.g. goat, beef; chicken or their products)?</i>	Chicken				
	Beef				
	Goat meat				
	Rabbit meat				
<i>Pulses/legumes, nuts (e.g. beans, lentils, green grams, cowpeas; peanut,)?</i>	Beans				
	Green grams				
	Cowpeas				
<i>Roots and tubers (e.g. sweet potatoes, cassava, arrowroot Irish potatoes)?</i>	Cassava				
	Arrowroot				
<i>Vegetables (e.g.</i>	Mnavu				

<i>green or leafy vegetables, tomatoes, carrots, onions)?</i>	Mkunde				
	Mchicha				
	Sukuma wiki				
<i>Fruits (e.g. water melons, mangoes, grapes, bananas, lemon)?</i>	Mangoes				
	Bananas				
	Oranges				
	Bananas				
	Pawpaw				
	Madafu				
	Mangoes				
<i>Fish and sea foods (e.g. fried/boiled/roasted fish, lobsters)?</i>	Fresh water fish				
	Sea fish				

33. What foods do you grow on your farm?

Food category	Specify food
Cereals(e.g maize)	
Pulses/legumes, nuts (<i>e.g. beans, lentils, green grams, cowpeas; peanut,)?</i>	
Roots and tubers (<i>e.g. sweet potatoes, cassava, arrowroot Irish potatoes)?</i>	
Vegetables (<i>e.g. green or leafy vegetables, tomatoes, carrots, onions)?</i>	
Fruits (<i>e.g. water melons, mangoes, grapes, bananas, lemon)?</i>	

34. How much of what you produce do you use yourself in a season?

35. Do you sell any of your produce? Which one and how much of it?

36. What are the main sources of your food?

Food category	Food	Source		
		Farm= 1	Nature/Forest = 2	Shop = 3
Cereals and cereal products (e.g. maize, spaghetti, rice, bread)				
Sugar and honey?				
Oils/fats (e.g. cooking fat or oil, coconut milk ,butter, ghee, margarine)?				
Meat, poultry, offal (e.g. goat, beef, wild meat; chicken or their products)?				

Pulses/legumes, nuts (<i>e.g. beans, lentils, green grams, cowpeas; peanut,)?</i>)?				
Roots and tubers (<i>e.g. sweet potatoes, cassava, arrowroot Irish potatoes</i>)?				
Vegetables (<i>e.g. green or leafy vegetables, tomatoes, carrots, onions</i>)?				
Fruits (<i>e.g. water melons, mangoes, grapes, bananas, wild fruits/indigenous fruits</i>)?				

Fish and sea foods (e.g. fried/boiled/roasted fish, lobsters)?				

Benefits of nature-medicine and energy

42. Please specify where you source your medicine, cooking and lighting energy?

	Own farm=1	Forest/Nature=2	Market/Shop=3	Other specify=59
Medicine				
Lighting energy				
Cooking energy				

SECTION E: OPPORTUNITIES AND THREATS TO BIODIVERSITY

Threats to benefits from biodiversity

43. Do you face any difficulties sourcing medicine, food, construction material and energy from nature?

0=No 1=Yes

If yes, what benefits here below are affected and how?

Type of benefit	Category	Problem narrative
Foods	1=Fruits 2=Vegetables 3=Meat 4=Oil 5=Milk	
Medicine	1=Herbs 2=Bark 3=Leaves 4=Roots	
Construction material	1=Wood 2=Palm leaves 3=Mangrove 4=Stone	
Energy sources	1=Firewood 2=Charcoal 3=Electricity	

44. Is land tenure an issue in this area? 0=NO 1=Yes		
Opportunities of biodiversity to livelihoods		
45. Do you think collective action helps to address any environmental problems and/or opportunities? 0=No 1=Yes	46. Are you involved in any nature conservation efforts? If yes how?	
47. What in your opinion should be done to ensure there is sustainable use of natural resources?		
48. Would you wish to participate in a community based action plan for improving management of natural resources?		
49. Any comments?		

Thank you for your time

Annex 2: FGD

1. What do people in this community use land for?
2. Do people in this community lease out/sell their land?
3. What crops do people grow in their farm?
4. What are the staple foods eaten in this community?
5. What are the fruits commonly obtained in this community? And vegetables?
6. List the meats obtained and eaten in this community
7. Where do you obtain all these from?
8. Do people in this community use traditional medicine? Which one(s) for what use?
9. What construction material is used to make the following? Where is it obtained?
 - Houses
 - Furniture
 - Livestock kraal
 - Fences
 - Bee hives
 - Animal traps
 - Tools
10. What are the three important energy sources for **cooking**? Where are they sourced from?
11. What are the three important energy sources for **lighting**? Where are they sourced from?
12. What cultural services does nature provide?
 - Rite of passage
 - Religion and spirituality
 - Aesthetics
 - Recreation and tourism
13. Overall how do you appreciate the balance between benefits and trade-offs from biodiversity?
 - a. Only benefits
 - b. Benefits are higher than trade-offs
 - c. Equal benefits and trade- offs
 - d. Tradeoffs are higher than benefits
 - e. Only trade-offs
14. Do you address any challenges to do with nature communally?
15. As a community what challenges do you face with nature?

16. Would you be interested in a community based action plan for improving management of natural resources in future?

Annex 3: Key Informants Questions

1. Tell me about yourself
2. How long have you lived in this community?
3. How long have you worked in this organization?
4. Tell me about your organization and whom it serves/ its mandate
5. Do you engage with the community in executing your mandate? If so, how?
6. What is the role of regulation service in biodiversity (soil erosion prevention, shade provision)?
7. How do the communities here benefit from ecosystem goods and services?
8. Are there any threats to biodiversity? If yes, which ones?
9. Is land tenure an issue in this area?
10. Is the community here involved in protecting nature/biodiversity? If yes, how?
11. What do you think could be done to encourage more community involvement? By whom?
12. What do you think should be done to ensure sustainable natural resource use?
13. What other institutions addressing biodiversity exist in this area?
14. Would you be interested in a community based action plan for improving management of natural resources in future?
15. Are there any other people that you think we should talk to?