GOVERNANCE DILEMMA AND SUSTAINABLE PROVISION OF ECOSYSTEM SERVICES BY MT. MARSABIT FOREST, KENYA

BY

OUKO, CAROLYNE A.

Z81/96193/2014

CENTRE FOR ADVANCED STUDIES IN ENVIRONMENTAL LAW AND POLICY (CASELAP)

A THESIS SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF PHD IN ENVIRONMENTAL POLICY AT THE

UNIVERSITY OF NAIROBI

22ND NOVEMBER, 2019

DECLARATION

This thesis is my original work and has not been submitted in any other university.

Signature: _____ Date: _____

Caroline Achieng Ouko

This thesis has been submitted to the Centre for Advanced Studies in Environmental Law and Policy (CASELAP) in partial fulfilment of the requirements for the degree of Doctor of Philosophy in Environmental Policy, of the University of Nairobi with our approval as supervisors.

Signature: _____ Date: _____

Prof. Nicholas Otienoh Oguge

Signature: _____ Date: _____

Prof. Richard Mbithi Mulwa

Signature: _____ Date: _____

Dr. Robert Machatha Kibugi

ACKNOWLEDGEMENTS

Design, implementation, and preparation of this thesis were made possible by the support of academic staff, friends, and colleagues. First and foremost, I would like to express my sincere gratitude to my supervisors, Prof. Nicholas Oguge, Prof. Richard Mulwa, and Dr. Robert Kibugi for their support, patience, and encouragement throughout my research. The main supervisor, Prof. Oguge's teaching, guidance and technical advice were essential to the completion of this thesis. Many thanks to the teaching and administrative staff at the Centre for Advanced Studies in Environmental Law & Policy (CASELAP) for their immense help and guidance.

This research was made possible by financial assistance from the Northern Kenya Biodiversity Conservation (Marsabit) Project KWS/AFD/CKE 1036 led by its coordinators especially Godwin Leslie Muhati, who provided support in data collection. I would also like to thank my colleagues and the entire Centre for Training & Integrated Research for ASAL Development (CETRAD) family led by Dr. Boniface Kiteme, who granted me the study leave necessary to accomplish my studies.

I would like to thank my entire immediate and extended family, especially my husband Gregory Opiyo for their dedication and support without which my studies would not have been possible.

Lastly, my sincere gratitude to all the people and organizations I interacted with during the course of my Doctor of Philosophy studies. Since I cannot name each and every person who has contributed in one way or another to this research, to all those who assisted at the many different stages of my research work and preparation of this manuscript, I say "Asanteni sana".

DEDICATION

This thesis is dedicated to my late parents Henry Barrack Ouko and Anastacia Ouko for their inspiration and love for education; and to my husband, Gregory Opiyo Agola who never fails to remind me how to live as if every other day were my most precious.

LIST OF ABBREVIATIONS

ALRMP	Arid Lands Resource Management Project
ASALs	Arid and Semi- Arid Lands
CASELAP	Centre for Advanced Studies in Environmental Law and Policy
CBD	Convention on Biological Diversity
CEC	County Environment Committee
CETRAD	Centre for Training and Integrated Research for ASAL Development
CFA	Community forest Association
CFAs	Community Forest Association
CIDP	County Integrated Development Plan
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CWA	Constituency Wildlife Associations
DEC	District Environment Committee
DPSIR	Drivers-Pressure-State-Impact-Response
DSC	District Security Committee
DSG	District Steering Group
EA	Environmental Audit
EAC	East African Community
EIA	Environmental Impact Assessment
EMC	Environmental Management Committee
EMCA	Environmental Management and Coordination Act

ES	Ecosystem Services
FAO	Food and Agriculture Organization
GDP	Gross Domestic Product
GESIP	Green Economy Strategy and Implementation Plan
GEO	Global Environmental Outlook
GHG	Greenhouse gas
GHGs	Greenhouse Gasses
GoK	Government of Kenya
HQ	Headquarters
IGAD	Intergovernmental Authority on Development in Eastern Africa
IPBES	Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services
IPCC	Intergovernmental panel on Climate Change
IUCN	International Union for Conservation of Nature
KFS	Kenya Forest Service
KFWG	Kenya Forest Working Group
KWS	Kenya Wildlife Service
KWTA	Kenya Water Towers Agency
LDN	Land Degradation Neutrality
LULUCF	Land Use, Land-Use Change and Forestry
MEA	Millennium Ecosystem Assessment
MECOG	Marsabit Environmental Conservation Group
MT	Mount

NACOSTI	National Commission for Science Technology and Innovation
NCCAP	National Climate Change Action Plan
NCCRS	National Climate Change Response Strategy
NDC	Nationally Determined Contribution
NDMA	National Drought Management Authority
NEC	National Environment Committee
NEMA	National Environmental Management Authority
NEPAD	New Partnership for Africa's Development
NFP	National Forest Program
NGOs	Non-Governmental Organisations
NMK	National Museums of Kenya
NRT	Northern Rangeland Trust
ODK	Open Data Kit
OECD	Organization for Economic Cooperation and Development
PA	Protected Area
PAs	Protected Area System
PELIS	Plantation Establishment Livelihood Improvement System
PFM	Participatory Forest Management
RIA	Risk Impact Assessment
ROK	Republic of Kenya
SAGA	Semi-Autonomous Government Agency
SDG	Sustainable Development Goal

SEA	Strategic Environmental Assessment
SES	Social-Ecological System
SIA	Social Impact Assessment
SSA	Sub Saharan Africa
TEEB	The Economics of Ecosystems and Biodiversity
UNCCD	United Nation Convention on Combating Desertification
UNDP	United Nations Development Programme
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFCCC	United Nations Framework Convention on Climate Change
WRA	Water Resources Authority

ABSTRACT

The effects of different anthropogenic drivers acting singly or in combination have been shown to slowly but gradually disrupt the provision of vital ecosystem goods and services. Loss of key ecosystem services undermines the ability of the biophysical environment to sustain people and their livelihoods. The situation in Mt. Marsabit forest ecosystem is further complicated by the management regime being a multi-stakeholder protected area system (PA). The existing governance structure and the prevailing policy and legislative framework seem inappropriate to address the continued degradation of the Mt. Marsabit ecosystem. The main objective was to assess how different actors and systems interact in a multiuse landscape and influence sustainable provision of ecosystem services. Specifically, the study; i) determined how prevailing ecological processes and socioeconomic dynamics affect the provision of Mt. Marsabit ecosystem services, ii) measured the effectiveness of governance as perceived by respondents, and iii) assessed governance scenarios to ensure sustainability of Mt. Marsabit social-ecological system. A mixed method study design comprising interviews of 265 households, 36 key informants, 3 focus groups, scenario workshops and analysis of secondary literature was undertaken. The findings indicated that trees, forage, water, fall-back land cultivation, aesthetic enjoyment and shade were the key services derived from the forest. However, this did not prevent overexploitation of forest resources which has led to extensive degradation as bare-land increased from 24% in 2000 to 37% in 2015. The tested principles of protected area (PA) governance (UNDP, 1997) suggested that the governance of this PA was moderately effective (61%). The positive indicators for effective governance included the legitimacy, clear demarcation of borders and directed management that led to a reduction in poaching. Negative indicators included weak linkages between different actors with regard to communication, accountability and collaborative decision making. The interaction of stakeholders in the Forest PA, scored low density which showed weakness of the stakeholder's network, which could negatively affect the flow of information and other resources between stakeholders. Perception of the stakeholders showed that the local communities were minimally involved in developing governance structures or management of this forest. Family size, education level, and age were important predictors of level of local community involvement in management. The study recommends that policies upholding conservation in multiuse landscapes such as Mt. Marsabit PAs should ensure local ownership and strong linkages between actors. These are important governance ingredients for positive conservation

outcomes of PAs. Additionally, meaningful engagement of communities in the management of this forest will be critical to its sustainability. Policies should ultimately recognise the wellness of the current and future generations by improving the conservation of PAs.

TABLE OF CONTENTS

List of Tables

List of Figures

CHAPTER ONE: INTRODUCTION

1.1 Background to the Study

The loss of key ecosystem services undermines the ability of the biophysical environment to sustain people and their livelihoods. There are a number of drivers and pressures responsible for the loss of biodiversity and reduction in ecosystem services provision. Most of them are anthropogenic in nature and include conversion of natural ecosystems to agriculture and other land uses, wildfires, increase in aggregate human consumption of the planet's ecological assets, deposition of reactive nitrogen, conversion of wetlands, and introduction of new species into the environments, among others (Hicks et al. 2015; Rockström et al. 2009).

Arresting acceleration of ecosystem degradation is becoming increasingly urgent, leading to the need to identify governance strategies that successfully mitigate human impact. Within the last decade, significant progress has been made and various mechanisms designed to reduce or halt biodiversity loss and enhance ecosystem services provision (Bennett et al., 2017; Duraiappah et al., 2005). One such key mechanism has been co-management (involving participation of local residents) which has been viewed as a fundamental part of sustainable use and management of natural resources (Chan, et al., 2012; Cuni-Sanchez et al. 2016). Ecological and social sustainability is one of the main challenges to global environmental governance and sustainable development (Bennett et al. 2015; Bouahim et al. 2015; de Groot et al. 2010; Hicks et al. 2015; Wangai et al. 2017). Sustainable use and management of natural resources is attributed to good governance (Agrawal, et al. 2014). In areas where governance has been compromised, rampant ecosystem degradation has often been the result (Agrawal, et al., 2014; Mansourian, 2016; Piso, et al., 2019; Reed, 2008).

In Kenya, the environmental sector is embracing co-management as a solution for tackling conservation challenges (GoK, 2013; Frank et al., 2017). In the past two decades, several organizations and institutions have been initiating, supporting, and engaging partnerships in biodiversity management (Frank et al., 2017). One such ecosystem where this has been happening is the Mt. Marsabit Forest Ecosystem, which is governed via co-management by the County-Community-Public sector stakeholders (Robinson, 2013). Mt. Marsabit Forest harbours a diverse range of ecosystems and associated biodiversity. Its ecosystem service functions and goods provision are important for livelihoods (CIDP, 2013).

This forest ecosystem is very important to many communities and cultures in Kenya and Ethiopia. It is also a watershed for a vast area, and the predominant source of water for human and wildlife.

The forest has experienced cover losses over the years, with the area under crops and grass increasing at the expense of natural forests. The primary drivers of deforestation are: i) conversion of forest to agricultural land (particularly to the east of the forest), ii) deforestation through over abstraction of fuel wood), and iii) over-grazing by domestic livestock. The forest being the only source of water and dry season pasture for wildlife and livestock, increased disturbance risks leading to loss of the forest in the future with reduced ecological service provision (Maina & Imwati, 2015; Oroda, 2011). The forest is also vulnerable to climate variability affecting the ecosystem function and structure. The forest contains an array of trees and is home to animal species listed as vulnerable by the IUCN (Bussmann, 2002).

Kenya Wildlife Service (KWS) and Kenya Forest Service (KFS) are in charge of the protection of the forest. There is dual gazettement of the forest as a national park and as a forest reserve, that is; 1932 gazettement as a Forest Reserve, and 1948 gazettement of the National Reserve. Although Cap. 385 of 1985 was repealed through the Forest Act 2005, the Act still recognizes the role of KWS in co-managing the forest with KFS. The Forest Act, 2005 has since been repealed by the Forest Conservation and Management Act, 2016. Whilst KWS manages the area as a *de facto* national park, it allows fuel wood harvesting in the 72km square portion of the forest under the management of the Kenya Forest Service (formerly, Forest Department). The county government and the community members are also key stakeholders of the forest. Despite the co-management efforts, degradation of the forest ecosystem is still notable. The threats are mainly anthropogenic activities and have led to the rapid forest degradation in the form of increased conversion of the forested areas into farmlands outside and within the forest reserve (GoK, 2013; Maina & Imwati, 2015).There is therefore need for intervention to reverse these trends or the ecosystem will become extinct.

1.2 Statement of the Problem

Studies undertaken in Mt. Marsabit ecosystem show that the existing governance system has problems of "fit", with the overall system having little in the way of institutions whose mandate and focus are explicitly at a landscape holistic level of Mt. Marsabit. As a result, there is somewhat of a governance vacuum. Institutional linkages, while strong amongst government departments through the former district-level committees, only weakly connect with other important actors on key decision-making processes (Bussmann 2002; Robinson 2013) leading to the decline of ecosystem services. The effects of different anthropogenic drivers acting singly, or in combination, have been shown to slowly but gradually disrupt provision of vital ecosystem goods and services[1]. For instance, land use/land cover in the Marsabit forest has been changing over time (Maina & Imwati, 2015) due to heightened increase in different anthropogenic activities (Robinson, 2013). Forest cover has greatly reduced over years, and if urgent radical conservation measures are not put in place, this ecosystem will be destroyed by 2050 (Oroda, 2011). There are dual and potentially conflicting interests of households in using the Mt. Marsabit forest resources in order to meet immediate needs. This contrasts the long-term objectives of conservation and protection of the resources (Bussmann, 2002; Cuni-Sanchez et al., 2016) leading to the need for characterization of the social-ecological dynamics of the ecosystem.

The existing management system further complicates the situation. Being a multi-stakeholder protected area system (PA), the forest has a governance system based on co-management. Stakeholders include the national and county governments, and local communities (Robinson, 2013). The national government agencies are the Kenya Wildlife Service (KWS) and the Kenya Forest Service (KFS). The two quasi government bodies have different mandates and work strictly along sector-based approaches. The conflicting legislation from the two quasi government bodies, and lack of sufficient buy-in from local communities and county government have led to problematic partnerships in this management arrangements. This co-management of the forest has not allowed for a full appreciation of conservation from the local communities (Bussmann, 2002; Maina & Imwati, 2015; Robinson

[1]Ecosystem services are 'the aspects utilized to produce human well-being' (Hassan et al. 2005; Fisher et al. 2009).

2013), and as a consequence, deforestation and unsustainable harvesting of forest products have been observed (Maina & Imwati, 2015).

The existing co-management governance structure, and the prevailing policy and legislative framework, seem inadequate to address the continued degradation of the Mt. Marsabit ecosystem. There is, therefore, a need to interrogate the complex scenario in Mt. Marsabit ecosystem and balance the environmental, economic, and societal sustainability through exploring options of governance systems which can reverse ongoing ecosystem degradation in the area. Such a governance scheme should be clear on effective co-management arrangements and also appreciate the importance of local communities and county government in conservation efforts.

1.3 Research Questions

This research is guided by the following overall research question: How are the different actors and systems interacting to influence sustainable provision of ecosystem services in Mt. Marsabit? The sub-questions are;

1. How do the existing socioeconomic dynamics and ecological processes interact and influence sustainable provision of Mt. Marsabit ecosystem services?
2. What are the dynamics of the existing governance system in Mt. Marsabit ecosystem?
3. Which governance options are most appropriate for protected areas such as Mt. Marsabit?

1.4 Objectives

The purpose of this study was to assess how different actors and systems interact and how they influence sustainable provision of Mt. Marsabit forest ecosystem services. This is operationalized into the following specific objectives;

1. To determine how prevailing socioeconomic dynamics, interact with ecological processes to affect provision of ecosystem services on Mt. Marsabit
2. To evaluate governance dynamics in the management of Mt. Marsabit social-ecological system
3. To develop alternative PA governance options to sustain ecosystems service provision in the Mt. Marsabit social-ecological system

1.5 Justification

Being a mist forest in an arid location, Mt. Marsabit is a unique ecological system. However, it is threatened by many factors such as over-abstraction of fuelwood, deforestation, human encroachment as a result of expansion of the Marsabit town, overgrazing, and an infrastructural boom. The results of the study will be useful in mapping various land-use changes over time, their impact on ecosystem goods and services provision, and suggest remedial measures to mitigate their effects. The results of this study will also be important in identifying governance options for sustainable ecosystems goods and service provision under anthropogenic pressures and climate shifts.

This research is relevant in three aspects that would generally define the key aspects of research contributions. First, the contribution to the development of a common understanding, through exploration and explanation of governance outcomes. Second, the contribution to discussions and examination of crucial themes of the paradigm of co-management; and third, the contribution to policy ideas and innovative policy alternatives in a given area.

Theoretically, it seeks to uncover the linkages between state-society partnerships in Kenya and Africa in general. The study contributes to the debates on collaborative partnerships by exploring and explaining theoretical and policy tools that provide innovative alternatives. As governance research, it examines the manifestations of interactions between the state and non-state actors. Thematically, it covers topics that are gaining currency in academic and policy quarters. It addresses institutional design aspects of governance systems, capacity building, and empowerment. The contributions to co-management research are based on the innovative aspects of the research study. The study expounds on the theory of collaboration, and challenges policy makers face to complement their intervention targets with tools that appropriately and effectively capture pathways and prerequisites for co-management. From this study, the required interventions for meaningful impact will be isolated targeting the local community, Kenya Forest Service, Kenya Wildlife Service, National Environmental Management Authority, among others.

1.6 Organization of the Thesis

This thesis is organized around three principal articles published in peer-reviewed journals. There is also the introduction and a concluding chapter linking the papers to the core research purpose. The introduction explains the background of the research problem, governance of the Mt. Marsabit PA and provides details for the methods used in this research. The concluding chapter provides overall conclusions, integrating the findings into the literature and explains the implications of the findings.

CHAPTER TWO: LITERATURE REVIEW

This chapter presents the review of pertinent literature in relation to the specific objectives of the study. It considers studies conducted and observations by other researchers on the subject of protected areas and governance.

2.1 Social-Ecological Systems and Provision of Ecosystem Services

Ecological and socio-economic systems share many characteristics. For example, Limburg et al. (2002) posit that both are complex networks of components linked by dynamic processes and are open to exchanges across their boundaries by connectivity. Moreover, social and ecological systems are interlinked and their separation is arbitrary when analysing sustainable use of ecosystem services. This linked human-nature systems have been referred in recent literature as social-ecological systems (Costanza et al., 2014; Nita et al., 2019; Ostrom, 1990).

According to Pascual et al. (2017), ecosystems and social systems are characterized by containing (1) components (which as a whole constitute the structure of a system), (2) the interactions between them, which generate the processes of the system (functioning), and, (3) in open systems such as ecological or social ones, fluxes crossing the system boundaries. Among these characteristics, interactions (of components, processes or systems with other systems) are responsible for the emergence of complex behaviours. Verburg et al. (2015) adds that social-ecological systems are complex systems, which consist of heterogeneous individual components that interact locally and evolve as a result of those interactions. Thus, socioeconomic dynamics and ecological processes are complex and multi-causal, and since causes can be remote in space and time from the event, uncertainty is an intrinsic characteristic of ecosystem services assessments.

The links between socioeconomic dynamics and ecological processes, and provision of ecosystem services has been attracting increasing attention in scientific literature over the past years (Sachs 2012; Scholte, et al., 2015; UNESCO 1973; Verburg et al. 2013). There is a current scientific recognition of the urgent need to improve approaches for assessing ecosystem services (Carpenter & Folke, 2006). This study determines how prevailing socioeconomic dynamics interact with ecological processes to affect provision of ecosystem services on Mt. Marsabit. Martín-López et al. (2009) concludes that the ecosystem services

framework explicitly states that there is a complex relationship and feedbacks among ecosystems and human systems. Consequently, investigating ecosystem services necessarily requires working with social-ecological systems.

2.2 Protected Area (PA) Governance Systems

The 2003 5th World Parks Congress in Durban recognised governance as the key factor in the conservation of PAs across the world (Hockings, 2003). The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) report states that "humans are changing the Earth's ecosystems so dramatically that as many as one million plant and animal species are now at risk of extinction, and that current global response insufficient to stop this decline in resources". The Global Environmental Outlook (GEO) 6 report also states that "either we drastically scale up environmental protections, or cities and regions in Asia, the Middle East and Africa or we could see millions of premature deaths by mid-century". It also warns that "pollutants in our freshwater systems will see anti-microbial resistance becomes a major cause of death by 2050 and endocrine disruptors impact male and female fertility, as well as child neurodevelopment". The IPBES report tells us that "it is not too late to make a difference, but only if we start now at every level from local to global."

Governance of protected areas is argued to be the main way of effectively conserving the ecological system. Protected areas require clear mainstreams of how they ought to be governed through which conservation policies and rules are effectively implemented. A study by Byrne and Goodall (2013) on transnationalism and its effect on national park in Sydney, Australia established that lack of governance systems led to increase in migrants who were not aware or ignorant of the conservation policies hence heading up encroaching protected areas. This is an indication that the governance system directly and indirectly connects to effective conservation of the protected areas. Protected areas have the potential to play an important role in the delivery of crucial ecosystem services for poverty alleviation (Bennett et al., 2017; Chan et al., 2006), but they remain in the spotlight for negative reasons too, with accusations of human rights violations against indigenous communities continuing to cause controversy (Matsuura, 2017). As a result, both moral and instrumental reasons, international conservation policies and the approaches of many organisations are moving beyond the standard livelihoods approach to dealing with the social costs of conservation, to emphasise pro-poor strategies, human rights and equitable management with participation by local communities (Kisingo, et

al, 2016). According to Shields et al., (2016) protected areas are rarely implemented or managed as isolated interventions and will typically exist in conjunction with other development initiatives, such as tourism, alternative livelihoods, infrastructure and education. These projects may form part of 'community-based conservation' initiatives, or development may be attracted to the area in a more uncoordinated and opportunistic manner, increasing interactions between communities and a range of external organisations (Bouahim et al., 2015).

There are significant challenges for ensuring competent management and governance of protected areas to meet their goals and protected area professionals are required to increasingly meet new demands and challenges and their job is becoming ever more complex. The rationale for the establishment of protected areas includes the maintenance of the functions and value of natural ecosystems to address, amongst other objectives, the concerns and needs of human society (Pimm, et al., 2014). These areas are legitimate and wise use of land and aquatic resources will provide value to society now and in the future. It is increasingly apparent that many protected areas not only provide essential ecosystem services, but also can contribute natural solutions to critical environmental challenges (Zafra-calvo & Garmendia, 2019).

Sims (2010) carried out a study on the influence of conservation and development of protected areas in Thailand. The study established that as a result of governance and effective management among the government forest agencies, the protected areas were more conserved. Through effective decision making and smooth flow of information, the protected areas gain more relevance in contributing to the community development. This illustrates the need for effective governance of the protected areas through which they are capable of achieving the intended mandate.

Research on partnerships for governance of biodiversity has surged in the recent years (Costanza et al., 2014) with a consensus that decentralized approaches have positive ecological, economic, and socio-political benefits compared to centralized command and control types (Torri, 2010). Studies indicate that there is a growing trend indicating that programs are scaling up participatory systems in biodiversity management (Robinson, 2013; Lockwood, 2010). Thus, enhancing participatory governance of forest ecosystems has been a

core element of dominant discourses on conservation at local, national, and global forums (Patrício, et al., 2016).

2.2.1 Protected Areas Governance in Kenya

Kenya has a rich abundance of wildlife in different habitats namely, forested ecosystems, savannah woodlands, Indian Ocean, mountain peaks and the rift valley. There is diversity of ecosystems and habitats at the Indian Ocean, Mount Kenya and the deserts. Historically, in the 1800s and earlier, there was mutual coexistence between the local communities and wildlife in Kenya (Chongwa, 2012). British colonization introduced the concept of game hunting. However, due to a reduction of wildlife numbers, there was declaration to set up wildlife game reserves in 1896; and the national park ordinance of 1945 that led to the establishment of two protected areas in Kenya. These were the Aberdare Royal Park and mount Kenya Royal Park (Chongwa, 2012). The exclusion of local communities led to human wildlife conflicts and displacements. After independence in 1963, establishment of more national parks and reserves for wildlife protection and recreation increased. Over the years, the Ministry of Tourism and Wildlife has adopted various policies to manage protected areas. Initially, the state was the sole regulator but subsidiary legislation allows others to participate in PAs governance including local communities, private entities and non-governmental organizations. Ecotourism and wildlife conservation involve various stakeholders and initiatives such as conservancies are recognized in the subsequent policies and laws.

Previous research has demonstrated that the success of community organizations is a function of the tactics that its leadership provides (Wangai, et al., 2016). Local, national, and global socio-political forces contributed to this shift. Countries with experience in co-management began institutionalizing reforms. In Kenya, the new devolved government system is responsible for natural resource management, and this includes county forests, livestock among others. Both County and National governments are weak in policy implementation and enforcement (Munya et al. 2015). There are also other governance issues such as conflicting mandates, jurisdiction, clarity of roles and responsibilities within the main government institutions.

2.3 The Kenyan Forest Ecosystem

According to various studies (Frank et al., 2017; Bussmann, 2002), there is increased exploitation of forests in the world. Across the globe, forests covers are being depleted by intense human activities, posing severe threat to forests existence, including indigenous plant species. This effectively leads to loss of biodiversity and ecosystem services (Cuni-Sanchez et al., 2017) necessary for the sustenance of livelihoods and wildlife populations (Bussmann et al., 2006; Oroda, 2011; GoK, 2013). Currently, demands for ecosystem services such as food and clean water is increasing at a high rate, but human actions are diminishing the capability of many ecosystems to meet these demands (Wangai et al., 2016). Alterations to ecosystems directly or indirectly affect the human population.

Kenya is a country endowed with a wide range of forest ecosystems. These range from montane, rainforests, savannah woodlands; dry forests; coastal forests and mangroves. According to scholars, the forests have high species richness and endemism, which has led to the country being classified as mega diverse. The diversity is wide (GoK, 2013) it puts the number of variety of tree coverage at 9.4 million hectares existing both on farmlands, settlements areas and urban centres. The actual forests in the country is said to cover a total area of 37.6 million hectares out of which 2.1 million hectares are woodlands, 24.8 million are bushlands and 10.7 million are wooded grasslands. Even though, the area occupied is disproportionately small, it is ranked highly as one of the country's most important natural asset because of the environmental, life supporting functions, and the provision of diverse goods and services (ecological, social, cultural, and economic functions) (Act, 2016).

Forests in Kenya are important in regulating water supplies. The country relies on high forest "water towers" notably five main water catchment areas (Mt. Kenya, Mt. Elgon, Aberdares, Cherangany and the Mau forest), where also the hydro-electric power stations are located and along major rivers, which also provide water to support big irrigation schemes. Forests also support most productive and service sectors in the country, particularly agriculture, fisheries, livestock, energy, wildlife, water, tourism, trade and industry that contributes between 33% and 39% of the country's GDP. Biomass comprises about 80% of all energy used in the country, while they also provide a variety of goods, which support subsistence livelihoods of many communities (Gok, 2013; GoK, 2016).

2.3.1 Mt. Marsabit Forest Ecosystem

According to Robinson and Kagombe (2018), Mt. Marsabit is an ecosystem of vital importance for tens of thousands of people in Marsabit County in Kenya. Mt. Marsabit is a "water tower" that is, a source of runoff and groundwater as far away as the Chalbi desert (situated near the border with Ethiopia). However, Marsabit seems to have been suffering from an unsustainable rate of deforestation and, related to this, progressive degradation of water resources. Thus, experts and researchers argue that if the trend of degradation continues, severe impacts for both human beings and wildlife can be expected.

In regard to the critical role played by the Mt. Marsabit in enhancing the ES of the region, the management of the forest is quite important and plays a major role in promoting the conservation of the region. Currently, there are two major stakeholders who are involved in management of the forest. They include the Kenya Wildlife Service (KWS) and the Kenya Forest Service (KFS). The management system however has seen colliding roles while conserving and manning the forest being at stake (Matikua, et al., 2013). Studies have shown that for any management/governance system to deliver the best results, there ought to be proper mainstreams and reporting procedures which in this case are not clearly outlined. As much as the two major government agencies involved in governance of the Mt. Marsabit forest have different roles and stipulations, there are conflicting incidences whereby as one of the agencies is seeking to protect and conserve the Wildlife, the other one is interested in conserving the forest. This means that the interests of one agency could override the interests of the other thus affecting their effectiveness.

In Mt. Marsabit forest, claims have always arisen that there are duplication of roles and insufficient commitment among the management team thus leading to encroachers having easier time in intruding in the forest (Mwangi & Njuguna, 2010). While contemplating on the need for efficient management systems in forest management, Kinyili (2014) stated that communication and involving of the community members was a major aspect in promoting proper management of the forests. The management of Mt. Marsabit forest is organized such that the community members are part of the stakeholders who ought to be consulted and their views used whenever decision regarding the forest and protected areas are to be made (Kenya Wildlife Service, 2016). However, as the report on strategic environmental assessment of the Forest Conservation and Management Act, 2016 by World Bank (2018) stated, "management

of forests in Kenya including Mt. Marsabit forest has not been properly done". This is because there are no clear reporting channels and inter-linkages between the various agencies involved in management including the KWS, KFS and NEMA as there are not clearly outlined hence leaving management gaps and conflict of duties.

The perceptions of the community determine the extent to which the management of the forests promotes the conservation of the ecological system. However, the community perception is mainly driven by the level of their involvement by the leaders in the process of forest management. According to Titus (2014), "participation is a comprehensive and inclusive approach designed to integrate and mobilize local communities to make decisions to conserve natural resources and control activities that influence their lives". Titus (2014) further asserts that local communities should be accorded powers, rights, and authority as other stakeholders in the management and conservation of natural resources; considering that, they directly depend on forest resources for their livelihood.

Literature has previously revealed that integrating the concept of community participation to change their perceptions through policy formulation and adoption of effective collaborative approaches in forest management bear positive results in enhancing conservation of protected areas (Mogoi, et al., 2012). Even with the continued sensitization and creation of government agencies to enhance forest management, crucial forests such as the Mt. Marsabit forest continues to experience an alarming rate of forest destruction. The community members should form small protection groups via established laws to govern the exploitation and use of forest resources to address the issue. Matikua, et al. (2013) carried out a study on the impact of participatory forest management on local community livelihoods in the Arabuko-Sokoke Forest, Kenya. The study established that the involvement of the local community through their representatives and ensuring that they develop positive perceptions on the need for conservation of protected played a key role in enabling the effective management of the forests. This, therefore, raises the need to address the management systems of the forests and how they are constituted to enhance the community's perceptions of the need to conserve the forests.

2.4 Forest Management and Planning in Kenya

Sustainable forest management is more likely to be achieved under effectively developed and enforced local institutions. Studies have shown a positive correlation among strong local institutions, collective activities, and good forest management (Agbenyega, et al.,2009; Torri et al., 2011). According to Ostrom, (1999), institutions are shared concepts used by humans in repetitive situations organized by norms and rules. While norms refer to the moral behaviour of a society, rules are understood by institutional analysts as sets of regulations, and are differentiated from simple rules because, in order to exist, they need sanctions, which must be enforced; otherwise, regulations are of little worth (Basurto, et al., 2010). Institutional analysts are interested in studying the working rules, or rules-in-use, that individuals use in making decisions, in opposition to the rules of the law, which are formal rules.

Experts and researchers stipulate that the legal framework which guides natural resource management partnerships and other collaborative operations in Kenya consists of diverse laws and policies drawn from local, national, regional, and international institutional arenas (UNESCO 1973; United Nations, 2009). Kenya's protected area system is based on total protection of core areas, surrounded by buffer zones where limited human interaction and exploitation is allowed and transition zones (UNESCO 2005; Nelson, 2012). This land consists of national parks, reserves, sanctuaries, and monuments located in various terrestrial, riparian, and marine ecosystems. Some of the policies and laws are discussed below;

2.4.1 Constitution of Kenya

The Constitution of Kenya gives prominence to national values and principles of good governance. Listed in Article 10 (2) as: "a) patriotism, national unity, sharing and devolution of power, rule of law, democracy and participation of the people; b) human dignity, equity, social justice, inclusiveness, equality, human rights, non-discrimination and protection of the marginalized; c) good governance, integrity, transparency and accountability; and d) sustainable development". Article 42 provides for "the right to a clean and healthy environment", which includes the right to have the environment protected for the benefit of present and future generations through various measures and obligations relating to the

environment. The state as the duty bearer of this right invokes Article 69 "it is a duty of every Kenyan to cooperate with state organs and other persons to protect and conserve the environment and ensure ecologically sustainable development and use of natural resources". Article 69 and 70 further support this provision of the Constitution by giving legal substance to any individual or institution that would like to initiate, support, and/or establish partnerships for the sake of conserving the ecosystems. Article 60 (2) of the Constitution vests all public land to county governments, which have this authority in trust for the people who reside in an area. Article 69 (1) (a) to "ensure sustainable exploitation, utilization, management and conservation of the environment and natural resources, and to ensure equitable sharing of accruing benefits".

The Constitution of Kenya has been subjected to amendments to have a greater impact on natural resource management either directly or indirectly. In its Preamble, it proclaims "Respect of the environment which is our heritage, and determined to sustain it for the benefit of future generations" (Kenya Constitution, 2010). It calls for more radical reforms that protect Kenya's natural resources and secure rights that were previously ignored or given minimal attention in the previous constitutions and constitutional amendments. The basic law on Kenya's land and environmental management is stipulated in Chapter 5. The section defines some of the principles upon which all activities and initiatives including partnership-related ones are to be initiated and governed. Article 60 (1) states that, "Land in Kenya shall be held, used, and managed in a manner that is equitable, efficient, productive, and sustainable, and in principles of land policy in accordance with the following principles": (a) equitable access to land; (b) security of land rights; (c) transparent and cost-effective administration of land; (d) sustainable and productive management of land and resources; (e) sound conservation and protection of ecologically sensitive areas; (f) elimination of gender discrimination in law, customs, and practices related to land and property; and (g) encouragement of communities to settle land disputes through recognition of local community initiatives consistent with the Constitution.

Article 185 (2), 186 (1), 187 (2), and the fourth schedule of the Constitution stipulates the core functions of county governments. The fourth schedule (1) and (2) distinguishes the roles of national and county governments – on environment, forestry, soil and water conservation. Finally, Chapter IV Section 63 articulates a provision that incentivizes management systems towards more participation and collaboration as a new opportunity to

protect property rights of communities. As one expert opines that the measures "that will see …the replacement of trust lands with a new tenure category 'community lands' would enable local groups of people to better secure and title their collective properties" (Nelson, 2012, p. 10). To enhance subsidiarity, the Constitution's Section 176 (2) specifically authorizes the county governments to decentralize their functions and the provision of services.

2.4.2 Sessional Paper No. 10 of 1965

The first legal document for planning socio-economic development that recognized the importance of wildlife conservation was the *Sessional Paper No. 10 African Socialism and its Application to Planning of 1965*. While it did not provide for or advocate any specific type of management, it did set the basis for wildlife management as an important agenda in planning for economic progress. It also recognized proper protected areas zoning, envisioned commoditization of the wildlife sector and set the basis for a national acknowledging of the significance of wildlife to Kenya's overall development. As the first blueprint legislation for planning in Kenya, it is the statute that first facilitated the transfer of some powers away from the national to sub-national levels so as to allow for bottom-up planning.

It categorically provided leeway for extending planning to (at the time) provinces, districts, and municipalities so as to ensure progress in each administrative unit (Chitere & Ireri, 2004). Based on the initial premises of the document, recent development planning efforts have deliberately targeted arid and semi-arid lands (ASALs) as part of broader efforts to link environment to Kenya's national development. In this setting, partnerships have been visibly encouraged. The Ministry of State for the Development of Northern Kenya and other Arid Lands was mandated by Presidential Circular No.1/2008 to support partnerships which tackle environmental and food insecurity in ASALs. The directive had additional support of the Arid Lands Resource Management Project, the implementation structure for policy interventions in ASALs at the sub-national level.

2.4.3 Economic Recovery Strategy Action Plan

Poverty eradication remains an intractable challenge for the government of Kenya. Economic recovery strategic action plan outlined four pillars which were to be used to chart a way forward for the country to realize the two dual economic goals. The four pillars were; 1) maintain revenues above 21% of gross domestic product (GDP), 2) strengthening institutions of governance 3) rehabilitation and expansion of physical infrastructure and 4) investment in

human capital. In essence, the law was modelled on a process which sought to "harmonize strategies for accelerated economic growth with the country's poverty reduction strategies...." Page 15. While this plan was an important instrument for introducing new strategies and thinking about institutional design of structures that are congenial to socio-economic transformation, it was equally an attempt to address the adverse effects and pressure on Kenya's natural resources landscape.

The Action Plan showed that it was important to directly tackle poverty in order to handle environmental pressures. Second, the Action Plan particularly envisioned a process of growth modelled on the sustainable development paradigm. It particularly focused on "promoting actions leading to sustainable management of natural commons such as land, water, forests to which the very poor depend on" Page 18.

The Action Plan equally targeted the tourism industry as one of the productive sectors that was to be revamped. A major component of the sector's revitalization strategy encompassed the involvement of local communities in tourism development. This was to be facilitated by 1) availing affordable credit and 2) forging partnerships with major tour venture companies. The Action Plan targeted the tax regime in order to incentivize further the participation of the private sector.

2.4.4 Sessional Paper No. 10 of 2012 on Kenya Vision 2030

Kenya Vision 2030 is the current development blueprint guiding Kenya's path to achieving the status of an industrialized middle-income country. It was launched on June 10, 2008. This is dependent on the realization of an ambitious GDP growth rate of 10%. Its timing was significant as the Action Plan was expiring as a model for guiding the country's path to development. Vision 2030 continues to be a major instrument for enabling partnerships across the various sector domains that are directly or indirectly linked to protected areas. First, the planning of the Vision's roadmap involved an extensive process of consultation of various stakeholders from the government, private sector, and civil society. Second, the implementation process is gauged on successive five-year Medium-Term Plans which are designed with the expectation that Kenya can effectively meet Sustainable Development Goals (SDGs). Third, it endorses the principles of constitutional supremacy, public participation, and decentralization which are paramount factors to creating an enabling framework for partnerships.

Vision 2030 is a critical entry point for non-state entities to start partnerships and engage in programs targeted by its plan. In the strategic plans, tourism is also one of the key sectors targeted as a 'key growth driver' to realizing the vision. This is based on the objective of making Kenya to be among the top ten long-haul tourist destinations in the world. This will be a critical entry point for initiating and supporting different venues for partnerships in protected areas. Finally, the Vision 2030 proposes a formula for realizing middle income status based on three pillars: economic, political, and social. Environmental management is referenced in the social pillar which seeks to "build a just and cohesive society with social equity in a clean and secure environment".

The sessional paper recommended paradigm shift in implementation of the strategy by establishing a Semi-Autonomous Government Agency (SAGA) to oversee the Kenya vison 2030 implementation in close collaboration with sector ministries, private sector, civil society and relevant stakeholder groups in a coordinated coherent arrangement.

2.4.5 National Environment Policy

The National Environment Policy of 2013 was put forward by the Ministry of Environment, Water and Natural Resources with the main aim of enhancing the conservation of environment and the ecosystems thus promoting the livelihoods of present and future generations (GoK, 2014). The policy defines the environment as the totality of the surroundings including the animals, the plants as well as the microorganisms and the socio economic and cultural aspects, the physical surroundings including water, forestry, atmosphere land and soil. The National Environment Policy (2013) was in line with the National Environment Action Plan (NEAP) of 1994 that proposed updated policies to house continued changes and advancements in the society.

The NEP pointed out several environmental issues such as lack of harmonization of the environmental policies and laws thus leading to increased confusion and poor implementation, continued loss of biodiversity due to growth in population and other demographic aspects, lack of appropriate valuation of environmental and natural resources, poor rehabilitation of environmentally degraded areas, increased urbanization, climate changes among other challenges (NEP, 2013).

The Policy states the need for sustainable management of environment and natural resources and ensuring the available policies are harmonized for easier and effective implementation. A study by Usenobong and Chuku (2011) established that the continued degradation of environment especially in the developing countries was as a result of continued policing with little implementation. The Policy also provided a framework for an integrated approach to planning and sustainable management of Kenya's environment and natural resources and the need for enhanced cooperation and collaboration and partnerships in order to enhance effective conservation. Section 4.4 of the Policy provides the framework for conserving the mountain ecosystems. The major drivers of degradation of the mountain ecosystems pointed out in the policy include deforestation, illegal logging, poaching of wild plants and animals, fires and mining, uncontrolled grazing as well as increased encroachment. To conserve the mountain ecosystems, NEP (2013) points out that the government ought to create awareness, promote an integrated watershed management system and zone all the water catchment areas in the forests. Involving and empowering communities has also been widely proposed by the NEP (2013) as a major strategy towards conserving the ecosystems.

2.4.6 The National Water Policy

The National Policy on Water Resources Management and Development (NWP, 1999) is effective to date. It aims to achieve sustainable development and management of the water sector. The draft National Water Policy (2012) (currently referred to as 2019 policy) has exceedingly pointed out the frameworks of ensuring protection of water bodies and sources and steering the provision of adequate water to the Kenyan households (WASREB, 2017). The Policy was in an attempt to address key inadequacies in the Water Act (2002) as well as improve the guidelines of the first NWP of 1999. The draft policy acknowledges the challenges facing the water sector in Kenya which range from uneven temporal and spatial water distribution and the increased human activities affecting water resources.

The policy also notices the lack of inter-linkages between the Ministry in charge of water and other water sectors thus leading to conflicts as well as over centralized-decision making regarding water conservation and supply thus lacking avenues to mainstream and narrow down the decisions and policies to the grassroots (WASREB, 2017). The recommendations of the draft National Water Policy (2012) saw the birth of Water Act (2016) which has helped transform the water supply, conservation and coordination of the entire sector in the country.

The draft National Water Policy (2012) recommends the establishment of water permit and control of water-basin in both river and ground water as a way of preventing the depletion of the aquifers. The Policy also proposed for the establishment of a mandatory Environmental Impact Assessment for all the water development activities across the country which would see that any activity that touched on development or use of water bodies would be effectively assessed and audited. The policy however did not elaborate on the conservation of water resources although this has been covered on the Water Act (2016) which states that the water sources and other ecological resources ought to be protected for the public interests by the agencies mandated to do so. Mt. Marsabit ecosystem is a water tower with Bakuli springs in the forest being the source of water used in Marsabit County and its surroundings.

The Kenya Water Towers Agency (KWTA) is a State Corporation under the Ministry of Environment and Forestry established in 2012 through Kenya Gazette Supplement No. 27 Legal Notice No. 27 of 20th April, 2012. It is mandated to coordinate and oversee protection, rehabilitation, conservation and sustainable management of all critical water towers in the country. Water towers are under pressure from increased population growth and associated demand for water as an ecosystem service. Mt. Marsabit forest ecosystem is a water tower under anthropogenic pressures.

2.4.7 The National Forest Policy

The national policy framework for forests and their management aims to guide decision-making and provide direction over time. This provides the basis for sustainable forest management. The first forest policy was published in 1968 as sessional paper no. 1 of 1968. Subsequently there has been updates and evolution of the policy framework to date. The current National Forest Policy of 2015 was brought forward by the Ministry of Environment, Water and Natural Resources in the year 2014. The motive of the policy was enhancing the management and governance of the forests in the country as a result of continued deforestation and mismanagement of forests. The policy was in view of the Forests Act (2005) which introduced participatory forest management, through the engagement of local communities, and the promotion of the private sector investment in gazetted forest reserves. The Act highlighted the concomitant institutional and organization change through the establishment of the Kenya Forest Service (KFS), and the formation of Community Forest Associations. The National Forest Policy (2015) elaborates the ways in which the guidelines in the Forest Act

(2005) would be successfully integrated based on the continued changes as a way of enhancing conservation of the forests.

The National Forest Policy (2015) proposed for the review of the Forests Act (2005) to clearly highlight the ways to deal with the modern challenges facing forestry, clear division of responsibilities among the stakeholders (environmental committees, ministry and the county governments), devolution of the community forest preservation and management and to introduce a chain-of-custody system for timber and wood products, and legal origin and compliance certificates for exporters of timber and wood products. These proposals however remain withheld with little being done to ensure they are implemented to enhance forest conservation. According to Román and Cuesta (2016), properly aligned policies on environmental governance and conservation of ecosystems play a significant role in promoting successful environmental conservation. This however can only be achieved if the policies are implemented and keenly monitored (Hou & Xu, 2012).

The National Forest Policy, 2015 ultimately seeks "to balance the needs of the people of Kenya with opportunities for sustainable forest conservation, management and utilization". The policy was informed by the constitution, transition to Devolved Government Act, 2012, Intergovernmental Relations Act, 2012, Land Act 2012 and the National Climate Change Response Strategy. The policy is operationalized by the Forest Conservation and Management Act, 2016 and guidelines such as participatory forest management (PFM) and plantation establishment livelihood improvement system (PELIS), farm forestry rule, 2009 and other strategies such as;

The National forest program (NFP); launched in 2017 aimed at bringing coherence and complementarity by including the private sector, public sector, commercial forestry, gazetted forests and integrated climate change response. The NFP is a strategy to implement Kenya vision 2030 by increasing the forest coverage to 10%. The forest landscape restoration program; In 2016, the government of Kenya committed to restore 5.1 million hectares of land by developing several national scale restoration opportunity maps. Most of the targeted areas are in northern Kenya including Mt. Marsabit ecosystem.

2.4.8 The National Wildlife Conservation and Management Policy

The framework for conserving in perpetuity, Kenya's rich species diversity, habitats and ecosystems for the well-being and benefit of the country are mainly derived from the strategies, plans and policies used in managing protected areas in Kenya. The policy promotes partnerships and incentives for wildlife-based enterprises and ensures proper management of viable wildlife populations and their habitats. The National Wildlife Conservation and Management Policy (2017) facilitates collaboration for effective governance and financing of the wildlife sector between communities, private conservancies, counties, national government and international partners. The laws and strategies are;

2.4.9 Environmental Management and Coordination Act (EMCA) 1999

The adoption of the Environmental Management and Coordination Act (EMCA) in 1999 marked a critical juncture in Kenya's history. The law exhibits Kenya's ascendancy to a pluralistic legal regime. It defined the momentum that saw Kenya's land and environmental sectors undergo significant transformation through policy and program reforms, at both national and sub-national/county levels. A new state of relations between the state and non-state counterparts who constitute the environmental constituency was to take force. Before EMCA, previous legal framework was fragmented across seventy-seven statutes.

EMCA established a new institutional architecture whose role was to fuel innovative reforms and pave the way for radical changes in protected areas conservation. It is touted as the legislation that overwhelmingly shifted the country's focus from command to collaborative management. Accordingly, it can be credited for enabling a legitimate platform for inclusive and multi-stakeholder management regimes achieved legal backing; redirecting dialogue back to the role of marginalized but critical stakeholders such as resource adjacent communities and institutions; and enhancing mechanisms for scaling up support and resources for the re-designing of institutions that would eventually nurture innovative collaborative partnerships in the sector.

EMCA provides for the National Environment Action Plan Committee, the Environmental Impact Assessment Technical Advisor Committee, and County Environment Committees. All these institutions have had an impact in nurturing and sustaining partnerships at both national and sub-national levels. EMCA's National Action Planning framework is an avenue for decentralized collaborative planning between governmental and non- governmental actors through which partnerships can come into fruition. This is because the process involves interactions in which five-year plans are shared and prepared by county and national action plan committees. EMCA statutes have also been instrumental in pacing and phasing policy priorities geared towards mobilizing resources needed for conservation partnerships at both national and sub-national levels. With regard to institutional resources, it provides for the establishment of the National Environment Committee (NEC) which is charged with policy formulation and promotion of environmental management partnerships, among other goals.

Under section 9 of EMCA, 1999, NEMA has overall supervisory powers in forests, hillsides etc but their human resource capacity is limited by the size of PA such as Mt. Marsabit

ecosystem. The County environment committee (CEC) was constituted to consider all matters relating to sustainable water management; mining; climate change management and conservation; forestry; natural resources; pollution and waste management but not all the counties have established the CEC. Environmental assessments such as environmental impact assessment (EIA), strategic environmental assessment (SEA), social impact assessment (SIA) and risk impact assessment (RIA) needs constant proper guidance, better public engagement and evidence-based decision-making (Nita, 2019). Incorporating changes requires resources namely time, manpower and legal frameworks. SEA, EIA and EA powers are relative to activities being undertaken in PAs. For instance, the Marsabit Management plan requires SEA but this has not been done yet.

2.4.10 Forest Sector Laws

In 2005, the Forest Act made provisions for communities to be involved in forest management. The Forest Act (2005) has since been repealed by the Forest Conservation and Management Act, 2016, which also encourages participatory forest management. The Forest Act of 2005 (Section 46) provided for collaboration within and beyond the community landscape and endeavours to support the initiation of Community Forest Associations (CFAs). The architects of this law envisaged that these structures are strategic entry points for enhancing local organization and capacity building because they facilitate proactive participation of local communities. An additional condition stipulates that any community seeking to initiate CFAs must formally organize, establish working committees, and develop a formal association. For example, the association must have a working constitution, an organized accounting system for receipts, management plans, and concise proposals outlining their strategies for forest use and biodiversity conservation.

This law encouraged many communities to establish, register, and mobilize resources for initiation of forest associations and scaling up of activities with larger partnerships. As a way to encourage proactive participation in forest governance, the (2016) Forest Conservation and Management Act's Section 47 (2) confers members of CFAs various rights. These include, but are not limited to, collection of medicinal herbs; harvesting of grass, honey, timber or fuel wood; grazing; collection of forest products for community-based industries; ecotourism and recreational activities; contracts for silvicultural operations and development of wood and non-wood forest-based industries.

Concerning the role of private sector participation in partnerships, the Forest Rules of 2009 authorize KFS to invite the private sector to participate in sustainable management of state forests "whenever circumstances make it necessary to do so" and prescribes the types of agreements KFS can enter into with the sector. The Forest Conservation and Management Act, 2016 set a specific platform for KFS-community-county collaboration as a requirement for all forest management partnerships. Forest Associations are established as implementation platforms for co-managing forest resources.

2.4.11 National Climate Change Response Strategy (NCCRS)

This was launched in 2010 followed by the National Climate Change Action Plan (NCCAP 2018 - 2022). The NCCAP helps mainstream climate resilience in support of Kenya's Vision 2030. In addition, the Green Economy Strategy and Implementation Plan (GESIP) finalized in 2016 and the National Climate Change Framework Policy strengthens the efforts to address climate change in all development sectors. The policy addreses the need to ensure compliance with the constitutional framework, acknowledges that natural ecosystems are under threat from land degradation and desertification. Caused by climatic variations and anthropogenic activities such as, livestock overgrazing, smallholder farming on poor soils and creation of small cities and towns. Impacts include loss of biodiversity, threats to animal and plant species, change in vegetation composition and structure, decrease in forest coverage, rapid detterioration of land cover, and depletion of water quality and quantity through the destruction of catchments and underground aquifers. There are more than 50 policy statements. The Climate Change Act of 2016 was enacted and is operational as it aims to strengthen climate change governance coordination structures and outlines the key climate change duties of public and non-state actors.

2.4.12 Wildlife Sector Laws

In the wildlife sector, partnerships are encouraged among individuals, corporate, and community land owners. However, the poorly designed incentive systems does not enhance property rights for communities leading to conflict between local communities and state agencies. Regardless of the type of partnership, the Wildlife Act Cap 376 in its Section 3A (l) mandated the KWS to provide advice to the government, local authorities and landowners on the best methods of wildlife conservation and management. Section 19 (1-4) of the Wildlife Act, Cap 376 authorized and enabled partnership-mediated conservation programs on both private and community land. While the law provided specific tools to incentivize participation,

the Act had not, since 1977, articulated a clear and formal regime for extending user rights to wildlife for communities. More so, decision-making was still monopolized KWS.

The current law has instituted radical changes in aspects such as access, management and benefit sharing of wildlife resources. Part VI Section 40 (1) of the Wildlife Conservation and Management Act 2013 states that a community can register a Constituency Wildlife Associations (CWA) provided they register with the County Wildlife Conservation and Compensation Committee. In Section 40 (2), the association is duly encouraged to enter into partnerships that enhance sustainable use of wildlife resources. A second entry point for capacity building is through conservation anchored on benefit sharing. The Wildlife Conservation and Management Act of 2013 provides a legal status to benefit sharing within conservancies. This provision was lacking in the previous law. The new law provides a mechanism via an institutional framework anchored on the Kenya Wildlife Regulatory Council. The council has the mandate to grant user rights and regulate partnership activities within conservancies owned and managed by local CBOs. The new rights to wildlife utilization and consumption includes; culling, cropping, research and tourism, which were prohibited in the previous law. A final set of provisions governed mobilization of resources. Partnerships usually require enormous amounts of resources to support their operations.

Folke et al. (2005) stipulates that more attention is placed on multilevel governance and interactions in terms of social-ecological systems. It has, however, been noted that there are challenges when dealing with governance systems that are dynamic, where social-ecological systems change overtime, creating major issues particularly in the division of roles and responsibility among centralized and decentralized actors (Pritchard & Sanderson, 2002). Normally, the interest of Kenya's laws lies largely in using the partnership model for organization and empowerment of governance institutions.

2.4.13 The international laws

Kenya is a party to several conventions and protocols and it is obligated to support them and implement them in all of the operations that govern conservation. Forest conservation and management Act, 2016 section 73 (1) states that "treaties, conventions or international agreements concerning forests or forest resources as provided for under the constitution will be adhered to" and the Wildlife Conservation and management Act, 2013 section 109 describes international treaties, conventions and agreements. These include:

The Paris Agreement and the UNFCCC

The Paris agreement was signed in 2015, unifying the nations on earth to combat climate change and limit global warming to 2 degrees Celsius. Countries are allowed to formulate contextually-appropriate, national approach known as Nationally-determined Contribution (NDC). This enables countries to design strategies which can deliver real, verifiable reductions in greenhouse gasses (GHGs) against their baseline reference year, according to national circumstances, resources and prioritized sources and sinks. The Government of Kenya ratified the UNFCCC on 30th August, 1994 and ratified the Paris Agreement on 28th December, 2016. This commits Kenya to take action on climate change.

Convention on Biological Diversity (CBD) was ratified on 26th July, 1994 to ensure biodiversity conservation, sustainable utilization of natural resources and equitable sharing of benefits arising from use of genetic resources. CBD created Nagoya and Cartagena protocols which was ratified on 11th September, 2003. The CBD is an international legally binding treaty aimed at conserving the biodiversity.

United Nations Convention to Combat Desertification (UNCCD) is a multilateral instrument for environmental protection and for development cooperation. Its first objective is "to combat desertification". The UNCCD also "creates an enabling environment for land degradation neutrality (LDN) and its potential contribution to enhancing well-being, livelihoods and the environment" by providing "science-based evidence on the potential contribution of LDN to enhancing the well-being and livelihoods as well as the environmental conditions of people affected by desertification/land degradation and drought". This is done by capturing evidence on the configuration of an enabling environment for LDN drawn from the scientific literature, the outcomes of the LDN target setting programme, and the experiences of individual stakeholders directly involved in LDN initiatives gathered through a global LDN survey. An enabling environment for LDN is found to consist of "inclusive policies and regulations building on already existing national plans and programmes, an LDN conducive institutional setting, access to multiple sources of finance, and an effective science-policy interface designed to inform sustainable land-based interventions". This is directly related to SDG 15.

Ramsar Convention on Wetlands of International Importance provides a framework for voluntary international cooperation for wetland conservation. Ramsar recognizes the importance of wetlands to communities, cultures, governments, and businesses and encourages wetland conservation and wise use of wetlands.

There are other international agreements such as; the convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), Forest principles East African Community (EAC), Intergovernmental Authority on Development in Eastern Africa (IGAD) among others. International and regional institutions are also involved in promoting actions which are directly or indirectly related to forest resources conservation activities. For example; United Nations Environment Programme (UNEP); A specialized UN agency constituted under a Governing Council of 59 members elected by the General Assembly and is based in Kenya. It is the secretariat to the Nairobi Convention and is thus central in driving the initiative to regulate, control and coordinate land-based activities at the regional level including the implementation of the International environment-based Protocols. Others are; United Nations Development Programme (UNDP); New Partnership for Africa's Development (NEPAD) among others.

2.5 Mt. Marsabit Protected Area Governance

The creation of protected areas in Northern Kenya dates back to 1902 when the Northern Game Reserve (including Marsabit) was established (Synott 1979; Marsabit District Development Plan 1979 - MDDP 1979) for brevity. Forests in protected areas such as the Mt. Marsabit forest offer various ecosystem services. Mt Marsabit is a high-altitude area with important ecological links to the surrounding plains for providing underground water (Robinson, et al., 2010). It is evident that Marsabit County has been experiencing unsustainable rate of deforestation, and as result, severe impacts on both humans and wildlife will increase, in part, due to progressive degradation of water sources. Mt. Marsabit is seen as an ecosystem which is very important for the people of the county, it is a water tower (Robinson, 2013).

Governance in the Mt. Marsabit ecosystem is shared among various actors. It is managed by government institutions and the line ministries whose work is supported by other organizations, including civil society organizations, foreign aid donors, community-based

organizations, non-governmental organizations and the private sector. These bodies are involved in policy formulation and decision-making as well as developing and implementing site-specific plans. The main institution is the Kenya Forest Service (KFS) established under the Forest Act, 2005. Others include the Kenya Wildlife Service (KWS), as wildlife's habitat is mostly forests, Kenya Water towers Agency (KWTA), National Museums of Kenya (NMK) and NEMA, which was established to exercise general supervision and co-ordination over all matters relating to the environment, including the forest. Other institutions involved in the Mt. Marsabit Forest ecosystem include the County government of Marsabit, Physical Planning under the Ministry of Lands, Ministry of Agriculture and Irrigation, National Drought Management Authority (NDMA) under the Ministry of Devolution and Arid and Semi-Arid Lands (ASAL) areas among others. There are also other government departments who are also part of the system but the main stakeholders in Mt. Marsabit are;

Kenya Forest Service (KFS); The KFS is a nationally mandated authority for managing and conserving forests in Kenya. This includes ground operations, enforcements, forest conservancy, national and international coordination. KFS has limited capacity for implementing land management activities. **Community forest associations (CFAs);** According to the Forest Act (2005) and the subsequent Forest Conservation and Management Act (2016) CFAs are empowered to manage forests directly which are in or adjacent to the community. In gazzeted forests, the formal legal control of the land is KFS which has joint management agreements with CFAs through management plans. CFAs represent community level institutions. The main challenge is that CFAs are nascent. **Kenya Wildlife Service (KWS);** The KWS is the nationally mandated authority for managing and conserving wildlife in Kenya. KWS also has a role in protecting wildlife habitat. Mt. Marsabit is dually gazetted as both a forest and wildlife reserve so KFS and KWS have authority to manage it. **County governments;** The county governments were instituted by the Constitution of Kenya, 2010 to ensure involvement of the people in governance and devolution of governement service at the grass root. The county governments' mandate is to create opportunities for constituents and develop and implement county integrated development plans (CIDP). There is empahsis on sustainable development especially sustainable management of natural resources such as, water, forests and biodiversity, and woodlands. The main challenge is inadequate capacity in natural resourse mangement and planning. There are 47 counties with two arms of government

i.e. the County Assembly and the County Executive. Functions of county governments are stipulated in article 185 (2) and the fourth schedule of the Constitution of Kenya, 2010.

Kamugisha and Tessema (2012) allude that the management commitment and the smooth flow of the governance team determines the effectiveness of conservation of protected areas. The scholars noted that as a result of continued management wrangles and lack of proper mainstreams of leadership among the governing agencies, the protected areas in East and Southern African continued to face degradation this posed danger to the ecosystem services over time.

2.5.1 Marsabit County Government Regulations

The County Government of Marsabit has also embraced the conservation of the ecosystems in the county by coming up with policies and by-laws aligned to the conservation and protection of PAs to promote the welfare of the people of Marsabit (County Government of Marsabit, 2018). In the revised integrated development plan (2017), the County Government has pointed out the need for conservation of water resources and forests in the county. The plan recognizes the role played by Mt. Marsabit as an important water tower not only in Marsabit County but also in the entire north eastern Kenya. The plan noted the increased deforestation of Mt. Marsabit forest through conversion of forest to agricultural land, abstraction of fuel wood and charcoal rating to over 16,382 tonnes annually and overgrazing by the domestic pastoralists. The County Government has stepped in to control the continued degradation by partnering with the KFS and the District Steering Group (DSG) to sensitize the community on the need to conserve the forest and to mobilize tree planting as a reforestation strategy (County Government of Marsabit, 2019). The County Government has however not embraced effective measures to come up with clear policies on conservation of ecosystems and particularly the Mt. Marsabit forest (Benoit & Adongo, 2015).

The Marsabit County Energy Development Act (2016) published under the Marsabit County Gazette Supplement number 2 emphasizes the need for provision of energy to enhance access by the households as a way of preventing them from cutting down trees for the purpose of wood fuel (ROK, 2017). The Act highlights that a member of the Executive Committee with the approval of the County Assembly shall adopt measures that provide for the universal access to appropriate forms of energy or energy services for all the people of the County at affordable prices. This according to Shahbaz, Jalil and Dube (2010) is one of the major ways through

which the conservation of forests can be enhanced whereby the households don't have to cut down trees for wood fuel or charcoal and at the same time reducing the market for commercial deforesters.

2.6 Different Governance Approaches

Studies show that there are various governance approaches that can be used to manage protected areas (Eagles, 2008; Graham, et al., 2003; Ison & Wallis, 2017). For instance, Graham et al., (2003) employed the UNDP list of governance principles for protected areas (Table 1).

Table 1 Principles of good governance

The Five Good Governance Principles	**The Ten United Nations Development Program Principles**
Legitimacy and Voice	Participation
	Consensus orientation
Direction	Strategic vision
Performance	Responsiveness
	Effectiveness and Efficiency
Accountability	Accountability
	Transparency
Fairness	Equity
	Rule of Law

(Source: Graham et al., 2003)

These principles can be used to evaluate the governance of individual parks or park agency systems. However, testing Graham et al.'s grouping of the ten UNDP principles of governance into the five categories has not yet been undertaken, and as such, is only theoretical.

According to Folke et al., (2005), adaptive co-management as a governance strategy involves sharing of management power and responsibility by encompassing multiple institutional linkages among all stakeholders. It also extends into the social domain through focusing on ecosystem dynamics and ecological knowledge into governance (Torri, 2010b). An important factor in this context is organizations in adaptive co-management that emerge to bridge local actors and communities with other scales of organizations. Such bridging organizations can serve as filters for external drivers (Hanim et al., 2012) and also provide opportunities by bringing in resources, knowledge, and other incentives for ecosystem management (Folke et al., 2005). Westley (1995) used the term "bridging" for inter-

organizational collaboration. For example, in Kristianstad, southern Sweden, a bridging organization, the Eco museum Kristianstad Vattenrike, emerged as a local response to the perceived crisis in wetland landscape management. The Eco museum provides an arena for building trust, sense making, learning, vertical and/or horizontal collaboration, and conflict resolution. The bridging organization encompasses the function of a boundary organization (Carpenter, et al., 2006) by communicating, translating, and mediating scientific knowledge to make it relevant to policy and action. The organization also uses its network of stakeholders to mobilize knowledge and social memory in turbulent times, which in turn help deal with uncertainty and shape change (Folke et al., 2005).

Among proponents of participation is the concurrence that formal and informal rules are at the heart of successful co-management programs. Studies show that in many contexts, communities are less accustomed to contractual roles (Agbenyega et al., 2009) though they can cope creatively through risk adjustment and innovative resource management (Caff, 2015). Local communities have long established formal and informal mechanisms for planning and managing their biodiversity (Bennett et al., 2015; Ostrom, 1990, 1999) which exist as property rights regimes for territorially bound public and private resources (Agrawal et al., 2014; Ostrom, 1990).

Co-management is a continuum of arrangements for managing biodiversity that relies on various degrees of power and responsibility sharing between governments and local communities (Berkes, 1998; Hicks, et al., 2015). Ordinarily, major stakeholders are proactively engaged in planning and decision-making in a partnership (Borrini-Feyerabend, 1996). In recent studies, its conceptualization focuses on elements such as continuous problem solving and learning processes through which partners share decision-making functions (Hauck, et al., 2013).

Traditionally, biodiversity management in many developing countries was predominantly a top down and exclusionary system (Kisingo et al., 2016; Reed, 2008). Studies indicate that despite the reluctance by states to fully divest the powers to communities (Agrawal et al., 2014; Nelson, 2012), there is a growing trend indicating that programs are scaling up participatory systems in biodiversity management (Bennett et al., 2017).

There are numerous connotations for the co-management approach to forest conservation, and this include collaborative management, joint management, participatory forestry, forest stewardship and community-based conservation (Menzies, et al., 2007). In essence, co-management is one of the many manifestations of the increasingly adopted approaches in natural resources management which aims at increasing the social and material well-being and sustaining the health of the forests (Bennett et al., 2017; Berkes, 1998; Sanderson et al., 2014; Hinkel, et al., 2014). Many researchers place co-management/joint management under a big umbrella of community-based management approaches. However, some of the restricted applications such as of Ribot, et al., (2010) shows that the degree of democracy in decision-making in co-management is less than in those forests that are fully managed by the community. Specifically, the term co-management has been defined differently by different scholars. Berkes, (1998) definition states that co-management is "...the term given to governance systems that combine state control with local, decentralized decision making and accountability and which, ideally, combine the strengths and mitigate the weaknesses of each". World Bank's definition explains co-management as "the sharing of responsibilities, rights and duties between the primary stakeholders, in particular, local communities and the nation state; a decentralized approach to decision-making that involves the local users in the decision-making process as equals with the nation-state". The definitions from various authors captures the concept of co- management as related to three important aspects; a) it is associated with natural resource management; b) it is some kind of partnership; and c) it is evolving, and is not fixed.

By design, the overarching goal of co-management is to restructure existing power asymmetries. The logic is that co-management incentivizes coordination systems and nurtures a stewardship ethic on the part of local users by encouraging local proprietorship and regulated resource use (Pimbert & Pretty, 1997). More recently, the focus is on balancing rights and roles of communities in co-management. Notwithstanding, advocates in this tradition agree that the interconnection between rights and roles remains to be a daunting challenge for ensuring effective partnership-mediated results, (Agrawal et al., 2014; Ribot et al., 2010).

Regardless of the strategy of participation, co-management offers innovative and expanded access to structures for decision-making. Substantive dimensions of empowerment are given minimal attention in co-management studies with a few exceptions (Miller et al., 2014; Shields et al., 2016). Changes in the degree of community representation are not enough

without increases in the effectiveness of institutions' ability in managing economic and organizational processes. Additionally, a key prerequisite for effective empowerment is systemic institutionalization of co-management.

Menzies, et al., (2007) linked the rise of co-management with sustainable development movement and thus regards the 'improved forest health' as an essential characteristic. Sustainable Forest Management (SFM) is used as an outcome of co-management forestry. It is used to highlight to the extent co-management practices fostered sustainable forest practices and thereby improving the forest health condition. According to Maryudi et al. (2011), this is seen as one of the three broad goals of the co-management forest regime (that is, improving economic security, social security and ecological security), which corresponds with sustainable development principles. Specifically, parameters that define forest sustainability as developed by Maryudi et al. (2011) include aspects such as increasing biodiversity cover and reducing the rate of deforestation as potentially related to co-management as one form of community-based management. The parameters that define the forest sustainability aspects such as effective management of conflicts, reduction of trends in poaching activities are at the core in defining sustainable forest management. Various studies linked co-management with improvement of these practices (Menzies et al., 2007; Sanderson et al., 2014).

Collaborative governance is a strategic, practical and effective strategy for realizing positive environmental and developmental outcomes. Its salient dimensions encompass the infrastructure for changing incentives, knowledge, institutions, decision-making, and behaviours (Agrawal et al., 2014; Oldekop, et al., 2019). As a management principle, it signals a shift from top-down, centralized and exclusionary management which limited the participation of non-governmental units (Zaal & Siloma, 2006).

Collaboration as a management tool is not new (McGuire, 2006). Early accounts examined collaboration in the early 1970s. Proponents of this approach agree that collaboration is a response to various drastic changes in social, cultural, economic, and political aspects that the society has undergone in the past decades. These changes have served as avenues for restructuring modes and institutions of participation while simultaneously influencing results that emerge from interactions between the state and other actors. The state was traditionally the sole regulator and guarantor of rights and controller of planning and management of provision of goods and services. The most important shift has been the

reduction in the state's role and influence. Collaboration is a purposive multi-organizational system of inter-relationships designed to solve problems by creating or discovering a solution within a given set of constraints (McGuire, 2006; Wyborn et al., 2015). Current research indicates that resource needs only shape the initial motivations of collaborators in joining networks, but this need is not a factor in explaining increased subsequent engagement (Wyborn et al., 2015).

Enhancing participatory governance of ecosystems overarching consensus is that the successful abatement of destruction of biodiversity needs the concerted efforts of all relevant stakeholders (UNEP, 2002; IBRD/World Bank, 2004, 2007; UNCBD, 2005; FAO, 2009). There is a consensus that proactive, inclusive and effective community structures are critical domains for enhancing stewardship among resource-adjacent and resource-user communities. However, some studies offer a cautionary tale on participatory programs modelled on collaboration and decentralization (Ribot et al., 2010), arguing that democratized spaces may directly or indirectly reinforce and redirect power to institutions that embrace and support systemic exclusion of community organizations (Nelson, 2012).

2.7 Governance Scenarios for Protecting Forests

Parks and protected areas are seen as valuable and important to preserve. They are viewed as a social good because they protect and preserve environments from future human development, human induced impacts, and human created threats. Ultimately, parks and protected areas preserve natural environments for the benefit and enjoyment of future generations. Researchers, policy makers and the general population are also increasingly realizing and understanding new benefits attached to creating and maintaining parks and protected areas, among them increasing visitor-generated revenue, education purposes (Eagles, 2008; Shields et al., 2016), maintaining biodiversity, scientific discoveries, and improving human well-being (Secretariat of the Convention on Biological Diversity, 2000). Society can benefit from parks and protected areas but this can only happen if these areas put under strong management framework and appropriate level of governance.

2.7.1 Scenario Archetypes

Heugens and van Oosterhout (2001) define a scenario as a coherent, internally consistent, and plausible description of a potential future trajectory of an ecosystem. Further, planning of a scenario encompasses articulating multiple alternative futures, which in the process can result in uncertainties, for example, during governance (Kok & van Delden, 2009). According to Van Notten, et al., (2003), scenario planning has its roots in operations research, but it has increasingly applied in different environmental research (Table 2) in the past 25 years, including biodiversity assessments, ecosystem services, and management of protected areas.

Table 2 3 GSG Scenarios - 4 archetypal social vision for the future

World end-state	**Scenario Variants**	**Archetypal Social Visions**
'Conventional'	Market Forces (MF)	A world that evolves gradually, shaped by dominant driving forces
	Policy Reform (PR)	A world that is influenced by a strong policy push for sustainability
'Great Transitions'	New Sustainability Paradigm (NSP)	A world where new human values and new approaches to development emerge
	Eco-Communalism (EC)	
'Barbarization'	Fortress world (FW)	A world that succumbs to fragmentation, environmental collapse, and institutional failure
	Breakdown (B)	

Source: Kahn, 1986

In addition, the purpose of scenarios is to examine important themes and key elements among the stakeholders' concerns for the future to develop different stories that will eventually guide decision-making, rather than try to determine the right version of future management (Wack, 1985).

2.7.2 Local and Global Perspectives of Governance Scenarios

The concept of governance is such that it can easily be applied to global, national, institutional and community contexts (UNDP, 1997). On both local and global perspectives, governance of forests and protected areas has been upheld as one of the major ways of enhancing success in protecting the ecosystem. In the developed World, the governance of the ecosystems has been seen as an approach of shared social values, which Kenter et al., (2016) present as those values that an individual hold on behalf of a community or group of which they are a part through which conservation is embraced. More recently, relational values, which are understood as ethical and moral principles that guide 'good' human-nature relationships and may differ across cultures (Chan et al., 2016), have emerged as a new conceptualisation more coherent with the pluralistic views promoted by new approaches to ecosystem services (Stacey, et al., 2013). As much as the hierarchical management systems could be considered as the major drivers of successful conservation of the ecosystem, there ought to be dimensions to have a well-balanced community-based approach of governance.

A study by Muradian (2017) on the limits of the ecosystem services paradigm and the search for alternative ways of conceiving human nature relations, local perspectives in governance which included the commitment of the community and management competency were found to be the key determinants of the success of ecosystems services in protected areas. Stakeholders at the global level have proposed a scenario where on the need for social norms and values that supported the conservation of protected areas.

Some international policy standards on conservation of protected areas such as the US Endangered Species Act have opted for the condition of '*Low human capacity to adapt'* governance systems since such systems can be structured and efficient under stable conditions. The policy pursued a return of ecosystems to their 'historical' natural conditions and emphasised on restoring habitat for single species, often to the exclusion of other species, but with increasing rates of global environmental change (DeCaro et al., 2017). There are other proposed scenarios at global level where 'high global environmental change' is emphasized which could be slow to adapt to changes thus rendering seemingly good policies less effective. An example of such a situation is Lake Chad, which shrank by 90% over a period of 35 years, which is putting pressure on sustainable food production, wetland habitat conservation, water

management in transboundary basins and adaptation to climate change (Tar & Mustapha, 2017).

A global scenario that seems to be a desired future is where ‘low global environmental changes’ are prevalent and where there is ‘high human capacity to adapt’. Although there are fewer uncertainties about environmental conditions in this context, the opportunities brought about by change are also limited. Policy options under these conditions will focus on sustainable practices on the supply side (forests and water) and greater efficiencies in the ever-increasing demand side (social and economic activities). In a local perspective, this approach may not achieve much results since there is a danger of complacency in this scenario, where environmental change may not be immediately apparent, such as the case in Mt Marsabit forest where intensive groundwater use and other activities degrading the forest often exceed replenishment (Aldaya, 2017).

Studies have suggested that in the context similar to that of Mt. Marsabit forest, the ideal policies are framework policies that enable adaptive approaches and are supported by rapid feedback loops and learning systems. Ultimately, adaptive governance consists of a range of interactions between actors, networks, organisations, and institutions emerging in pursuit of a desired state for social-ecological systems (Chaffin et al., 2016). The drivers of change in governance are relevant at global, regional, national and local spatial scales, however, their manifestation would be different at each scale. Environmental change may be driven by global systems but has significant implications for local conditions. Likewise, the capacity to adapt to change can be facilitated through policies and processes at scale, but also depend on local capacity for action. These dimensions emphasise the need for cooperation across scales to mitigate change and increase adaptive capacity. The implication of this scenario approach of conserving ecosystems lies in its reframing of the social response to risk and uncertainties and in viewing policy as not just something within the government domain but also within that of markets and civic movements (Gyawali & Thompson, 2016).

2.8 Research Gaps

Literature has revealed that despite the increasing scientific and political attention on the ecosystem, it is important for research areas to incorporate the ecosystem service framework into the environmental conservation programmes. For instance, Muhamad et al. (2014) explains that one of the most important gaps in scientific knowledge is often associated with multidisciplinary approach, which involves the use of biophysical and socioeconomic information. In this study, there is a deliberate attempt to provide better information on sound policies and management interventions that are likely to reverse ecosystem degradation. It is well understood that scientific knowledge and improved information is not a guarantee that forest management and planning will improve, but it is a prerequisite for sound decision-making.

Understanding the ecosystem services in resource-rich developing countries can contribute to poverty alleviation and foster sustainable development (Díaz et al., 2015; Duraiappah et al., 2005; Frank et al., 2017; MEA, 2005; TEEB, 2010; Wangai et al., 2017) However, the assessment of ecosystem services demands an integrative triad approach considering the ecological, economic and social evaluation criteria (De Groot et al., 2010); (Cuni-Sanchez, 2017). In spite of this demand, most studies focus on ecological and economic valuation of ecosystem services (ES), with limited studies using social approaches.

It is clear from Kenya's legal framework that there are a number of institutions responsible for planning and management of forests. Most of these institutions have overlapping mandates. Governance in the Mt. Marsabit ecosystem is shared among various actors, including Kenyan national government agencies, county governments, non-governmental organizations and community-based organizations. Literature reveals that sharing of information and coordination is fairly effective in terms of governance system's technical approach in the District Level Committees. In his study, Robinson (2013) points out that the Provincial Administration plays an important role in handling issues concerning governance of the forest. It is however, important to note that it is not clear whether there is a right balance in implementing the governance systems and issues around access to the forest. Literature shows that governance system in Mt. Marsabit is not perfect and has some weaknesses. For example, Robison (2013) found that government staff turnover is a worrying issue since they play a very important role in the continuity of the governance system.

Review of literature shows that there are several governance models that are used to manage various systems and it may not be possible to exhaustively dissect them in this study. Through review of past literature, it is evident that there is a dearth of research that has attempted to examine the manner in which various governance systems implemented in protected areas affect the SES, and Mt. Marsabit falls within this category. For instance, information within the local contexts on how the government and other stakeholders can effectively be engaged to address weaknesses within governance models is lacking. Studies by Bovaird (2005) and Edgar et al. (2006) show that cooperation between various stakeholders in the governance model processes is important for proper management of the systems.

The literature further revealed that there might be an interaction between different variables such as governance systems and key actors that are likely to sustain ecosystems service provision. This study emphasizes that a variable such as government staff are likely to influence the governance system. It is hoped that by clearly defining roles and duties that key actors play in governance, our study will improve understanding in terms of the most appropriate governance options for sustaining the ecosystem service provision in the Mt. Marsabit social-ecological system. Issues relating to sustainable development such as funding, decision-making, decentralization, accountability, among others, have emerged central in governance of PAs (UNDP, 1997). However, questions still remain on how PAs agencies are structured, how accountability is established, how decisions are made, what influences these decisions, how these governance factors have changed over a period of time, and the kind of challenges for governance.

In addition, there is a lack of explicit recommendations on how different actors and systems interact. Most of the literature reviewed showed that there is no general consensus on guidelines and procedures for managing the SES, although they have attempted to present conceptual guidance (for example, Hinkel et al. 2015; Partelow 2016).

2.9 Analytical Framework

The theoretical and conceptual frameworks used in this study are as described below.

2.9.1 Theoretical Framework

This study employed a social-ecological systems (SES) theory (Ostrom, 1990) to examine interactions among different actors in the Mt. Marsabit ecosystem. The theory-outlines the multifaceted and interactive effects of personal and environmental factors conceptualized as resource governance systems. Key elements of resource governance systems include attributes of resources, actors or agents, and institutional arrangements (Vatn, 2005). In addition, there is a dual function for institutional arrangements, that is, interactions between humans and the environment. Thus, experts argue that institutions are central when it comes to understanding human versus environment interactions (Ostrom, 1990). The theoretical approach used in this study recognizes that different stakeholders have an important role to play in ecosystem governance. For instance, actors are socially constructed and their role in governance may originate from different capacities such as institutional mandate or a more traditional economic interest (Woodcock, 2002). This study further recognizes that the SES theory accommodates a multifaceted nature for human versus environment relationship.

This study involved human-environment interaction and social-ecological systems to explain such interactions. A social-ecological system is defined as an ecological system that is intricately linked with and affected by one or more social systems (Anderies, 2004). As a consequence, both the social and ecological systems contain objects that interact interdependently. The theoretical underpinning of the conceptual framework is rooted in the concept of systems thinking which encompasses examining a phenomenon using holistic approaches. The concept of system thinking associates every event to one or more causal factors. The loss or degradation of an ecosystem resource generates feedbacks as it becomes unable to perform its natural duties, such as the production of goods and services. The feedbacks could be within the ecosystem or external to it.

This approach combined perceived social and ecological outcomes mainly by examining governance structure, processes and outcomes. Thus, the use of social-ecological system in this study emphasized the integrated concept of humans in nature, and stressed the complex relationship between social and ecological systems.

2.9.2 Conceptual Framework

The study sought to analyse the governance dilemma and provision of ecosystem services by Mt. Marsabit Forest. The conceptual framework points on the flow of variables with the major social ecological drivers (demographic factors, socio-political factors and externalities) which are the independent variables lead to pressures on the forest which includes forest product extraction and expansion of agriculture. These factors have been found to highly contribute to degradation and deforestation. After these pressures are diverted to the forest, the forest cover reduces and the land use cover also changes leading to loss of biodiversity and ecosystem services. This is the dependent variable of the study. The interventions proposed in the study to enhance the governance of the protected area, through control of the drivers and reduction of the pressures by understanding how the socioeconomic dynamics such as socio-demographics and human-wellbeing and biophysical changes such as land use change, land cover change, climatic variations etc are influenced by the different governance principles. These processes influence the status of the ecosystem. In response, there is need to identify appropriate governance strategies so as to reduce degradation and conserve the ecosystem so that it can ultimately recover and be able to sustainably provide ecosystem goods and services for better livelihoods. The framework is graphically depicted below (Figure 1):

Conceptual Framework

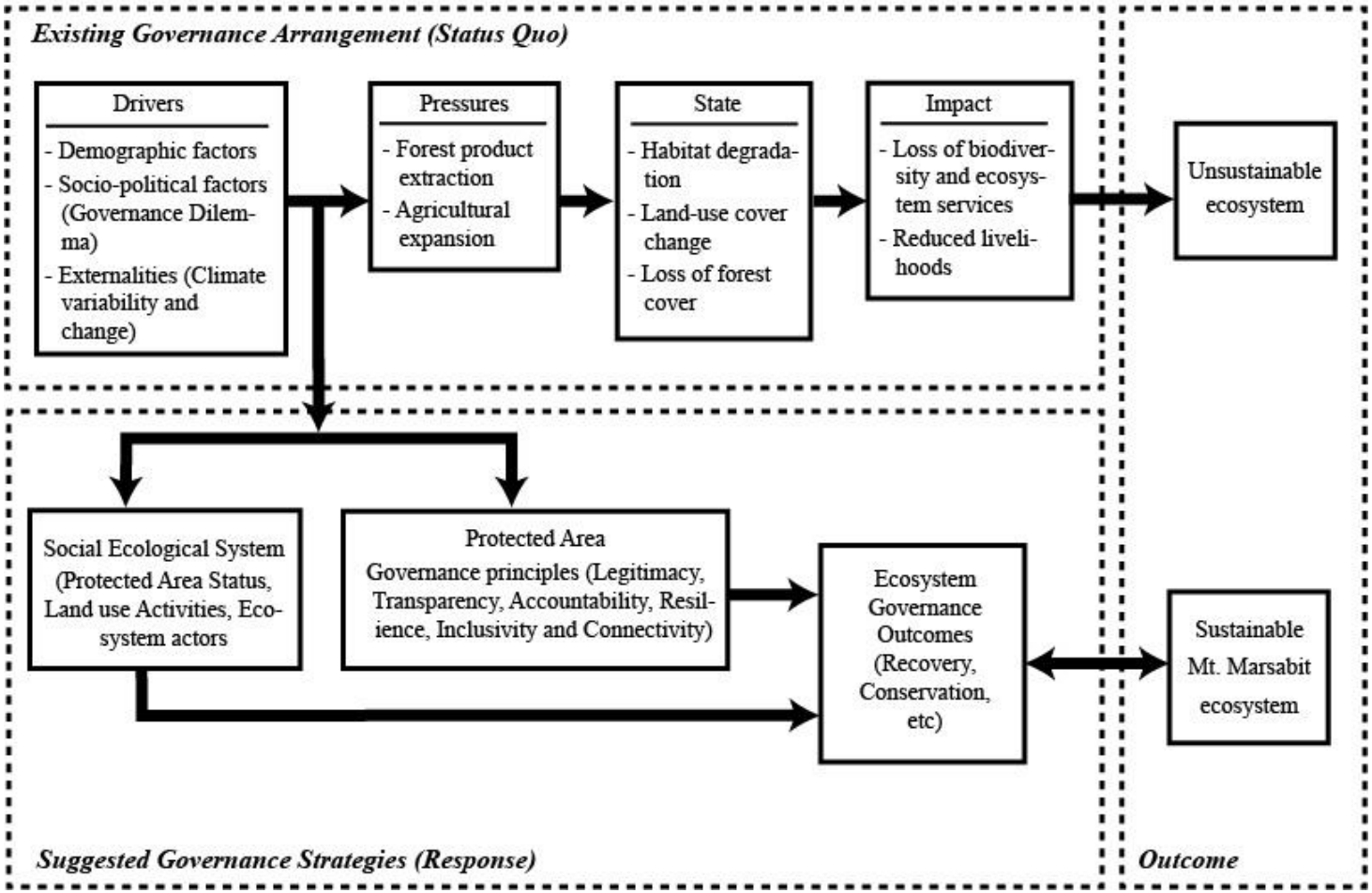

Figure 1: Conceptual framework showing multifaceted nature of humans and environmental interdependent interactions

(Source: Author, 2019)

CHAPTER THREE: STUDY AREA AND GENERAL METHODS

This chapter contains the description of the methodology used in order to achieve the set objectives. It discusses the study area, data types and sources, sampling framework, data collection and analysis

3.1 The Study Area

Mt. Marsabit forest (2^0 19' N37^0 59' E) is located in Marsabit County, in northern Kenya (Figure 2). The forest covers an extinct Holocene shield volcano characterized by hills and several craters shrouded in mist (Ogutu et al. 2016) (Robinson 2013). The volcano rises almost a kilometre above the surrounding arid plains to a summit of 1,865 m above sea level with an elliptical shape about 45 km (NW-SE) wide and 70 km (NE-SW) long. Mt. Marsabit forest experiences a bimodal rainfall pattern ranging from 600 to 1,000 mm per year, with a mean annual rainfall of 800 mm. The temperature ranges between a minimum of 15^0C to a maximum of 26^0C, with an annual average of 20.5^0C. Evaporation rates are high with the total annual potential between 1,800-2,200 mm (Maina & Imwati, 2015).

Figure 2 Location of Mt. Marsabit forest ecosystem in northern Kenya showing land use and land cover 2016

Figure 3 Map showing converted areas and Marsabit township

Figure 4 Map showing the extent of Marsabit township

Figure 5 Images illustrating settlement and cropping as drivers of degradation in the Mt. Marsabit forest PA in Kenya (November/2017). A, B, C, D - Small scale farmlands showing crops adjacent to the PA. E, F, G, H -Community members outside their homes living less than 5km to the PA' I. J – Lake Paradise inside the forest PA and visible degraded land (Photos by Caroline Ouko)

Mt. Marsabit forest area covers about 15,700 hectares. The mountain harbours two crater lakes – Paradise and the Elephant Pool. Mist condensate is the primary source of

precipitation that recharges both the lakes and groundwater sources (Maina and Imwati 2015). The population in Marsabit County tripled between 1979 (96,216 inhabitants) and 2009 (291,166 inhabitants) (KNBS, 2010). This huge increase in population can be attributed to new births being higher than deaths and immigration from Ethiopia due to unrest. Migration to the counties as a result of devolution is another contributing factor (Munya, et al., 2015). The population increase leads to increased water and food demand, thus a need of land for agricultural expansion. There has been a shift from nomadic pastoral systems to more sedentary agricultural types by residents of Marsabit County over the years (Maina & Imwati, 2015). nomadic pastoral systems to more sedentary agricultural types. Small-scale agricultural activities are also increasingly spreading in the area, leading to increased land fragmentation and sedentarization. As a result, the rising population and increasing spread of settlements has led to a decline in forest cover, loss of wildlife habitat, decrease in biodiversity, and insufficient supply of spring and well water (CIDP, 2013; Oroda, 2011).

3.2 Philosophical Underpinning of the Study

According to Ojala (2015), research philosophy is the prototype that has the capability of reinforcing a research. The author further highlights two paradigms that are mostly used and the paradigms are: positivist paradigm and phenomenological paradigm. Positivist paradigm is associated with quantitative data whereas phenomenological paradigm encompasses the qualitative data (Ojala, 2015). Positivist is also known as scientific approach and interpretivist or subjectivism approach (Lee, 1991). According to positivists, “reality is stable and can be observed from an objective stand point”. In order to identify and define existing relationships, manipulation of independent variables against the dependent variable is performed. In positivism, predictions and explanations are made on the basis of observed and explained realities (Levin, 1988). Positivism is said to be in the realm of theory, where the data is theory driven and research design is utilised to test the accuracy of the theory (Lee, 1991).

The study employed a positivist research philosophy since it dealt with quantitative data which is precise and can be easily compared thus generating reliable evidence from the responses collected through use of questionnaires (Bryman, 2011). The study also used qualitative data to further explain the responses obtained quantitatively. According to Ashley and Orenstein (2005), positivism school of thought is grounded on the philosophy that only one

reality exist though can only be known imperfectly due to human limitations and researchers can only discover this reality within the realm of probability.

3.3 Data Types and Sources

To determine how prevailing ecological processes and socioeconomic dynamics affect provision of Mt. Marsabit ecosystem services, the study used both primary and secondary data sources. Secondary data collection was through desk research. This involved taking a comprehensive review of all available documents relating to forest ecosystem governance and especially Mt. Marsabit forest ecosystem. It involved reviewing all available reports to provide insights into how the social-ecological processes and governance has progressed over time. Primary data sources were both qualitative and quantitative from the households, County Government officials especially the ones in charge of environment and natural resources and relevant stakeholders in the study area. The type of data included land use and land cover change, forest resources use, insight on the drivers, pressures and reasons for the current status of the forest ecosystem. The respondents were also asked for their views on how to conserve the forest and ensure continuity of ecosystem services provisions.

Land use change and regimes were established with habitat change/ disturbance also recorded. A time series analysis was used to establish existence of climatic variability in the study area. Data to determine land use regimes over time was from secondary sources which included digitized land use maps of the study area and satellite imagery Landsat TM at 30 meters resolution. Actual ground observation of the land use regimes was also done. Land use classification was then done by identifying the key land use systems in the study area.

Primary data sources to explore the applications and outputs of co-management in ensuring sustainability of Mt. Marsabit social-ecological system, was by qualitative data on the status quo, challenges experienced, interventions made and expectations by key informants. Secondary data sources especially the Forest Policy 2007 and Forest Conservation and Management Act 2016**;** National Wildlife Conservation and Management Policy, 2018; Wildlife Conservation and Management Act 2013; Mt. Marsabit Forest Management Plan (2017-2022); Progress update of forest decentralization processes and other relevant literature. The desk study aided in understanding the policy and legislative framework, institutional framework and the role of the communities. Data obtained through key informant interviews, focus group discussions and document analysis addressed perceptions of Mt. Marsabit PA

forest ecosystem governance focusing on the outcomes and structures. The desk research provided the information for developing tools and instruments used in the study.

To determine the most appropriate governance strategy for PAs like Mt. Marsabit, literature review of materials that included successful managed PAs and stakeholder workshops were conducted. Qualitative data was collected from institutions mandated to manage natural resources in the Country. Qualitative research is exploratory and interpretative rather than descriptive and works with relatively small numbers of people. It deals with less tangible and measurable topics and allows for close examination of motives, perceptions, beliefs and attitudes.

3.4 Sampling and Sample Size Determination

The study involved collection of information from respondents from a select sample from the study population which was identified from Marsabit County. The sample size was obtained using a sampling formula proposed by Yamane (1967);

Assuming a 95% confidence level with a Z^*- score value of 1.96, standard deviation of 0.5 and a margin of error of 0.5 using the formula: -

$$n = N * X/(X + N - 1)$$

Where;

$X = Z_{\frac{\alpha}{2^2}} * p * (1 - p/MOE^2$and $Z_{\alpha/2}{}^2$ is the critical value of the normal distribution at α/2 (for a confidence level 95%, α is 0.05 and the critical value is 1.96), MOE is margin of error, p is the sample proportion and N is the population size.

$(1.96)^2$ *0.5 (0.5)/ $(0.05)^2$ =308416*2.5/0.0025 =0.9604/0.0025 =384.16 =384

This gave a total of 384 respondents. However, due to logistics, refusals and the missing respondents, a total of 265 questionnaires were sampled as shown in table 3 below. The respondents were picked from different sub-locations through purposive sampling where the heads of the households were the units of observation. Required sample size per sub-location (which is the lowest administrative unit in Kenya) was determined proportional to the overall population in the sub-location (Table 3).

Table 3 Overview of the sampled population per administrative unit (sub-location)

Sublocation	Total population (number)	Sampled population (number)
Dakabaricha	3,053	39
Nyayo Rd	2,328	14
Wabera	4,204	32
Milima Tatu	1,606	15
Karare	2,119	20
Songa	1,447	14
Kituruni	1,268	15
Hula	1,835	21
Rukesa	4,220	35
Gar Qarsa	1,156	10
Badasa	1,850	17
Gabra Scheme	3,796	33
Total	**28,882**	**265**

There are 24 administrative sub-locations units of Central and Gadamoji divisions adjacent to the Marsabit Forest Reserve. These sub - locations include; Nagayo, Majengo, Jirime, MilimaTatu, Wabera, Township, Parkishon, Karare, Karare Scheme, DiribGombo, Bad'aasa, GoroRukesa, Gabbra Scheme, Qilta Korma, Hula, Sagante, Qachacha, Songa/Leyai, Kituruni, Ilpus, Mata Arba, Songa and Dakabaricha. This sample size was proportionately sub-divided to selected villages such that villages with larger number of households had higher chances of selection. Once the sample villages were selected, a fixed number of sample households to be interviewed per village were chosen using simple random sampling approach ensuring that the sample population interviewed was representative of the study area.

There are two key methods for collection of qualitative data; Focus Groups and Key Informant Interviews. Focus groups bring together a group of between 6-12 people at a central location to explore in a relaxed atmosphere the issues in question while key informant interviews are one-on-one discussions. Focus groups are usually the preferred method because the interaction between respondents can generate much more insightful information. However, when the information required is confidential or sensitive in nature or when it is difficult to

bring together the target group due to the nature of their work, key informant interviews are employed. The approach gives insights into how respondents understood the project but also provide a forum through which new ideas can be generated for future projects. Key informant interviews and focus group discussion respondents were purposively sampled.

The selection of the key informants was based on their knowledge of the PA. Key informants included middle and top level managers at the; Ministry of Environment & Forestry (HQ), Ministry of Tourism & Wildlife (HQ), Kenya Wildlife Service (KWS), Kenya Forest Service KFS), National Drought Management Authority (NDMA), National Environment Management Authority (NEMA), Water Resources Authority (WRA), Ministry of Agriculture, Fisheries & Livestock, Ministry of Energy & Petroleum, Ministry of Interior Coordination, Marsabit Prison, Marsabit County hospital, County Government departments namely; Environment & Water, Lands and Agriculture, Non-Governmental organisations (NGOs) namely, Food for the Hungry and Concern-wide. A total of 36 key informants participated in this study. Three focus group discussions from KWS rangers, KFS rangers and Community Forest Association (CFA) members were conducted. The selection of focus group participants considered background knowledge of the PA. Composition of the FGDs were as follows; KFS rangers = 6 men; KWS rangers = 1 woman and 11 men and CFAs = 12 - 4 women and 8 men. Stakeholder workshops participants were middle and top-level managers from the following institutions (Table 4);

Table 4 List showing institutions represented by the workshop participants (n = 26)

Institution
Kenya Wildlife Service
Kenya Forest Service
National Environment Management Authority
Water Resources Management Authority
County Government departments (Environment and water; Lands; Agriculture; Culture services)
Northern rangeland trust (NRT)
Conservancy representatives (songa, shurr and Jaldesa conservancies)
Non-governmental organization (NGOs) Food for the Hungry
Ministry of Agriculture, Fisheries and Livestock
Community Forest Associations (CFA)

3.5 Data Collection

The study was conducted using primary data from a field survey as well as secondary data sources. Secondary data was collected through a comprehensive review of published and unpublished documents relating to forest ecosystem governance especially focused on Mt. Marsabit forest. This information was used to provide insights into how social-ecological processes and governance have changed over time.

3.5.1 Households Survey

The primary data was collected from households using a survey questionnaire between March and May 2017. The questionnaire through an android platform running on tablets was used for data collection to ensure data validity and reliability. It was designed in XLSFORM adapted in Open Data Kit (ODK) in a mobile data platform (JeffreyCoker & Basinger, 2010). The questionnaire was semi-structured and comprised both open-ended as well as multiple choice questions. According to Christie et al. (2008) this combination of question types counteracts biases of single data sources. The design of the questionnaire was to elicit interviewee's perceptions on (1) ecosystem services provided by Mt. Marsabit forest, (2) observed ecosystem changes, and (3) their involvement in the governance of the ecosystem.

Figure 6 Map showing the distribution of sampled households adjacent to the PA

Stratified sampling method was used to select the households included in the interviews. The strata were as follows i) sample size was per sub-location, (which is the lowest administrative unit in Kenya), and to ensure that the sample population interviewed was representative of the overall study area, it was determined proportional to the overall population in the sub-location. ii) proximity to the forest in terms of distance to the forest namely homestead being less than 2km, 2-5Km, 5 – 10 Km and more than 10km to the forest was observed. iii) socioeconomic characteristics such as type of roof, whether thatched or corrugated iron sheet were considered.

Once the number of samples per sub-location was established, the fixed number of sample households to be interviewed per village was determined. Selection of specific households, were done in consultation with the local village chiefs. They indicated the households based on the researchers' criteria namely, a diverse set of households in terms of distance to the forest and availability at the time of the study. The questionnaire was administered to the self-designated household heads aged above 18 or their representatives in individual households. The enumerators were from the study area and conducted the interviews in the local Borana, Rendille, Gabra, and Burji dialects, depending on the respondent's origin. The enumerators were trained before interviews for ease of acceptability and interpreting the questions to the respondents in their native language. The answers were directly translated to English by the enumerators and keyed into the mobile device. Interviews lasted for an average time of one hour. The length was influenced by interviewees' knowledge and attitude towards disclosure.

3.5.2 Focus Group Discussion and Key Informant Interviews

As focus group discussion are exploratory and interpretative rather than descriptive and deals with less tangible and measurable topics to allow for close examination of motives, perceptions, beliefs, and attitudes, the study used a guide to conduct the discussions. There was also a key informant guide for the key informant interviews. The key informants and focus group discussion participants were consulted, briefed about the research, and requested for their consent as stipulated in the research permits. A total of 36 key informants and three focus groups with participants drawn from KWS rangers, KFS rangers and CFA members were

conducted. The selection of focus group participants considered background knowledge of the PA. Specific structured data was collected where key informant participants were required to give their views on certain governance indicators in five-point Likert scales. Interviews for each key informant lasted approximately 60 minutes, followed by transcription of the recorded interviews.

3.5.3 Stakeholder Workshops

The stakeholder workshops aided in finalizing the stakeholder mapping from the key informants. The list of stakeholders was refined and interviews conducted to acquire data used to analyse interactions and networks. Interaction in this study was defined as direct links through communication, collective decision making or working together for the benefit of Mt. Marsabit forest ecosystem. The stakeholders were asked for the type of knowledge or information or other type of resources they exchanged and how important the relationship was, for which the responses were captured in a Likert scale; 1 = not important at all, 2=low importance, 3=medium importance, 4=high importance, 5=very high importance.

The stakeholder workshop also aimed at guiding participants through scenario-based analysis of the governance of Mt. Marsabit Forest Ecosystem. Scenarios were preferred as they provided a more innovative and resilient management measure for the future by giving intuitions about uncertainties and an assessment of the robustness of different factors that would play out and different management actions across the range of actors. The stakeholder workshop was designed to answer one critical question - how should governance policies and strategies be adopted in the face of a number of driving forces to degradation and critical future uncertainties.

3.5.4 Land Use Land Cover Change

Land use maps were generated from freely available Landsat satellite image data. Combining remote sensing (RS) and household survey information is useful in monitoring cost-effectively temporal trends of land use change and making informed decisions for interventions. The study considered three reference years between 2000 and 2015. Images for the year 2000, 2010, and 2015 were selected. These satellite data were obtained from the Landsat archive for cloud free imagery related to these years. Image classification was conducted on the three-image data to discern five cover classes as bare land, bush land, wetland, forest and grasslands. The algorithm used to classify the data followed supervised

image classification approach but with random forest modelling as the technique for grouping similar pixels. Random forest model was trained in R Program using training samples collected in the field during household survey work. A significant model with overall accuracy of 0.967 at p-value 0.05 was obtained and used to classify the images. The results of this classification are presented as maps and tables. The overall change map was also calculated whereby changes that occurred over forest land between the year 2000 to 2015 were recorded. The map difference between classified image for 2015 and the year 2000 was also noted.

3.6 Data Analysis

The data was analysed with a focus to address the objectives. The quantitative data was entered into an MS Excel spreadsheet for cleaning and preparation and then transferred to SPSS version 20 for analysis (IBM Corp Armonk, 2011). Fisher's exact test was performed to test for statistical differences between the most important ES provided by Mt. Marsabit forest perceived and the distance of the respondents' households from the forest. Cronbach's alpha and factor analysis were used for establishing the status of the Mt. Marsabit forest in terms of the perception of threats to ES, data. To explore community participation in forest management by different sociodemographic and biophysical factors, a logistic regression algorithm was used to predict a binary outcome (1, 0) (Dreiseitl & Ohno-Machado 2002; Goal & Red 2003).

The central themes for analysis were perception on ES and involvement in the management of Mt. Marsabit forest. The unit of analysis was the interviewee, on behalf of his/her household. Measures of central tendency (mean) and dispersion (range) were computed to summarize the demographic data. Descriptive and inferential statistics were used to analyse perceptions on the provision of different ES from Mt. Marsabit forest.

Qualitative data obtained from the interviews and field notes were transcribed and cleaned. All transcripts were thoroughly crosschecked with the audio/video tapes, making reference to the field notes for clarification. Through transcription, the audio/video recordings were transformed into written text, taking note of the sounds, pauses, and other audible behaviours of the respondents. The analysis of key informant interviews involved summarizing the narratives, categorizing responses, as well as collating and filtering to extract dominant themes related to the governance structures, processes and outcomes. First, the data were identified as representing a particular aspect of the study and given labels corresponding to governance attributes (legitimacy, transparency, etc.). Later, codes with the same label were grouped into particular themes (conflict management, governance structures, etc.), and the

resultant themes formed the basis for further analysis and interpretation. Thematic analyses involved the identification of similar phrases, patterns and themes.

Focus group discussions provided an opportunity for triangulation to improve data validity and reliability. Secondary data from the analysis of documents about PA governance supplemented the data. Document analysis was used to trace outcomes and triangulate the collected information. Some structured data were also collected in which key informant participants were required to give their views on certain governance indicators using Likert scales. Social network analysis (SNA) was used to assess ties between actors. SNA employs network algorithms and a combination of ethnographic and field observations to capture stakeholders' relations (Prell, & Reed, 2009; Reed et al., 2009). UCInet was used to analyse data on network statistical measures of strength of ties and centrality. Stakeholders are linked by one or more ties and results displayed graphically and consist of points or nodes to represent stakeholders and lines or ties to represent relations. In this study the SNA measures analysed strength of ties and centrality. Strength of ties measured frequency of interactions and centrality measured interconnectedness. Eigenvector centrality was based on inequality among stakeholders' connections. Governance principles were analyzed using inferential statistics with factor analysis and reliability Tucker Lewis index to establish correlations and coherence of items on perception of the governing bodies in relation to the governance indicators. Factor analysis and reliability test was used because some data values were less than five due to some agencies having fewer than five staff members in total or with mandates on PA-related issues. Principal Component Analysis (PCA) was used to calculate the overall governance status.

Triangulation of collected data from two or more methods of data collection, theoretical perspectives and sources of information and informants, were used to compare, contrast, investigate, and to analyse related data or phenomena of interest. Triangulation offers a multidimensional perspective which enables the researcher to reduce biases, confirm and discover which inferences are valid, and increases a more reliable interpretive potential (Thurmond, 2003). Analysis of scenarios provided answers to important management questions. Scenario development assessed the impacts of future change so that optimal management strategies and practices can be implemented in response. The social-ecological systems thinking of ensuring integration was adhered to.

3.7 Ethical Considerations

A research permit was obtained from the National Commission for Science Technology and Innovation (NACOSTI). Thereafter, written consent was sought from the different selected institutions. The respondents were granted prior informed consent regarding their participation and were at liberty to agree or decline participation. Finally, the principle of unanimity was used whereby personal identities of respondents would not be revealed or data released to third parties.

CHAPTER FOUR: RESULTS AND DISCUSSIONS

This chapter details findings of the research carried out to (i) determine how prevailing socioeconomic dynamics interact with ecological processes to affect provision of ecosystem services on Mt. Marsabit; (ii) measure the effectiveness of governance as perceived by respondents, and iii) assess governance scenarios to ensure sustainability of Mt. Marsabit socio-ecological system.

4.1 Community Perceptions of Ecosystem Services and the Management of Mt. Marsabit Forest

The first objective determined how existing socioeconomic dynamics and ecological processes interact and influence sustainable provision of Mt. Marsabit ecosystem service. This was done by establishing perception of different community members regarding the ES provided by Mt Marsabit forest and the threats to the forest. This is important because the neighbouring community of every protected area play a critical role in promoting the conservation of the ecosystem. Their behaviour, perceptions and norms therefore are a subject of concern to any management that seeks to uphold the conservation of the ecosystem. It remains unclear how the management of the Mt. Marsabit forest has engaged the community.

4.1.1 Perception of Respondents

The total number of respondents was 265, with 53% male and 47% female. The mean age was 43 years with the youngest respondent being 20 years and the oldest 97 years old. In terms of education, more than half (58%) lacked formal education and the dominant ethnic community was the Boranas (32%). About one-third (29%) of the respondents had a residency of over two decades having settled in the area between 1985 and 1994 (appendix 1). This study investigated how local community members around Mt. Marsabit forest use and perceive their environment and its ecosystem services. The results showed that the respondents benefitted from a wide range of provisioning and cultural ES from Mt. Marsabit ecosystem for their economic, physical, and social wellbeing (Figure 3).

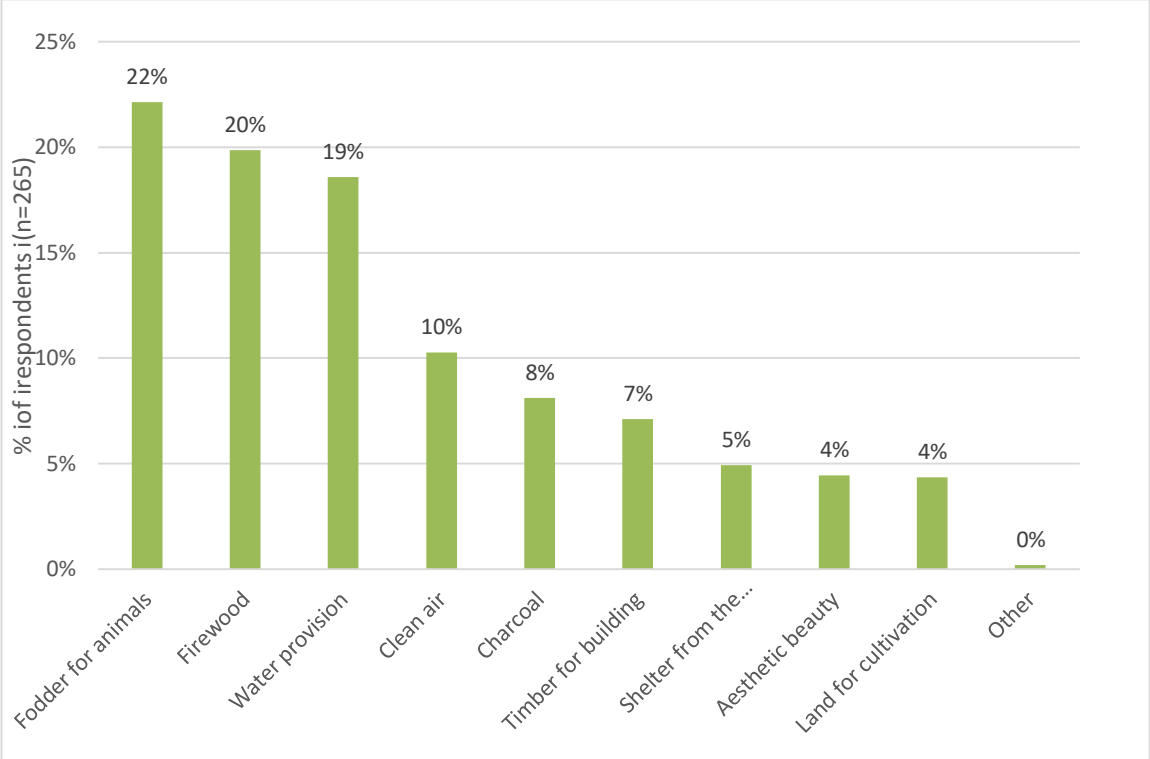

Figure 7 Perception of the most important ES provided by Mt. Marsabit forest

The three most important ecosystem goods and services obtained by communities were animal fodder (22%), firewood (20%) and water (19%). Others were; clean air, charcoal, shade, aesthetic beauty and land for cultivation. Culture was identified by about one-quarter (23%) of respondents as an important factor in their forest utilization. The cultural practices included the use of *Acacia xanthophloea* regarded as the head of all trees, but also planting of trees around graves to provide shelter for the dead, cutting branches instead of the whole tree, and using plants as medicine and for sacrifices.

The findings reveal a wide range of provisioning and cultural services that the local residents use for their wellbeing. Two other types of services, which do not directly provide humans with benefits, but are necessary for the production of provisioning and cultural services, namely, supporting services and regulating services, were hardly mentioned by the respondents (except for water, which is considered as both a provisioning service and a supporting service, when it supports primary productivity). Similarly, other researchers have also concluded that while cultural and provisional services are directly affecting human

wellbeing, supporting and regulating services, which are indirectly affecting human wellbeing, are more difficult for people, and even scientific experts, to identify (Fisher, et al., 2011).

According to Christie et al. (2008), residents in developing countries often have greater immediate dependency on ES than those in developed countries as shown by results from this study. Provisioning ES, as cited by respondents, mainly covered for their basic needs and the resources reported most often were trees and forage for their livestock, spring water (for their livestock and domestic use), and future cultivation land. Water sources and wind (although usually considered climate conditions), were also defined as ES in this study. About 26% of the respondents said that the forest ecosystem was used for agriculture and particularly to raise livestock (Figure 3). Livestock raising in the study area is focused mainly on cows, while goats, sheep, and camels are less common. There is also a notable dependence on the use of provisioning services for fuel. Several respondents cited using fuel wood energy sources from the forest. Dry wood from bushes and trees is used for cooking and heating. However, there was no mention of various types of renewable energy, such as, solar energy, wind power and bio-diesel, although the government has introduced wind power in Marsabit County. Respondents referred to cultural ES in far greater detail than to the provisioning ES. The cultural ES were mainly expressed in terms of aesthetic enjoyment of the landscape and shade provided by trees. According to the typology of sentiments to place presented by (Torri et al., 2011), "the natural environment, including the landscape, as well as climatic and biological components of the ecosystem, can create a strong sense of place, sense of being at home, and attachment." The respondents also spoke often of the recreational activities that are particularly suited for their environment. They cited that tourists enjoy engaging in activities such as camping, bird watching, rhino charge, and watching wild animals.

Perception of ES varied between households dependent on residential distance to the forest edge. Provision of animal fodder was most important to respondents living within 2 km of the forest, and least so for those living 5 km or more (Figure 4). Conversely, the forest as a source of water was perceived to be more important for respondents living further than nearer the source.

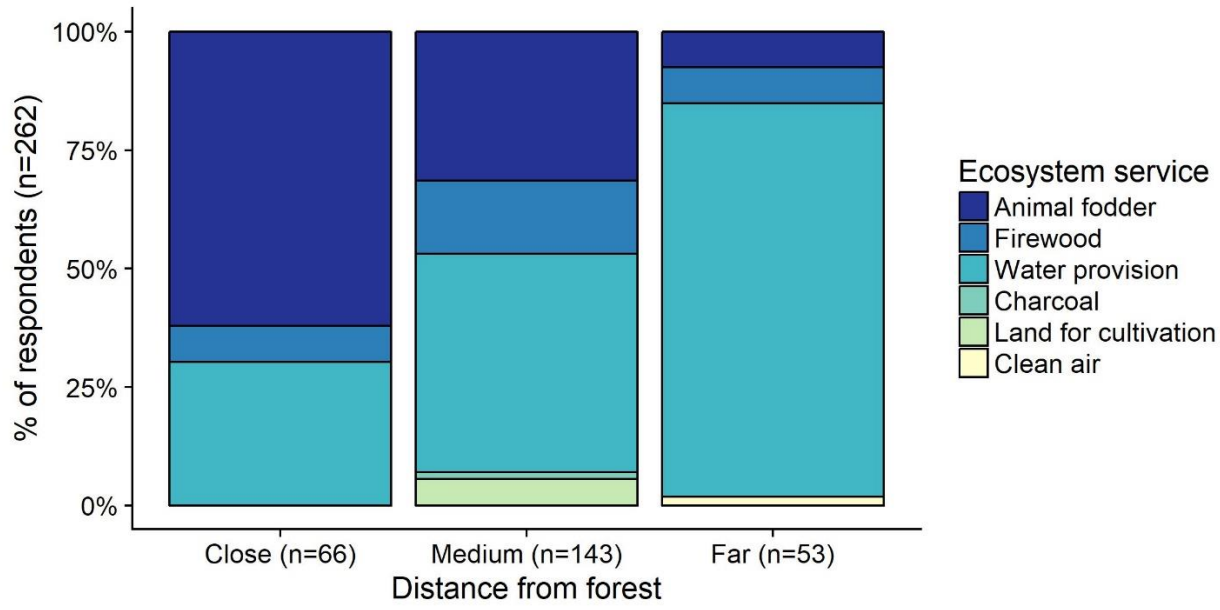

Figure 8 Perception of most important ES by respondents living in different distance from the forest

("close" < 1 - 2 km; "mid" 2 -5 km, "far" 5 ->10 km from the forest)

These perceptions of most important ES differed significantly between respondents living in the three distance categories ($p<0.001$, n=265). Respondents who live "close" to the forest perceive mostly firewood collection and fodder for animals as the most important ES. For those in the "mid" category, land for cultivation and timber for building are perceived as the most important ES, while for those households living "far" from the forest firewood collection and fodder for animals are the most important.

The analysis of ES perceptions by respondents living in different locations from the forest edge showed that while respondents living close to the forest perceived it to be mainly important for livestock grazing, those respondents living further away highlighted the importance of water provision. This shows that disaggregating findings between different categories of land users is important, as they might have different priorities for forest management. Previous studies revealed that perceptions of ecosystems as sources of particular ES vary among respondents as a result of a complex set of factors, including formal education, gender, origin, age, individual needs, cultural traditions, access to ecosystem services, agricultural land ownership, spatial patterns, and household income (Agbenyega, et al., 2009; Comberti, et al., 2015; Frank et al., 2017; Muhamad et al., 2014; Sagie, et al., 2013).

Of the, 265 respondents, 54% (n=144) perceived threats to the Mt. Marsabit forest ecosystem either in the past, present, or in the future (Table 5). Past threats were perceived to be insecurity (43%), and degradation (39%). While security as a threat was perceived to have declined (28%) and will continue the trend (23%), degradation was considered to have increased (40%) and that such trend would persist (39%). Future human population would also increase pressure (17%) leading to habitat change (13%).

Table 5 Perceived drivers and threats to the Mt. Marsabit forest ecosystem (n =144)

Threats	In the Past %	In the present %	In the future %
Insecurity	43.1	27.8	22.9
Change in climate	8.3	16.0	8.3
New emerging diseases	0.7	0	0
Habitat change	4.2	6.3	13.2
Degradation	38.9	40.3	38.9
Human population pressure	4.9	9.7	16.7
Total	100	100	100

In this study, insecurity in the past and currently degradation were found to be the main threats to Mt. Marsabit forest ecosystem, which is similar to findings from other studies (Imo, 2012; Randhir & Erol, 2013) that have flagged human induced activities to be associated with degradation of forests, thus rendering them incapable of continuously supplying ES.

Table 6 Main perceived pressures to Mt. Marsabit forest ecosystem (n = 265)

	Percent
Overexploitation of forests	57.4
Overstocking and overgrazing	38.5
Loss of soil and productivity	1.5
Cultivation on steep slopes	1.1
Drying up of river sources	0.8
Loss of insects/plants/animals (biodiversity)	0.4
Other	0.4
Total	100.0

The main perceived pressure leading to the threats to the forest ecosystem was overexploitation of the forest, mentioned by 57% of the respondents, followed by overstocking and overgrazing (Table 6). Other pressures leading to the threats were mentioned only by very few respondents.

The impact of these threats is the overexploitation of the ecosystem and thus a reduction of its ability to supply ES sustainably. These results are related to the perception of the respondents on ES that agriculture and especially crop farming and livestock keeping lead to degradation, which threatens the long-term persistence of the forest ecosystem.

4.1.2 Local community involvement in the management of Mt. Marsabit forest

Overall, 35% (n=265) of the respondents stated that they are engaged in conservation activities while 65% did not engage. The conservation activities they are involved in include tree planting (80%) and soil conservation measures (20%). About 21% of the respondents (n=265) are members of a conservation group and of these, 35% attended meetings a few times. 10% of these respondents hold positions such as a chairperson, vice-chairperson, secretary, treasurer, or committee member, in the group. 97% belong to only one group, while the remaining 3% are members of between two and five groups. For 33% of the respondents, meetings are scheduled monthly, and for 50%, once after 1-3 months. The activities these local conservation groups engage in are income generation, tree planting and others namely, patrolling around the forest, looking after wildlife, as well as soil conservation by building gabions.

Only 6% (n=265) of the respondents have been involved in monitoring the forest through patrols, while 4% have been involved in sanctioning rule breakers. 18% of the respondents (n=265) were aware of initiatives by the National and County governments to conserve the forest. The initiatives they cited include: enabling local communities to plant trees in their homesteads (23%), national government agencies hosting meetings to discuss forest conservation (20%), creating awareness on the importance of forests (11%), fencing off the forest by the national government agencies (11%), tree planting by the County government in communal areas and schools (8%), KFS and KWS planting trees in schools (8%), conducting seminars and issuing uniforms to committee members (multi-agency county committee for security) involved in patrols (8%), provision of tree seedlings to the local community (5%),

measures against poaching and logging (2%), recruiting forest rangers (2%), as well as constructing gabions (2%). Of the respondents who cited the initiatives, 42% (n=48) of them say that these initiatives have been moderately successful.

The community members in Marsabit are aware of the importance of the forest ecosystem and the goods and services it is providing. However, the community is sparsely involved in forest management, with only 6% having been involved in implementing rules. Recently, interviews carried out on 11 cases of participatory management of forest in Spain and Portugal revealed that transparency and trust, especially between land users and government bodies, are a basis of successful participatory management (Frank et al., 2017; Tadesse, et al., 2017). If trust is present, participation provides further opportunities to get to know each other's concerns and take them into account (Nkonya, et al., 2016). Without a secure right to access protected-area resources, local communities will always tend to consider the area as “lost villages resources” that are not worth caring for in the long-term (Mogoi et al., 2012). Conservation groups and community-based conservation network encouraging conservation was observed to be a more efficient method to discourage illegal practices elsewhere in Kenya (Mogoi et al., 2012).

Mt. Marsabit is currently in the process of forming a community forest association (CFA). The strong link between knowledge of policy and involvement in participatory forest management through Community Forest Association membership was underlined for the Kakamega National Reserve in Kenya in 2012 (Mogoi et al., 2012). It was argued that the involvement of communities could be enhanced by a better diffusion of information and simplification of the management plans, adapted to less educated people. Reticence and fear linked to previous governance are likely to disappear if wardenship of the local communities is respected but also if direct economic benefits are felt amongst the population involved (Reed, 2008).

Changes in management practices will eventually affect forest conservation and regeneration. Recently, Kenya has decentralized the management of natural resources. However, an engaged decentralization process does not necessarily lead to communities’ involvement. It is important for any kind of management plan and especially within a participatory management scheme to make sure the work will be equally shared between villages and communities relying on the resource under management (Mensah et al., 2017; Reed, 2008).

4.1.3 Factors influencing the participation of community members in forest management

The results of the binary logistic regression model analysis indicated that different socio-demographic and biophysical related factors influence involvement of community members in management of the forest ecosystem (Table 7). The logistic regression model was statistically significant as shown by the Wald Chi-Squared Test (χ^2 (4) = 20.323, p < 0.0005). The model explained 16.1% of the variance in community participation and correctly classified 64.1% of cases.

Table 7 Results of logistic regression model analysis

Variables tested	β	S.E.	Wald
Main impact of threat	.203	.175	1.347
Most important ES	.273***	.152	3.214
Education level	.245***	.116	4.474
Gender	-.537***	.291	3.408
Respondent's age	-.044***	.015	8.470
Family size	.150***	.073	4.153
Land size (acres)	.078	.085	0.832
Distance to forest (km)	-.232**	.154	2.284
Constant	.013	.834	.000

Number of obs = 265
LR chi2 (8) = 60.56
Prob > chi2 = 0.005
Log likelihood = -152.40566 Pseudo R2 = 0.166

The logistic regression results demonstrated that there was a significant and positive association between family size and level of involvement in management of the forest (b= 0.150, P=0.042), indicating that an increase in family size increases the probability of community members' levels of involvement in the management of the forest. The level of education and level of involvement was also positive and significant (b = –0.245, P = 0.034). This implied that more educated forest users had a higher probability of involvement in its management. Age was negatively and significantly correlated with level of involvement in forest management (b=-0.044, P=0.004) indicating that the older people grow the more likely it is that the probability of participation decreases.

With respect to the factors influencing levels of involvement in forest management, family size as well as level of education, were positively and significantly correlated with level of participation in conservation. This could be because households with larger families have a higher demand for forest products such as fodder and firewood. Education catalyses the

process of information and knowledge flow thus enabling the educated community members to participate in management. Several other studies have also shown that respondents with larger families participated more in community forest management and those without formal education showed low levels of participation in Nepal, Haiti, and Ethiopia, respectively (Chhetri, et al., 2013; Dolisca, et al., 2006; Tadesse et al., 2017). On the other hand, age was negatively and significantly correlated to participation in the forest management program. This finding matches results of (Tadesse et al., 2017), which reported that age had a negative influence on involvement in forest management in Kenya. This could be because the older people are unable to participate in activities requiring physical inputs.

These results show that communities identify with livestock keeping and crop farming. The focus of the community on the ES, which directly benefit them, could explain their minimal involvement in forest management although they acknowledge that the forest is overexploited and the ES are under threat due to degradation. This has important implications for designing effective strategies to ensure community members participation in sustainable forest management. Assessments of local people's perceptions of ES, such as the one conducted in this study, add to the growing body of policy-relevant knowledge on human-nature relationships (Pascual et al., 2017; Sachs, 2012).

4.2 Effectiveness of Protected Area Governance of Mt. Marsabit Forest Ecosystem

Good governance of protected areas is crucial in enhancing the provision of ecosystem services. The procedures and approaches of governance have continually affected the conservation of protected areas. This has seen continued degradation of forests including Mt. Marsabit forest despite the efforts put across by relevant authorities to enhance conservation of the forest.

4.2.1 Interactions of Governance Actors in the Protected Area

Governance in the Mt. Marsabit ecosystem is shared among various actors, including Kenyan national government agencies, county governments, non-governmental organizations and community-based organizations. Mt. Marsabit Forest ecosystem is managed by government institutions and the line ministries whose work is supported by other organizations, including civil society organizations, foreign aid donors, community-based organizations, non-governmental organizations and the private sector. These bodies are involved in policy formulation and decision-making, as well as developing and implementing site-specific plans. The main institution is the Kenya Forest Service (KFS) established under the Forest Act. Others include the Kenya Wildlife Service (KWS), as wildlife's habitat is mostly forests, Kenya Water towers Agency (KWTA) and NEMA, which was established to exercise general supervision and co-ordination over all matters relating to the environment, including the forest and National Museums of Kenya (NMK).

Other institutions involved in the Mt. Marsabit Forest ecosystem include the Marsabit County, Physical Planning under the Ministry of Lands, Ministry of Agriculture and Irrigation, NDMA under the Ministry of Devolution and ASAL areas among others. In this study, the definition of stakeholders was limited to formally organized groups sharing a common interest or stake (Reed et al., 2009). The list of stakeholders was derived from document reviews (CIDP, 2013; Robinson, 2013) and the stakeholders then categorized as shown below (Table 8).

Table 8 List of stakeholders in Mt Marsabit forest PA

A) Government agencies/authorities

I. Kenya Forest Service (KFS)
II. Kenya Wildlife Service (KWS)
III. National Environment Management Authority (NEMA)
IV. Water Resources Authority (WRA)
V. National Drought Management Authority (NDMA)
VI. Kenya Water Tower Agency (KWTA)
VII. National Government Administration Office (NGAO)

B) Government ministries/departments

I. Ministry of Environment and Natural Resources
II. Ministry of Tourism and Wildlife
III. Ministry of Water and Sanitation
IV. Ministry of Devolution and ASAL Areas
V. Ministry of Physical Planning
VI. Ministry of Interior and Coordination of National Government

C) Devolved government

I. County Government of Marsabit
II. Ministries in charge of natural resources

D) NGOs

I. Food for the Hungry
II. Concern Worldwide

E) Community-based organizations

I. Community Forest Association (CFA)

F) Local resource user groups

I. Livestock owners living on the mountain
II. Pastoralists living in the lowlands
III. Commercial firewood collectors and charcoal burners
IV. Agriculturalists and agropastoralists

In this study, 21 stakeholders were identified with representation from the public, private and civil society sectors. The identified stakeholders were categorized into six groups, with the government having the highest number of stakeholders. The agencies (Group A) from the ministries (Group B) were separated because the former is composed of institutions formed with specific mandates and focus on resource management. The level of interest was guided by (Krott, 2005) postulation that, "Interests are based on action orientation, adhered by individuals or groups, and they designate the benefits the individual or group can receive from certain objects." Primary interests for selected stakeholders are shown (Table 9) below:

Table 9 Mt. Marsabit selected stakeholders' interests

Group/Organization	Primary interest/mandate
Local resource users	
Livestock owners living on the mountain	Access to regular grazing and water
Pastoralists living in the lowlands	Access to water during droughts. Occasional access to grazing
Commercial firewood collectors and charcoal burners	Access to fuel wood
Agriculturalists (farmers) and agro-pastoralists	Access to land for cultivation
Community members generally	Natural resource-based livelihoods
Devolved government	
County government of Marsabit	Create opportunities for constituents, develop and implement county integrated development plans with emphasis on sustainable development including natural resources
Public entities	
KFS	Forest conservation and production
CFAs	Joint management agreements with KFS to manage forests adjacent to the community
KWS	Wildlife management
NDMA	Food security and drought preparedness
NEMA	Overall environmental protection and management
WRA	Water resource management, i.e., water catchment area conservation
National Government Administration Office	Several, especially security
NGOs	
NGOs (Food for the Hungry, Concern Worldwide, etc.)	Involved in capacity building and conservation efforts to promote sustainable forest management in Marsabit County

The stakeholder's perceived influence and interest shows that majority of the key actors are public entities including ministries and departments, then local resource users and two non-governmental organisations. The functions of the majority actors from public entities are regulation, coordination, formulation and implementation of policies and strategies. They include; KFS, KWS, NDMA, WRA, NEMA, national government administration office and the county government of Marsabit. NEMA is the main government authority charged with the supervision and coordination of all matters relating to the environment; hence its mandate is critical for the Mt. Marsabit Forest protected area. There are challenges in NEMA in terms of resources such as minimal capacity in managing the Mt. Marsabit PA. Additionally, the adoption of the devolved system governance in Kenya, through the Kenyan Constitution of 2010, led to the creation of 47 county governments. Marsabit County holds some part of the land under the national reserve in trust as it is situated in the former municipality land, but has now been taken over by the county (CIDP, 2013). This is despite the fact that Marsabit forest is listed in Third Schedule forest law as a public forest and Marsabit County government is not involved in the day-to-day running of the PA.

The national government units have regulatory powers and authority which they exercise in managing the PA. They derive their mandates from various relevant legislations. The local resource users largely depend on the ecosystem for their livelihoods. The NGOs had some influence probably due to working closely with resource users in diverse projects (Robinson & Kagombe, 2018). The stakeholders' influence in the ecosystem could be used to further their interest depending on the prevailing dynamics. The interactions between the actors in terms of decision-making and management of the PA are shown in figure 5 below.

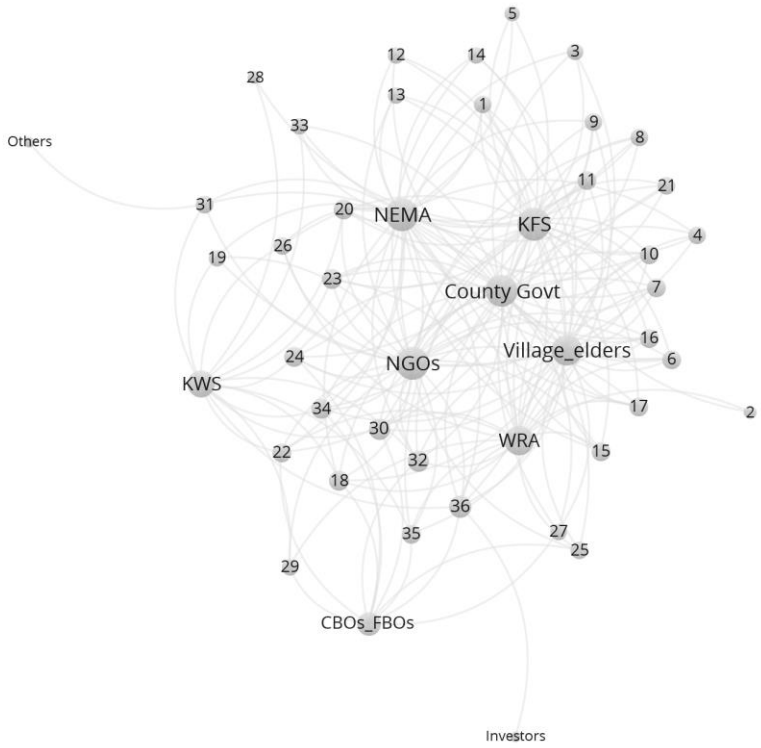

Figure 9 Network diagram showing interactions of stakeholders in Mt. Marsabit forest ecosystem

(*Density =10.3; connectedness = 0.3; centralization = 35.8%; average distance = 1.6*)

Using data from stakeholder interactions, a network graph with 193 ties was created (figure 9) Stakeholders were linked by ties of diverse strengths i.e., varying frequencies of interaction. The node sizes show the centrality of the institutions with larger nodes showing a higher number of ties. However, only 10% of potential ties in the network (density = 10.33%) were captured. The figure shows evidence of stakeholder interactions with a low connectedness index of 0.3. Low connectedness indicates that stakeholders were weakly linked. The degree of connectedness varies such that NGOs were the strongest followed by public entities and investors were the weakest. Differences between stakeholders were based on the number of connections each had. The mean degree centrality score was 35.8% (minimum = 4, maximum = 140, SD = 16). Connectedness for each institution was 141 (NGOs), 140 (NEMA), 134 (Marsabit County Government), 132 (KFS), 122 (village elders), 109 (WRA), 80 (KWS), 60 (CBOs/FBOs), 8 (investors), and 4 (others).

The centralization of a particular actor in a network is a declaration of importance or possibly an expression of power depending on the nature of the measured relations (Wyborn, 2015). This study showed that the governance of Mt. Marsabit forest ecosystem is complex, with a multiplicity of stakeholders with diverse interests and relations. The dominance of government and its affiliates as key players and central stakeholders show the pivotal role of regulation, supervision, planning, and coordination in natural resource governance. Co-management and decentralization should encourage participation and links with non-state actors and community members. However, the government should steer the process as reflected by national priorities.

The weakness of the stakeholder network was observed by the low level of interactions and associations, as reflected by the low density, which could negatively affect the flow of information and other resources between stakeholders. Most of the interactions are characterized by sporadic associations and low emotional intensity, which could affect the collaboration and execution of complex participatory tasks. The weak ties can be attributed to weak coordination and a lack of institutionalization of the links. The actors, rules and prevailing ecological processes interdependently dictate the PA status.

Adaptive governance focuses the attention on the relationships between science and management, whereby the so-called 'gaps' between these groups are an obstacle to effective adaptive responses to biophysical change. Yet, the relationships between science and governance, knowledge and action, remain undertheorized in discussions of adaptive governance, which largely focuses on abstract design principles or preferred institutional arrangements. In contrast, the metaphor of co-production highlights the social and political processes through which science, policy, and practice co-evolve. Co-production is invoked as a normative goal (Mitchell et al., 2004) and analytical lens (Jasanoff, 2004), both of which provide useful insight into the processes underpinning adaptive governance. This study builds on and integrates these disparate views to reconceptualize adaptive governance as a process of co-production.

Drawing on theoretical and empirical material, co-productive governance moves beyond longstanding debates that institutions can be rationally crafted or must emerge from context resituate adaptive governance in a more critical and contextualized space. This reframing focuses on the process of governance through an explicit consideration of how normative considerations shape the interactions between knowledge and power, science and governance (Wyborn, 2015).

In the context of co-productive management, according to Pryke, (2012), therefore, in our study, the most centralized stakeholders were the NGOs, village elders, county government of Marsabit, KFS, and NEMA. This implies that these five stakeholders are the most important in ensuring governance of the PAs. Thus, their roles are critical in promoting the conservation of the PA, and hence, they ought to work together if any success is to be achieved.

The county government of Marsabit supports involvement of the local community in governance and devolution of key government services to the grass root level. The KFS is nationally mandated for managing and conserving forests in Kenya and NEMA is mandated to coordinate and supervise all matters related to the environment. The village elders are highly regarded in communities in northern Kenya and they have traditional hierarchical powers. NGOs have been known to work closely with local communities involving diverse livelihood projects. The results showed that NGOs, NEMA, and KFS are the most influential stakeholders in the Mt. Marsabit forest ecosystem due to their central position, and have a higher inclusion rate and more opportunities to participate in the co-management of the PA.

The closeness centrality measure describes how close the other actors are. An actor may be important if relatively close to the rest of the actors in the network (Hansen, et al., 2011). Putting this into the context of the findings shown in figure5, water resource authority (WRA) was closer to centrality, followed by KWS, then CBOs and the investors. This is an indication that these stakeholders also have a role to play in the governance of the PA but again have not done so effectively. Our findings compare with those of Robinson and Makupa (2015) who indicated that poor linkages between government agencies and failure to work together has seen governance of PAs deteriorate, thus translating to a lack of conservation of natural resources in PAs.

Eigenvector centrality assumes that central stakeholders should be connected to those who are central within a given network. This measure, therefore, takes into consideration direct and indirect connections. In this study, the mean eigenvalue was 0.28 (minimum = 0.01, maximum = 0.43, SD = 0.16). Eigenvalues for each institution were NEMA (0.43), NGOs (0.42), KFS (0.41), Marsabit County Government (0.4), village elders (0.37), WRA (0.32), KWS (0.22), CBOs/FBOs (0.16), investors (0.02), and others (0.01). According to Balazs and Stark (2010), for one to gain insight into the findings of an SNA, it is important to summarize them in a clear manner, similar to the framework presented in figure 10.

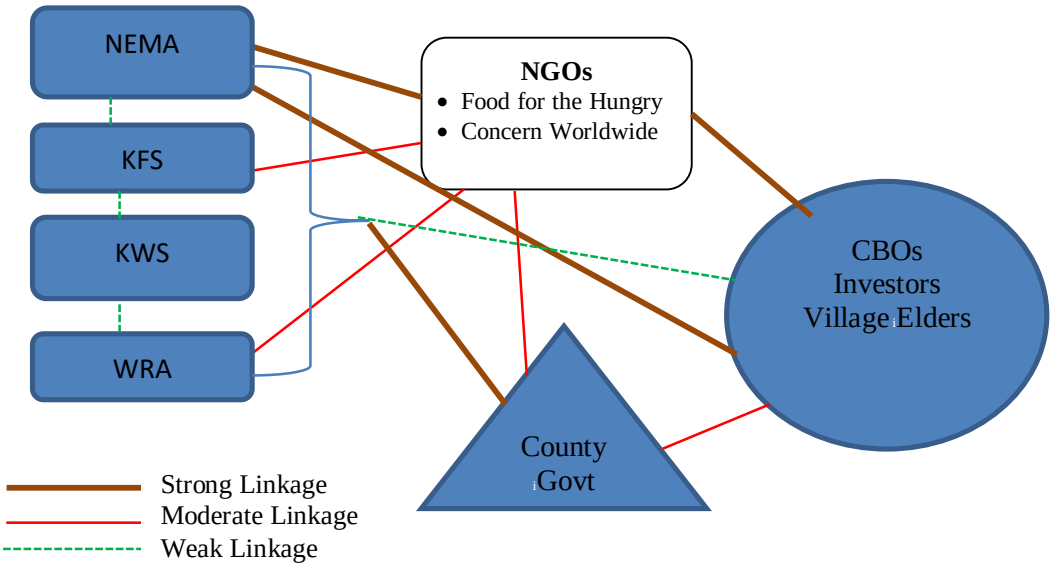

Figure 10 Summary of the strength of linkages among the stakeholders

The summary of the SNA output as shown in Figure 10 indicates that the linkage between some stakeholders was stronger than others, and that the role they play in the governance process varies. As the figure depicts, the NGOs (i.e., Food for Hungry and Concern Worldwide), which have been known to work together, had strong linkages with one of the government agencies (NEMA), the CBOs, investors, and village elders. The figure further showed that the NGOs had a moderate linkage with the county government, KFS, and WRA. This implies that NGOs play a significant role in the governance of the PAs by interacting across the majority of stakeholders, including the residents in the community. These findings compare with those of Robinson and Kagombe (2018) who found that NGOs help in bringing government agencies together for a common purpose; thus, achieving the mandate of conserving PAs.

Figure 10 also shows weak linkages amongst government agencies (NEMA, KFS, KWS, and WRA). This implies that government agencies have minimal consultations as far as policing is concerned, and this could negatively affect the governance of the PAs. The study findings are in accord with the argument of Wyborn, (2015) that when the main stakeholders in a network do not embrace strong linkages amongst themselves, the entire governance system is unable to deliver effectively as expected. This indicates that since NEMA, KFS, and KWS are apportioned with the mandate to ensure the conservation of the PAs and they are not consulting or properly interacting among themselves, accountable for the poor governance of the PA, which is evidenced by the continued degradation of the forest. Additionally, the county

government of Marsabit is equally accountable for the continued degradation because it has planning powers over the land adjacent to the PAs.

The government agencies, namely, the KWS and KFS, are tasked with the day-to-day administration of the PA and decision-making under their management plans. There is unstructured communication between the actors, namely, the agencies and the ministry, as well as with other stakeholders. There is strong vertical communication within the KWS and KFS, particularly in patrols, animal control and access by communities (Table 10). The communication is weak between the agencies and the ministry regarding policy issues, especially those on tourism and the wellbeing of community members. This exacerbates the overexploitation of the ecosystem because if the public entities do not share this information with the local community members, there is room for misinterpretation, conflicts and misinformation.

Table 10 Evidence of collaboration among various actors

Category of issue	**Description of activities and actors involved**
Preparation of management plans	Involvement of various actors in the development of the plan
Joint patrols	Joint patrols involve KWS, KFS, and officers from the Ministry of Interior Coordination
Problems with animal control	KWS has areas of operation and shares findings and activities with other actors, e.g., KFS
Boundary dispute settlement	Dispute resolution is mainly discussed with various actors and resolved

(Source FGDs & KIIs 2017)

Collaboration has been noted during the preparation of the KWS led management plan, in joint patrols, and response to emerging conflict resolution such as boundary issues, encroachment, and human versus wildlife conflict. The KFS, KWS, Marsabit county

government, and security personnel from the Ministry of the Interior collaborate to solve the emerging conflicts, but other actors such as research institutions, NGOs, and other government institutions are rarely involved unless they are directly affected. For instance, WRA would be involved in water-related issues and NDMA in drought emergencies. The county government is yet to be fully involved, as it has delegated the running of the PA to KFS and KWS, and only attends ceremonial meetings such as the signing of management plans. There was no mention of the PA in the first County Integrated Development Plan (CIDP) and no budget allocation for its management by the county government.

There were strong vertical linkages at the ministerial level but a disconnection between the local communities and PA governance institutions, which results in a weak working relationship. Scholars suggest that there is a relationship between the governance of PAs as described above with respect to the Mt. Marsabit forest ecosystem and outcomes on the ground concerning conservation and community livelihood (Kisingo et al., 2016). Some ecological goods and services that come from the PA contribute to community livelihood. Furthermore, community participation in the patrols helps the state with conservation of the PA.

There is very weak direct communication between PA management agencies and community members. The CFA, a platform for communication, is currently being formed. There is also no County Wildlife Association in Marsabit, although a committee for compensation in case of wildlife attacks is in place. Community members take sides and play the agencies against each other. There are few socioeconomic projects, notably a joint tree-planting project with the county government, thus explaining the weak connectedness of investors found in our study. Very few community members are involved in patrols although conflicts do affect the community members. There is a lack of frequent contacts and meetings. Currently, two ministries, namely the Ministry of Tourism and Wildlife and the Ministry of Natural Resources and Forestry, nationally oversee wildlife and forest management. The collaboration between the two ministries, although important, is not structured.

4.2.2 Assessment of the Effectiveness of PA Governance as perceived by the Stakeholders

In this study, factor analysis was performed to establish which statements in the series of questions formed coherent subgroups that are relatively independent of each other (Tabachnick & Fidell, 2013). The results indicated that sufficient correlations were found within the correlation matrix for factor analysis to be used. Some factors combined items from two to three governance criteria. The highest factor score was 0.98 under the resilience factor while the lowest was 0.45 under accountability.

The five common factors, extracted during factor analysis, were interpreted to represent: 1) legitimacy, 2) transparency 3) accountability, 4) inclusivity–connectivity, and 5) resilience. These indicators were determined by looking at the predominant concern for each factor, as recommended by other studies (Kisingo et al., 2016). Variables developed from summated scales are used as predictor components during reliability tests (Cangur & Ercan, 2015). Each of the five governance principles constructed after factor analysis were subjected to reliability tests (or Tucker-Lewis Index) to analyze within group consistency and robust governance principles, which were then used to define the Mt. Marsabit PA governance status.

Reliability assessments produced well-correlated items within the five governance criteria that constituted useful principles for evaluating PA governance. Previous studies have shown similar trends in PA governance evaluations (Kisingo et al., 2016; Shields et al., 2016). However, this study differed from some studies by combining some of the principles, as described below:

Legitimacy

Legitimacy refers to the people entitled to make rules and how authority itself is generated (Lockwood, 2010). Failure to actively pursue protected area objectives is a dereliction of duty that undermines legitimacy (Table 11).

Table 11 Legitimacy

Items	Factor Score	Source
The PA governing bodies has legal authority	0.736	Lockwood (2010) Legitimacy
The PA governing bodies acts in accordance with its legal authority	0.796	Lockwood (2010) Legitimacy
The PA governing bodies acts with integrity and commitment	0.668	Lockwood (2010) Legitimacy
Stakeholders freely accept the governing body's authority	0.584	Lockwood (2010) Legitimacy
The PA governing bodies has a long-standing cultural attachment to the area	0.709	Lockwood (2010) Legitimacy
Reliability (Tucker Lewis Index)	**1.247**	
% Variance explained	**52.4**	

The five items used for legitimacy under (Lockwood, 2010) all loaded into one factor indicating a high degree of internal consistency. In this study, the reliability test showed that there was strong internal consistency.

Transparency

Transparency refers to: i) the visibility of decision-making processes; ii) the clarity with which the reasoning behind decisions is communicated; and iii) the availability of relevant information about a governance authority's performance. Transparency is a requirement, grounded in ethics, of stakeholders' right to know about matters that affect them (table 12). In general, all decisions about protected areas should be accessible to stakeholders (Lockwood, 2010).

Table 12 Transparency

Items	Factor Score	Source
Governance and decision-making are open to scrutiny by stakeholders	0.906	Lockwood (2010) Transparency
The reasoning behind decisions is evident	0.786	Lockwood (2010) Transparency
Achievements and failures are evident	0.904	Lockwood (2010) Transparency
Information is presented to stakeholders in ways they can understand	0.786	Lockwood (2010) Transparency
Reliability (Tucker Lewis Index)	**1.096**	
% Variance explained	**76.8**	

In this study, transparency and accountability are not combined like in other studies (Kisingo et al., 2016; Shields et al., 2016). They are treated separately. Lockwood (2010), recommends that transparency should not be a subset of accountability since governance can be transparent but not accountable. The reliability test also shows a high degree of internal consistency among the items.

Accountability

Accountability emphasises: i) the allocation and acceptance of responsibility for decisions and actions; ii) the extent to which a governing body is answerable to its constituency; iii) the extent to which a governing body is answerable to 'higher-level' authorities; and iv) allocation of responsibilities to those institutional levels that best match the scale of issues and values being addressed (Lockwood, 2010). Instrumental conditions for effective accountability and good protected area governance are that the roles and responsibilities of governing bodies and their personnel are precisely identified and governing bodies have demonstrated acceptance of these responsibilities, for example, through their plans and activities.

Table 13 Accountability

Items	Factor Score	Source
The governing bodies and staff have clearly defined roles & responsibilities	0.589	Lockwood (2010) Accountability
The governing bodies has demonstrated acceptance of its responsibilities	0.945	Lockwood (2010) Accountability
The governing bodies is answerable to its constituents (stakeholders)	0.704	Lockwood (2010) Accountability
The governing bodies is subject to "upward accountability" (e.g. government)	0.966	Lockwood (2010) Accountability
Powers are exercised appropriately	0.456	Lockwood (2010) Accountability
Reliability (Tucker Lewis Index)	**1.206**	
% Variance explained	**65.3**	

Indicators included clearly defined roles and responsibilities, demonstration of acceptance of responsibilities, accountability to stakeholders, and being subject to "upward accountability". There was, however, only upward accountability with no downward accountability whatsoever. the 5 items in this study are similar to the ones by (Lockwood, 2010). The reliability test showed high degree of internal consistency among constituent items (table 13).

Resilience

Resilience refers to the magnitude of change or disturbance that a system can withstand without reconstituting its structures and processes (Holling, 2001). Resilience in PAs helps to measure the possibility for governance improvement or deterioration when there are natural disasters such as floods, cyclones, wildfires or disease and pest outbreaks (Table 14).

Table 14 Resilience

Items	Factor Score	Source
The governing bodies like to use lessons learned from experience.	0.843	Lockwood (2010) resilience
The governing bodies like to use new knowledge acquired	0.723	Lockwood (2010) resilience
The governing bodies has some flexibility to respond to changing conditions (management plan is adaptive and can be amended)	0.879	Lockwood (2010) resilience
The governing bodies has procedures for assessing and managing for risk	0.980	Lockwood (2010) resilience
The governing bodies has long term security for managing the PA ecosystem	0.749	Lockwood (2010) resilience
Reliability (Tucker Lewis Index)	**1.073**	
% Variance explained	**77.7**	

(Lockwood, 2010) had similar items describing resilience. The reliability test showed a high degree of internal consistency.

Inclusivity and Connectivity

Inclusiveness refers to the opportunities available for all stakeholders to participate in and influence decision-making processes and actions (Lockwood, 2010). Connectivity requires: i) effective coordination within and between levels of protected area governance; ii) coherence in broad policy intent and direction within and between levels of protected area governance; and iii) effective liaison between protected area authorities and organizations with responsibilities for tourism, forestry, agriculture and fisheries policy, planning and management (Lockwood, 2010).

Table 15 Inclusivity and connectivity

Items	Factor Score	Source
All stakeholders have appropriate opportunities to participate in decisions	0.902	Lockwood (2010) inclusivity
The governing body actively seeks to engage marginalized stakeholders	0.900	Lockwood (2010) inclusivity
The PA governing bodies are effectively connected with other nearby actors	0.849	Lockwood (2010) connectivity
The PA governing bodies direction and actions are consistent	0.872	Lockwood (2010) connectivity
Reliability (Tucker Lewis Index)	**1.07**	
% Variance explained	**78.9**	

The reliability test showed that the items under inclusivity and connectivity had a high degree of internal consistency (table 15). When assessing the perception on governance the limit is such that the evaluation is subjective.

4.2.3 Overall Governance Index

Principal component analysis was used to reduce the governance parameters into a single composite governance index divided into three equal tertiles, where the lower tertile is described as low governance performance, the second tertile as a medium level of governance performance, and the third tertile represents high governance performance. The results show that the overall governance performance is moderate, as shown in figure 11.

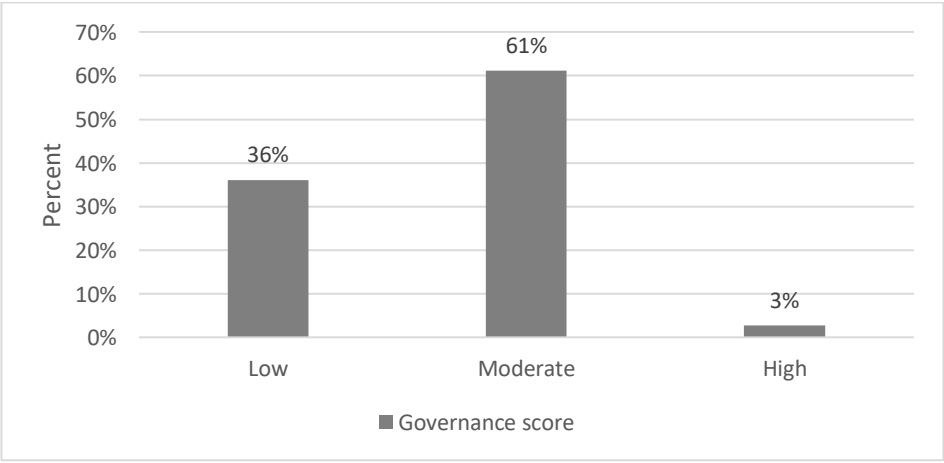

Figure 11 Overall governance performance

Overall, the reliability test showed that perception by the actors that included legitimacy, transparency, accountability, inclusivity and connectivity, and resilience were fair. The moderate score of governance is in line with the findings of other studies. There is a need to create an evidence base for the use of planning and management 'levers' to better achieve impact. As such, we propose a dual strategy for making protected areas more effective in their basic role of conserving nature, by outlining ways to develop targets and objectives focused on impact while also improving the evidence for effective planning and management.

4.3 Local Perspectives, Global Scenarios and the Governance of Mount Marsabit Forest

The perception of the local community members, the local leaders and other stakeholders is essential in determining how best the protected areas are governed. This is emphasised by comparing with how the case scenarios are addressed at the global perspective. There exists an empirical and conceptual gap on how the practices by the local stakeholders in Mt. Marsabit forest compare with the global requirements, policies and practices. The study therefore sought to establish how the local scenario perspectives compare with the global scenario archetypes to influence the governance and conservation of the of Mt. Marsabit forest.

4.3.1 Scenario Workshop Sequence

The historical land use change and general description was prepared in collaboration with the stakeholders before the workshops. First, we reviewed published and grey literature relating to forest ecosystem governance in Mt. Marsabit forest and how this has changed over time. This included the Mt. Marsabit forest PA management plan, the legislative framework at County and National government levels, peer reviewed literature on Mt. Marsabit and surrounding landscape among others.

Second, land use maps were generated using Landsat satellite cloud-free imagery image data as follows; for years, 2000 (21/02), 2010 (19/08), and 2015 (05/01), discerning five land cover classes. The algorithm used to classify the data followed supervised image classification approach but with random forest modelling as the technique for grouping similar pixels. Random forest model was trained in R Studio using samples collected during household surveys. A significant model with overall accuracy of 0.967 at p-value 0.05 was obtained and used to classify the images. Overall change in forest cover between 2000 and 2015 was also calculated.

Third, key informant interviews (n=36) were conducted, exploring historic drivers, environmental change, risks, governance of and community participation in forest management, decision making processes, social-ecological values, and envisioned governance processes of land use transformations. This was to enable a deeper understanding of the land use changes and the status of the ecosystem services. Participants were selected using snowball purposive sampling, to ensure they were aware of the governance status of Mt. Marsabit forest

PA (Camarillo, 2002). The stakeholders gave information on the status of the PA focusing on the years past that is the 1980s and 1990s, and the recent past 2000, 2010 and 2015 which they could recall in details. The years were chosen deliberately due to legislative and political changes that took place during these periods. For instance, in the 1980s, there was one party rule, and 1990s, the clamour for multi-party democracy. In 2000, there was a coalition government, while in 2010, the new constitution that paved way for full implementation of developed system of governance in 2015 was inaugurated. Participation was voluntary, and interviews were conducted in English and Swahili where necessary, averaging one hour at the place of formal employment after booking prior appointments over the phone (Ouko et al., 2018).

Two Participatory Scenario Planning workshops were held in November, 2017 in Marsabit County. The aim of the workshop was to develop diverse, plausible scenarios of governance policies and strategies to be adopted in Mt Marsabit PA. Expert knowledge from organizational leaders was used to identify interacting local and global drivers of change of ecosystem degradation, their interdependencies, and provide foresight to future trends in the face of critical uncertainties. To push the stories into more provocative territory, workshop participants drew from a myriad of sources of inspiration, including the Millennium Ecosystem Assessment, science fiction, national and international news stories. Four narratives were produced in each workshop, and results from key informant interviews were incorporated into the narratives.

Workshops followed six sequential steps in Participatory Scenario Planning. First, researchers elaborated on the background theory of PSP. Second, researchers presented a synopsis of Marsabit Forest Ecosystem Management Plan, with the following objectives: institutional collaboration; ecosystem restoration and ecological management; community involvement; economic ecotourism opportunities; and the security management program. This step was important to establish consensus among the stakeholders of the baseline conservation situation, and mitigation plans therein. Third, highlights of the results of the key informant interviews regarding historical trends were presented and discussed. Fourth, based on this information, drivers of change in Mt. Marsabit forest were identified, and implications of governance. For ease of understanding, the questions posed to participants were: What factors form the focal system of the forest? What will drive change (in the future up to 2070)? What does this imply for the governance of the PA? Fifth, stakeholders created a set of scenario

logics using qualitative narratives of possibilities (i.e., what? how? where?) tailored to the context of Mt. Marsabit forest, and identified critical governance action points. Finally, when the groups completed deliberations, the scenario narratives were branded, the scenario narratives were presented back to the larger group for appraisal of consistency and plausibility.

Local perceptions of change were compared with predetermined global scenarios. They proposed three scenario archetypes with two themes each. The interdisciplinary global scenario group (GSG) proposed different themes at global scale (Hunt et al., 2012). Conventional archetype had a) markets whereby actors' advance growth, liberalization and privatization; and b) policy in which government action drives sustainable development. Great transitions archetype had a) social value change promoting broad-based SES; and b) Localism in which local self-reliance in rule making and economic growth drives further change. Barbarization archetype had a) inequity whereby authoritarian rule divides the haves and have-nots; and b) collapse in which conflict creates institutional collapse, which drives further change (Hunt et al., 2012). Six themes (markets, policy, social values, localism, inequality and collapse) were used to represent pathways of change in global scenario (Table 16)

Table 16 Global Scenario Group archetypes, themes and social visions (Adapted from (Hunt et al., 2012))

Scenario archetype	**Scenario variant**	**Change themes**	**Archetypal social visions**
'Conventional world' currently dominant driving forces, i.e., the economy and Government shapes social- ecological conditions	Market forces	Markets	A world that evolves gradually, shaped by dominant driving forces
	Policy reform	Policy	A world that is influenced by a strong policy push for sustainability
'Great transitions' novel value systems and approaches' to development and decision making emerge	New sustainability paradigm	Social values	A world where new human values and new approaches to development emerge
	Eco-Communalism	Localism	
'Barbarization' Society succumbs to fragmentation, collapse, and institutional failure	Fortress world	Inequality	A world that succumbs to fragmentation, environmental collapse and institutional failure
	Breakdown	Collapse	

4.3.2 Ecological Changes

The study shows that land use and land cover has been changing over the years (figure 12). The highest rate of change was visible from year 2000 to 2010.

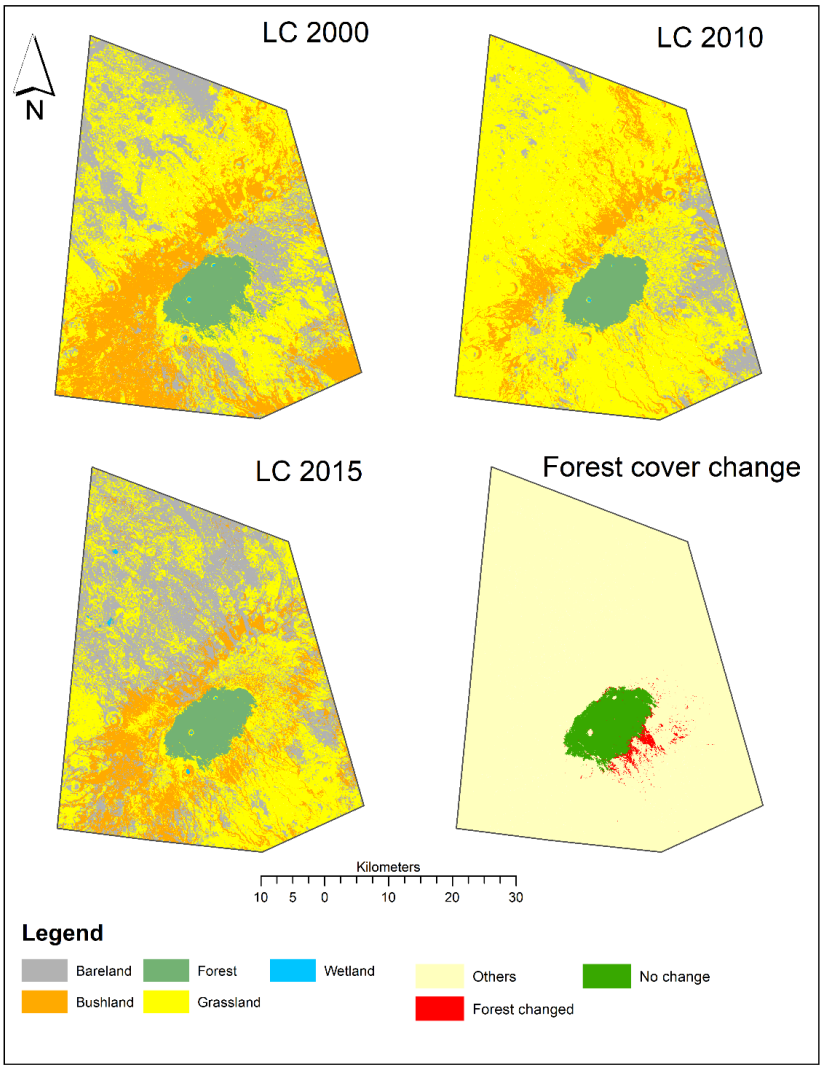

Figure 12 Land cover maps showing different land use land cover changes

The different land use and land cover have been changing at different rates (table 18) with bare land having changed from approximately 24% in 2000 to 37% in 2015 while wetlands from 0.04% in 2000 to 0.1% in 2015. The forest cover change analysis shows most change has been from forest cover to grasslands (9.16 sq. km) as shown in table 17.

Table 17 Areas and percentage cover of different land cover types in Mt. Marsabit forest PA

	2000		2010		2015	
Landcover class	**Area (sq. km)**	**% Cover**	**Area (sq. km)**	**% Cover**	**Area (sq. km)**	**% Cover**
Bare land	501.71	24.40	229.04	11.14	751.07	36.53
Bushland	512.39	24.92	247.78	12.05	362.12	17.61
Forest	123.94	6.03	107.83	5.25	109.98	5.35
Grassland	917.03	44.60	1470.92	71.55	830.6	40.40
Wetland	0.86	0.04	0.35	0.02	2.15	0.10

The ecological changes were also influenced by socioeconomic dynamics including population increase, livestock production, crop production, urban settlement, rural settlement, physical infrastructure, conservation measures among others. The numbers and distribution of people and their livestock have increased over the years with profound influence on the study area and the pattern of land use within it. This huge increase in population can be attributed on the one hand to new births being higher than deaths, and on the other hand to immigration from Ethiopia due to unrest. Devolution is another factor contributing to migration, as it incites Kenyans to migrate towards the counties (Munya, et al., 2015). The population increase is resulting in increased water and food demand, thus a need of land for agricultural expansion. Residents of Marsabit County have been shifting their livelihoods from nomadic pastoral systems to more sedentary agricultural types over the years (Maina & Imwati, 2015). There are increasingly small-scale agricultural activities spreading in the area, leading to increased land fragmentation and sedentarization. The rising population and increasing spread of settlements has also led to a decline in forest cover, loss of wildlife habitat, decrease in biodiversity, and insufficient supply of spring and well water (CIDP, 2013; Oroda, 2011). These results show that the Mt. Marsabit forest PA is an important and vital ecosystem for a large landscape in northern Kenya. However, it is under anthropogenic threat from land use change, climate change, increase in population, unsustainable use of the ecosystem goods and services ultimately leading to degradation (Muhati et al., 2018).

4.3.3 Local Perspective of Mt Marsabit Future Scenarios

Local stakeholders described four future plausible scenarios and perceived direct and indirect drivers of change in uncertain futures of Mt. Marsabit as tabulated below. In order to manage the drivers, they suggested governance action points (table 19).

Table 18 Drivers and governance action points

Driver of change	Governance considerations
Community participation	Effective engagement process of the community with the guiding principle of using adequate information to guide engagement. Creating awareness on importance of the forest ecosystem through public barazas (meetings), local medias -training of the community-based institutions e.g. environment management committees (EMC), community forest associations (CFA), and conservancies. Policy formation and development - to be given legal backing on the role of CFA, EMC and the conservancy committees. Integration of traditional resource management model in the policy management plan e.g. elders. Harmonize communities on the natural resource use through elders and community-based institutions.
Institutional coherence/ policy alignment/ lack of devolved government's ownership	There is need to promote coordinated governance to drive this scenario, the need to establish accountable institutional mechanisms and to unify decision making, lead to the recommendation of a single management platform. This platform would coordinate and promote cooperation among stakeholders. The group called this unified management platform a strategic advisory committee The County government would lead this platform All stakeholders identified in the study to be included into this platform The mandate of this platform should be backed by legislation passed by the County government The advisory platform should be guided by a long-term management plan and backed by a budget for forest management and implementation of the plan
Land use Conflict/ Use of traditional governance system in eco-system governance	Incorporation of the traditional norms, customs and values in governance of the eco system. This is an effective means to guarantee community support in conservation. -Contested land use delineation that results to improved habitats/improved community PA relationships based on trust, provision of viable alternatives for community livelihood, optimal service provision and a mutual understanding of shared benefits of conservation.

	Importance of checks and balances to hold politicians accountable in managing the Mt. Marsabit Forest ecosystem (MFE). These will ensure that politicians work to promote rather than discourage ecosystem conservation
Climate change, drought and political goodwill	A governance scenario that improves community perceptions towards conservation would improve the community's capacity to hold political elite accountable.
	Multi-sectoral approach to conservation would ensure inclusivity at multiple levels

The local stakeholders elaborated four scenarios based on plausible futures. These scenarios were;

Land use conflicts resolution in the context of traditional governance systems

In the first local scenario which stakeholders developed for 2070, negative impacts are associated with climate change and land use change. Climate change is worse than expected and society is unprepared, leaving the ecosystem vulnerable. The society focuses on mere survival. Climate change also leads to land use conflict, leading to an increase in inter-ethnic tension without conservation and restoration efforts. This is because livestock incursions persist, and the relationships between Mt. Marsabit PA management authorities and community deteriorate. With persistent conflict, agricultural production is expected to reduce and a reduced welfare of the surrounding community by 2070. Therefore, human wildlife conflict leads to compensation claims surge which will be unsustainable by 2070. Land use change exerting pressure in the PA and population increase, will eventually lead to a crisis. Traditional governance structures for forest management exist but not fully utilized. The council of elders (Abagatha, Rendille, Gabra) hold the ability to mitigate potential land use conflict that result in ecosystem degradation. This is compounded by a policy and institutional regime that is exclusionary in nature. The community is left alienated as they are not involved in decision-making and management of the ecosystem.

Strategic advisory group-led governance of Mt. Marsabit PA

Stakeholders developed a second local scenario where all the actors in the PA were proactive. The national leaders invest heavily in technology in response to environmental crises, creating a highly engineered landscape. The use of social media, Global Positioning Systems (GPS) and digital software is used to manage data in forest landscapes. Communities

are introduced to use of innovative alternatives which save energy, light bulbs and climate smart technologies spearheaded by the state. In this scenario, with every actor perusing an individual role irrespective of complementary actions by other actors, degradation is expected to persist. The lack of a unified approach to mitigating human impact to the eco-system is critical uncertainty in managing the ecosystem to the future. The multiplicity of actors ultimately does not put the community at the forefront of ecosystem management, this alienation presents an uncertainty as it does not incentivize the community to conserve. There is also lack of unified decision-making model thus this exposes the ecosystem to individual benevolence as opposed to conservation being vested in institutional structures and systems. The rapid development of technology is funded by national, state, and local government (Policy) and private companies (Markets). The ecosystem is managed by multiple stakeholders, each formed under a separate legal framework. Each actor works disjointedly without all the relevant complementarities, resulting in an institutional conflict/impasse. For example, the forest PA is dual gazetted, leading to conflict and mistrust between KFS and KWS.

Community-led governance of Mt. Marsabit PA

In this scenario, looming environmental crises incite a global movement to adopt sustainable values and behaviours by 2070. When the community is alienated from the conservation, in the face of climate change and unpredictable rainfall patterns, the possibility of land grabbing and community conflict will increase. The drivers here is such that when the community is excluded from the process of the forest ecosystem management and conservation, it is expected that the present situation of 1) delineating the forest through. land acquisition 2) Extraction of forest products e.g. charcoal, fuel wood- this may sometimes lead to forest fires, illegal logging of forest trees for timber and building material, and over extraction of some tree species which are normally used during cultural events to persist will be accelerated and 3) uncontrolled grazing 4) threats to wildlife and forest biodiversity as the ecosystem is degraded and land use changes 5) Resource use conflicts among communities.

Addressing Climate change and drought effects in forest through policy development and community inclusion

In this scenario, climate change is worse than expected and the forest ecosystem faces a crisis. Persistent climate change through prolonged occurrence of drought ultimately puts pressure on the ecosystem as the community ultimately relies on the forest reserve for dry season grazing. Fostering political good-will in forest conservation was identified as un uncertainty in the future of governing the forest ecosystem. Community perception and involvement in preserving the forests was uncertain. Multi-sectoral approach to conservation leads to a high risk of degazzement of the forest, land grabbing, water catchment destruction. This pressure presented by climate change is expected to lead to reduced percentage of forest cover and mass, as well as disruption or extinction of some species, such as, sandal wood. Government-led change results in a national reorganization of ecosystem management with focus at lower levels (forest scale).

From literature, the four scenarios elaborated by the global scenario group were:

1. Abandonment and renewal

In this scenario, climate change is worse than expected and society is unprepared and unable to deal with environmental disasters. By 2070, some of the people abandon the place and there are a few people in the wild state of the environment. The people who remain behind focus mainly on survival.

2. Accelerated innovation

Technology use is to achieve sustainable social-ecological systems and adapt to climate - related disasters. By 2070, the focus on technology does not translate to ecological integrity but solutions to emerging issues are use of innovative technologies.

3. Connected communities

Sustainability and community involvement are central to governance of the ecosystems. All decisions are oriented towards the well-being of the community. Climate change adaptation is stabilized but the conditions are altered.

4. Nested ecosystems

There is an environmental crisis due to climate change and to curb the crisis, the authorities regulate most aspects of the environment. By 2070, the adaptive processes are small and the crisis is not adequately addressed.

4.3.4 Linking Local Perspectives to Global Archetypes

There are synergies between local stakeholder perspectives and the global archetypes. Comparing the four scenarios:

1. Land use conflicts resolution in the context of traditional governance systems, representing Abandonment and renewal

This scenario is closely related to the global archetype of the fortress world (Barbarization scenario) as there is an Abandonment and Renewal phase. The Collapse theme characterizes the Abandonment phase. An environmental disaster occurs as a result of failure to adapt social and governmental institutions to the governance of the changing ecosystem. The second phase, Renewal, depicts fragmented, self-sufficient, and highly dense living settlements aligned with the Localism theme. Governance is small scale and decentralized, and many communities are completely dependent on the forest ecosystem.

2. Strategic advisory Group led governance of Mt. Marsabit PA, representing Accelerated innovation

This scenario most closely related to the global archetype of the market forces (conventional scenario) and the Markets theme because “natural processes are valued economically and controlled by market mechanisms," and people are drawn to the forest ecosystem for jobs, as "entrepreneurs and businesses base their headquarters here.”

3. Community-led governance of Mt. Marsabit PA, representing connected communities

Here, this scenario aligns with the global archetype of Eco-Communalism (great transition scenario) and Social Values theme, as “the younger generations embrace community building and sustainability through grassroots action to get their voices heard and included in ecosystem governance. This values shift has also happened at a global scale.” Global youth, disenchanted by political gridlock and dismayed by climate change impacts, organize effectively to create a sustainable, values-driven society referred to as the Great Transition. By 2070, “connectivity, community, and environmental sustainability” are the new norm.

4. Addressing Climate change and drought effects in forest through policy development and community inclusion, representing Nested ecosystems

This scenario aligns most with the global archetype of policy reform (conventional scenario). Change here is most influenced by Policy. The country passes new legislation, creating a new forest PA governance framework, and giving authority to local governments to tailor site specific policies. Management authorities have the power to incentivize or regulate landowners and forest product users in their respective regions "to maintain, improve, and distribute forest resources." The threat posed by climate change has potential to incentivize conservation and result to possible income from carbon credit trading for the community.

Local stakeholders' perceptions of direct and indirect drivers of change in uncertain futures of Mt. Marsabit mirror those represented in commonly used global scenario archetypes. Key drivers of change were associated with markets, policy, and social values. A number of drivers were used to describe change across multiple themes; for instance, technology was conceived as a driver in Markets and Policy themes, whereas extreme climate change was described as a catalyst across several themes.

Literature shows that there is an increase in use of scenarios of future SES change to help societies grapple with how to fulfil diverse human needs sustainably without compromising ecosystems (Levin, et al., 2012; Raskin, 2002). There is need to integrate change themes from scenarios literature with local stakeholder perceptions (Metzger et al., 2010). Results from the global scenarios group, showed overlap and some differences with local stakeholder perspectives, themes from global scenarios archetypes, and the Mt. Marsabit PA scenario narratives. Social values, economy (markets) and government (policy) were mentioned, by stakeholders as the main drivers of change. However, there was low emphasis on extreme change. According to the GSG, the Great Transitions archetype's themes of social values and localism, are positive as they predict hopeful visions associated with the power of human values and social movements (Raskin, 2002). The stakeholders alluded to similar change, citing communities, social values, and grassroots driven changes. This was mentioned more frequently than themes of change associated with Conventional or Barbarization scenario archetypes which are inequality and collapse. The Mt. Marsabit scenario Connected Communities is primarily driven by the shift of social values. This can be associated with understanding of sustainable change being ethical and concerning responsibility to future generations and nature's worth (Miller et al., 2014). Market forces and policy reforms which

are conventional archetype themes, assume the continuation of current trends without significant rupture in values, economies, or politics (Raskin, 2000). Market forces and policy reforms were predominant during discussions and may reflect stakeholders' familiarity with the existing governance status associated with historical attachment and fear to shift to or change to the unknown (Levin, et al., 2012).

Inequality and collapse themes associated with the Barbarization archetype, are pessimistic visions of institutional failure and chaos. The PA stakeholders rarely mentioned these types of breakdown narratives when they described what they see as influential determinants of the future. It is difficult to imagine drastic institutional changes. This is can be explained by psychological distance whereby when threats that seem more distant from an individual (i.e., occurred in the past, to others people," or in geographically distant places) are less concerning and less likely to come to mind (Liviatan, et al., 2008). GSG literature also showed that the inequality and collapse are less common (Hunt et al., 2012). Inequality and collapse narratives have the potential to dissuade pessimists, and can provide provocative contrast to other storylines, creating the most unexpected future outcomes compared to other themes from the other two archetypes (Notten et al. 2003; Kriegler et al., 2014).

Mt. Marsabit PA scenario land use conflicts resolution in the context of traditional governance systems comparable to the abandonment and renewal depicts societal and institutional collapse, with significant impacts on both social and environmental variables. The type of change associated with particular themes depends on the archetype. For example, global and local markets and governments can go experience rapid, unexpected changes that may disrupt the SES. This may result in greater changes than the ones associated to the Barbarization themes. Other classifications of scenario narratives could also change the analysis of scenarios' and stakeholders' narratives of change. For example, Kriegler et al., (2014) classify themes similar to inequality and collapse under a "regional competition/regional markets" category, which is less extreme than the Barbarization archetype.

It is important to include a variety of stakeholders in the participatory scenario development process. This is because, representation by different gender and across major sectoral scales ensures more diversity of opinion regarding how change might occur (Metzger et al., 2010). The potential benefits of expanding beyond common local views include connecting with themes important in other places and times around the world, and suggesting ideas for transformational change that may advance public. The Mt. Marsabit forest PA

scenario with the most dramatic and negative social changes, was driven by land use change and low participation in conservation by community members. Ecological and social changes may occur without adequate attention to climate change, pollution, and resource overuse. There is need to strike a balance between social and ecological considerations when developing scenarios (Zafra-calvo & Garmendia, 2019).

4.4 General Discussion

There is a high population increase in Marsabit County which has led to increased demand for basic needs namely water, food and shelter. These are sourced from the existing forest ecosystem. As the population increases, the pressure to meet the basic needs also increases, the ecosystem becomes fragile due to overexploitation without requisite improvements. Agricultural expansion to meet the increased food and water demand leads to land use change in the fragile ecosystem. Mt. Marsabit forest is located in Saku constituency with four main dominant ethnic communities with Borana being more than the Burji, Gabra and Rendile. There are also other ethnic communities such as Samburu, Turkana, and Kikuyu, among others. Most of the community members settled around the forest from 1985-2014 (69%) and the greatest biophysical changes especially forest excision was highest from 1990 to 2000.

The 1985-2014 period coincides with various legislative changes, including introduction of multi-party democracy in 1991, the formation of a coalition government in 2002, and the enactment of a new constitution in 2010, which culminated to a devolved system of governance in 2013. Settling around the forest led to excision and overexploitation of the resources and change in land use. Land use change over time also depends on the land tenure. There exists mostly individual land ownership, without title deeds, together with communal land tenure. This is not good for natural resource management because ownership is not absolute. There is right of access and right to use, but because ownership is not absolute, the right to conserve depends on the individual or the community in general.

The socioeconomic dynamics and biophysical changes impact the ecosystem goods and services from the forest directly. Perceptions of the community members show that they are detached from the forest ecosystem so much so that the people living adjacent to the forest mention livestock keeping as the main land use, while those slightly far off mention crop farming. This shows that the forest ecosystem is not embedded as a land use but viewed as a means to livelihood. The three main ES from the forest are provision of food (grass for fodder), wood fuel (or firewood) and water. These are provisioning services and so the community members associate the forest as a means for their livelihoods. Due to the socioeconomic dynamics and biophysical changes, provision of the ES by the forest ecosystem is not sustainable. Evidence shows that the pressure is too high and there is need for sustainable

conservation strategies to reverse the situation. The ecosystem is clearly under threat from degradation, which if not curbed, the natural processes will halt, with devastating repercussions.

Currently, Mt. Marsabit forest ecosystem is governed jointly by the national and county governments, and local communities. Forests in protected areas like Mt. Marsabit forest are managed under the Forest Conservation and Management Act, 2016 as well as the Wildlife Conservation and Management Act, 2013. These Acts are implemented by different state institutions. The Forest Act is implemented by the KFS, while the Wildlife Conservation Act is implemented by the KWS. Until 2004, the level of community participation in forest management in Kenya was reported to be very low. However, in 2005, the Forest Act, 2005 made provisions for communities to be involved in management of forests. The Forest Act, 2005 has since been repealed by the Forest Conservation and Management Act, 2016 which also encourages participatory forest management. However, communities are required to form Community Forest Associations (CFAs) to be allowed involvement in forest management. CFAs consist of individuals, self-help groups, women groups and community-based organisations (CBOs). Upon registration, the associations are granted permission to conserve and manage forest resources. The CFAs are charged with obligations as specified in Section 49, Sub-Section 1 of the Forest Conservation and Management Act, 2016. Under the Wildlife Management and Conservation Act, 2013 section 39; any person or community who own land on which wildlife inhabits, may individually or collectively establish a wildlife conservancy or sanctuary in accordance with the provisions of the Act. The community also has the option of registering an association. Such associations and/or wildlife managers are approved by the Cabinet Secretary on the recommendation of the service in consultation with the county wildlife conservation committees. The associations are charged with obligations specified in Section 40, Sub-Section 1 of the Wildlife Management and Conservation Act, 2013.

The Kenyan constitution 2010 and the two Acts clearly state the involvement of community members in conservation and management of protected areas. The Mt. Marsabit forest ecosystem recently established a community forest association but lacks a county wildlife association. The CFA was registered as Saku CFA in 2018, more than ten years after the requirement was legislated. There is no County Wildlife Association as the new conservancies are under the northern rangeland trust (NRT). As a result, the connection between the institutions governing Mt. Marsabit forest ecosystem and the community level

governance structures are weak. The community is not adequately involved in the governance of the forest ecosystem. There is a big gap between what the Kenya constitution 2010, Forest Conservation and Management Act, 2016 and Wildlife Management and Conservation Act, 2013 stipulate and the practice. There are no agreements or programs by the community and KFS or KWS to conserve the forest in Marsabit County. The responses by the community members on the governance of the forest showed lack of knowledge on what is expected from them. They do not belong to conservation groups; they have not been involved in forest conservation and there are various disputes.

The Mt. Marsabit forest ecosystem has several stakeholders, but there is no clear working arrangement or "fit" although the processes of governance do occur. Meetings are held, but there is ad-hoc decision-making when problems occur. Considering the principles of good governance, (legitimacy, accountability, resilience, transparency, connectivity, inclusivity and equity) the ecosystem scores low on communication, resilience and accountability. The numerous stakeholders need a good fit in order to reverse degradation and ensure sustainable provision of ecosystem services. Governance is about actors, institutions and processes. Actors make and implement laws or rules and are responsible for processes formally or informally. Institutions or rules and laws which can be statutory or customary are made by actors and provide foundation for processes. The most important institution is tenure or property because it is about rights and duties. It can be private, public or common. Processes are a series of actions to achieve something such as decision-making. In the case of Mt. Marsabit forest, there are a group of actors with institutions but the processes do not have a "good fit". Better fit between social and ecological systems increases effectiveness of natural resource management.

The local perspectives on the PA governance scenario emphasized markets, social values and policy as the themes which will bring transformative change. Climate change, lack of community involvement, and land use change are the main drivers of uncertainty in the Mt. Marsabit PA. Understanding the social-ecological system will enhance the choice of governance scenario which will consider future uncertainties. Each of the presented four scenarios show plausible critical ideas that cannot be ignored moving forward. The winning governance scenario is one that builds on all critical strengths of each of the solutions. Market forces, social values and policy reforms are the critical themes in ensuring a sustainable governance scenario which will consider future dynamics in the social-ecological system.

These results can be used to expound the understanding of PA governance in the tropics. However, there is need for support for local communities in terms of infrastructure, social services and employment in conservation related initiatives instead of direct support to households. This is similar to findings by (Liviatan et al., 2008) that PAs can support local people socially and economically. This study does not support the position by (Dudley, et al., 2010) that effective PA networks will only work if there are recognized benefits. This study suggests that inclusion of local community in governance of the PA may ensure sustainability. Evidence from this study shows that degradation is ongoing at a rate that is unsustainable. The study suggests the cause-effect link between governance, degradation and provision of ecosystem services. Weak governance exacerbates degradation as the gap in the processes enable divers such as overexploitation of the ES to continue unabated. There are other factors such as sociodemographic dynamics and biophysical changes which can enhance or reduce governance efforts towards a sustainable SES. The interaction among various actors in Mt. Marsabit forest PA lack fit, and the low connectedness reduces the effectiveness of various governance arrangements. The lack of participation by local communities further weakens the existing co-management arrangement.

Other studies have shown that involvement of local communities in PA governance, enhances conservation (Berkes, 1998; Frank et al., 2017; Muhamad et al., 2014). The involvement of local communities in governance, needs time and investment to ensure optimal participation which will translate into better ecosystems with long-term social-ecological benefits (Fisher et al., 2011). Studies by Bennett et al. (2015) and Kisingo et al. (2016) suggest that PAs should be assessed on the basis of conservation and social benefits. However, benefits are perceived differently at household level. The demographic determinants of participation by communities such as age, education, gender and family size are as described by other studies such as (Chhetri et al., 2013; Dolisca et al., 2006; Mogoi, et al., 2012b; Tadesse et al., 2017). There is need to change the structure of the co-management arrangement to enhance accountability, decision-making to ensure effectiveness. Empowerment in requisite skills will enhance transparency, accountability, efficiency and ensure effective governance of the PA. The study supports the need to put emphasis on participatory scenario development to take cognizance of the future of the PA. There is need to improve the current PA governance structure to ensure participation of all relevant actors particularly, the local community in decision-making and management.

This study contributes to the understanding of SES with a focus on PAs and examines the governance and linkages between actors including ecosystem services provision where there is rampant degradation. The study suggests that sustainable provision of ES depends on the right decision-making for the PA and surrounding land uses (Hauck, et al., 2013). However, the PA actors should ensure a balance between ecological integrity, social good and economic gain (Bennett et al., 2017; Berkes, 1998; Metzger et al., 2010; Oteros-Rozas et al., 2012).

The current co-management governance arrangement is ineffective. There is need for realignment to create an adaptive co-management alliance to bridge the PA actors and the local communities with other organizations. Such bridging will serve as filters for external drivers (Alcorn et al., 2003) and also provide opportunities by bringing in resources, knowledge, and other incentives for ecosystem management (Folke et al., 2005). Inter-organizational collaboration or bridging will be in response to the perceived crisis in the forest ecosystem management. This provides an arena for building trust, learning, vertical and/or horizontal collaboration, and conflict resolution. There will be need for communicating, translating, and mediating scientific knowledge relevant to policy and action. The inter-organizational collaboration will use existing PA network of stakeholders to mobilize knowledge and establish a written working arrangement ensuring “fit”.

CHAPTER FIVE: KEY FINDINGS, CONCLUSION AND RECOMMENDATIONS

This chapter reviews the key findings and points to areas for further research that are crucial to clarify the role of governance of PAs in attainment of social-ecological integrity in PAs. The chapter also highlights contribution of the study to governance literature.

5.1 Introduction

The thesis contributes to ecosystem service science and focuses on governance of protected areas by analysing social-ecological dynamics effects on ecosystem services and interactions among stakeholders in the Mt. Marsabit forest social-ecological system. The study contributes to an improved understanding of human-environment interactions. The study set out three objectives.

5.2 Key findings

Objective 1: To determine how prevailing socioeconomic dynamics, interact with ecological processes to affect provision of ecosystem services on Mt. Marsabit:

a) The key services derived from the forest are; trees, forage, water, fall-back land cultivation, aesthetic enjoyment and shade. However, this did not prevent overexploitation of forest resources which has led to extensive degradation with bare-land increasing from 24% in 2000 to 37% in 2015.
b) Perception of the stakeholders showed that the local communities were minimally involved in developing governance structures or management of this forest. Additionally, family size, education level, and age were important predictors of level of local community involvement in management.
c) The analysis of ES perceptions by respondents living in different locations from the forest edge showed that while respondents living close to the forest perceived it to be mainly important for livestock grazing, those respondents living further away highlighted the importance of water provision. This shows that disaggregating findings between different categories of land users is important, as they might have different priorities for forest management.

Objective 2: to evaluate governance dynamics in the management of Mt. Marsabit socio-ecological system:

a) The governance of Mt. Marsabit forest ecosystem is complex, with a multiplicity of stakeholders with diverse interests and relations. The dominance of government and its affiliates as key players and central stakeholders show the pivotal role of regulation, supervision, planning, and coordination in natural resource governance.
b) The interaction of stakeholders in the Forest PA, scored low density which showed weakness of the stakeholder's network, which could negatively affect the flow of information and other resources between stakeholders.
c) Stakeholder interactions scored a low connectedness index of 0.3. This indicates that stakeholders were weakly linked. The degree of connectedness varies such that NGOs were the strongest followed by public entities and investors were the weakest. Differences between stakeholders were based on the number of connections each had. The mean degree centrality score was 35.8%.
d) There are weak linkages between different actors with regard to communication, accountability and collaborative decision making. The weak ties can be attributed to weak coordination and a lack of institutionalization of the links. The actors, rules and prevailing ecological processes interdependently dictate the PA status.

To support the actor interactions, governance principles were measured. Factor analysis resulted in 5 governance factors that in total explained 75% of the variance in responses. The factors are outlined below including their reliability coefficients in bracket via Tucker Lewis Index (TLI)

a) Legitimacy refers to acceptance and justification of shared rule by a community (5 statements TLI = 1.247)
b) Transparency refers to the stakeholders' rights to know matters about the PAs (5 statements TLI = 1.096)
c) Accountability refers to the answerability of managers to lower and higher authorities (5 statements TLI= 1.206)
d) Resilience refers to the amount of change or disturbance that can be absorbed by the system without being forced into a different set of processes and structures (5 statements TLI = 1.073)
e) Inclusivity & connectivity refers to opportunities for all to participate and the effective coordination (4 statements TLI = 1.07)

The findings indicate that perceptions of governance can be measured quantitatively. In this study, transparency and accountability are loaded separately as suggested by Lockwood 2010 and Graham 2003. Unlike in Kisingo 2013, where they are loaded together. The ecosystem scored 61% but the governance as it is ineffective.

Objective 3: to develop alternative PA governance options to sustain ecosystems service provision in the Mt. Marsabit socioecological system.

a) Four divergent but plausible exploratory scenarios were generated namely: i) land use conflicts resolution in the context of traditional governance systems ii) strategic advisory group-led governance of Mt. Marsabit PA iii) community-led governance of Mt. Marsabit PA, and iv) addressing climate change and drought effects in forest through policy development and community inclusion.
b) Local stakeholders, as in the global archetypes, emphasized social values, market forces, and policy reform as major influencers in determining the future (2070) of Mt. Marsabit forest PA. However, stakeholders were less concerned with institutional breakdown, an important theme from the global scenario's perspectives.
c) Our findings offer a new approach to analysing similarities and differences between scenarios' narratives and local perspectives, and contributes to the growing body of place-based scenario studies.

5.3 Policy Implications

Ecosystem services are integral to resource and human systems and we must devote resources to identify drivers for the inefficient management, model how the drivers operate and interact at multiple spatial and temporal scales. Assessment of local communities' perception on ecosystem services aid in deeper understanding and relevance. For effective policies, there is need for trade-offs between resource and human systems to trigger transition from the status quo to the desired status.

In order to improve governance, ecosystem services information at policy level is relevant to managers at different scales and focused on interactions among different types of ecosystem services that are directly important to people and the resilience of the social-ecological systems

Stakeholder interactions and identification of central stakeholders in a PA deepens understanding and is important consideration during institutional arrangement for policy implementation. Some governance aspects are best addressed by the state while other decisions are more appropriately made at community level. This will ensure that stakeholders may agree to prioritize values like community and environment as they are receptive to central regulations and policies. This will provide pathways to discuss how different values can be realized at different scales and through different mechanisms.

Place-based scenario planning policies should consider multi-levels from local, national, regional to global lens so as to anticipate and mitigate future governance uncertainties in SES such as Mt. Marsabit PA.

5.3 Recommendations

The national government together with the county government of Marsabit have the mandate to ensure that Mt. Marsabit forest is protected from the on-going degradation which has highly affected the forest. The County government and KFS should mobilize and motivate the Community Forest Association (CFA) members to spearhead rehabilitation of the degraded parts of the forest and provide the required inputs such as the seedlings, tools and remunerations to rehabilitate the forest.

The government through the Ministry of Environment, and Forestry and the Ministry of Wildlife and Tourism and the Ministry of Water, Sanitation and Irrigation should come up with the strategies to ensure that the local communities are involved in the PA governance. This could be achieved through operationalising the various Acts of parliament which mandates government institutions namely, KFS, NEMA, WRA and KWS to involve the local communities in governance and protection of the PA.

The government through the responsible ministries and the legislators should put clear roles and responsibilities of the key players in conservation of PAs (NDMA, KWTA, WRA, KFS, NEMA and KWS) to avoid conflicting roles and to provide a well-framed operational framework through which the governance would be enhanced. The conservation of the PAs will be centred towards filling any gap that has previously led to environmental degradation. Additionally, there is need to empower these actors through capacity building to improve governance as a measure that will ensure that they are aware of their roles and play them effectively for enhanced PA conservation.

The management of NDMA, WRA, KFS, NEMA and KWS should be focused towards working together to ensure they align their collaborations and frameworks for better achievement in environmental conservation. The top management of these agencies should narrow down the commitment and responsibility to the bottom level employees who are the key actors in the grassroots so as to enhance their effectiveness in conserving the Protected Areas.

The governments need to spearhead and promote the implementation of various policies on environmental and ecosystem conservation. Without implementation of these policies, then their presence will not be beneficial hence the government through the ministry

of Environment and other related ministries such as the Ministry of Tourism and Wildlife among others should come up with implementation formulas to enhance conservation of PAs.

The Government agencies such as NDMA, WRA, KFS, NEMA and KWS should conduct sustainability assessments of policy, plans and programmes so as to determine the potential effect that will improve implementation and reinforce policy measures to abate vices such as corruption and impunity. These agencies are mandated to ensure that the PAs are conserved and this is what they should strive to achieve.

The national and the county governments should take into consideration the future uncertainties when developing the policies and plans for the conservation of the Protected Areas. This should be embraced through a proper analysis and forecasting through scenario planning to ensure that the PAs are not affected by other government projects in future and that any agency or committee formed to undertake any activity in the ecosystem is aligned with the existing agencies to avoid future conflicts.

The preferred governance scenario is the strategic advisory led governance of PAs scenario. It is touted as the scenario which will ensure future sustainable supply of ecosystem services. The stakeholders suggest an implementation action plan to be developed so as to mitigate negative aspects of the other three alternative scenarios.

5.5 Further Areas for Research

There is need for more emphasis on less explored areas which include:

- The influence of cultural, social, political and legal historical changes on the perception of the inhabitants and actors on protected areas.
- There is need for participatory research to link up rural economies with national and regional forestry conservation policies.
- Further, research is required to reveal the best ways for community involvement in PA governance and ensure enhanced conservation and economic benefits to the local communities
- Targeted research on the relationship between PA governance and the social benefits, with the aim to single out best governance approaches for different aspects of the PA ecosystem.

- Research to better understand local community attributes which influence conservation efforts.
- Governance principles need further attention as this study heavily relied on concepts from Lockwood, 2010.

5.6 Conclusion

In operationalizing the ecosystem service concept, this research contributes to the analysis of human-environment relationships through a case study of a mountain forest ecosystem in northern Kenya. The importance of studying these relationships was emphasized by UNESCO in its *Man and the Biosphere Program*, which suggested that such studies would increase the efficiency of natural resource management and ecosystem conservation (UNESCO, 1973). The importance of such studies has increased over time (Bennett et al., 2015; Reenberg, 2009; Verburg et al., 2015, 2013).

The findings of this study show that perception of ES is skewed towards provisioning and cultural services. Our study also found that distance from the forest influence the respondents' perception of ES. However, due to sociodemographic and biophysical factors, involvement of local communities in management was limited.

This study advances the debate on the social impact of PAs and their relevance for nature conservation. Stakeholder network analysis of Mt. Marsabit PA is important as it provides insights of the complexity in collaborative governance set ups. The results show central stakeholders and their importance in interactions and representation. Multi-stakeholder processes should be strengthened based on stakeholders' positions through improved policy and communication strategies. This study shows that central key stakeholders can exploit their interests and influence governance in a collaborative setup. The stakeholder perception that the governance Mt. Marsabit PA is moderately effective is in line with discussions of other authors, in that the perception by actors, though fair, does not mean that the PA is being governed well. This discrepancy is clear from the outcomes that show that the PA continues to be under anthropogenic pressure. These threats are manifested by the reduction in forest size, and consequently a reduction in ecosystem services. Ultimately, the PA does not meet its objective of protecting biodiversity. The low level of interactions and associations among stakeholders suggest a weakness in the networks that may negatively affect the flow of

information and other resources. This weakness was attributed to lack of institutionalization of the links leading to poor coordination of processes. The new Constitution of Kenya adopted in 2010, the Wildlife Conservation and Management Act, 2013, and the Forest Conservation and Management Act, 2016, emphasize the importance of collaboration between the state and local communities, but our study results show that the local communities are not adequately involved in the governance of Mt. Marsabit PA. Policy and practices around PAs are poorly aligned with the basic purpose of protection, conservation and healthy sustainable ecosystems. This study concludes that the governance model in the Mt. Marsabit forest PA is not effective for sustainable outcomes as it currently stands.

Mt. Marsabit forest PA, like many other multi-use Pas, will benefit from developing provocative but plausible scenarios that emphasize unpredictable shifts and consequences for SES futures. Each of the presented scenarios present critical ideas that cannot be ignored. The winning governance scenario is one that builds on all critical strengths of each of the solutions. During the ongoing preparation of county-based policies and legislative framework, this study shows that the planners, scientist and policy makers should ensure that they incorporate local perspectives and established global scenario literature perspectives. This should be through participatory scenario planning to recognize the drivers, plausible futures at multiple scales because the SES is complex and deeper understanding will be holistic and ensure sustainable PA. These results can help identify governance mechanisms and management options that respond to future challenges while understanding the complexity of SES, considering multiscale dynamic, different perspectives, and potential for change.

References

Act, F. *Forest Conservation and Management Act No 34 of 2016*. , (2016). Government printers, Kenya

Aldaya, M.M. (2017). Environmental science: Eating ourselves dry. Nature, 543(7647), p.633.

Agbenyega, O., Burgess, P. J., Cook, M., & Morris, J. (2009). Application of an ecosystem function framework to perceptions of community woodlands. *Land Use Policy*, *26*(3), 551–557. https://doi.org/10.1016/j.landusepol.2008.08.011

Agrawal, A., Chhatre, A., & Hardin, R. (2014). Changing Governance of the World ' s Forests. *Science, New Series*, *320*(5882), 1460–1462. https://doi.org/10.1126/science.1155369

Basurto, X., Kingsley, G., McQueen, K., Smith, M., & Weible, C. M. (2010). A Systematic Approach to Institutional Analysis: Applying Crawford and Ostrom's Grammar. *Political Research Quarterly*, *63*(3), 523–537. https://doi.org/10.1177/1065912909334430

Bennett, E. M., Cramer, W., Begossi, A., Cundill, G., Díaz, S., Egoh, B. N., … Woodward, G. (2015). Linking biodiversity, ecosystem services, and human well-being: Three challenges for designing research for sustainability. *Current Opinion in Environmental Sustainability*, Vol. 14. https://doi.org/10.1016/j.cosust.2015.03.007

Bennett, N. J., Roth, R., Klain, S. C., Chan, K., Christie, P., Clark, D. A., … Wyborn, C. (2017). Conservation social science: Understanding and integrating human dimensions to improve conservation. *Biological Conservation*, *205*, 93–108. https://doi.org/10.1016/j.biocon.2016.10.006

Benoit, H. & Adongo, C. (2015). "Green grabbing," pastoralism and environmental dynamics in Northern Kenya. An assessment of conservation models and practices in Marsabit County. *The East African Review, 50*;(15); 40-62.

Berkes, F., and C. F. editors. (1998). *Linking Social and Ecological Systems: Management Practices and Social Mechanisms for Building Resilience* (Vol 4). Cambridge University Press, New York, New York, USA.

Borrini-Feyerabend Grazia. (1996). International Union for Conservation of Nature and Natural Resources. *Nature*, *188*(4752), 716–717. https://doi.org/10.1038/188716b0

Bouahim, S., Rhazi, L., Ernoul, L., Mathevet, R., Amami, B., Er-Riyahi, S., … Grillas, P. (2015). Combining vulnerability analysis and perceptions of ecosystem services in sensitive landscapes: A case from western Moroccan temporary wetlands. *Journal for Nature Conservation*, *27*, 1–9. https://doi.org/10.1016/j.jnc.2015.05.003

Brewer, J. D. (2007). The New Sociological Imagination. *European Journal of Social Theory*, *10*(1), 173–176. https://doi.org/10.1177/1368431006073840

Bussmann, R. W. (2002). Islands in the Desert—Forest Vegetation of Kenya'S Smaller Mountains and Highland Areas (Nyiru, Ndoto, Kulal, Marsabit, Loroghi, Ndare, Mukogodo, Porror, Mathews, Gakoe, Imenti, Ngaia, Nyambeni, Loita, Nguruman, Nairobi). *Journal of East African Natural History*, *91*(1), 27–79. https://doi.org/10.2982/0012-8317(2002)91[27:IITDVO]2.0.CO;2

Bussmann, R. W., Gilbreath, G. G., Solio, J., Lutura, M., Lutuluo, R., Kunguru, K., … Mathenge, S. G. (2006). Plant use of the Maasai of Sekenani Valley, Maasai Mara, Kenya. *Journal of Ethnobiology and Ethnomedicine*, *2*, 1–7. https://doi.org/10.1186/1746-4269-2-22

Byrne, D. and Goodall, H. (2013) 'Placemaking and transnationalism: recent migrants and a national park in Sydney, Australia', PARKS: The International Journal of Protected Areas and Conservation 19 (1): 63–72.

CAFF. (2015). *The Economics of Ecosystems and Biodiversity (TEEB) Scoping Study for the Arctic. Executive Summary. Conservation of Arctic Flora and Fauna, Akureyri*. (September).

Camarillo, G. C. (2002). *FORUM : QUALITATIVE SOCIAL RESEARCH SOZIALFORSCHUNG Review: 1. Words Connecting the World*.

Cangur, S., & Ercan, I. (2015). Comparison of Model Fit Indices Used in Structural Equation Modeling Under Multivariate Normality. *Journal of Modern Applied Statistical Methods*, *14*(1), 152–167. https://doi.org/10.22237/jmasm/1430453580

Carpenter, S. R., Bennett, E. M., & Peterson, G. D. (2006a). Scenarios for ecosystem services: An overview. *Ecology and Society*, *11*(1), 29. https://doi.org/29\rArtn 29

Cent, J., Grodzińska-Jurczak, M., & Pietrzyk-Kaszyńska, A. (2014). Emerging multilevel environmental governance—A case of public participation in Poland. *Journal for Nature Conservation*, *22*(2), 93–102. https://doi.org/10.1016/j.jnc.2013.09.005

Chan, K. M. A., Satterfield, T., & Goldstein, J. (2012). Rethinking ecosystem services to better address and navigate cultural values. *Ecological Economics*, *74*, 8–18. https://doi.org/10.1016/j.ecolecon.2011.11.011

Chebii, J., K. (2015). *Forest Management And Conservation In Kenya: A Study Of The Role Of Law In The Conservation Of Forest Resources*. Unpublished PhD Thesis; University of South Africa, South Africa. Retrieved from: http://uir.unisa.ac.za/bitstream/handle/10500/20093/thesis_chebii_jk.pdf?sequence=1&isAllowed=y

Chhetri, B. B. K., Johnsen, F. H., Konoshima, M., & Yoshimoto, A. (2013). Community forestry in the hills of Nepal: Determinants of user participation in forest management. *Forest Policy and Economics*, *30*, 6–13. https://doi.org/10.1016/j.forpol.2013.01.010

Chitere, O., & Ireri, O. N. (2004). *District focus for rural development in Kenya: Its limitations as a decentralisation and participatory planning strategy and prospects for the future*. Institute of Policy Analysis and Research.

Chongwa, M. B. (2012). The History and Evolution of National Parks in Kenya. *The George Wright Forum*, *29* (1), 4.

Christie, M., Cooper, R., Hyde, T., & Fazey, I. (2008). An Evaluation of Economic and Non-economic Techniques for Assessing the Importance of Biodiversity to People in Developing Countries . *Development*, (i), 22. http://dx.doi.org/10.1016/j.ecolecon.2012.08.012

CICES. (2013). *Roy Haines-Young Centre for Environmental Management School of Geography, University of Nottingham Nottingham, NG7 2RD*. 34.

CIDP. (2013). *Marsabit County Integrated Development Plan*.

County Government of Marsabit (2017). *The Revised Integrated Development* Plan (2013-2017). Marsabit County, Kenya.

Comberti, C., Thornton, T. F., Wylliede Echeverria, V., & Patterson, T. (2015). Ecosystem services or services to ecosystems? Valuing cultivation and reciprocal relationships between humans and ecosystems. *Global Environmental Change*, *34*. https://doi.org/10.1016/j.gloenvcha.2015.07.007

Costanza, R., de Groot, R., Sutton, P., van der Ploeg, S., Anderson, S. J., Kubiszewski, I., … Turner, R. K. (2014). Changes in the global value of ecosystem services. *Global Environmental Change*, *26*(1), 152–158. https://doi.org/10.1016/j.gloenvcha.2014.04.002

Cox, M., 2011. Advancing the Diagnostic Analysis of Environmental Problems. *International Journal of the Commons,* 5 (2).

Cuni-Sanchez, A., Pfeifer, M., Marchant, R., & Burgess, N. D. (2016). Ethnic and locational differences in ecosystem service values: Insights from the communities in forest islands in the desert. *Ecosystem Services*, *19*(November), 42–50. https://doi.org/10.1016/j.ecoser.2016.04.004

Cuni-Sanchez, A., Pfeifer, M., Marchant, R., Calders, K., Sørensen, C. L., Pompeu, P. V., … Burgess, N. D. (2017). New insights on above ground biomass and forest attributes in tropical montane forests. *Forest Ecology and Management*, *399*, 235–246. https://doi.org/10.1016/j.foreco.2017.05.030

DeCaro, D., Chaffin, B., Schlager, E., Garmestani, A. and Ruhl, J.B., (2017). Legal and institutional foundations of adaptive environmental governance. Ecology and Society, 22(1).

De Groot, R. S., Alkemade, R., Braat, L., Hein, L., & Willemen, L. (2010). Challenges in integrating the concept of ecosystem services and values in landscape planning, management and decision making. *Ecological Complexity*, *7*(3), 260–272. https://doi.org/10.1016/j.ecocom.2009.10.006

Díaz, S., Demissew, S., Carabias, J., Joly, C., Lonsdale, M., Ash, N., … Zlatanova, D. (2015). The IPBES Conceptual Framework—Connecting nature and people. *Current Opinion in Environmental Sustainability*, *14*, 1–16. https://doi.org/10.1016/j.cosust.2014.11.002

Dolisca, F., Carter, D. R., McDaniel, J. M., Shannon, D. A., & Jolly, C. M. (2006). Factors influencing farmers' participation in forestry management programs: A case study from Haiti. *Forest Ecology and Management*, *236*(2–3), 324–331. https://doi.org/10.1016/j.foreco.2006.09.017

Dreiseitl, S., & Ohno-Machado, L. (2002). Logistic regression and artificial neural network classification models: A methodology review. *Journal of Biomedical Informatics*, *35*(5–6), 352–359. https://doi.org/10.1016/S1532-0464(03)00034-0

Dudley, N., Parrish, J. D., Redford, K. H., & Stolton, S. (2010). The revised IUCN protected area management categories: The debate and ways forward. *Oryx*, *44*(4), 485–490. https://doi.org/10.1017/S0030605310000566

Duraiappah, A. K., Naeem, S., Agardy, T., Ash, N. J., Cooper, H. D., Díaz, S., … Millennium Ecosystem Assessment. (2005). Ecosystems and human well-being. In *Ecosystems* (Vol. 5). https://doi.org/10.1196/annals.1439.003

Eagles, P. F. J. (2008). Investigating Governance Within the Management Models Used in Park Tourism. *University of Waterloo*, *3*, 13.

Fisher, B., Bateman, I. J., & Turner, R. K. (2011). Valuing Ecosystem Services: Benefits, Values, Space and Time. *… of Regulating Services of …*, (January), 11. https://doi.org/10.4324/9780203847602

Folke, C., Hahn, T., Olsson, P., & Norberg, J. (2005). Adaptive Governance of Social-Ecological Systems. *Annual Review of Environment and Resources*, *30*(1), 441–473. https://doi.org/10.1146/annurev.energy.30.050504.144511

Frank, C., Kairo, J. G., Bosire, J. O., Mohamed, M. O. S., Dahdouh-Guebas, F., & Koedam, N. (2017). Involvement, knowledge and perception in a natural reserve under participatory management: Mida Creek, Kenya. *Ocean and Coastal Management*, *142*, 28–36. https://doi.org/10.1016/j.ocecoaman.2017.03.009

Goal, O., & Red, T. (2003). *Logical Framework planning matrix: Turkish Red Crescent HIV/AIDS Project*.

GoK, G. of K. (2013). *Analysis of drivers and underlying causes of forest cover change in the various forest types of Kenya*. Government printers, Kenya

GoK, G. of K. (2016). *Forest Programme*. Government printers Kenya

Graham, J., Amos, B., & Plumptre, T. (2003). *Principles for Good Governance in the 21st Century*. 9.

Greiner, C. (2017). Pastoralism and Land-Tenure Change in Kenya: The Failure of Customary Institutions. *Development and Change*, *48*(1), 78–97. https://doi.org/10.1111/dech.12284

Groot, R. De, Fisher, B., Christie, M., Aronson, J., Braat, L., Gowdy, J., … Shmelev, S. (2010). Chapter 1 Integrating the ecological and economic dimensions in biodiversity and ecosystem service valuation. *The Economics of Ecosystems and Biodiversity Ecological and Economic Foundations.*, (March), 1–40. https://doi.org/10.4324/9781849775489

Guest, G., Namey, E., & McKenna, K. (2017). How Many Focus Groups Are Enough? Building an Evidence Base for Nonprobability Sample Sizes. *Field Methods*, *29*(1), 3–22. https://doi.org/10.1177/1525822X16639015

Gyawali, D. and Thompson, M., (2016). Restoring Development Dharma with Toad's Eye Science. *IDS Bulletin Special 50th Anniversary Issue*, 47(2A), pp. 179-190.

Hanim Mohamad Zailani Suhaiza. (2012). The impact of external institutional drivers and internal strategy on environmental performance (Choon Tan Keah, Trans.). *International Journal of Operations & Production Management*, *32*(6), 721–745. https://doi.org/10.1108/01443571211230943

Hauck, J., Görg, C., Varjopuro, R., Ratamäki, O., & Jax, K. (2013). Benefits and limitations of the ecosystem services concept in environmental policy and decision making: Some stakeholder perspectives. *Environmental Science and Policy*, *25*, 13–21. https://doi.org/10.1016/j.envsci.2012.08.001

Heugens, P.M.A.R. and J. Van Oosterhout (2001), "To Boldly Where No Man Has Gone Before: Integrating Cognitive and Physical Features in Scenario Studies", Futures, Vol. 33 (10), pp. 861 - 872

Hicks, C. C., Cinner, J. E., Stoeckl, N., & Mcclanahan, T. R. (2015). Linking ecosystem services and human-values theory. *Conservation Biology*, *29*(5). https://doi.org/10.1111/cobi.12550

Holling, C. S. (2001). Understanding the Complexity of Economic, Ecological, and Social Systems. *Ecosystems*, *4*(5), 390–405. https://doi.org/10.1007/s10021-001-0101-5

Hou, Y. & Xu, J. (2012). Socialism and Ecological Crises: A View from China. *Journal of Sustainable Development,* 5(12); 19-36.

Hunt, D. V. L., Lombardi, D. R., Atkinson, S., Barber, A. R. G., Barnes, M., Boyko, C. T., … Rogers, C. D. F. (2012a). Scenario archetypes: Converging rather than diverging themes. *Sustainability*, *4*(4), 740–772. https://doi.org/10.3390/su4040740

IBM Corp Armonk, N. (2011). *No Title SPSS Statistics for Windows, Version 20.0.*

Imo, M. (2012). *Forest degradation in Kenya: Impacts of social, economic and political transitions*.

IPBES, Anantha, Belinda, Ivar Andreas, Bilgin, A., Brondizio, E., … Zlatanova, D. (2015). The IPBES Conceptual Framework—Connecting nature and people. *Current Opinion in Environmental Sustainability*, *14*, 1–16. https://doi.org/10.1016/j.cosust.2014.11.002

Ison, R. L., & Wallis, P. J. (2017). Mechanisms for Inclusive Governance. In E. Karar (Ed.), *Freshwater Governance for the 21st Century* (Vol. 6, pp. 159–185). https://doi.org/10.1007/978-3-319-43350-9_9

Janssen, M., 2000. *Complexity and ecosystem management: The theory and practice of multi-agent systems.* Cheltenman, UK: Edward Elgar Publishing.

Janssen, M. A., 2011. Resilience and adaptation in the governance of social-ecological systems. *International Journal of the Commons,* 5(2), p. 340–345.

JeffreyCoker, F., & Basinger, M. (2010). *Open Data Kit: Implications for the Use of Smartphone Software Technology for Questionnaire Studies in International Development*. (January), 12.

Johan Rockstrom, Will Steffen, Kevin Noone, Asa Persson, F.Stuart Chapin, E. F. L. et al. (2009). FEATURE. *Nature*, *461*(September).

Kahn, H. On Escalation: Metaphors and Scenarios; Praeger: New York, NY, USA, 1986.

Kamugisha, R. &Tessema, Y. (2012). *An Analysis Of Stakeholders in Community Involvement in Forest Management in Eastern and Southern Africa*. Nairobi: International Union for Conservation of Nature-East Africa Regional Office.

Kenya Institute of Public Policy Research and Analysis (KIPPRA). (2010). *Ndung'u Report on Land Grabbing in Kenya*: Legal and Economic Analysis. Nairobi: KIPPRA.

Kenya Wildlife Service. (2016). The Marsabit Forest Ecosystem Management Plan 2015-2025 Government printers, Kenya

Kenter, J. O., Bryce, R., Christie, M., Cooper, N., Hockley, N., Irvine, K. N., … Watson, V. (2016). Shared values and deliberative valuation: Future directions. *Ecosystem Services*, *21*, 358–371. https://doi.org/10.1016/j.ecoser.2016.10.006

Kinyili B.M. (2014) *Impacts of participatory forest management approach in Ol bolossat forest, Nyandarua County*, Kenya Government printers

Kisingo, A., Rollins, R., Murray, G., Dearden, P., & Clarke, M. (2016). Evaluating 'good governance': The development of a quantitative tool in the Greater Serengeti Ecosystem. *Journal of Environmental Management*, *181*, 749–755. https://doi.org/10.1016/j.jenvman.2016.08.002

Kok, K., & van Delden, H. (2009). Combining two approaches of integrated scenario development to combat desertification in the Guadalentín watershed, Spain. *Environment and Planning B: Planning and Design*, *36*(1), 49–66. https://doi.org/10.1068/b32137

Kriegler, E., Edmonds, J., Hallegatte, S., Ebi, K. L., Kram, T., Riahi, K., … van Vuuren, D. P. (2014). A new scenario framework for climate change research: The concept of shared climate policy assumptions. *Climatic Change*, *122*(3), 401–414. https://doi.org/10.1007/s10584-013-0971-5

Krott Max, M. (2005). *Forest Policy Analysis* (illustrated). Springer Science & Business Media, 2005.

Larson, A. M., 2010. Constituting Territory and Authority in Nicaragua's Indigenous Communities. *Land Use Policy*, pp. 1143-152.

Levin, K., Cashore, B., Bernstein, S., & Auld, G. (2012). Overcoming the Tragedy of Super Wicked Problems: Constraining Our Future Selves to Ameliorate Global Climate Change. *Policy Sciences*, *45*(2), 123–152. https://doi.org/10.1007/s11077-012-9151-0

Limburg, K. E., Neill, R. V. O., Costanza, R., & Farber, S. (2002). *Complex systems and valuation*. *41*, 409–420.

Liviatan, I., Trope, Y., & Liberman, N. (2008). Interpersonal similarity as a social distance dimension: Implications for perception of others' actions. *Journal of Experimental Social Psychology*, *44*(5), 1256–1269. https://doi.org/10.1016/j.jesp.2008.04.007

Lockwood, M. (2010). Good governance for terrestrial protected areas: A framework, principles and performance outcomes. *Journal of Environmental Management*, *91*(3), 754–766. https://doi.org/10.1016/j.jenvman.2009.10.005

Ludeki, J. V. (2006). *Environmental Management in Kenya:* A Framework for Sustainable Forest Management in Kenya 95.

Maina, P. M., & Imwati, A. T. (2015). *Use of Geoinformation Technology in Assessing Nexus between Ecosystem Changes and Wildlife Distribution: A Case Study of Mt. Marsabit Forest*. *4*(4), 718–724.

Mansourian, S. (2016). Understanding the Relationship Between Governance and Forest Landscape Restoration. *Conservation and Society, 14*(3), 267. https://doi.org/10.4103/0972-4923.186830

Matikua, P., Mireri, C., and Ogol C. (2013).The Impact of Participatory Forest Management on Local Community Livelihoods in the Arabuko-Sokoke Forest, Kenya. *Conservation and Society* 11(2): 112-129

McGuire, M. (2006). Collaborative Public Management: Assessing What We Know and How We Know It. *Public Administration Review*, *66*(s1), 33–43. https://doi.org/10.1111/j.1540-6210.2006.00664.x

Mensah, S., Veldtman, R., Assogbadjo, A. E., Ham, C., Glèlè Kakaï, R., & Seifert, T. (2017). Ecosystem service importance and use vary with socio-environmental factors: A study from household-surveys in local communities of South Africa. *Ecosystem Services*, *23*(October 2016), 1–8. https://doi.org/10.1016/j.ecoser.2016.10.018

Menzies, T. V., Filion, L. J., Brenner, G. A., & Elgie, S. (2007). Measuring Ethnic Community Involvement: Development and Initial Testing of an Index*. *Journal of Small Business Management*, *45*(2), 267–282. https://doi.org/10.1111/j.1540-627X.2007.00212.x

Metzger, M. J., Flanagin, A. J., & Medders, R. B. (2010). Social and Heuristic Approaches to Credibility Evaluation Online. *Journal of Communication*, *60*(3), 413–439. https://doi.org/10.1111/j.1460-2466.2010.01488.x

Michel P Pimbert, & Jules N Pretty. (1997). *Diversity and sustainability in community based conservation*. 25.

Millennium Ecosystem Assessment. (2005). Ecosystems and Human Well-Being, In: Reid, W.V. (Ed). *Our Human Planet - Summary for Decision Makers, Island Press, Washington DC.*, 25–36. https://doi.org/10.1079/PHN2003467

Miller, T. R., Wiek, A., Sarewitz, D., Robinson, J., Olsson, L., Kriebel, D., & Loorbach, D. (2014). The future of sustainability science: A solutions-oriented research agenda. *Sustainability Science*, *9*(2), 239–246. https://doi.org/10.1007/s11625-013-0224-6

Mireri, C. and Letema, C. (2011). "Review of Environmental Governance in Kenya: Analysis of Environmental Policy and Institutional Frameworks," in J. Meijer and A. Berg, eds. Handbook of Environmental Policy. *Nova Science Publishers*, 211, 371-380.

Mogoi, J., Obonyo, E., Ongugo, P., Oeba, V., & Mwangi, E. (2012a). Communities, Property Rights and Forest Decentralisation in Kenya: Early Lessons from Participatory Forestry Management. *Conservation and Society*, *10*(2), 182–194. https://doi.org/10.4103/0972-4923.97490

Muhamad, D., Okubo, S., Harashina, K., Parikesit, Gunawan, B., & Takeuchi, K. (2014). Living close to forests enhances people[U+05F3]s perception of ecosystem services in a forest-agricultural landscape of West Java, Indonesia. *Ecosystem Services*, *8*, 197–206. https://doi.org/10.1016/j.ecoser.2014.04.003

Muhati, G. L., Olago, D., & Olaka, L. (2018). Participatory scenario development process in addressing potential impacts of anthropogenic activities on the ecosystem services of

Mt. Marsabit forest, Kenya. *Global Ecology and Conservation*, *14*, e00402. https://doi.org/10.1016/j.gecco.2018.e00402

Munya, A., Hussain, N. H. M., & Njuguna, M. B. (2015a). Can devolution and rural capacity trigger de-urbanization? Case studies in Kenya and Malaysia respectively. *GeoJournal*, *80*(3), 427–443. https://doi.org/10.1007/s10708-014-9559-5

Muradian, R., (2017). *The limits of the ecosystem services paradigm and the search for alternative ways of conceiving humannature relations*. 12th Conference of the European Society of Ecological Economics, Budapest 20-23 June, 2017

Mwangi, E., &Njuguna, J. (2010).Workshop in political theory and policy analysis, Indiana University. *Decentralizing institutions for forest conservation in Kenya; A comparative analysis of resource conservation outcome under national park and forest reserve regimes in Mount Elgon ecosystem*

Nasong'o, W. S. (2017). Environmental Policy and Practice in Kenya: Between Cornucopians and Neo-Malthusians. *The International Journal on Green Growth and Development 3*(1); 1—19.

Nelson Fred. (2012). *Recognition and Support of ICCAs in Kenya*. 34. Government printers Kenya

Neugarten, R. A., Langhammer, P. F., Osipova, E., Bagstad, K. J., Bhagabati, N., Butchart, S. H. M., … Willcock, S. (2018). *Tools for measuring, modelling, and valuing ecosystem services*. https://doi.org/doi.org/10.2305/IUCN.CH.2018.PAG.28.en Nahanni

Nita, A. (2019). Empowering Impact Assessments Knowledge and International Research Collaboration—A bibliometric analysis of Environmental Impact Assessment Review journal. *Environmental Impact Assessment Review*, *78*, 106283. https://doi.org/10.1016/j.eiar.2019.106283

Nita, A., Hartel, T., Manolache, S., Ciocanea, C. M., Miu, I. V., & Rozylowicz, L. (2019). Who Is Researching Biodiversity Hotspots in Eastern Europe? A Case Study on The Grasslands in Romania. *PLOS ONE*, *14*(5), e0217638. https://doi.org/10.1371/journal.pone.0217638

Nkonya, E., Braun, J. Von, & Mirzabaev, A. (2016). *Concepts and Methods of Global Assessment of the Economics of Land Degradation and Improvement Á Natural capital Á Total*. 15–33. https://doi.org/10.1007/978-3-319-19168-3

Ogutu, J. O., Piepho, H. P., Said, M. Y., Ojwang, G. O., Njino, L. W., Kifugo, S. C., & Wargute, P. W. (2016). Extreme Wildlife Declines and Concurrent Increase in Livestock Numbers in Kenya: What Are the Causes? *PLoS ONE*, *11*(9), 1–46. https://doi.org/10.1371/journal.pone.0163249

Oldekop, J. A., Sims, K. R. E., Karna, B. K., Whittingham, M. J., & Agrawal, A. (2019). Reductions in Deforestation and Poverty from Decentralized Forest Management in Nepal. *Nature Sustainability*, *2*(5), 421–428. https://doi.org/10.1038/s41893-019-0277-3

Oroda, A. S. (2011). *The Impact of Increased Population and Sedentarization of the Pastoral communities on Land Cover and the Resources of Mount Marsabit Forest and Surrounding Lands*. Kenyatta University.

Ostrom, E. (1990). *Governing the commons: The evolution of institutions for collective action*. Cambridge ; New York: Cambridge University Press.

Ostrom, E. (1999). Coping with Tragedies of The Commons. *Annual Review of Political Science*, *2*(1), 493–535. https://doi.org/10.1146/annurev.polisci.2.1.493

Oteros-Rozas, E., González, J. A., Martín-López, B., López, C. A., & Montes, C. (2012). Ecosystem Services and Social–Ecological Resilience in Transhumance Cultural Landscapes: Learning from The Past, Looking for A Future. In T. Plieninger & C.

Bieling (Eds.), *Resilience and the Cultural Landscape* (pp. 242–260). https://doi.org/10.1017/CBO9781139107778.018

Oteros-Rozas, E., Martín-López, B., Daw, T. M., Bohensky, E. L., Butler, J. R. A., Hill, R., … Vilardy, S. P. (2015). Participatory scenario planning in place-based social-ecological research: Insights and experiences from 23 case studies. *Ecology and Society*, *20*(4), art32. https://doi.org/10.5751/ES-07985-200432

Parris, T. M., & Kates, R. W. (2003). Characterizing and Measuring Sustainable Development. *Annual Review of Environment and Resources*, *28*(1), 559–586. https://doi.org/10.1146/annurev.energy.28.050302.105551

Pascual, U., Palomo, I., Adams, W. M., Chan, K. M. A., Daw, T. M., Garmendia, E., … Phelps, J. (2017). Off-stage ecosystem service burdens: A blind spot for global sustainability. *Environmental Research Letters*, *12*(7), 075001. https://doi.org/10.1088/1748-9326/aa7392

Patrício, J., Elliott, M., Mazik, K., Papadopoulou, K.-N., & Smith, C. J. (2016). DPSIR—Two Decades of Trying to Develop a Unifying Framework for Marine Environmental Management? *Frontiers in Marine Science*, *3*(September), 1–14. https://doi.org/10.3389/fmars.2016.00177

Pearson, T. R. H., Brown, S., Murray, L., & Sidman, G. (2017). Greenhouse gas emissions from tropical forest degradation: An underestimated source. *Carbon Balance and Management*, *12*(1). https://doi.org/10.1186/s13021-017-0072-2

Pimm, S. L., Smith, M. D. and Wiener, J. B. (2014) 'Disconnects in evaluating the relative effectiveness of conservation strategies', *Conservation Biology* 18: 597–9.

Piso, Z., Goralnik, L., Libarkin, J. C., & Lopez, M. C. (2019). Types of urban agricultural stakeholders and their understandings of governance. *Ecology and Society*, *24*(2). https://doi.org/10.5751/ES-10650-240218

Prell, C., Hubacek, K., & Reed, M. (2009). Stakeholder Analysis and Social Network Analysis in Natural Resource Management. *Society & Natural Resources*, *22*(6), 501–518. https://doi.org/10.1080/08941920802199202

Randhir, T. O., & Erol, A. (2013). Emerging Threats to Forests: Resilience and Strategies at System Scale. *American Journal of Plant Sciences*, *4*(March), 739–748. https://doi.org/10.4236/ajps.2013.43A093

Raskin, P. (2002). *Great transition the promise and lure of the times ahead*. Retrieved from http://www.tellus.org/seib/publications/Great_Transitions.pdf

Raskin, P. D. (2000). Bending the Curve: Toward global sustainability. *Development*, *43*(4), 67–74. https://doi.org/10.1057/palgrave.development.1110199

Reed, M. S. (2008). Stakeholder participation for environmental management: A literature review. *Biological Conservation*, *141*(10), 2417–2431. https://doi.org/10.1016/j.biocon.2008.07.014

Reed, M. S., Graves, A., Dandy, N., Posthumus, H., Hubacek, K., Morris, J., … Stringer, L. C. (2009). Who's in and why? A typology of stakeholder analysis methods for natural resource management. *Journal of Environmental Management*, *90*(5), 1933–1949. https://doi.org/10.1016/j.jenvman.2009.01.001

Reenberg, A. (2009). Land system science: Handling complex series of natural and socio-economic processes. *Journal of Land Use Science*, *4*(1–2), 1–4. https://doi.org/10.1080/17474230802645618

Republic of Kenya. (2014). Kenya: Facts and Figures, Kenya National Bureau of Statistics. *Government Printers Kenya*, 50.

Republic of Kenya. (2016). *Government's Commitment to Conserve and Protect the Environment Through Policing.* Nairobi: Government Printer.

Republic of Kenya (2016). *Marsabit County Energy Development Act*, 2016; The Marsabit County Gazette Supplement No. 2. The Government Printer, Nairobi.

Republic of Kenya. (2016). *Environment Policy* Nairobi: Government Printer.

Republic of Kenya (1999). *National Policy on Water Resources and Management*; The Government Printer, Nairobi.

Republic of Kenya (2017). *The National Forest Policy* Government Printers, Nairobi.

Ribot, J. C., Lund, J. F., & Treue, T. (2010). Democratic Decentralization in Sub-Saharan Africa: Its Contribution to Forest Management, Livelihoods, and Enfranchisement. *Environmental Conservation*, *37*(1), 35–44. https://doi.org/10.1017/S0376892910000329

Ritchie, Jane, & Lewis, Jane. (2003). Qualitative Research Practice: A Guide for Social Science Students and Researchers. *Choice Reviews Online*, *41*(03), 41-1319-41–1319. https://doi.org/10.5860/Choice.41-1319

Robinson, L. W. (2013). *Mt. Marsabit , Kenya: An Assessment of the Governance System*. (2).

Robinson, L. W., & Kagombe, J. K. (2018). Institutional linkages and landscape governance systems: The case of Mt. Marsabit, Kenya. *Ecology and Society*, *23*(1). https://doi.org/10.5751/ES-09933-230127

Robinson, L. W., Sinclair, J. A., & Spaling, H. (2010). Traditional Pastoralist Decision-Making Processes: Lessons for Reforms to Water Resources Management in Kenya. *Journal of Environmental Planning and Management*, *53*(7), 847–862. https://doi.org/10.1080/09640568.2010.490051

Román N. Y.C, & Cuesta M., O., J. (2016): "Communication and Environmental Conservation: Advances and Challenges in Latin America". *Revista Latina de Comunicación Social*, 71, pp. 015 to 039.

Sachs, J. D. (2012a). From Millennium Development Goals to Sustainable Development Goals. *The Lancet*, *379*(9832), 2206–2211. https://doi.org/10.1016/S0140-6736(12)60685-0

Sagie, H., Morris, A., Rofè, Y., Orenstein, D. E., & Groner, E. (2013a). Cross-Cultural Perceptions of Ecosystem Services: A Social Inquiry on Both Sides of The Israeli-Jordanian Border of The Southern Arava Valley Desert. *Journal of Arid Environments*, *97*, 38–48. https://doi.org/10.1016/j.jaridenv.2013.05.007

Sanderson, I. a N., Policy, D., Book, M., Evans, M., Azwan, K., Kamal, M., … Hezri, A. a. (2014). What is the Policy Problem? Methodological Challenges in Policy Evaluation. *Evaluation*, *30*(4), 1–22. https://doi.org/10.1177/0095399713513140

Shahbaz, M., Jalil, A., and S. Dube (2010). *Environmental Kuznets Curve (EKC): Times Series Evidence from Portugal*, University, Islamabad, Pakistan, California State University, Sacramento (CSUS),Sacramento, CA, USA.

Schlüter, M., Hinkel, J., Bots, P. W. G., & Arlinghaus, R. (2014). Application of the SES Framework for Model-Based Analysis of The Dynamics of Social-Ecological Systems. *Ecology and Society*, *19*(1). https://doi.org/10.5751/ES-05782-190136

Scholte, S. S. K., van Teeffelen, A. J. A., & Verburg, P. H. (2015). Integrating socio-cultural perspectives into ecosystem service valuation: A review of concepts and methods. *Ecological Economics*, *114*, 67–78. https://doi.org/10.1016/j.ecolecon.2015.03.007

Shields, B. P., Moore, S. A., & Eagles, P. F. J. (2016). Indicators for Assessing Good Governance of Protected Areas: Insights from Park Managers in Western Australia. *Parks*, *22*(1), 37–50. https://doi.org/10.2305/IUCN.CH.2016.Parks-22-1BPS.en

Stanciu, E., & Lonita, A. (2003). *Governance of Protected Areas in Eastern Europe*.

Sims, K. R. E. (2010) 'Conservation and Development: Evidence from Thai Protected Areas', Journal of Environmental Economics and Management 60: 94–114.

Tabachnick, B. G., & Fidell, L. S. (2013). *Using Multivariate Statistics* (6th ed). Boston: Pearson Education.

Tadesse, S., Woldetsadik, M., & Senbeta, F. (2017). Forest Users' Level of Participation in A Participatory Forest Management Program In Southwestern Ethiopia. *Forest Science and Technology*, *13*(4), 164–173. https://doi.org/10.1080/21580103.2017.1387613

Tar, U. A., & Mustapha, M. (2017). The Emerging Architecture of a Regional Security Complex in the Lake Chad Basin. *Africa Development*, (3), 20.

TEEB. (2010). The Economics of Ecosystems and Biodiversity: Mainstreaming the Economics of Nature: A synthesis of the approach, conclusions and recommendations of TEEB. In *Environment*. https://doi.org/Project Code C08-0170-0062, 69 pp.

Torri, M. C. (2010a). Decentralising Governance of Natural Resources in India: Lessons from the Case Study of Thanagazi Block, Alwar, Rajasthan, India. *Law, Environment and Development Journal*, *6*(2), 228.

Torri, M. C., Schreckenberg, K., Luttrell, C., Moss, C., Reed, M. S., Graves, A., … Morris, J. (2011). Combining vulnerability analysis and perceptions of ecosystem services in sensitive landscapes: A case from western Moroccan temporary wetlands. *Journal for Nature Conservation*, *27*(6021), 1–9. https://doi.org/10.1016/j.jnc.2015.05.003

(UNEP-WCMC), U. N. E. P. and W. C. M. C. (2006). *World Database on Protected Areas*. https://doi.org/www.protectedplanet.net

UNESCO. (1973). *International classification and mapping of vegetation* (p. 102). p. 102.

UNFPA. (2016). *The State of World Population 2016*. 1–112.

United Nations. (2009). World Population Ageing, 2009. *Department of Economic & Social Affairs Population Division*, 73. https://doi.org/10.2307/1524882

Usenobong F., A. and A.C. Chuku (2011). *Economic Growth and Environmental Degradation in Nigeria*: Beyond the Environmental Kuznets Curve, University of Uyo, Nigeria.

van Notten, P. W. F., Rotmans, J., van Asselt, M. B. A., & Rothman, D. S. (2003). An Updated Scenario Typology. *Futures*, *35*(5), 423–443. https://doi.org/10.1016/S0016-3287(02)00090-3

Venkanna, K., Mandal, U. K., Solomon Raju, A. J., Sharma, K. L., Adake, R. V., Pushpanjali, … Peda Babu, B. (2014). Carbon Stocks in Major Soil Types and Land-Use Systems in Semiarid Tropical Region Of Southern India. *Current Science*, *106*(4), 604–611.

Verburg, P. H., Crossman, N., Ellis, E. C., Heinimann, A., Hostert, P., Mertz, O., … Zhen, L. (2015a). Land System Science and Sustainable Development of The Earth System: A Global Land Project Perspective. *Anthropocene*, *12*, 29–41. https://doi.org/10.1016/j.ancene.2015.09.004

Verburg, P. H., Erb, K. H., Mertz, O., & Espindola, G. (2013). Land System Science: Between Global Challenges and Local Realities. *Current Opinion in Environmental Sustainability*, *5*(5), 433–437. https://doi.org/10.1016/j.cosust.2013.08.001

Wack, P. Scenarios: Shooting the Rapids. Harvard Business Review 63(6) (1985): 139-150

Wangai, P. W., Burkhard, B., Kruse, M., & Müller, F. (2017). Contributing to The Cultural Ecosystem Services and Human Wellbeing Debate: A Case Study Application on

Indicators and Linkages. *Landscape Online*, *50*(1), 1–27. https://doi.org/10.3097/LO.201750

Wangai, P. W., Burkhard, B., & Müeller, F. (2016). A Review of Studies on Ecosystem Services in Africa. *International Journal of Sustainable Built Environment*, *5*(2), 225–245. https://doi.org/10.1016/j.ijsbe.2016.08.005

Wardropper, C. B., Gillon, S., Mase, A. S., McKinney, E. A., Carpenter, S. R., & Rissman, A. R. (2016). Local Perspectives and Global Archetypes in Scenario Development. *Ecology and Society*, *21*(2), art12. https://doi.org/10.5751/ES-08384-210212

Water Service Regulatory Board [WASREB] (2017). *The Water (Services Regulatory) Rules. Arrangement Of Rules*. Kenya Gazette Supplement No. 183 23rd November, 2012; Government Printers, Nairobi.

Westley, F. (1995) Governing Design The Management of Social Systems and Ecosystems Management. In Gunderson, L., Holling, C.S. and Light, S.S., Eds., Barriers and Bridges to the Renewal of Ecosystems and Institutions, Columbia University Press, New York, 391-427.

Wyborn, C. (2015). Co-Productive Governance: A Relational Framework for Adaptive Governance. *Global Environmental Change*, *30*, 56–67. https://doi.org/10.1016/j.gloenvcha.2014.10.009

Wyborn, C., Yung, L., Murphy, D., & Williams, D. R. (2015). Situating Adaptation: How Governance Challenges and Perceptions of Uncertainty Influence Adaptation in The Rocky Mountains. *Regional Environmental Change*, *15*(4), 669–682. https://doi.org/10.1007/s10113-014-0663-3

Yamane, T. (1967). *Statistics: An Introductory Analysis*, (2nd ed.). New York: Harper and Row.

Zaal, F., & Siloma, M. O. (2006). *Contextualising Conflict: Introduced Institutions and Political Networks Combating Pastoral Poverty*. 19.

Zaehringer, J. G., Schwilch, G., Andriamihaja, O. R., Ramamonjisoa, B., & Messerli, P. (2017). Remote Sensing Combined with Social-Ecological Data: The Importance of Diverse Land Uses for Ecosystem Service Provision in North-Eastern Madagascar. *Ecosystem Services*, *25*, 140–152. https://doi.org/10.1016/j.ecoser.2017.04.004

Zafra-calvo, N., & Garmendia, E. (2019). *Progress toward Equitably Managed Protected Areas in Aichi Target 11: A Global Survey*. (January). https://doi.org/10.1093/biosci/biy143

Appendices

Appendix I Demographics of the respondents

Demographic		N	Gender		Total %
			Female	Male	
Age of respondent	18 - 25	20	4.9%	2.6%	7.5%
	25 - 35	72	14.7%	12.5%	27.2%
	35 - 45	65	11.3%	13.2%	24.5%
	45 - 55	52	7.9%	11.7%	19.6%
	Over 55	56	9.4%	11.7%	21.1%
Age analysis	Mean	43.38			
	Median	42.0			
	Std deviation	14.453			
	Minimum	20 yrs			
	Maximum	97 yrs			
Education level	No Formal Education	153	31.7%	26.0%	57.7%
	Primary Education	69	12.1%	14.0%	26.1%
	Secondary Education	25	1.9%	7.5%	9.4%
	College or Tertiary	13	1.9%	3.0%	4.9%
	University (degree/Masters/PhD)	5	0.8%	1.1%	1.9%
Ethnicity	Borana	85	13.6%	18.5%	32.1%
	Burji	49	5.7%	12.8%	18.5%
	Gabra	53	14.7%	5.3%	20.0%
	Kikuyu	1		0.4%	0.4%
	Rendille	45	8.3%	8.7%	17.0%
	Samburu	19	4.5%	2.6%	7.2%
	Turkana	13	1.5%	3.4%	4.9%
Year of Settling In the area					
Ethnicity	Before 1964	20	1.9%	5.7%	7.5%

1965 - 1974	28	5.3%	5.3%	10.6%
1975 - 1984	26	4.9%	4.9%	9.8%
1985 - 1994	76	11.3%	17.4%	28.7%
1995 - 2004	40	7.2%	7.9%	15.1%
2005 - 2014	69	16.6%	9.4%	26.0%
After 2014	6	1.1%	1.1%	2.3%

Appendix II Household questionnaire

GOVERNANCE DILEMMA AND SUSTAINABLE PROVISION OF ECOSYSTEM SERVICES IN MT. MARSABIT FOREST

IDENTIFICATION

Village/S/Loc./Location/Division/County .....|___||___|

HOUSEHOLD NUMBER .....|___||___||___|

Date of Interview |___|___|___|___|

CONSENT FORM

Hello Sir/ Madam,

My name is……. I am an interviewer doing research on behalf of Caroline Ouko, a PhD student of the University of Nairobi. We are conducting a survey on resource use of Mt Marsabit by communities. You've been selected randomly and we wish, with your permission, to interview you.

Be assured that we want to learn from your experience and collect important information that will be used to determine how the sustainable governance of Mt. Marsabit can be achieved. It is possible that some of the questions asked, are of a sensitive nature, but please note that your name will not be recorded in the questionnaire, and any details related to your privacy will be kept confidential.

Your participation in this survey is very important and we rely on you to provide us with accurate information.

The interview will take approximately *30* minutes, but with your cooperation it can be done quicker.

May I have your permission to undertake this interview? Yes ☐ No ☐

If you do not want to participate, kindly explain why……

Signature of the interviewer that a verbal consent was obtained:

(Note to interviewer: 98 =No answer provided, 99 = Don't know)

N°	QUESTIONS	ANSWERS
	A. SOCIO-DEMOGRAPHIC CHARACTERISTICS OF RESPONDENTS	
1.	**Record sex of the respondent**	01 = Male 02 = Female |___||___|
2.	What is your Ethnic group?	
3.	What is your Religion?	
4.	What is your main occupation?	
5.	How old are you?	1 15-24 years 2 25-34 years 3 35-44 years 4 45-54 years 5 55-64 years 6 65+ years 888 No Response 999 Don't Know
6.	Marital status	1 Single 2 Married 3 Widowed 4 Divorced 888 No Response
7.	HH type? e.g. female headed or male headed	
8.	How many children do you have? Boys Girls	_____ _____ 888 No Response

N°	QUESTIONS	ANSWERS
9.	What is the highest Education Level you attained?	1 No Formal Education 2 Lower Primary Education, Class 1-3 3 Upper Primary Education, Class 4-8 4 Secondary Education 5 College or Tertiary Education 6 University degree or Masters or Doctorate
10.	Which year did you settle in this area?	
11.	What is the total land owned by the household	
12.	How was this land acquired?	
13.	What is the type of land ownership (Does this land have a title deed)?	
14.	Number of housing units in the compound	
15.	Type of fencing if any	
16.	Materials of roof construction (main house)	
17.	Materials of wall construction (main house)	
18.	Materials of the floor (main house)	
19.	Which are the 3 main sources of livelihood / income for the household?	
20.	Which source of income brings in most money in the household?	
21.	Name 3 main household assets	
22.	What is the main cooking fuel	
23.	Where do you acquire the fuel?	
24.	How long does it take?	

B. General questions

1. Approximately, how far is your home from the forest?
   - 1 Less than 1km
   - 2 1km to 2km
   - 3 2km to 5km
   - 4 5km to 10km
   - 5 Greater than 10km
   - 777 Does not Apply

999 Don't Know

2. Approximately, how long (in minutes) is your home to the forest when walking?
   □Less than 15 -30 minutes' Walk □Between 30-1hours walk□ More than 1 hour's walk.
3. What are the different land use activities practiced by the people living around the forest (Mt Marsabit)?
   3b. Please rank in order of importance, at the moment which one is the most commonly practiced important to you?
   DO NOT READ OUT. MULTIPLE CODE. PLEASE PROBE TO CLARIFY ACCURATELY.

	(MULTIPLE CODE)		**2b. (SINGLE CODE) Most important**
	Mentioned	**Not mentioned**	
Idle land	1	2	
Leased	1	2	
Crop	1	2	
Livestock	1	2	
Forest	1	2	
Other specify			

4. And specifically thinking of benefits of the forest, what do you get from the forest?

4b. Please rank which one is the most important to you in order of their value, where 1 represents very valuable, and the rest of the values assigned decreasing ranking in order of importance

	(MULTIPLE CODE)		**2. (SINGLE CODE) Most important**
	Mentioned	**Not mentioned**	
Water provision	1	2	
Grass/ food for animal	1	2	
Firewood	1	2	
Ground for cultivation	1	2	
Clean air	1	2	
Timber for building	1	2	
Clean air	1	2	
Aesthetic beauty	1	2	
Shelter from the wind	1	2	
Other specify----------			
Don't Know			

5. In your opinion, how well do you think the people living around the forest have taken care of the forest (Mt. Marsabit PA)?
□Very well □ Somehow well □Not at all □Don't Know

6. Is the supply or continued existence of the resources secure?□Yes □No

7. If No, what are the threats to the resource? (Rank)

Past	Insecurity ()	Change in climate ()	Disease ()	Habitat change ()	Degradation ()	Human population pressure ()
Present	Insecurity ()	Change in climate ()	Disease ()	Habitat change ()	Degradation ()	Human population pressure ()
Future	Insecurity ()	Change in climate ()	Disease ()	Habitat change ()	Degradation ()	Human population pressure ()

8. Is unsustainable utilization a threat? Yes () No ()
9. Who is responsible for it? Local people: Within () Outsiders () Both ()
10. Does culture play a role in utilization of the forest? Yes () No ()

10b. If yes how? _____

11. What has been the main impact of threats to the ecosystem goods and service provision?

INTERVIEWER DO NOT READ OUT. SINGLE CODE FOR EACH VALUE.

SINGLE CODE	**Very serious**	**Partly**	**Don't Know**	**Refused to Answer**
Overstocking and overgrazing	01	02	88	99
Overexploitation of forests	01	02	88	99
Cultivation on steep slopes	01	02	88	99
Loss of soil and productivity	01	02	88	99
Loss of insects/plants/animals (biodiversity)	01	02	88	99
River pollution	01	02	88	99
Drying up of river sources	01	02	88	99
Other (specify)	08			

In the next section I would like to ask you several questions on how you have observed the forest (Mt. Marsabit PA)**.**

C. Ecosystem services as perceived by community members

12. Name the observed changes to the environment and the weather around the ***forest*** (Mt. Marsabit PA) since you moved here***?***

13. I am going to read out a list of statements people have said about the climate and weather around this place, please indicate the extent to which you agree or disagree with each statement.

INTERVIEWER READ OUT. SINGLE CODE FOR EACH VALUE.

Statements	**Strongly Agree**	**Agree**	**Undecided (Neutral)**	**Disagree**	**Strongly Disagree**
There is less/more rainfall	1	2	3	4	5
Temperatures have become warmer in the recent past	1	2	3	4	5

Drought is more frequent	1	2	3	4	5
Floods are more frequent	1	2	3	4	5
There is increasing decline in Stream and river flows	1	2	3	4	5
Degradation of forests and other natural resources is increasing	1	2	3	4	5

14. How important to you is it for the environment to be conserved? Very important Important Moderately important of little importance Not important
15. What ecosystem services are you familiar with? Tick all that you are familiar with Regulation of climate water flow and purification Watershed protection Nutrient cycling Biodiversity protection (swamps, forests, savannah grasslands Carbon Sequestration and storage (Forests, grassland, swamps) Landscape beauty (hills, ridges and highlands with grass cover, forests) Pollination services to agriculture Other (Please specify) ……
16. Which of the above environmental services does Marsabit Forest produce? Regulation of climate water flow and purification Watershed protection Nutrient cycling Biodiversity and protection (swamps, forests, savannah grasslands Carbon Sequestration and storage (Forests, grassland, swamps) Landscape beauty (hills, ridges and highlands with grass cover, forests) Pollination services to agriculture other (Please specify)……
17. Who do you think are the current beneficiaries of environmental services produced here? Local community Conservation and development NGOs Government Private sector World Other (Please specify) ……
18. Do you think the environmental services in forest (Mt. Marsabit PA) can be enhanced? If yes by; Changing production services practices e.g. agro forestry Changing land use e.g. reforestation, afforestation Not changing land use e.g. reducing deforestation Other (Please specify) ……
19. Do you have any knowledge about Marsabit forest ecosystem? Yes No
20. Do you believe this is an area of special interest Yes No
21. If yes which is the most important issue of conserving the area?
    Agriculture Tourism development Plant and animals Aesthetics History, heritage and culture Scientific value; Other (Please specify) ……
22. Are you engaged in conservation activities? Yes Partly No
23. If yes, what activities? Tree planting Soil conservation Membership of a conservation organization other (Please specify) ……

D. Governance aspects

SECTION IV: Institutions and Governance aspects	**Choices**
q24a. How often do you attend meetings about forest use, management, disputes or resolution of disputes?	1. Always or nearly every time one was held 2. Often 3. A few times 4. Once or twice 5. Never 999. Don't Know 888. No Response

q24b. Why do you not attend these meetings?	1. Not interested 2. Feel they are not useful 3. Was no informed/did not know about the meeting 4. No meetings were held on these issues 5. Busy working/traveling 6. Was not invited to the meeting/people like me do not attend these meetings 7. My views are usually ignored 8. Other (Specify) 777. Does not apply
Q24c. Are you currently part of any local forestry-related organization?	1 Yes 0 No
Q24d. How many community organizations are you currently part of?	
Q24e. Do you hold any management position in the groups you are in?	1 Yes 0 No
Q24f. What position are you in?	
Q24g. On average, how frequent do you hold your groups meetings?	1. Monthly 2. Once after every 1-3 months 3. Once every 4-6 months 4. Rarely (Almost once a year) 5. Never 777. Does not apply
Q24h. What is the main purpose of these groups?	1. Tree Planting 2. Forest management 3. Income generation 4. Energy management 5. Other (Specify) 777. Does not apply
I am going to ask you questions regarding your participation in forest management in the communal area and/or Mt Marsabit forest during the past year:	
Q25a. Have you participated in forest management activities?	1 Yes 0 No

Q25b. Have you participated in making rules about forest product harvesting, use and management?	1 Yes 0 No
Q25c. Have you participated in sanctioning rule breakers (e.g. enforcing fines and penalties)?	1 Yes 0 No
Q25d. Have you participated in monitoring forest condition (such as patrolling) and monitoring compliance to forest use and management rules?	1 Yes 0 No
Q25e. Have you participated in arbitrating disputes?	1 Yes 0 No

25. I want you to think about forest protection services such as; discouraging illegal logging, poor agriculture practices such as ploughing down slope, planting more trees. Who do you think is responsible for these kinds of services? _____
26. Are you aware of any activities by the county or national government to protect the forest?□Yes□No
    26b. If Yes name the most important activity _____
27. How successful have these activities been please explain?□Yes□No □ Don't Know
28. What can be done to improve these services?

29. Who should improve these services□Localcommunity□Outsiders□ The County □, The government □Don't Know
30. Who should improve these services□Localcommunity□Outsiders□ The County □, The government □Don't Know
31. I will ask you a few questions about the authorities taking care of the forest and if not aware, please say so.

32. Do you think you have any role to play in asking authorities for better protection of the forest? □Yes □No □ Don't Know
33. Do you think you have any role to play in asking authorities for better protection of the forest? □Yes □No □ Don't Know
34. What role could this be?
35. Have you ever approached anyone in authority to report or request for action against anyone interfering with the forest?□Yes□No □ Don't Know
36. If yes, who did you approach and what was the outcome?□Local administration□ My neighbor□ The police□ Media□ Other specify _____

Now, I would like to discuss with you about occurrence of conflicts, challenges and approaches to conflict resolution in your village. Please refer to your own experiences in responding to these questions.	
Q37 a. Have you ever been involved in a land/forest related conflict during this past year?	1 Yes 0 No

	READ OUT STATEMENTS, SHOW THE SCALE SO RESPONDENT IS CLEAR ON OPTIONS, SINGLE CODE ONLY.							
	STATEMENTS	**Strongly agree**	**Agree**	**Neither agree or disagree**	**Disagree**	**Strongly disagree**	**Don't know**	**Refused**
a.	The community respects the authority in charge of the forest	5	4	3	2	1	88	99
b.	The authority works within the law	5	4	3	2	1	88	99
c.	The authority is transparent in its decision making	5	4	3	2	1	88	99
d.	The authority invites community participation	5	4	3	2	1	88	99
e.	The authority responds to community concerns	5	4	3	2	1	88	99
f.	The authorities work in harmony with other players NGOs, investors, county and regional authorities, communities	5	4	3	2	1	88	99
g.	When there are disputes, the authority finds adopts an inclusive approach the conflict	5	4	3	2	1	88	99
h.	There is good communication between the Authority and the community	5	4	3	2	1	88	99

Q37b. Who was the conflict with?	1. Community member 2. Someone outside the community 3. Government authority 4. Family members 5. Other (Specify) 888. No Response 777. Does not apply
Q37c. What was the conflict about?	1. Boundary conflict 2. Disputes between individuals within households over land

	3. Inheritance 4. Disputes between individual and village over land 5. Disputed tenure with individuals from outside the village 6. Dispute over forest products 7. Others (Specify) 888. No Response 777. Does not apply
Q37d. Was the conflict resolved?	1 Yes 0 No
Q37e. If yes, who resolved it?	1. NGO 2. Government 3. Court/ litigation proceeding 4. Elected village leaders 5. Other village leaders (elder, headman/woman) 6. Other (conflict resolution committee, cooperative farmer group) 666. Don't remember 999. Don't know 888. No Response 777. Does not apply
Q37f. How satisfied were you with the outcome?	1. Very satisfied 2. Satisfied 3. Neutral 4. Dissatisfied 5. Very dissatisfied 777. Does not apply
Q37g. How frequently do people within the community report conflicts?	1. Every year 2. Every other year 3. Only once before this 888. Prefer not to respond 999. Don't know/remember 777. Does not apply

38. In what ways would you like to be involved in the management of the forest (Mt. Marsabit PA)?

39. What kinds of disputes arise as a result of the authorities trying to make the community follow rules and regulation in relation to the forest management?
40. How are these conflicts resolved?
41. What do you see as the main challenges to the forest authorities implementing rules and regulations for the protection of the forest?

Thank you for taking part in the Interview

Appendix III Key informant guide

GOVERNANCE DILEMMA AND SUSTAINABLE PROVISION OF ECOSYSTEM SERVICES IN MT. MARSABIT FOREST KENYA

Interviewer .....|___||___|

Institution of Interviewee .....|___||___||___|

Date of Interview |___|___|___|___|

CONSENT FORM

Hello Sir/ Madam,

My name is……. I am an interviewer doing research on behalf of Caroline Ouko, a PhD student of the University of Nairobi. We are conducting a survey to understand how best people like you and other stakeholders can make

things much better on Mt Marsabit forest'. You've been selected randomly and we wish, with your permission, to interview you.

Be assured that we want to learn from your experience and collect important information that will be used to determine how the sustainable governance of Mt. Marsabit can be achieved. It is possible that some of the questions asked, are of a sensitive nature, but please note that your name will not be recorded in the questionnaire, and any details related to your privacy will be kept confidential.

Your participation in this survey is very important and we rely on you to provide us with accurate information.

The interview will take approximately *30* minutes, but with your cooperation it can be done quicker.

May I have your permission to undertake this interview? Yes ☐ No ☐

If you do not want to participate, kindly explain why……

N°	QUESTIONS	ANSWERS
	A. SOCIO-DEMOGRAPHIC CHARACTERISTICS OF RESPONDENTS	
37.	**Record sex of the respondent**	01 = Male 02 = Female |___||___|
38.	How old are you?	1 15-24 years 2 25-34 years 3 35-44 years 4 45-54 years 5 55-64 years 6 65+ years 888 No Response 999 Don't Know
39.	Marital status	1 Single 2 Married 3 Widowed 4 Divorced 888 No Response

N°	QUESTIONS	ANSWERS
40.	What is the highest Education Level you attained?	1 No Formal Education 2 Lower Primary Education, Class 1-3 3 Upper Primary Education, Class 4-8 4 Secondary Education 5 College or Tertiary Education 7 University degree or Masters or Doctorate
41.	How long have you worked with the institution?	
42.	Designation at work	
43.	Job title/group	
44.	**Residence**	01 = Permanent 02 = Temporary |___||___|

B. General questions

1. How are you involved with conservation issues in the Mt. Marsabit ecosystem? ……
2. Describe the objectives of conservation in the Mt. Marsabit ecosystem? ……
3. Are you engaged in conservation activities? □Yes □Partly □No 3b. If yes what activities? (Please specify the main 2)……
4. How can you best describe Mt. Marsabit ecosystem? [Private, community managed, government owned or collaboratively managed] Expound/explain your answer…
5. How important is environmental conservation to you □Very important □Important □Moderately important □of little important □Not important
6. Please indicate the extent of your agreement or disagreement with each of the following statements

Statements	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
Global warming is an Environmental problem	1	2	3	4	5
There is increasing decline in Stream and river flows	1	2	3	4	5
Temperatures have become warmer in the recent past	1	2	3	4	5
Degradation of forests and other natural resources is increasing	1	2	3	4	5
There are frequent floods incidences	1	2	3	4	5

7. What are the 3 main uses of the Mt. Marsabit forest services you are familiar with?
8. Which environmental services does Marsabit Forest produce? Regulation of climate □water flow and purification □Watershed protection □Nutrient cycling □Biodiversity and protection (swamps, forests, savannah grasslands □Carbon Sequestration and storage (Forests, grassland, swamps) □Landscape beauty (hills, ridges and highlands with grass cover, forests) □Pollination services to agriculture □other (Please specify)……

9. Who do you think are the current beneficiaries of environmental services produced at Mt. Marsabit? □Local community □Conservation and development NGOs □Government □Private sector □World □Other (Please specify)……
10. Do you think the environmental services can be enhanced? If yes by □Changing production services practices e.g. agro forestry □Changing land use e.g. reforestation, afforestation □Not changing land use e.g. reducing deforestation □Other (Please specify) ……
11. Do you believe that Mt. Marsabit forest is an area of special interest □Yes □No
12. If yes which is the most important issue of conserving the ecosystem? □Agriculture □Tourism development □Plant and animals □Aesthetics □History, heritage and culture □Scientific value Other (Please specify)……
13. Is the supply or continued existence of the resources secure? □Yes □No
14. If No, What are the threats to the resource? (Rank)

Past	Insecurity ()	Change in climate ()	Disease ()	Habitat change ()	Degradation ()	Human population pressure ()
Present	Insecurity ()	Change in climate ()	Disease ()	Habitat change ()	Degradation ()	Human population pressure ()
Future	Insecurity ()	Change in climate ()	Disease ()	Habitat change ()	Degradation ()	Human population pressure ()

15. Is unsustainable utilization a threat? Yes () No ()
16. Who is responsible for it? Local people: Within () Outsiders () Both ()
17. What have been the impacts of these threats to the ecosystem goods and service provision?

C. Governance aspects

I would like to ask you a number of questions related to the approach to management of the Mt. Marsabit protected area (PA).

18. As I read each question, please indicate if you strongly agree, somewhat agree, somewhat disagree, strongly disagree or not sure.

1. Strongly Disagree
2. Somewhat Disagree
3. Not Sure
4. Somewhat Agree
5. Strongly Agree

A. The PA governing bodies has legal authority

B. The PA governing bodies acts in accordance with its legal authority

C. The PA governing bodies acts with integrity and commitment

D. Stakeholders freely accept the governing body's authority

E. The PA governing bodies has a long-standing cultural attachment to the area

19. Describe powers and responsibilities of various actors in the ecosystem. [Prod for planning, decision-making, spending, revenue generation and power to enter into contracts]

20. How do you link/interact with other people in the PA and other organisations in the ecosystem? [Prod for who are the actors, and how are they involved]
21. How do PA management in the ecosystem ensure access and participation by stakeholders in the PA management processes and actions? [Prod for: public participation process, who are the actors, how are they selected, participatory mechanisms used to seek views from other actors, effectiveness of participatory mechanisms, and addressing complaints]
22. What mechanisms are used by PA managers to reach decisions when other organizations/actors are/should be involved
23. How would you describe the relationship between the PA and other actors in the ecosystem? [Prod for relationship with county, ecosystem-based forums etc.]
24. In what ways would you like to be involved in conservation of the Mt. Marsabit ecosystem?
25. How would you describe management transparency for the PA ecosystem? [Prod for openness of governance and decision making to scrutiny]
26. How transparent is decision-making for the PA ecosystem?
27. The next few statements refer to PA management "transparency" in the ecosystem. Please indicate the extent to which you agree or disagree with the following.

1. Strongly Disagree
2. Somewhat Disagree
3. Not Sure
4. Somewhat Agree
5. Strongly Agree

A. Governance and decision-making is open to scrutiny by stakeholders

B. The reasoning behind decisions is evident

C. Achievements and failures are evident

D. Information is presented to stakeholders in ways they can understand

28. How would you describe public participation in the management of the PA?

[Prod for: public participation process, fairness, seriousness and adequacy of the participation process]

28. How would you describe public participation in the management of the PA? [Prod for: public participation process, fairness, seriousness and adequacy of the participation process]
29. How would you describe **effectiveness** for the PA ecosystem? Rate it in a scale of 1-5; where 1=not effective, 2=slightly effective,3=neutral, 4=effective, and 5= very effective
30. Describe **responsiveness** for the PA ecosystem to complaints and public criticism from other actors. Rate responsiveness in a scale of 1-5; where 1=not responsive, 2=slightly responsive, 3=neutral, 4= responsive, and 5= very responsive
31. How would you describe management **accountability** of the PA ecosystem to other actors? [Prod for downward (constituency) Vs. Upward accountability]
32. The next few statements refer to PA management "accountability" in the ecosystem. Please indicate the extent to which you agree or disagree with the following.

1. Strongly Disagree
2. Somewhat Disagree
3. Not Sure
4. Somewhat Agree

5. Strongly Agree

A. The governing bodies and staff have clearly defined roles & responsibilities

B. The governing bodies has demonstrated acceptance of its responsibilities

C. The governing bodies is answerable to its constituents (stakeholders)

D. The governing bodies is subject to "upward accountability" (e.g. government)

E. Powers are exercised appropriately

33. How inclusive are PA management in this ecosystem?

34. The next few statements refer to "inclusiveness". Please indicate the extent to which you agree or disagree with the following.

1. Strongly Disagree
2. Somewhat Disagree
3. Not Sure
4. Somewhat Agree
5. Strongly Agree

A. All stakeholders have appropriate opportunities to participate in decisions

B. The governing body actively seeks to engage marginalized stakeholders

35. **Equity** is just treatment, requiring that similar cases are treated in similar ways. How would you describe benefit and costs sharing between the PA and other actors in the Mt. Marsabit ecosystem? [Prod for mechanisms for costs distribution]

36. The next few statements refer to "**fairness**" of PA management in the Mt. Marsabit ecosystem. Please indicate the extent to which you agree or disagree with the following.

1. Strongly Disagree
2. Somewhat Disagree
3. Not Sure
4. Somewhat Agree
5. Strongly Agree

A. Stakeholders and park staff are heard and treated with respect

B. There is respect for leaders who govern the PA

C. Decisions are made consistently and without bias

D. Human rights and local values are respected

E. Intrinsic value of nature is respected

F. Benefits and costs of decisions are shared fairly

37. How do you describe governance **strategic vision** for the Mt. Marsabit ecosystem? [Prod for kinds of partnerships and collaborative relations entered between the PA and other actors, and effectiveness of mechanisms for conflict resolution]

D. Ecosystem partnership

Next, I would like you to consider the various other agencies that are involved in the Mt. Marsabit ecosystem, and how you interact with each (e.g. for conflict resolution, decision making, activities and initiatives, resource sharing, etc.).

38. Who at each institution is your main contact (you may provide more than one)

39. Which mode of communication do you mostly use? (face to face; email; formal/ informal presentations; telephone; stakeholder workshops; conferences; other_____)

40. What resources are exchanged (type of knowledge or information or other type of resources e.g.…..)

41. How important is this relationship to you

1 = not important at all,

2=low importance

3=medium importance

4=high importance

5=very high importance

Institution	Rank importance	Institution	Rank importance
WRMA		NGOs	
NEMA		CBOs/FBOs	
KWS		Village elders	
KFS		Investors (Specify)	
County Govt		Others (Specify)	

42. Which of the above linkages has most benefited the Mt. Marsabit ecosystem? Please describe how?

43. Which of the above linkages has least benefitted the Mt. Marsabit ecosystem. Please describe why?

44. What are some of the obstacles to more effective linkages?

45. What ideas do you have about how knowledge sharing/linkages could be improved?

E. To establish the perceived outcomes of PA governance models including conservation and development processes.

46. How would you describe ecosystem management and connectivity in the Mt. Marsabit ecosystem?

[Prod for connectedness and coordination of PA management with those of other actors in the ecosystem]

47. What do you see are the outcomes of governance in the Mt. Marsabit ecosystem

48. Do you see any outcomes related to community development/benefits?

49. The next few statements refer to “connectivity” of the PA ecosystem. Please indicate

the extent to which you agree or disagree with the following.

1. Strongly Disagree
2. Somewhat Disagree
3. Not Sure
4. Somewhat Agree
5. Strongly Agree

A. The PA governing bodies are effectively connected with other nearby actors

B. The PA governing bodies direction and actions are consistent

50. Can you describe some of the important achievements for the Mt Marsabit PA ecosystem? [Prod for: main achievements, main challenges, critical decisions and opportunities, support by other actors, weaknesses and limitations]

51. To what extent do you feel these achievements are a result of the approach to governance in this PA?

Please explain.

52. What are some of the governance challenges encountered in managing Mt. Marsabit PA ecosystem?

53. Is legislation adequate to manage and protect the Mt. Marsabit ecosystem? (referring to content including how current it is?)

54. Thinking now about the entire Mt. Marsabit ecosystem (provide respondent with a map), including, other land management agencies, please provide your opinion about each of the following, by indicating one of the following opinions: very bad, somewhat bad, not sure, somewhat good, or very good.

1. Very Bad
2. Somewhat Bad
3. Not Sure
4. Somewhat Good
5. Very Good

A. Representation of the diverse wildlife in the PA

B. Representation of diverse plant life in PA

C. Representation of diverse water bodies in PA

D. Representation of diverse geological features in PA

E. Representation of diverse human cultures and history in PA

F. Total amount of land protected in PA

G. Configuration of the PA, there is a good diversity

H. Connectivity between PA

I. Collaboration between PA agencies

J. Level of funding for PA agencies

K. Number of staff working in PA

L. Level of training of staff working in PA (conflict resolution, climate change etc)

55. The next few statements refer to "resilience" of management in the Mt. Marsabit ecosystem. Please indicate the extent to which you agree or disagree with the following.

1. Strongly Disagree
2. Somewhat Disagree
3. Not Sure
4. Somewhat Agree
5. Strongly Agree

A. The governing bodies likes to use lessons learned from experience.

B. The governing bodies likes to use new knowledge acquired

C. The governing bodies has some flexibility to respond to changing conditions (management plan is adaptive and can be amended)

D. The governing bodies has procedures for assessing and managing for risk

E. The governing bodies has long term security for managing the PA ecosystem

56. Is there adequate staff capacity in the PA management agencies in the ecosystem?

57. How adequate is funding for the protected area system?

58. How reliable and sustainable is this funding?

59. Do you have any other comments you would like to make?

Thank you. This concludes our interview.

Appendix IV Focus group discussion guide

Focused group questions for community/KFS/KWS actors

CONSENT FORM

Dear Participants,

My name is……. I am doing research on behalf of Caroline Ouko, a PhD student of the University of Nairobi. We are conducting a survey to understand how best stakeholders can make things much better on Mt Marsabit forest'. Participation to this discussion is entirely voluntary. Be assured that we want to learn from your experience and collect important information that will be used to determine how the sustainable governance of Mt. Marsabit can be achieved.

Your participation in this survey is very important and we rely on you to provide us with accurate information.

The interview will take approximately *30* minutes, but with your cooperation it can be done quicker.

May I have your permission to undertake this interview? Yes ☐ No ☐

If you do not want to participate, kindly explain why……

community/KFS/KWS: _____
Total number of respondents: Women___ Men ____

1. What are the objectives of conservation in the Mt. Marsabit forest?
2. What do you say about its legitimacy and management?
3. Who has the most power over all in the forest? What are the roles and powers owned by the community/KFS/KWS?
4. What is the relationship between the community/KFS/KWS and the most powerful?
5. How are you as community/KFS/KWS involved in decision making and management?
6. How would you like to be involved in the conservation?
7. How do you see transparency, effectiveness, responsiveness in management?
8. How do you see fairness and equity with regard to distribution of costs and benefits?
9. What actors do you communicate with in the forest ecosystem? What is the importance of that communication?
10. Which actor do you see as the most important in communication with community/KFS/KWS amongst the conservation actors?
11. Which actor do you see as the least important in communication with community/KFS/KWS amongst the conservation actors?
12. What are the barriers to effective communication?
13. What should be done to improve communication?
14. What are the achievements attained in the forest?
15. How much do you see the achievements are linked to the governance?
16. Are there any social achievements?
17. What are governance challenges?
18. Are the present legislations sufficient to conserve the forest?
19. What do you say about sufficiency in size of the areas conserved in the forest ecosystem enough?
20. Any other comments with regard to this research?

Thanks

Appendix V Research Permit

CONDITIONS

1. **You must report to the County Commissioner and the County Education Officer of the area before embarking on your research. Failure to do that may lead to the cancellation of your permit.**
2. **Government Officer will not be interviewed without prior appointment.**
3. **No questionnaire will be used unless it has been approved.**
4. **Excavation, filming and collection of biological specimens are subject to further permission from the relevant Government Ministries.**
5. **You are required to submit at least two(2) hard copies and one (1) soft copy of your final report.**
6. **The Government of Kenya reserves the right to modify the conditions of this permit including its cancellation without notice**

REPUBLIC OF KENYA

National Commission for Science, Technology and Innovation

RESEACH CLEARANCE PERMIT

Serial No.A 13802

CONDITIONS: see back page

THIS IS TO CERTIFY THAT:
MS. CAROLINE ACHIENG OUKO
of UNIVERSITY OF NAIROBI, 0-200 Nairobi,has been permitted to conduct research in *Marsabit County*
on the topic: *GOVERNANCE DILEMMA AND SUSTAINABLE PROVISION OF ECOSYSTEM SERVICES IN MT. MARSABIT FOREST, KENYA*
for the period ending:
24th April,2018

Permit No : NACOSTI/P/17/60010/16821
Date Of Issue : 25th April,2017
Fee Recieved :Ksh 2000

.....
Applicant's Signature

.....
Director General
National Commission for Science, Technology & Innovation

NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY AND INNOVATION

Telephone: +254-20-2213471,
2241349,3310571,2219420
Fax: +254-20-318245,318249
Email:dg@nacosti.go.ke
Website: www.nacosti.go.ke
when replying please quote

9th Floor, Utalii House
Uhuru Highway
P.O. Box 30623-00100
NAIROBI-KENYA

Ref: No. **NACOSTI/P/17/60010/16821**

Date: **25th April, 2017**

Caroline Achieng Ouko
University of Nairobi
P.O. Box 30197-00100
NAIROBI.

RE: RESEARCH AUTHORIZATION

Following your application for authority to carry out research on ***"Governance dilemma and sustainable provision of ecosystem services in Mt. Marsabit Forest, Kenya,"*** I am pleased to inform you that you have been authorized to undertake research in **Marsabit County** for the period ending **24th April, 2018.**

You are advised to report to **the Chief Executive Officers of selected state Corporations, the County Commissioner and the County Director of Education, Marsabit County** before embarking on the research project.

On completion of the research, you are expected to submit **two hard copies and one soft copy in pdf** of the research report/thesis to our office.

BONIFACE WANYAMA
FOR: DIRECTOR-GENERAL/CEO

Copy to:

The Chief Executive Officers
Selected state Corporations.

The County Commissioner
Marsabit County.

The County Director of Education
Marsabit County.